

# Rethinking Our Water Ways

*A Guide To Water And Watershed Planning For BC Communities  
In The Face Of Climate Change And Other Challenges*

*October 2011*



Fraser Basin Council

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Fraser Basin Council staff Sheila Creighton and Steve Litke led the development of the guide. The Council is very appreciative of the wide range of input, advice, guidance and support that was offered through the project Advisory Committee.

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The guide was informed by a review of relevant literature including reports, guides, and other print and web-based publications. In addition, interviews were conducted with local government staff and other individuals involved in water or watershed planning. This helped to ground the Guide in the issues, priorities, experiences, circumstances and needs within communities across BC. In some cases, special advisors were engaged on a specific basis to bring their expertise on issues such as climate change adaptation and First Nations perspectives. A special thanks to Tracey Hooper, for editing services; Roxy Design, for graphic design services; and ExWare for the development of the web version of this guide.





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# 1. About This Guide

Water is the lifeblood of British Columbia. We depend on it, we value it, and with growing awareness of the potential impacts of population growth, climate change and other pressures on our water resources and watersheds, we must plan in order to effectively manage and steward our water resources long into the future.

Water enables the ecosystems, cultures and communities of British Columbia to survive, thrive and flourish. The future of species, ecosystems, communities, regions, provinces and future generations will undoubtedly be influenced, in large part, by how we manage this precious resource.

This guide has been developed for local governments, First Nations, and other government agencies, stewardship organizations, water use sectors and community stakeholders. The purpose of the guide is to help these organizations and individuals:


- Understand the value of water and watershed planning;
- Navigate through the web of current and emerging water issues;
- Understand the range of planning options that are available in BC; and,
- Build capacity to develop and implement plans that will strengthen watershed health and community sustainability.

The guide:

- Provides an overview of a variety of water and watershed planning processes that are available to communities in bc
- Helps communities understand how to integrate climate change considerations within water and watershed planning;
- Shares knowledge, experiences and lessons learned from the literature and from practitioners that have undertaken water and watershed planning; and,
- Connects community planners and other practitioners with a wide range of available tools and information resources.







Communities and ecosystems in BC are experiencing unprecedented changes at many different scales related to population growth, settlement patterns, use of natural resources, release of waste products into the environment, and a changing climate. From these changes, flow many impacts, including impacts to water resources, watershed health, and community health and sustainability.

Communities rely on water and watersheds for several immeasurable values including:

- A safe, secure, and adequate supply of water for domestic, agricultural, commercial, industrial, recreational and tourism uses;
- A receiving environment for wastewater discharges;
- Provision of fish, wildlife, habitat and biodiversity;
- Provision of ecosystems services including moderation of flooding, erosion and sedimentation processes;
- A host of other social, cultural, economic and spiritual values.

Planning plays a critical role in how communities define their vision of the future and their path to achieve that vision. Planning can be reactive or responsive, helping to make course corrections in response to existing issues and challenges. It can also be proactive in anticipating emerging issues on the horizon and helping communities to prepare for and manage those issues. When it comes to communities and watersheds, there may be as many different approaches to planning, as there are communities.

However, there are many common principles, practices and desired outcomes across the spectrum of different planning processes used in BC and beyond. These are discussed in further detail in the sections that follow.

Section 2 of this guide provides an overview of planning for water and watersheds. The rationale for and benefits of water and watershed planning are described, and examples of the desired outcomes of planning are identified. Overall guidelines for designing a planning process are described as well as some general challenges and opportunities associated with watershed planning processes. Ten different planning processes are profiled. These are described in more detail in later sections of the guide (5, 6, 7). See section 8 for a more detailed discussion about several concepts that are relevant to planning for water and watersheds, including integrated watershed planning, water centric planning, design with nature and the soft path approach.

Section 3 provides general information about the impacts of climate change on water and watersheds in BC. Some basic information about how to identify local and regional climate vulnerabilities, risks and risk management strategies, and how to integrate climate change into these strategies is also provided.

Lastly, this section includes general comments about how climate change information might influence water and watershed planning processes, resulting in plans that help communities address the impacts of climate change.

Section 4 provides information about the roles and responsibilities of different agencies and organizations in water planning, management and governance.

These include:

- Provincial Government
- Federal Government
- First Nations Government
- Local Government
- Other Organizations

In addition to roles and responsibilities, Section 4 includes some additional information regarding Living Water Smart: BC's Water Plan and modernization of the Water Act.

Sections 5, 6 and 7 provide information about a variety of specific approaches to water and watershed planning. These sections provide an introduction and overview of each of the different approaches to water and watershed planning, including a general description, an overview of the key elements and steps, as well as the characteristics, benefits and applications of each planning process. The planning processes have been grouped into the following three themes:

#### Section 5: Managing Water Supply & Demand

1. Water Conservation Plans
2. Drought Management Plans
3. Water Use Plans
4. Water Allocation Plans

#### Section 6: Protecting Drinking Water Quality

1. Well / Aquifer Protection Plans
2. Source Water Assessments and Assessment Response Plans
3. Drinking Water Protection Plans

#### Section 7: Integrating Water, Land & Watersheds

1. Water Management Plans (Water Act, Part 4)
2. Watershed Management Plans
3. Rainwater and Stormwater Management Plans

Section 8 provides a synthesis of several relevant issues to consider in relation to water and watershed planning. Several common themes emerged from the literature that was reviewed in the preparation of this guide, from project advisors, from interviews with communities and from water and watershed planning case studies. These broad themes are shared to help communities build a deeper understanding about the dynamics of watershed planning. These themes include:

1. Rethinking Watersheds and Planning
2. Community Collaboration and Engagement
3. Regional Approaches
4. Resourcing Water and Watershed Initiatives
5. Data, Information and Knowledge Resources

Section 9 of the guide includes several Tools and Resources to provide additional sources of information to support individuals and organizations on their path through water and watershed planning.

Find the web version of this guide at [www.rethinkingwater.ca](http://www.rethinkingwater.ca). The web version includes more details on climate change, lessons learned and tools and resources.



## 2. Planning for Water & Watersheds

“A new relationship between people and water needs to be established to ensure that there will be water supplies for human use, thriving ecosystems and a healthy economy... both now and in the future.”

—Cowichan Basin Water Management Plan, 2007<sup>1</sup>

Every living organism, ecosystem and community requires water for life, health and functioning. The water cycle also influences the availability of many natural resources for communities and the exposure of those communities to water-related hazards. Biodiversity, ecosystem functioning and most sectors of the economy are highly dependant on water resources and watershed health.

A watershed refers to a region or area of land that drains into a stream, river system or other body of water. Watersheds capture precipitation, filter and store water, and influence the timing and volume of water flows. They are integrated systems, with actions in one part of a watershed often impacting other parts of the watershed; therefore, the watershed is an important unit for planning and managing water. Watershed planning and management seeks to ensure the wise and effective use of water and land resources, and in particular, the quantity, quality and timing of water flows.

Communities rely on water and watersheds for a safe, secure and adequate supply of water for many uses; a receiving environment for wastewater discharges; provision of fish, wildlife, habitat and biodiversity; moderation of flooding, erosion and sedimentation processes; and a host of other social, cultural, economic and spiritual values. Communities and watersheds are experiencing unprecedented changes at many different scales related to population growth, settlement patterns, use of natural resources, release of waste products into the environment and a changing climate. These changes can lead to impacts on water resources, watershed health and community sustainability.

Water and watershed planning is about defining and achieving a desired future vision for water resources and watersheds. Planning plays a critical role in how communities define their vision of the future and their path to achieve this vision.



## 2.1 THE VALUE OF PLANNING

Through water-related planning processes, decision makers and the broader community will be better able to understand current and future pressures on water quantity and quality. They will be better able to manage in the face of those pressures. For example, population growth projections can inform the potential for growth in water use and demand relative to available supply. Similarly, future climate scenarios can help users understand if future water supplies might decrease. By exploring future climate, population, and development scenarios, planners can identify when water use might be projected to exceed supply and can help make the case for water conservation and other strategies to contain demand within supply limits. There can also be public education benefits associated with planning processes, which can lead to public support in implementing plans and any associated strategies.

The following section will explain what water and watershed planning is, why it is important, when it is needed and the range of options available in BC. Sections 5, 6 and 7 then describe in more detail the characteristics and requirements associated with different planning options.

A community vision for a sustainable watershed commonly includes one or more of the following desired outcomes:

- Managing water uses and rates of consumption within available water supplies seasonally, annually and over the long-term
- Developing and managing water supplies in ways that do not compromise the health and biodiversity of fish, wildlife, ecosystems and watersheds
- Managing the allocation of water in ways that support a variety of high-value water uses, including human consumptive and non-consumptive uses as well as instream, environmental uses
- Supporting a wide variety of economic development activities
- Managing wastewater discharges within the capacity of receiving waters to absorb and assimilate those wastes
- Supporting renewable energy sources while minimizing impacts on the environment
- Managing human development patterns in ways that stabilize rather than destabilize the hydrologic cycle
- Managing development in ways that reduce rather than increase the vulnerability of communities to flooding and erosion
- Maintaining and strengthening community resiliency and preparedness for change, including changes in climate

Planning can be reactive and responsive to longstanding issues and challenges. Planning can also be proactive in anticipating challenges that may be emerging on the horizon.

A significant new challenge for water and watershed planning is how to deal with climate change. Changes in temperature, precipitation and extreme weather events have already influenced hydrology, and subsequent drought, and flooding and erosion effects. These in turn contribute to a variety of impacts on communities and ecosystems. Scientists project that more changes will come. Identifying, understanding and preparing for these changes (sometimes referred to as climate change ‘adaptation’) should become an important component, or a relevant lens to apply, within water and watershed planning processes.

In sections 5, 6 and 7 of this guide the following approaches to planning for water and watersheds are profiled:

- Water Conservation Plans
- Drought Management Plans
- Water Use Plans
- Water Allocation Plans
- Well/Aquifer Protection Plans
- Drinking Water/Source Protection Plans
- Assessment Response Plans
- Water Management Plans (Water Act, Part 4)
- Watershed Management Plans
- Liquid Waste/Integrated Stormwater Management Plans

The suitability of these plans for a community, region or watershed will vary significantly depending on the nature and scope of the issues that need to be addressed. For example, the following are some key considerations:

- Water quantity or quality?
- Surface or groundwater?
- Drinking water or instream water?
- Water use, wastewater discharge, and/or use?

## 2.2 AN INTRODUCTION TO PLANNING

Simply put, planning attempts to logically solve a specific problem or issue and identify steps that can be taken to reach desired future outcomes. Planning can be initiated either through voluntary means or by regulation. According to the Canadian Institute of Planners, planning involves the scientific, aesthetic, and orderly disposition of land, resources, facilities and services with a view to securing the physical, economic and social efficiency, health and well-being of urban and rural communities.<sup>2</sup>

The goals of planning are oriented towards the future. Therefore, planning is an ongoing, dynamic process that needs to be attuned and adaptive to changing environmental conditions, social outlooks and community visions.

### The Planning Process

Approaches used in planning processes vary greatly. Some processes follow a rigid schedule of meetings, while others adopt a more flexible workshop approach. The approach selected is determined, in part, by the characteristics of the planning area, the specific issues being addressed, the needs and interests of the community, and the individuals involved. Planning for complex environmental, social or economic problems typically requires a process design that integrates most, if not all, of the following steps:<sup>3,4</sup>



- Involve key decision makers and partners. Consider who should be engaged in the process in order for it to work. Strong partnerships make for a strong plan.
- Characterize the area / issue to identify problems. If a problem is defined too narrowly, innovative solutions may be overlooked.
- Model or analyze the situation or problem. It is important to understand the causes of the problem, as well as the dynamics that may help solve it.
- Set goals and identify potential solutions, including resource requirements, and implementation and feedback procedures.
- Evaluate potential solutions in terms of technical feasibility, cost effectiveness, probable effects and political acceptability
- Make decisions and design an implementation program.
- Implement solutions and take action.
- Monitor and evaluate the success of the plan and its implementation.
- Modify the plan as required.

Planning with water in mind, or water centric planning, is a primary objective of Living Water Smart, British Columbia's Water Plan. Historically, the provincial government coordinated planning for water resources. More recently, First Nations, local governments, stewardship groups and other community stakeholders have shared this responsibility. Examples of collaborative approaches to planning are profiled throughout this guide. Living Water Smart advocates for water and watershed planning to continue to be a shared, collaborative endeavour.

There is no absolute template to follow for water and watershed planning. Every planning process and every plan is different. There are, however, many elements that are critical to the success of watershed plans. With this in mind, recommended guidelines for watershed planning processes include the following:

- Develop a clear vision, goals, objectives and action items; and set priorities among these.
- Seek involvement and support from elected decision-makers and those with legislative or regulatory responsibilities. The relevant decision makers have much to offer towards a plan that can be implemented.
- Ensure full representation of all affected parties, while keeping the size of the process workable.
- Ensure that the planning process is understood, used and broadly supported.
- Provide access to appropriate technical and analytical skills and information resources.
- Obtain sustainable funding.
- Strive for planning that is done before further development will undermine the effectiveness of the plan.
- Factor in the impacts of climate change and interception activities (e.g., farm dams and forestry) on future water inflows and recharge.
- Include socio-economic analyses to inform planning.

- Consult with those affected to improve the quality of decisions and build community confidence in the fairness of outcomes.
- Give high priority to ensuring that the values and interests of indigenous peoples are included.
- Develop capacity for learning and improving over time and the ability to evaluate the process.
- Provide adequate resources to develop and implement water plans and evaluate their outcomes.
- Improve monitoring and compliance of the use of water and other watershed resources.

Ideally, watershed plans and the organizations involved in implementing the plans should emerge from the planning process with:

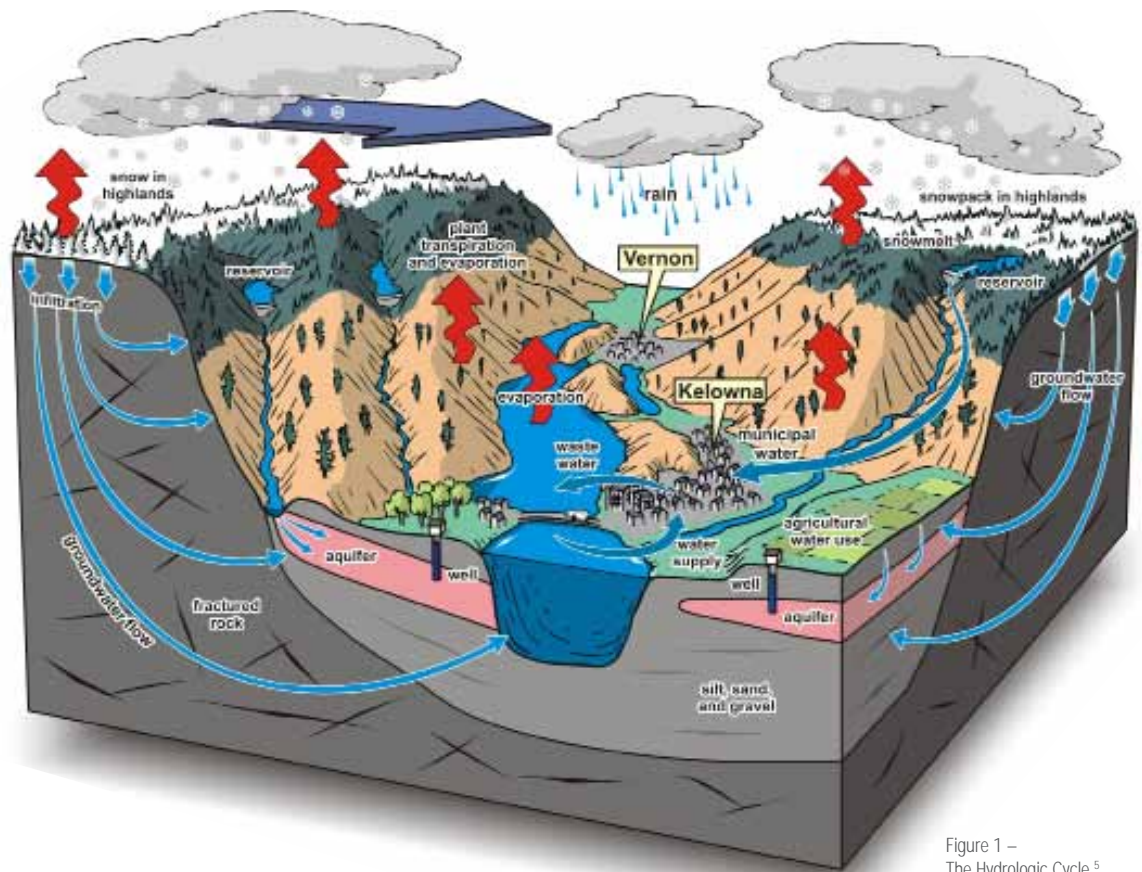
- Improved understanding of the watershed and how it functions
- Clear objectives of how to manage the water sustainably and in an integrated manner
- Clearly specified community and environmental outcomes
- Decisions that are based on the best available information
- Adequately resourced management and implementation
- Good integration with other regional and resource-based plans

It should be acknowledged that planning would not solve all of the water-related challenges and conflicts throughout BC. However, it is an important component of the management and governance of water resources and watersheds.

### 2.3 AN INTRODUCTION TO WATERSHEDS

Everything in the natural world is connected to other parts. Changes made to one element of a system affect many other elements and/or process throughout the system. A watershed—an area of land that contributes runoff to a lake, river, stream, estuary or bay—is a complex and dynamic natural system. Changes to land cover in upland regions of a watershed affect downstream hydrology; waste inputs from one community can affect water quality further downstream. Impacts to an aquifer, such as water withdrawal, may ultimately affect the flow and health of a nearby stream. The various resources that interact within a watershed—the land, the surface and ground water, the air and the organisms within the watershed—cannot be considered in isolation. By recognizing the interconnections between the components of a watershed and by integrating this understanding into planning and decision making within and across watershed boundaries, negative human impacts on watershed health are more likely to be more effectively managed.





Understanding the hydrologic cycle is critical to understanding how a watershed functions. While both salt water and freshwater are essential parts of the water cycle, the freshwater that we use on a daily basis for drinking water, irrigation, and other uses comprises only 1% of all water on Earth. This small proportion of water is “recycled” through the hydrologic cycle, year after year, through oceans, rivers, rain and the atmosphere (Figure 1).

When water falls to the earth as either rain or snow, it either:

- Soaks into the ground
- Flows over the surface of the land into a stream, lake, wetland or the ocean, or
- Returns to the atmosphere through evaporation.

The rate of infiltration within a watershed is determined by many factors, including soil permeability, rate of precipitation and the amount and type of vegetation cover on the land surface. Human activity can alter the rate of infiltration by changing the surface of the land. When rain falls or snow melts too fast to allow for infiltration, or when the ground is too hard (impermeable) for infiltration to occur, such as in an urban environment, the water flows over the land as surface runoff (also called overland flow). Surface runoff is evident within a watershed as streams, rivers, lakes, ponds, wetlands and drainage ditches.

Water that infiltrates into the ground can take one of several routes:

- Plant roots may absorb the water, which will be used for photosynthesis. This water will eventually leave the plant through the leaves, transpiring back into the atmosphere.
- Water that is not taken up by plants percolates downwards through the soil to the fully saturated zone at the level of the water table, where it becomes groundwater. Significant collections of groundwater are called aquifers. Aquifers are sometimes tapped with wells for drinking or irrigation. Groundwater may eventually flow back to the surface as a spring or through sub-surface pathways into streams, rivers or lakes.

The areas where precipitation or surface water infiltrates the soil and enters the groundwater system are known as recharge areas. They are often in upland areas of a watershed but may also be in low-lying valleys and floodplain areas. As water evaporates from collecting water bodies, it is returned to the atmosphere, and the cycle repeats itself. No new water is produced: the water that we use today is the same water that existed billions of years ago. How we develop and manage the land within our watersheds ultimately affects the quality of the water that is available for use. In the same way that streams and rivers flow through a collecting basin, the impacts of human activities also flow through a watershed.

It should be acknowledged that there are many different scales of watersheds. The scale of watershed that is appropriate to effectively plan for, and manage, a given issue (or issues) will depend on the nature and scope of those issues and the purpose and scope of the planning process.

## 2.4 REFERENCES

- <sup>1</sup> Westland Resources Group Inc. for a partnership of Cowichan Valley Regional District, BC Ministry of Environment, Fisheries and Oceans Canada, Catalyst Paper Corporation, Cowichan Tribes, and Pacific Salmon Commission. 2007. Cowichan Basin Water Management Plan. <http://cvrd.bc.ca/DocumentView.aspx?DID=1097>.
- <sup>2</sup> Nelitz, Marc, Douglas, Tanis, and Murray Rutherford (2009). Freshwater For Fish and People: Moving Towards "Living Water Smart". Pacific Fisheries Resource Conservation Council, Vancouver, BC.
- <sup>3</sup> Environmental Protection Agency (2008). Handbook for Developing Watershed Plans to Restore and Protect our Waters. EPA 841-B-08-002 [http://water.epa.gov/polwaste/nps/handbook\\_index.cfm](http://water.epa.gov/polwaste/nps/handbook_index.cfm).
- <sup>4</sup> West Coast Environmental Law, BC Guide to Watershed Law and Planning [www.bcwatersheds.org/issues/water/bcgwlp/o3.shtml](http://www.bcwatersheds.org/issues/water/bcgwlp/o3.shtml) [Accessed May 2010].
- <sup>5</sup> Turner, R.J.W., R.G., Taylor, B., Ceh, M., Grasby, S.E., Symonds, B. Adams, M., Armour, G., Carmichael, V., Curtis, J., Davis, D. Epp, P., Harlow, C., Journeay, M., Machin, D., Molyneux, T., Neilsen, D., Simpson, R., Stephens, K., & van der Gulik, T., (2006) Okanagan Basin Waterscape: Geological Survey of Canada. Miscellaneous.





### 3. Preparing for Climate Change & its Impacts

“Building adaptive capacity requires a strong, unifying vision; scientific understanding of the problems; an openness to face challenges; pragmatism in developing solutions; community involvement; and commitment at the highest political level”

—Holmes, 1996 in Smit et al. 2001<sup>1</sup>

This section of the guide provides information about climate change and the range of its potential impacts on water and watersheds in BC. It also provides basic information about the adaptation process, including the identification of climate vulnerabilities, risks, and risk management strategies. Lastly, this section includes some examples of how these issues can be integrated into water and watershed planning processes to help communities address the impacts of climate change.



### 3.1 CLIMATE CHANGE IMPACTS ON WATER

Climate, in a narrow sense, is usually defined as the “average weather” over a period of time. Some of the most familiar climate parameters are temperature, precipitation, humidity, cloudiness, and wind. Climate change refers to a change in the state of the climate which can be identified by changes in the mean and/or variability of these parameters, and which persists for a period of decades or longer.<sup>2</sup>

Climate change science suggests that by the middle of the century (2050s), mean annual temperatures across BC will be 1-3° C warmer on average. Extremely warm temperatures will become more frequent. A warmer climate will increase growing degree days and frost free days – increasing the potential for plant growth. In winter, most parts of BC will receive up to 20% more precipitation. In summer, northern BC will be up to 10% wetter, and southern BC will be up to 15% drier. In winter and spring, snowfall will decrease.<sup>3</sup> These are significant changes from a water perspective.

Water resources and the hydrologic cycle are significantly influenced by the climate. Therefore, water resources are highly sensitive to year-to-year climate variability as well as long-term changes in climate. Changes in air temperature and precipitation patterns are noticeably affecting our weather, water cycles and ecology, and are creating impacts on forests, fisheries, agriculture, recreational opportunities and communities across the province.

Climate change includes changes in the average climate, such as a general warming in mean annual air temperature, and changes in the frequency of extreme temperature and precipitation events. Changes in climate will affect physical systems, including stream flows. Impacts will vary from one location to another and will include lower “normal” stream flows (i.e., average seasonal and annual flows) and more frequent drought and flood conditions. There may also be larger streamflows in some regions including larger and earlier peak flows. Changes in both climate averages and extremes may have a wide range of impacts on water and watershed resources and these impacts will vary between different regions of the province. Therefore, we need to consider these impacts within water and watershed plans to strengthen the ability of communities to manage such impacts. Projected changes are highly dependent upon location, topography, and watershed type. Some examples of impacts related to climate change are:

- Decreased seasonal and/or annual water supplies, which may lead to increased conflict among water users and between human consumption and water uses within the natural environment;
- Degraded water quality, which may impact the suitability of water for drinking and for agricultural, commercial, industrial, recreational and environmental water uses; and
- Increased frequency and severity of drought, flood and extreme rainfall events, which may impact water supplies, drainage infrastructure, other critical infrastructure, public and private property, and—in extreme circumstances— human health.

These and other climate-related impacts will be discussed in more detail in Sections 3, 5, 6 and 7 of this guide, along with suggestions on how to integrate and address these issues within water and watershed plans.

As expressed in Living Water Smart, British Columbia’s Water Plan, “*we need to design our communities to adapt to our changing climate while thinking long term to revitalize*

*our natural systems*”. At a 2008 conference of the BC Water and Waste Association, Jim Mattison, former Assistant Deputy Minister, Water Stewardship Division, BC Ministry of Environment, spoke to water managers about the two responses to climate change: mitigation and adaptation. “*Mitigation and adaptation are both necessary and complementary strategies to cope with the climate change challenge. If mitigation (alleviating the effects of climate change through reducing greenhouse gasses) is about carbon, then adaptation (preparing for the changes that occur) is about water*”.<sup>4</sup> While human systems within impacted watersheds “*may adapt to climate change, albeit at some cost, natural ecosystems and wildlife cannot adapt very quickly to a sudden, large change and hence are at risk.*”<sup>5</sup>

Climate change impacts on water resources, watershed health, and communities are anticipated to be complex and significant, and are expected to vary for different regions of the province. Projected changes are highly dependent upon location, topography, and watershed type. In general there are four different types of watersheds with different hydrological regimes, and differences in how these watersheds are affected by climate change need to be considered within water, watershed, and/or adaptation planning:

- Rain-dominated watersheds
- Snow-dominated watersheds
- Transition watersheds
- Coastal watersheds (rain and transition, but with added the impact of sea level rise).

The range of potential climate-related impacts on water, watersheds and communities across BC include the following (see also section 9. Tools and Resources for other sources of information on climate impacts):

#### Hydrology and Geomorphology

- Changes in the hydrology of rivers, streams and watersheds, including the volume and timing of water discharge (e.g., increased frequency and magnitude of both peak [flood] flows and low [drought] flows)
- Changes in the geomorphology of rivers, streams and watersheds, including the volume, sources and destinations of sediment transport (e.g., increased rates and shifting locations of erosion and sedimentation processes)

#### Water Quantity

- In some regions, more frequent water shortages and increased potential for competition among water uses (e.g., hydroelectricity, irrigation, communities, recreation and instream flow needs for aquatic ecosystems), with implications for transboundary agreements in some cases.
- In some regions there may be an overall reduction in annual water supply, particularly where water supplies are partially dependent on snowpack or glaciers and where water storage is limited.





## First Nations Concerns

First Nations in Canada have also identified and expressed concerns about these potential climate change impacts. In workshops held in Toronto and Vancouver in the summer of 2010, 18 First Nations from across Canada identified potential policy directions related to First Nations, water security and climate change. A report emerging from these workshops indicated that First Nations in rural areas are experiencing various impacts of climate change on water resources, including: <sup>6</sup>

- Poor water quality;
- Increasing drought;
- Rapid glacier melt;
- Widespread thawing of permafrost;
- Earlier peak streamflows;
- Changing water temperatures; and
- Shifting marine ecosystems.

Other climate change impacts on water and watersheds identified as being of relevance to First Nations in BC include:

- Increased flood damage to buildings, roads, bridges, rail lines;
- Increased air pollution and exposure to water- and food-borne pathogens;
- Increased risk to water quantity due to low water levels; and
- Increased risk to water quality due coastal erosion and storm surges.

Climate change has also impacted First Nations' ability to harvest fish, both commercially and for subsistence purposes, due to significant changes in fish habitat, migratory patterns and spawning beds, and to changes in water quality and temperature.

### Water Quality

- Increased risk, frequency and magnitude of extreme precipitation events and related natural hazards such as flood and erosion, resulting in loss or degradation of land; deposition of silt, sand, gravel and debris; damage to and disruption of critical infrastructure, property, community services, farmland, businesses and the environment.
- Increased risks of other water-related hazards such as debris flows, landslides and avalanches.
- During periods of low water flows, normal waste discharges will result in higher concentrations of pollutants within water bodies that receive those wastes
- Saltwater intrusion in coastal regions due to a rise in sea level, in particular in combination with reduced groundwater tables.
- Increased water turbidity from increased flooding, erosion and sediment transport, with potential health impacts from water-borne pathogens.

### Aquatic Ecosystems

- Continued stresses on fish migration patterns and survival rates of some populations due to a variety of impacts to freshwater and marine habitat, including warming water temperatures, low freshwater flows in late summer and early autumn in some regions, degradation of spawning and rearing habitat, and changes to food availability and predators in the marine environment

- Forests that are stressed — for example, from reduced water supply — are more vulnerable to diseases and pests such as the mountain pine beetle. Climate change can therefore lead indirectly to changes in forest cover over large regions, which in turn can affect watershed functions and processes.
- Longer and drier summers in BC with increased severity and length of the fire season. Forest fires reduce forest cover, and in turn, may contribute to faster runoff, and affect stream and river hydrology, and water quality

### Infrastructure

- Increased risk of damage and disruption to drinking water and wastewater collection, treatment and distribution infrastructure to due to flooding and erosion.
- Increased impacts on drainage systems.
- Increased risk of damage and disruption to transportation, energy, communications, and other critical infrastructure due to flooding and erosion.

The impacts above can interact with a variety of different community and/or ecosystem vulnerabilities such as:

- Vulnerability of water supplies (quantity and quality) to flooding, erosion, turbidity, drought and saltwater intrusion;
- Vulnerability of all water use sectors to reduced water supplies and increased conflict;
- Vulnerability of aquatic and marine ecosystems to warming water temperatures, shifting hydrological and geomorphological regimes, low instream flows and shifts in the food web; and
- Vulnerability of people, infrastructure (including but not limited to drinking water, wastewater and drainage infrastructure), community services and property due to water-related natural hazards such as flooding, erosion, debris flows, landslides and avalanches.

In many cases, there can be a cascade of climate-related impacts. For example, more frequent and/or extreme rainfall events are a highly probable impact of climate change in many areas of BC. This can lead to high flows in streams, rivers and drainage systems, which can cause flooding, erosion, mobilization of contaminants and downstream sedimentation. Depending on the location and design of community water and wastewater systems, flooding may impact the quality of community water supplies, damage or disrupt the operation of water or wastewater treatment systems, and damage or disrupt other infrastructure and property. There may also be a risk to life or injury due to flood events. Although flooding and erosion are natural processes, extreme rainfall events can have adverse impacts on the environment, including degradation of water quality, habitat, and other ecosystem functions and services. This can, in turn, adversely impact social, cultural and economic values that are derived from healthy and abundant watershed resources. Thus, a single storm event can result in devastating, widespread and long-lasting impacts to the health, resiliency and sustainability of communities, water resources and watersheds.

## 3.2 PREPARING FOR CLIMATE CHANGE – THE ADAPTATION PROCESS AND WATER AND WATERSHED PLANNING

Because of the many, significant, current and projected impacts of climate change on water resources and watersheds, the value of planning and adaptation should be self-evident. The better we are able to understand the changes that are coming and how they are affecting communities and ecosystems, the better we will be able to plan for, manage and adapt to these changes.

Many methodologies have been developed to help communities learn more about the regional impacts of climate change, prioritize associated risks and opportunities, and develop climate risk

management plans. Some of these methodologies are listed in in Section 9 Tools and Resources. More resources are available on the community adaptation first-stop website “ReTooling for Climate Change at [www.retooling.ca/](http://www.retooling.ca/).

This guide suggests that many water and watershed planning processes should consider climate change and its impacts, focusing on how climate has changed and is likely to change within the planning region, and the impacts of a changing climate on water and watersheds within the planning region.

Users of this guide are referred to existing generic methodologies identified in Tools and Resources and on the ReTooling website for details on the steps involved in identifying regional impacts, vulnerabilities, and risks, and relevant risk management strategies. The sections that follow provide additional information that specifically addresses adaptation in the context of water and watershed planning.

### 3.2.1 LEARNING ABOUT REGIONAL CLIMATE CHANGE IMPACTS

*What are the impacts of climate change on water and watersheds in my region?*

Information about climate change and its impacts on water and watersheds in BC is available, although the amount and level of detail varies from one region to another.

Information about changes in climate, changes in hydrology, and changes in aquatic and terrestrial ecosystems in BC during the past century is available from reports published by the BC Ministry of Environment, Natural Resources Canada, and the Pacific Climate Impacts Consortium. See Tools and Resources for links to key publications.

The planning tool Plan2Adapt provides a good starting point for learning about future climate. It provides regionally relevant information about projected climate for 2020s, 2050s, and 2080s, based on a standard set of climate model projections. It presents this information in the form of simple-to-understand maps, graphs and text. Users can view the information online as well as download material for use in presentations and reports. Users with more technical knowledge can also download the data used to create the maps for further analysis. See <http://plan2adapt.ca/>.

It's not enough to know what future climate will look like. Equally important is to understand the implications of future climate to future stream flows, water availability, and watershed health in the planning region. Much of the existing information on these topics is provincial in scope. There are only a few regions – including the Okanagan, the Columbia Basin, and the Lower Mainland – for which detailed information on water and watersheds exists. Not all of the existing information is written in simple language. Section 9 Tools and Resources provides links to key sources of information about impacts on water and watersheds.

Where detailed local or regional information about future climate or hydrology is not readily

available, communities have been able to obtain it by engaging consultants or the Pacific Climate Impacts Consortium, or by working with academic researchers and students.

While many communities believe they need accurate information about future climate and future impacts on water and watersheds, in many cases general information about the direction of these impacts will be adequate for initial planning purposes. The following information, for example, can guide water and watershed management decisions:

- Whether or not regional snowpack (a low-cost water storage mechanism) will likely decrease in future;
- Whether or not summer flows will likely be lower in future, with impacts for water temperature and health of fish stocks; or
- Whether or not heavy rainfall events – associated with flooding and stream turbidity – are becoming more frequent.

### 3.2.2 EXPLORING LOCAL AND REGIONAL VULNERABILITY TO CLIMATE CHANGE

*How will the impacts of climate change affect water supply, demand, quality and watershed health in my region?*

Science alone cannot provide all the information water and watershed planners need to prepare for climate change. In many cases it is local people who are in the best position to identify the water and watershed values they care about, how sensitive those values are to year-to-year changes in climate, and local capacity to address existing problems.

Some of the adaptation planning methodologies identified in Tools and Resources (section 9 of this guide) describe two types of assessment: vulnerability assessment and risk assessment. Vulnerability assessment looks specifically at the ability of the community to address emerging pressures related to climate. Questions for water and watershed planners to consider in assessing vulnerability related to climate change are:

- What aspects of climate are currently important to our water supply or our watershed? In particular, how have extreme weather events affected our water supply or watershed in the past?
- Given projected climate change and related impacts: Is the community water supply likely to increase or decrease? Is damage to water infrastructure likely to increase or decrease?
- How prepared is our community to projected changes? Are we resilient or vulnerable?

In many cases, climate change will exacerbate existing management challenges, such as water shortages, water use conflicts, protecting water quality and managing natural hazards – things that communities are already struggling to address.



### 3.2.3 EVALUATING LOCAL AND REGIONAL RISK RELATED TO CLIMATE CHANGE

*What climate-related risks are priorities for my community in terms of the hazards and consequences?*

Many communities are familiar with risk assessment and risk management. Preparing for climate change can be approached as just another aspect of risk management. Risk is the product of the likelihood of a hazard (e.g., flood, fire, drought, water contamination, landslide) occurring, and the consequences of exposure to that hazard. Communities can manage risk by reducing exposure to a hazard or by minimizing its consequences.

Sometimes climate change will introduce a new hazard (for example sea level rise, glacier loss), or a new consequence (for example new, invasive species). More often, climate change will increase or decrease the likelihood that a hazard will occur.

Water and watershed planners can use their knowledge of regional climate changes and its impacts to inform a basic risk assessment. Planners should also consider whether climate change presents new hazards or consequences relevant to water and watershed planning.

### 3.2.4 IDENTIFYING CLIMATE RISK MANAGEMENT STRATEGIES

*What are the most important short, medium and long-term strategies that my community can implement to reduce the risks and impacts of climate change?*

Once communities have a deeper understanding of past and future climate change, potential impacts, local vulnerabilities, and priority risks, they will be in a good position to identify, evaluate and select strategies that will minimize local or regional climate-related risks. Most of these strategies will look familiar.

Where climate change will likely reduce supply, communities can:

- Develop water conservation and/or drought management plans.
- Reduce demand through conservation measures or more efficient water use.
- Expand the storage capacity of existing water supplies.
- Develop new water supplies or retention structures.

Where climate change will have negative effects on Water Quality, communities can:

- Change design capacity of drainage infrastructure such as storm sewers, catch basins, and erosion protection structures.
- Manage rainwater on-site to ease demands on drainage infrastructure.
- Where climate change will negatively affect Other Water and Watershed Values communities can:
  - Protect wetlands and other sensitive habitats.
  - Restore riparian and instream habitat.

Currently, there is no list of “best practices” for adaptation. This is because climate change and its impacts vary from one location to another, and communities vary in their exposure and ability to cope. In addition, vision, values, risk tolerance, priorities, resources, and other factors vary from one community to another, so even those facing similar risks and opportunities may make different adaptation choices. Thus, while many adaptation options are theoretically possible, communities should evaluate to the extent possible the likely local costs and benefits of specific strategies before selecting those they wish to implement.

Where climate change exacerbates existing management challenges, such as water shortages, water use conflicts, protecting water quality and managing natural hazards, consideration must be given to the degree to which climate change is compounding those problems and to how strategies and responses need to be refined to address additional pressures related to climate change. “No regrets” actions that address both current and future risk are particularly popular.







### 3.3 INTEGRATING ADAPTATION INTO WATER AND WATERSHED PLANNING – SOME EXAMPLES

How can my community integrate climate science and adaptation into water and watershed planning to help prepare for, and manage the impacts of climate change?

Minimizing vulnerabilities and managing climate-related risks are only two of a number of criteria considered in water and watershed planning processes.

In many cases, climate change exacerbates existing management challenges, such as water shortages, water use conflicts, protecting water quality and managing natural hazards. Therefore, when adaptation is integrated into water and watershed plans, consideration must be given to the degree to which climate change is compounding those problems and to how strategies and responses need to be refined to address additional pressures related to climate change.

The ways in which adaptation is integrated into water and watershed planning will be influenced somewhat by the scope and detail of a particular plan. For example, if the plan presents broad goals and

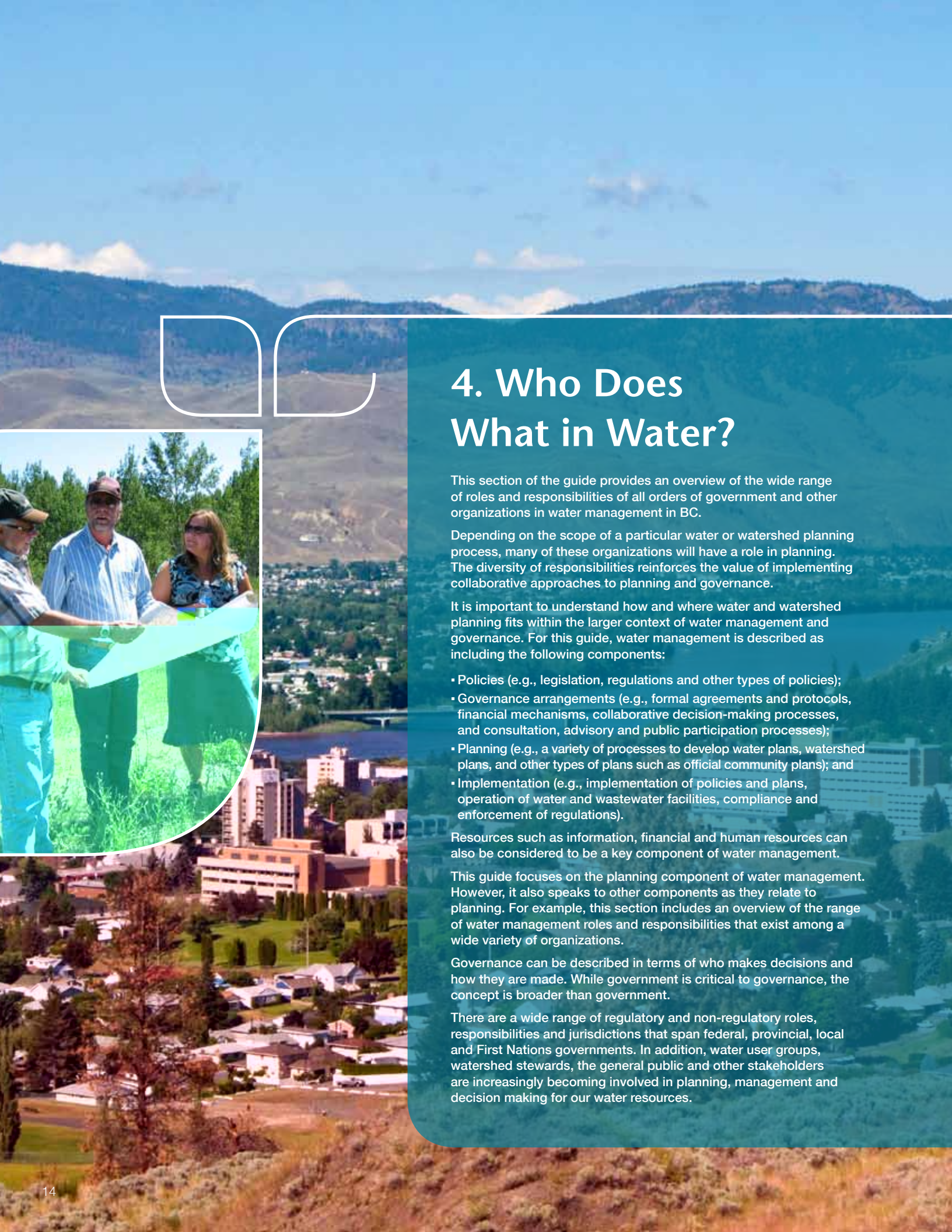
objectives, references to climate change adaptation may be general. However, if very specific targets and strategies are identified, the climate change scenarios, impacts, vulnerabilities and risks should inform those targets and strategies. The following are a few examples of how plans can be informed by considering climate change:

- A water conservation or drought management plan would be informed by future climate scenarios of drought events or water shortages rather than by historical levels of drought (e.g., an increased frequency and severity of drought).
- A stormwater, drainage, or flood management plan would be informed by current hydrological information and by an understanding of how the hydrological regime is anticipated to shift in response to climate change.
- A drinking water protection plan would be informed by information and knowledge about all possible threats to water quality, including climate-related impacts such as increased peak flows and turbidity.

### 3.4 REFERENCES

- <sup>1</sup> Centre for Indigenous Environmental Resources (2010). First Nations Water Security and Climate Change: Workshop Report.
- <sup>2</sup> Intergovernmental Panel on Climate Change. 2007. IPCC Fourth Assessment Report: Climate Change 2007. [www.ipcc.ch/publications\\_and\\_data/publications\\_and\\_data\\_reports.htm#1](http://www.ipcc.ch/publications_and_data/publications_and_data_reports.htm#1) [Accessed November, 2010].
- <sup>3</sup> Kharin, V. V., F. W. Zwiers, X. Zhang & G. C. Hegerl (2007) Changes in Temperature and Precipitation Extremes in the IPCC Ensemble of Global Coupled Model Simulations. *Journal of Climate*, 20, 1419-1444. The summary of future climate change also includes information from the Pacific Climate Impacts Consortium Regional Analysis Tool and Plan2Adapt sites [Accessed October 2011].
- <sup>4</sup> Brown, G., T. van der Gulik, R. Fung, J. Finnie, M. Tanner, and J. Bradley. 2010. Beyond the Guidebook 2010: Implementing a New Culture for Urban Watershed Protection and Restoration in British Columbia. [www.waterbucket.ca/rm/?sid=45&id=642&type=single](http://www.waterbucket.ca/rm/?sid=45&id=642&type=single) [Accessed December 2010].
- <sup>5</sup> Haley, D. and H. Auld. 2000. Integration of Climate Change into Watershed Management. Paper presented at the Ontario Water Conference, Challenges and Solutions, April 2000.
- <sup>6</sup> Centre for Indigenous Environmental Resources (2010). First Nations Water Security and Climate Change: Workshop Report.





## 4. Who Does What in Water?

This section of the guide provides an overview of the wide range of roles and responsibilities of all orders of government and other organizations in water management in BC.

Depending on the scope of a particular water or watershed planning process, many of these organizations will have a role in planning. The diversity of responsibilities reinforces the value of implementing collaborative approaches to planning and governance.

It is important to understand how and where water and watershed planning fits within the larger context of water management and governance. For this guide, water management is described as including the following components:

- Policies (e.g., legislation, regulations and other types of policies);
- Governance arrangements (e.g., formal agreements and protocols, financial mechanisms, collaborative decision-making processes, and consultation, advisory and public participation processes);
- Planning (e.g., a variety of processes to develop water plans, watershed plans, and other types of plans such as official community plans); and
- Implementation (e.g., implementation of policies and plans, operation of water and wastewater facilities, compliance and enforcement of regulations).

Resources such as information, financial and human resources can also be considered to be a key component of water management.

This guide focuses on the planning component of water management. However, it also speaks to other components as they relate to planning. For example, this section includes an overview of the range of water management roles and responsibilities that exist among a wide variety of organizations.

Governance can be described in terms of who makes decisions and how they are made. While government is critical to governance, the concept is broader than government.

There are a wide range of regulatory and non-regulatory roles, responsibilities and jurisdictions that span federal, provincial, local and First Nations governments. In addition, water user groups, watershed stewards, the general public and other stakeholders are increasingly becoming involved in planning, management and decision making for our water resources.





## 4.1 PROVINCIAL GOVERNMENT

Under the Canadian Constitution Act, provinces and territories have primary responsibility for water management, with a number of ministries and agencies sharing responsibility for different aspects of water management. The Province is the lead jurisdiction for setting policy, legislating prices, permitting uses, and managing water sources in BC. Provincial jurisdiction includes public lands, municipal institutions, local works and undertakings, non-renewable resources, property and civil rights, and shared jurisdiction over agriculture.<sup>1</sup> Typically, the Province devolves the responsibility of community-scale water management to municipalities or other local organizations such as water suppliers. In British Columbia, the BC Water Act (administered by the Ministry Forests, Lands and Natural Resource Operations) and the Drinking Water Protection Act (administered by the Ministry of Health) provide the basic regulatory framework for water management. The following are some of the key provincial roles and responsibilities in water management and planning.

### Ministry of Environment (MoE)

The MoE provides leadership for water stewardship and promotes responsible water use, community health and safety, maintenance of terrestrial and aquatic ecosystems, and other priorities. The Ministry applies a stewardship approach based on the principles of integrated water resource management. The Ministry of Environment works in partnership with other agencies (such as the Ministry of Forests, Lands and Natural Resource Operations) to deliver this mandate and ensure the health of the province's water resource. MoE roles include:

- Parks, wilderness and protected areas;
- Air, land and water quality standards;
- Pollution prevention and waste management;
- Species and ecosystem protection policy;
- Water protection and water sustainability policy;
- Water and air monitoring and reporting;
- Conservation and resource management enforcement;
- Climate action secretariat;
- Environmental assessment office;
- State of environment reporting; and,
- Environmental monitoring.

The MoE also provides the following support roles in water stewardship, including:

- Assists with policy and plan development;
- Assists with continual evolution of legislation and policy;
- Develops innovative approaches to water governance;
- Assists with the development of regulatory and non-regulatory tools;
- Leads and reports on living water smart implementation;
- Provides source water protection;
- Provides groundwater monitoring and protection; and,
- Provides water quality and quantity monitoring.

### The Ministry provides information, research and knowledge about BC's water resources:

- Collects water-related data;
- Provides scientific analysis and guidance in support of planning and stewardship;
- Provides forecasts and models to support risk management and decision making; and,
- Collaborates in water science research.

Ministry of Environment branches have responsibilities for protecting and restoring fish habitat, monitoring ambient water quality, permitting activities that affect water quality, monitoring aquifer levels, and enforcing water regulations.

Ministry of Forests, Lands and Natural Resource Operations  
Water-related responsibilities of the MFLNRO include:

- Administering the water act and the water protection act and associated regulations
- Aquaculture licensing and regulation;
- Water use planning and authorizations;
- Aboriginal consultation and coordination—natural resource operations;
- Provincial hatchery and stocking program;
- Watershed restoration;
- Fish, wildlife and habitat management;
- Drought management;
- Dam and dyke safety and regulation;
- Floodplain management;
- Resource management compliance;
- Manages and protects water as a forest resource under the forest and range practices act;
- Integrated land management bureau considers water in regional land and resource planning; and,
- Front counter bc provides clients with information on water licences and approvals and assists with processing their applications.

### Ministry of Health

- Administers the drinking water protection act and associated regulations;
- Mandate for drinking water protection under the drinking water protection act;
- Interagency memorandum of understanding for the protection of drinking water commits all provincial agencies to consider drinking water protection in their statutory decisions and approvals; and,
- Drinking water protection officers have statutory authority to ensure potable water supplies are protected.

### Ministry of Agriculture

- Supports agricultural industry water requirements used in the production of food and agricultural products.

### Ministry of Energy

- Develops energy policy and works to sustainably support industry water requirements.

### Oil and Gas Commission

- Issues approvals for short-term water use and for changes in and around a stream in connection with authorizations for oil and gas development.



## Ministry of Community, Sport and Cultural Development

- Provides water infrastructure and planning funding;
- Supports local government activities under the local government act;
- Assists with the development of regional growth strategies and relations between local government and first nations.

## Ministry of Public Safety and the Solicitor General

- Coordinates response to water-related emergencies such as floods, and provides funding to mitigate hazards.

## Ministry of Aboriginal Relations and Reconciliation

- Leads the negotiation of treaties that consider water as a resource of interest.

## Ministry of Transportation and Infrastructure

- Approves rural subdivision developments, including the assessment of potential risks and obstacles involving water supply and sewage disposal.

## Environmental Assessment Office

- Coordinates the assessment of proposed major projects under the environmental assessment act to ensure they are conducted in a sustainable manner.

In addition to these roles and responsibilities, new provincial plans and policies are emerging. The following are two key developments.

### Living Water Smart:

In June 2008 the provincial government released Living Water Smart: British Columbia's Water Plan. The plan establishes new provincial water priorities to keep our water healthy and secure for the future by taking into consideration the challenging context of water management in BC today. In anticipation of continuing competing demands for water, a growing population, and the effects of climate change on our communities, Living Water Smart outlines 45 new commitments, divided into three categories:

- Doing Business Differently.
- Preparing Communities for Change.
- Choosing to Be Water Smart.

The plan sets specific commitments and targets to help ensure that a finite supply of water (or potentially a reduced supply) will go further without compromising nature's needs. For example:

- By 2012, government will regulate groundwater use in priority areas and large groundwater withdrawals.
- Government will support communities to do watershed management planning in priority areas.
- By 2020, water use in BC will be 33% more efficient.
- Government will improve the quality and protection of drinking water sources.
- 50% of new municipal water needs will be acquired through conservation by 2020.

Many of these commitments and targets will have direct impacts on communities across the province. To help advance these commitments, the plan draws on a variety of policy "tools", including planning, regulatory change, education, and incentives like economic instruments and rewards.<sup>2</sup> See Living Water Smart:

<http://livingwatersmart.ca/> for more information.

### Looking Ahead – Modernizing the *Water Act*

As part of the commitment to Living Water Smart, and in response to new water management challenges including population growth and climate change, the BC Government is looking at ways to modernize the *Water Act*. Initiated in 2008, this significant undertaking is considering new arrangements to address water management challenges in BC, with the following goals:

1. Protect stream health and aquatic environments;
2. Improve water governance arrangements;
3. Introduce more flexibility and efficiency in the water allocation system; and,
4. Regulate groundwater extraction and use.

The initiative has included a public engagement process, distribution of a Discussion Paper, Technical Background Report, and a Report on Engagement. In December 2010, the BC Government released a Policy Proposal on BC's new Water Sustainability Act for public comment. See [www.livingwatersmart.ca/water-act/](http://www.livingwatersmart.ca/water-act/) for more information.

At the time this Guide was published, Government was further refining the proposal and assessing implications. Every effort will be made to update this Guide to reflect any changes to planning related to the Water Sustainability Act if and when it is enacted.

Key policy areas under consideration and relevant to water and watershed planning include:

- Protecting stream health and aquatic environments through the protection of instream flows through enforceable terms and conditions in water licences;
- Establishment of Provincial Water Objectives to guide decisions made by statutory decision makers under the new Act and other laws affecting land and resource use on Crown and private land;
- Regulation of groundwater extraction and use for all large groundwater withdrawals across BC and smaller withdrawals in problem areas. All existing and new large groundwater users throughout the province will be required to obtain a licence or an approval;
- Regulating water during times of scarcity using a staged approach that includes efficiency and conservation measures, priority date and proportional reduction targets;
- Enabling a range of economic instruments, incentives and best management practices to improve water security, water use efficiency, conservation and beneficial use;
- Additional requirements for measuring and reporting on water use;
- Enabling a range of governance approaches to support increased collaboration and participation in activities and decision processes, including the ability to delegate responsibility for activities and decisions to others;



- Water resource assessments that consider available and anticipated water supply and demand, and potential conditions for water use;
- Watershed sustainability plans in areas where degraded watersheds require recovery action and will affect both land and water development and use.

## 4.2 FEDERAL GOVERNMENT

The Constitution Act assigns the federal government a specific set of water management responsibilities, including navigable waters, commercial fisheries and fish habitat, water on First Nations land, transboundary flows, international relations, trade and commerce, agriculture, and federal lands. <sup>1</sup> The federal government also develops water policy. For example, refer to: Federal Water Policy. The following are some of the key federal roles and responsibilities in water management and planning:

### Environment Canada

- Operates hydrometric, climate and water quality monitoring networks in partnership with the provincial ministry of environment;
- Undertakes research on water quality and quantity, watershed management and climate change.

### Fisheries and Oceans Canada

- Administers the fisheries act, which protects anadromous and marine fish habitats.

### Aboriginal Affairs & Northern Development Canada

- Manages water on Indian reserves jointly with First Nation governments.

### Health Canada

- Sets drinking water standards for Canadians.

### Agriculture and Agri-Food Canada

- Conducts research and provides information on water use in agriculture and agricultural impacts on the water resource.

### Transport Canada

- Regulates transportation on water.

### Natural Resources Canada

- Conducts research on groundwater and hydrologic impacts of climate change.

Over the years, the federal government has also had roles in funding infrastructure, including water, wastewater and flood protection infrastructure. In 2011, at the time this guide was completed, these functions were implemented through the Building Canada Fund, administered by Infrastructure Canada.

## 4.3 FIRST NATIONS GOVERNMENT

At present, the roles of First Nations in water planning, management and governance relate to legally assigned responsibilities in the administration of federal water policies, and the management of provincially or federally assigned roles. While Aboriginal rights to water have not been eliminated, and governance (i.e. jurisdiction) of water resources is a goal for many BC First Nations, few if any existing forums formalize Aboriginal rights to, and governance of, water.

First Nations hold more than 700 active provincial water licences for a wide range of purposes associated with Indian Reserves. These licences are held either by a First Nation or jointly by the First Nation and Aboriginal Affairs and Northern Development Canada.

Legally, the protection and provision of water to First Nations is a responsibility of the federal government, specifically Aboriginal Affairs and Northern Development Canada (AANDC). Band Councils, AANDC and Health Canada share responsibilities for providing water services to Aboriginal communities. Band Councils are responsible for ensuring that drinking water systems are run in accordance with the Protocol for Safe Drinking Water in First Nations Communities (developed by AANDC), and for implementing drinking water monitoring programs on reserves. AANDC provides financial assistance for water facilities, and Health Canada works with communities to ensure water quality monitoring programs are in place, trains the monitors, and provides community-based education on water issues.<sup>3</sup> However, concerns about the extent to which the federal government has met these responsibilities

are well documented. Many First Nations have been left with limited capacity to manage water resources, and as a result, their populations are disproportionately vulnerable to water-borne diseases, drinking water advisories and health effects associated with poor water quality. <sup>4</sup>

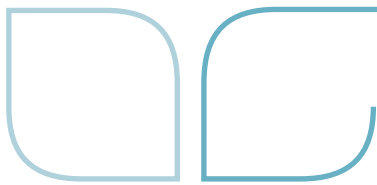
Legally, the provincial government is obligated to consult with First Nations on water use decisions that might affect them. This relationship is defined by the Supreme Court of Canada (e.g., Delgamukw and Haida), and is reflected in the “New Relationship” that was struck in 2005 between the Province and the First Nations Leadership Council. <sup>5</sup>

## 4.4 LOCAL GOVERNMENT

Local governments have significant roles to play in water and watershed management. In BC, local government includes municipalities, regional districts, and improvement districts. In order for local governments to have jurisdiction over specific subjects, they first need authorization from the Province under the Community Charter and the Local Government Act. It is important to note that municipalities and regional districts have somewhat different jurisdictions and procedures. For example, for some water-related functions such as drainage and flood protection, regional districts may need to first establish a specific function and service delivery area following a referendum to confirm (or deny) public consent.

In BC, local governments are gaining more discretionary powers over local matters, as demonstrated by changes to the Community Charter.<sup>6</sup> The following are some of the key local government roles and responsibilities in water management and planning:

- Development and management of municipal water supplies, including treatment and distribution systems. This includes provision of safe drinking water in accordance with the public health act;
- Development and management of municipal drainage and wastewater treatment systems;
- Responsibility for floodplain management under the flood hazard statutes amendment act;
- Delivery of local water conservation programs;
- Responsibility for local land use planning and development on private lands, including the protection and management of riparian areas, wetlands and other sensitive habitats;
- Responsibility for the operation and maintenance of flood protection infrastructure in their local areas; and,
- Water and watershed planning.



Local governments have contributed to water management planning across the province by initiating, managing and participating in various activities related to water management and planning, including:

- Developing water conservation plans and drought management plans;
- Participating in or leading multi-sector water planning initiatives;
- Developing floodplain management plans and strategies;
- Developing liquid waste management plans and integrated stormwater management plans;
- Developing integrated watershed management plans; and
- Developing official community plans and regional growth strategies.<sup>7</sup>

Local governments also promote community and economic development, which has the potential to impact water resources.<sup>8</sup>

In addition to the planning processes listed above (and those discussed in Sections 5 through 7 of the guide), local governments across BC are drawing on other innovative tools and approaches to help protect watersheds and plan for water resources.

#### 4.5 OTHER ORGANIZATIONS

Many other organizations have important roles to play when it comes to water. The following are some of these organizations and their roles and responsibilities in water management and planning:

##### Industry

- Relies on water as a vital component of production; and,
- Develops plans, policies, procedures and practices regarding water use, efficiency and wastewater for individual business operations.

##### BC Hydro

- Is licensed to use the largest amount of surface water in the province, with operations that depend on reliable, carefully managed water supplies;
- Works to reduce the need to expand hydropower operations by encouraging consumer energy conservation; and,
- Develops water use plans, which modify hydropower dam operations to mitigate their impact on downstream fish habitat and other values.

##### Academic Institutions

- Conduct critical research on topics such as water quality and quantity, impacts of climate change, watershed functioning, groundwater and aquifer function, governance policy, demand management; and,
- Provide education and training to future water managers.

##### Professional Associations

- Provide policy advice, planning support, technical support, knowledge sharing and a wide range of services related to water planning, management, and operations (e.g. BC Water and Wastewater Association, the BC Ground Water Association, and the Canadian Water Resources Association, geo scientists, engineers, planners, biologists, geographers and many other professionals.

##### Community Organizations and Individuals

- Provide vital services through outreach, conservation, restoration of source water, and maintenance or restoration of aquatic habitat;
- Are enabled to take greater responsibility for water stewardship through new, collective shared stewardship approaches; and,
- Work to advance sustainability across local and regional watersheds, help resolve stakeholder conflicts and educate the public about water issues.

#### 4.6 MOVING FORWARD IN WATER PLANNING, MANAGEMENT & GOVERNANCE

As will become evident in later sections of this guide, a wide array of planning processes have been developed to assist local governments and other organizations in navigating the challenges of water management. In some regions of the province, significant momentum is building towards collaborative decision-making regarding watershed health in the face of economic and environmental change. As policy makers analyze and adjust management strategies with the current social, political, economic and environmental context, and as managers strategize to resolve conflicts between human and ecosystem needs, communities are learning to live water smart. The outlook is encouraging. In addition to the emergence of a new Water Act for BC, an overarching provincial policy framework presently exists comprised of Living Water Smart and the Green Communities Initiative, two complementary initiatives. Living Water Smart provides the vision of the framework, and the Green Communities Initiative complements the Local Government Act tools to enable the vision. As a package, the framework provides guidance for aligning local actions with provincial and regional goals to *“design with nature”*, in order to create greener communities, live water smart and prepare for climate change. As observed in Beyond the Guidebook 2010, *“BC is now at a tipping point. Implementation of a new culture for urban watershed protection and restoration is within our grasp”*.<sup>9</sup>








#### 4.7 REFERENCES

- <sup>1</sup> De Loë, R.C. (2008). Toward a Canadian National Water Strategy. Final Report. Prepared for the Canadian Water Resources Association. Guelph, ON: Rob de Loe Consulting Services.
- <sup>2</sup> BC Ministry of Environment. (2008). Living Water Smart: British Columbia's Water Plan. [www.livingwatersmart.ca](http://www.livingwatersmart.ca).
- <sup>3</sup> Okanagan Basin Water Board Website: <http://www.obwb.ca> [Accessed March, 2010].
- <sup>4</sup> Water Policy and Governance Group (2010). Water Challenges and Solutions in First Nations Communities: Summary of Findings from the Workshop "Sharing Water Challenges and Solutions: Experiences of First Nations Communities, April 15-16, 2010, Kitchener-Waterloo, Ontario."
- <sup>5</sup> BC Ministry of Environment (2010). British Columbia's Water Act Modernization: Technical Background Report. Vancouver, BC. [www.livingwatersmart.bc.ca](http://www.livingwatersmart.bc.ca).
- <sup>6</sup> Brandes, Oliver, Keith Ferguson, Michael M'Gonigle, and Calvin Sandborn (2005). At A Watershed: Ecological Governance and Sustainable Water Management in Canada. The POLIS Project on Ecological Governance. Victoria, BC.
- <sup>7</sup> BC Ministry of Environment (2010). British Columbia's Water Act Modernization: Technical Background Report. Victoria, BC. [www.livingwatersmart.bc.ca](http://www.livingwatersmart.bc.ca).
- <sup>8</sup> BC Ministry of Environment (2010). British Columbia's Water Act Modernization: Discussion Paper. Victoria, BC. [www.livingwatersmart.bc.ca](http://www.livingwatersmart.bc.ca) (accessed February, 2010).
- <sup>9</sup> Brown, Glen, Ted van der Gulik, Raymond Fung, John Finnie, Mike Tanner, Jay Bradley (2010), ed. Kim Stephens. Beyond the Guidebook 2010: Implementing A New Culture for Urban Watershed Protection and Restoration in British Columbia. <http://www.waterbucket.ca>.



## 5. Managing Water Supply & Demand



There are many diverse pressures and challenges to consider in water supply and demand planning and management. These include (but are not limited to) population growth, community and economic development, infrastructure and asset management, and the need for environmental stewardship.

It is also becoming increasingly important to consider the impacts of climate change when planning and managing water supply and demand. Climate change is having, and will continue to have, far-reaching implications on all aspects of water management.

In Canada, water allocation and licensing decisions are the responsibility of the provincial government. In BC, these responsibilities are administered by the Ministry of Forests, Lands, and Natural Resource Operations (MFLNRO), which issues water licences. MFLNRO balances responsible use, community health and safety, maintaining terrestrial and aquatic ecosystems and other priorities.

Once water licences are issued, the management of water supply and demand becomes largely the responsibility of those that hold the licenses including local governments, First Nations, and other community-scale water suppliers. These groups develop and manage community water supplies as well as treatment and distribution systems. Local and First Nations governments also have roles in developing and implementing various water-related plans and programs. These include strategies to conserve water and manage demand and also to mitigate the impacts of drought. Local governments, First Nations and other water suppliers also participate in, or lead, multi-sector water and watershed planning initiatives. We all use water, so as citizens, farmers, ranchers and countless other businesses and industries that use water, we all share in the responsibilities to manage our water use.

### Types of Water Supply & Demand Plans

This section of the guide profiles four specific types of plans:

- Water Conservation Plans
- Drought Management Plans
- Water Use Plans
- Water Allocation Plans





## Why Plan for Water Supply and Demand?

There are many pressures on watershed that are placing – and will continue to place – pressures on water supply and demand. Common pressures throughout BC include population growth, land use practices, community and economic development, climate change and other changes in ecosystems (such as the Mountain Pine Beetle infestation). Therefore the extent of existing water use requirements and the hydrological characteristics of watersheds are important considerations in managing supply and demand.

BC communities are adopting a wide range of strategies to manage water. Water planning processes can help communities understand challenges by improving knowledge about water supplies and demands including sharing the allocation of water across various human activities and also ensuring that environmental needs (i.e. instream flows) are also met. For a comparison of three water management techniques (supply side, demand management, and the “soft path” approach) see the 2005 POLIS publication *At a Watershed*. These approaches can be especially helpful in managing community conflicts during times of water shortages and drought. The process of water management planning also serves to increase awareness in a community, and stakeholders will be more likely to promote responsible water management practices in their homes, businesses and neighbourhoods.

Water supply, demand and allocation management are primarily about balancing water use. These include human water uses for domestic, agricultural, hydroelectrical, commercial and industrial consumption, as well as natural system water uses to support healthy ecosystems, particularly fish and fish habitat. Good water management can allow for human use without compromising the environment. Desired outcomes of water planning may include:

- Managing water use and consumption rates to account for seasonal and annual changes (e.g. Reducing use in months that are especially dry and in years with lower snowpacks and less recharge of water supplies)
- Managing water use and consumption rates for long term changes in an area, such as climate change and population growth
- Developing and managing water supplies in ways that do not compromise the health and biodiversity of fish, wildlife, ecosystems and watersheds in general
- Managing for recreational non-consumptive water uses, such as swimming, fishing and canoeing
- Managing the future allocation of water in ways that support a variety of high-value water uses, including human consumptive and non-consumptive uses as well as environmental needs.

## Challenges and Pressures

Water supply is a significant issue in many communities in BC and around the world. Water supply is particularly important in regions where supplies may be limited, storage capacity is limited, and/or

water demand is nearing or exceeding water supply. The characteristics of water supply and demand are community specific, and depend on many factors. The following are a few examples of topics and factors to illustrate the range of water supply and demand challenges experienced in communities across BC.

### *Total and Seasonal Population Growth*

Some communities and regions, such as the Lower Mainland, the east coast of Vancouver Island and parts of the Thompson-Okanagan region, are experiencing significant population growth. This growth puts increased demand and pressure on existing water supplies, particularly where supplies are already stressed. Communities that are heavily influenced by seasonal tourism may have unique challenges in managing seasonal fluctuations in demand for domestic use. For example, in Tofino, the population grows 10-fold in the summer because of the significant amount of tourism in the area. This is the same time when the creeks are at their lowest flow-levels.

### *Drought Conditions*

When communities are faced with water shortages or drought conditions, conflicts between different water users may emerge or increase. For example, in 2003, Summerland’s water supply was substantially depleted, which resulted in a significant conflict between the provision of water in streams to ensure fish survival and the provision of water for farmers and food production. In extreme cases, senior levels of government may intervene in water allocation issues. In the spring of 2010, the BC Ministry of Environment used its authority under the Water Act, to change the regulated amount of diversion and use of water, and invoked priority rights in the Chimney Lakes area.

### *Surface and Groundwater Interactions*

Conflicts may also arise between users of surface water and users of groundwater because these sources are often closely linked. For example, excessive withdrawal of groundwater may reduce groundwater contribution to instream flows, particularly in the dry summer months when streams, aquatic ecosystems and other users of surface water are most vulnerable to low flows. Also excessive surface water withdrawal can lead to groundwater sources being depleted, as some aquifers are recharged from surface supplies such as rivers.

### *Aging and Inadequate Infrastructure*

Many BC communities are also facing challenges associated with aging infrastructure, such as inadequate supply capacity or leaky distribution systems. Water infrastructure is very expensive to replace and upgrade, and often water conservation is viewed as a preferable alternative to increasing capacity. Because of the wider infrastructure deficit throughout BC and Canada, water infrastructure – for water supply and distribution, wastewater treatment, drainage and flood protection – has to compete with other types of infrastructure for limited capital funds.



## Climate Considerations

Climate change is impacting, and will continue to impact, many aspects of water supply and management in BC. Reduced annual and seasonal precipitation, reduced snowpacks, loss of glaciers, changing surface and groundwater hydrology, increased drought and increased demand for irrigation are just a few examples. These and other climate-related impacts should be addressed in plans that aim to consider medium to long-term pressures on water supply and demand. The plans should develop solutions for dealing with those pressures. See sections 3 and 9 of this guide for information, tools and resources about climate change impacts on water, related community vulnerabilities and risks, as well as considerations about how climate impacts can be managed through adaptation and water and watershed planning.

### 5.1 WATER CONSERVATION PLANS

Water conservation planning is receiving more and more attention in BC. There is a growing appreciation of the limited availability of water supplies, and an increasing concern about the impacts of climate change on water supply and demand. Water conservation is one of the best mechanisms to manage water demand within existing supplies, and avoid the cost of developing additional supplies. Rainwater harvesting, leak detection and repairs, and greywater recycling are just a few water conservation strategies that can reap significant benefits for communities. Conservation is particularly important in areas that are experiencing population growth, economic development and other changes that lead to increased demand for water.

Water conservation is important in areas where there may be a reduced water supply in the future as a result of climate change.

#### Characteristics, Benefits and Applications

Water conservation plans focus on managing water demand, reducing consumption, and improving efficiency of water use. These plans extend beyond household water savings to include industrial, commercial, institutional and agricultural water users. The plans, are relevant to both surface and groundwater sources.

Water conservation plans can help communities manage the impacts of water shortages that are less severe than drought conditions. These plans can also deliver benefits to communities that are not presently experiencing water shortages. Through conservation, water suppliers can reduce the costs associated with developing new water supplies, drinking water treatment, drinking water distribution, wastewater treatment and associated pumping and energy costs.

Local governments in BC are now required to have water conservation plans to be eligible for

provincial capital grant funding for drinking water and wastewater infrastructure.

Water conservation plans are typically developed at the geographic scale of a community or region. It is important to consider all water users (residential, agricultural, industrial), all water supplies (surface and groundwater) and how these users and supplies interact with, and affect, each other. Therefore, the use of a holistic approach or “watershed eye-view” to water conservation planning is beneficial. This translates into considering entire watersheds in the decision-making process, and integrating all aspects of water management into the plan.

#### Key Elements and Steps

The following are some of the key elements and steps in preparing a Water Conservation Plan:

- Developing a comprehensive community water use profile that outlines the amounts of water used by different sectors (such as household, industrial, agricultural, municipal and other use);
- Forecasting future water supplies and demands;
- Developing a future vision of water use and supply for the community;
- Quantifying and understanding the impacts of different water conservation measures; and,
- Integrating the water conservation plan with other plans (e.g., Regional growth strategies, official community plans, land use plans, transportation plans, integrated community sustainability plans and watershed plans).

The POLIS Project on Ecological Governance is a BC-based organization that has undertaken significant research on water issues and has recently published a guide on water conservation planning.

POLIS characterizes a strong water conservation plan as having:

- At least a 20–50 year time frame;
- A comprehensive and thoughtful rationale for water conservation;
- An integrated approach to water conservation, which is linked to other plans such as wastewater, land use, and asset management plans; and
- An effective implementation strategy.

POLIS characterizes an excellent water conservation plan, as one that goes further to:

- Place ecological health at its core;
- Be tailored to a community's watershed context and consider the community's impact on the watershed;
- Blend innovative legal tools such as water restrictions and land use planning bylaws with practical measures such as rebate and metering programs;
- Make managing demand a part of daily business rather than a stop-gap measure designed merely to buy time needed to increase supply;
- Build in measures that are geared towards rainwater capture and wastewater reclamation, reuse and recycling to better match water quality to end uses;
- Implement outreach and education programs that go beyond information dissemination to engage and inspire citizens to permanently change behaviour; and,
- Use a “triple bottom line” approach to valuing water.<sup>2</sup>

While it may not be possible or practical in all cases for communities to achieve these characteristics, it is important to consider them during the development and implementation of water conservation plans to ensure the plans are effective, comprehensive and successfully implemented.

### 5.2 DROUGHT MANAGEMENT PLANS

The Province of BC defines drought as a period of sustained low precipitation and high evaporation, resulting in low stream flows and groundwater levels, and water shortages.





Significant drought is characterized by particularly low stream flows.

*"In British Columbia, drought may be caused by combinations of insufficient snow accumulation, hot and dry weather or a delay in rainfall. Hydrological drought is associated with the effect of low precipitation on water levels in rivers, reservoirs, lakes and aquifers. Hydrological drought affects uses which depend on ground and surface water levels and stream flows."* –Living Water Smart<sup>3</sup>

BC communities have experienced drought in the past and will continue to do so in the future. Drought is a projected impact of climate change in BC so communities might experience more frequent or severe drought conditions than in the past. Drought circumstances can have profound impacts on the socio-economic and environmental health of communities including agriculture and food. Aquatic ecosystems and fisheries are also affected by drought conditions. When water availability is very low, there can also be concerns about water quality, because pollution levels are relatively concentrated, and more bacteria can survive in warmer water. Lower water availability can also lead to higher costs of water, and restrictions on water use. Water use restrictions can in turn impact business operations, employment, personal use and tourism. There is a strong rationale for undertaking a broad assessment and analysis of overall water allocation in a community or region to help inform the development and implementation of a Drought Management Plan.

### Characteristics, Benefits and Applications

Drought management plans are an important means of minimizing the impacts of water shortages and drought in a region. Similar to water conservation plans, they focus on managing demand, reducing consumption and improving efficiency of water use. Like conservation plans, effective drought management plans need to consider all water uses (including household, industrial, commercial, institutional and agricultural). These plans place an emphasis on reducing water demand but are developed to address the extreme circumstances associated with drought.

Drought management plans are typically developed at the community or regional scale. It is important to consider all uses of a particular water supply such as a watershed or aquifer, and the interactions between water supplies. A watershed-based approach is particularly relevant because a drought event typically affects a large area and all types of water supplies.

A key characteristic of drought management plans is that they identify drought stages and trigger appropriate response actions. The Province of BC uses a four level drought classification (normal, dry, very dry and extremely dry) to describe the severity of drought conditions and appropriate levels of response. Drought management plans develop specific responses to these drought stages and triggers (e.g., limiting lawn watering if a reservoir drops to a specified level).

Drought management plans should be developed before conditions require their use. Because of the potentially severe socio-economic and environmental impacts of droughts, emotions can run very high during these events. Therefore, planning well in advance of a drought will allow more time for thoughtful, rational and comprehensive planning than when a community is already experiencing a drought situation. A proactive approach also enables farmers, ranchers, other businesses, institutions and households to assess the plans in advance of a drought and offer feedback. These groups of stakeholders can also take measures to prepare for the challenges and opportunities associated with implementing drought management and water conservation measures.

### Key Elements and Steps

The Dealing With Drought Handbook – published by the BC Ministry of Environment in 2004 and available online – provides a common template for developing Drought Management Plans. The following are some of the key elements and steps in preparing such a plan:

- Establish a local drought management team;
- Document the membership and operating procedures of the local drought management team.
- Document the water system profile;
- Evaluate the potential impacts of drought on the region's economy;
- Evaluate the potential impacts of drought on the social & environmental well-being of the region;
- Identify data requirements, frequency of data collection and reporting protocols on local water supplies and climate;
- Develop clear definitions of local drought stages and corresponding local responses; and
- Prepare communications plans.

The province of BC has established a Drought Management Framework – refer to Drought Information, for information on:

- Drought Advisories;
- Levels of Water Shortages and Drought Conditions;
- The Provincial Drought Response;
- Individual Drought Response Measures;
- Resources; and
- Snow Surveys and Additional Important Info.

### 5.3 WATER USE PLANS

When it comes to water planning and management, a wide variety of human uses and instream environmental needs must be considered and balanced. Water use planning is one approach to achieving this balance for a specified watercourse, watershed and/or water facility such as a reservoir. To date, Water Use Plans (WUP) have for the most part been associated with waterpower licences that are held by BC Hydro. The Comptroller of Water Rights or other appropriate authorities under the Water Act may require that a WUP be prepared for any existing licence. Expected priorities for the completion of plans are power developments, municipal water systems, and larger-scale industrial operations. WUPs may also be required for other water control facilities where there is an undesirable effect on fish, aquatic habitat, or other important values. While WUPs for existing licences may be required as needs are identified, plans may also be required as a condition of proponents seeking new licences for larger-scale operations (industrial, agricultural, municipal, or other facilities), or for works located on particularly valuable or sensitive streams.



## Characteristics, Benefits and Applications

A Water Use Plan is a formal agreement that clarifies how water will be shared among water licensees while still providing adequate flows for fish and wildlife. A water licensee leads the planning process. The overarching goal of a Water Use Plan is to find “a better balance between competing uses of water, such as domestic water supply, fish and wildlife, recreating, heritage and electrical power needs, which are environmentally, socially and economically acceptable to British Columbians”. As such, Water Use Plans can help resolve conflicts among competing water users. To be effective, the plans need to consider all water uses and water licensees within a specified watercourse or watershed, as well as instream flow requirements for fish and aquatic ecosystems.

A watershed-based approach is particularly relevant because it includes all water uses, including instream environmental flows. The water use planning process has provided valuable information about environmental flow requirements in many of BC's water systems. Water Use Plans may result in an agreement to amend a water license, resulting in a change in legal rights. They can also support water use regulation through voluntary changes to water use within existing water rights. The Guidelines state that if there are financial impacts on the licensee related to a reduction in water rights, compensation for losses will be an important consideration.

The Water Use Plan process could be broadly applied to other licence holders in BC because it has shown “great promise in dealing with conflicts among owners of water licences and non-licensed users of water, such as fish and aquatic resources”. Local and regional governments may also develop Water Use Plans. For example, the District of Summerland in the Okanagan region used the water use planning process for Trout Creek (Summerland Water Use Plan). “Metro is developing a Joint Water Use Plan for the Seymour and Capilano Watersheds. This Water Use Plan is about how the reservoirs and dams are operated, how water is released from the reservoirs and how it is allocated (as examples: drinking water, fisheries habitat, proposed power generation)... The planning process will explore whether and how hydropower generation from existing reservoirs can be accommodated within Metro Vancouver's commitment to: continue to supply clean, safe drinking water, protect fish habitat, adapt to climate variability and climate change. Other community interests such as recreation, culture and heritage, and safety, will be reviewed within the context of the planning process.” (Metro Vancouver Water Use Plan).

To date, all Water Use Plans have been prepared for surface water resources. This type of planning process is unlikely to be applicable to groundwater resources within current contexts. Although the Water Act vests ownership of both surface and groundwater to the province of British Columbia, the Act does not require a licence to withdraw and use subsurface water. However, groundwater regulation is within the scope of the Water Act Modernization initiative. Assessing the role of groundwater resources in maintaining instream flows and related surface water values is extremely complicated. Therefore, Water Use Plans may be an inappropriate or impractical approach to planning for groundwater resources at this time. However, some of the other characteristics and benefits of Water Use Plans could potentially be adapted to plan for and manage groundwater resources. Facilitating collaborative, multi-sector planning to achieve a balance across multiple water users and management goals is a key attribute of Water Use Plans that could be adapted to groundwater strategies.

As of 2010, 24 Water Use Plans had been completed for BC Hydro facilities. For more information on these plans see: Water Use Planning or BC Hydro Water Use Planning [www.bchydro.com/planning\\_regulatory/water\\_use\\_planning.html?WT.mc\\_id=rd\\_wup](http://www.bchydro.com/planning_regulatory/water_use_planning.html?WT.mc_id=rd_wup).

## Key Elements and Steps

The following are some of the key elements and steps in preparing a Water Use Plan:

- Develop the plan in accordance with the provincial water use plan guidelines;
- Ensure the plan is consistent with the water act and the fisheries act;
- Develop the plan through an inclusive, consultative, multi-stakeholder planning process associated with a water act licence, and include local, provincial, federal and first nations governments, local citizens, industrial users, water licence holders and other interest groups;
- Undertake hydrological studies, modeling, and assessments of instream flow requirements to develop a water budget that characterizes water supply and demand within the planning area;
- Define the proposed operating parameters to be applied in the day-to-day operations of hydroelectric or other water storage facilities;
- Under the water act the comptroller's responsibility relates to amending waterpower licences and issuing orders to help implement: “operational changes, monitoring studies and physical works outlined in the plan”; and,
- Implement the plan in accordance with conditions stated in the water licence renewal or amendment, or through an engineers' orders under the water act.

## 5.4 WATER ALLOCATION PLANS

When planning for water allocation, a wide variety of human and ecosystem needs must be identified and balanced. Water allocation planning is an approach to achieving this balance in the future for a specified watershed or for a large water source. For example the Lemieux Creek Water Availability Report - 2004 is a water availability study that is used to some extent as a WAP. It is very important to undertake this type of planning before a watershed approaches its limits of available supply relative to future demands, and before drought or other extreme conditions threaten good relationships between stakeholders.

Water Allocation Plans were first developed on Vancouver Island, as a means to facilitate making water allocation decisions by the Regional Water Manager under the Water Act. WAPs for other regions of the province may follow. See Water Allocation Plans.

## Characteristics, Benefits and Applications

The Ministry of Forests, Lands and Natural Resource Operations (MFLNRO) may lead or provide assistance to the WAP planning process. The plan allows for information about the Ministry's position on water allocation decisions to be made available to future water license applicants and the public. By providing greater clarity, consistency and transparency regarding water allocation decisions,



Water Allocation Plans can help avoid or reduce potential conflicts related to future water licence applications.

Water Allocation Plans are considered regional policy, and the MFLNRO uses these plans while exercising its authority (e.g. issuing water licences) under the Water Act. The plans are operational tools developed and used by the Ministry to help determine the quantity of water required in a watershed to protect ecosystem health, and the quantity of water available to be allocated for human use.

Where developed, these plans have improved the efficiency of making water allocation decisions while protecting environmental flows. The plans have also assisted government agencies and water licence applicants as they ensure that their applications and actions align with environmental laws.

The Shawnigan-Goldstream Water Allocation Plan describes these plans as “a means of anticipating and planning for water uses, identifying water demands and ensuring that water use is compatible with the goals of a sustainable environment.

Advantages of Water Allocation Plans include:

- The provincial government's position on water allocation decisions is available to applicants and the public;
- Response time for a water license application is reduced;
- The need for individual studies and reports on each water licence application is eliminated;
- Decisions are made more consistently, and allocation directions are defined; and,
- There is no need for referrals on individual water license applications.”

As of March 2011, 23 WAPs have been completed and three water management plans have been developed for watersheds on Vancouver and the Gulf Islands. One water availability study (to inform water allocation decisions) has also been completed for a water source

in the Southern Interior. To view a list or to access the plans, visit [www.env.gov.bc.ca/wsd/water\\_rights/wap/index.html](http://www.env.gov.bc.ca/wsd/water_rights/wap/index.html).

To date, all Water Allocation Plans have been prepared for surface water resources. As with water use plans, WAPs are unlikely to be applicable to groundwater resources because of the complexity of groundwater resources and because the Water Act does not presently require a licence to withdraw and use subsurface water. Therefore, Water Allocation Plans may be an inappropriate or impractical approach to planning for groundwater resources. However, some of the characteristics and benefits of Water Allocation Plans, such as area-based planning and consideration of future water demand, can be adapted to plan for and manage the allocation of groundwater resources. In addition, groundwater regulation is within the scope of the Water Act Modernization initiative.

### Key Elements and Steps

The following are some of the key elements and steps in preparing a Water Allocation Plan:

- Planning is initiated by the regional water manager (or equivalent) of the ministry of forests, lands and natural resource operations;
- The planning process is led by ministry staff when a business case has been established that demonstrates efficiencies in making water licence and allocation decisions;
- Assessments are conducted on a watershed basis to identify the available surface water resources, instream flow requirements for fish, existing and potential licensable water demands, and to provide direction regarding future water licence allocations;
- Significant resources may be invested in gathering required water flow information, undertaking assessments, and working with agencies and stakeholders to develop the plan;
- The WAP is submitted to the regional water manager for approval;
- The WAP becomes regional policy upon signature by the regional water manager; and
- The WAP is reviewed when the regional water manager feels that it is appropriate to update or amend the plan.

## 5.5 REFERENCES

- <sup>1</sup> Brandes, O.M., 2005. "At a Watershed: Ecological Governance and Sustainable Water Management in Canada." *Journal of Environmental Law and Practice* 16(1): 79-97.
- <sup>2</sup> Wong, Jennifer, Susanne Porter-Bopp, Oliver M. Brandes, and Liam Edwards (2009). *Water Conservation Planning Guide for British Columbia's Communities*. The POLIS Project on Ecological Governance. University of Victoria. Victoria, BC.
- <sup>3</sup> Province of BC. [www.livingwatersmart.ca/drought/about.html](http://www.livingwatersmart.ca/drought/about.html) [Accessed February 2011].
- <sup>4</sup> Water Sustainability Committee of the BC Water and Waste Association (2004). *Water Sustainability Action Plan for British Columbia: Framework for Building Partnerships*.
- <sup>5</sup> Econnics (2010). *British Columbia Drought Response Plan*. Prepared for the Ministry of Environment on behalf of the Inter-Agency Drought Working Group. [www.env.gov.bc.ca/.../drought.../bc\\_drought\\_response\\_plan\\_fa\\_q\\_june-2010.pdf](http://www.env.gov.bc.ca/.../drought.../bc_drought_response_plan_fa_q_june-2010.pdf).
- <sup>6</sup> BC Hydro Website for Water Use Planning: [www.bchydro.com/planning\\_regulatory/water\\_use\\_planning.html?WT.mc\\_id=rd\\_wup](http://www.bchydro.com/planning_regulatory/water_use_planning.html?WT.mc_id=rd_wup).
- <sup>7</sup> Okanagan Water Stewardship Council (2008). *Okanagan Sustainable Water Strategy, Action Plan 1.0*, Burnaby, BC.
- <sup>8</sup> Rosenau, Dr. Marvin L. and Angelo, Mark (2000). *Water Use Planning: a Tool to Restore Salmon and Steelhead Habitat in British Columbia*. Prepared for the Pacific Fisheries Resource Conservation Council. Vancouver, BC.
- <sup>9</sup> See BC Hydro's website for further details on individual processes in provincial regions, by hydroelectric facility: [www.bchydro.com/planning\\_regulatory/water\\_use\\_planning.html?WT.mc\\_id=rd\\_wup](http://www.bchydro.com/planning_regulatory/water_use_planning.html?WT.mc_id=rd_wup).
- <sup>10</sup> BC Hydro Website for Water Use Planning: [www.bchydro.com/planning\\_regulatory/water\\_use\\_planning.html?WT.mc\\_id=rd\\_wup](http://www.bchydro.com/planning_regulatory/water_use_planning.html?WT.mc_id=rd_wup) [Accessed February 2011].
- <sup>11</sup> BC Ministry of Environment (2010). *British Columbia's Water Act Modernization: Discussion Paper*. Victoria, BC. [www.livingwatersmart.bc.ca](http://www.livingwatersmart.bc.ca) [Accessed February 2010].
- <sup>12</sup> BC Ministry of Environment. 2006. *Shawnigan-Goldstream Water Allocation Plan*. [www.env.gov.bc.ca/wsd/water\\_rights/wap/vi/shawnigan\\_goldstream/shawnigan-goldstream.pdf](http://www.env.gov.bc.ca/wsd/water_rights/wap/vi/shawnigan_goldstream/shawnigan-goldstream.pdf) [Accessed February 2011].



## 6. Protecting Drinking Water Quality



Drinking water in BC communities comes from a variety of surface and groundwater sources.

There are diverse pressures and challenges to be considered when planning and managing for drinking water quality. These include a wide variety of point sources (e.g. wastewater discharges from sewage treatment, commercial and industrial facilities) and non-point sources (e.g. runoff from urban development, agriculture, forestry and other land uses) of pollution. Natural processes, such as flooding, landslides, erosion and sediment transport can also impact water quality with turbidity and water-borne pathogens (such as *E. coli*, *Cryptosporidium*, and *Giardia*). It is also important to consider the impacts of climate change when planning and managing for drinking water in BC.

Healthy watersheds can contribute significantly to clean surface and groundwater sources because healthy watersheds purify water, and vegetated riparian areas filter and process pollutants such as heavy metals, oils, sediment and waste products. Aquatic ecosystems, such as wetlands and rivers, filter water, allow for the deposition of suspended sediments and provide extra storage capacity in times of high precipitation. Natural states of land cover, such as forest ecosystems, also help to naturally manage stormwater runoff and reduce flooding risks, and provide important habitat for fish and wildlife. When the health and functionality of

a watershed is compromised by human intervention, changes to water quality can occur and additional planning and management may be needed.

The primary responsibilities for protecting water quality are shared by all orders of government including federal (departments of Aboriginal Affairs and Northern Development, Environment, and Fisheries and Oceans), provincial (ministries of Health and Environment), regional health authorities, First Nations, municipalities, regional districts, other water suppliers. When you consider the variety of pressures on water quality, we all have roles in the protection of water quality. The roles and responsibilities for drinking water treatment vary across the province, but lie primarily with municipalities, regional districts, or other water suppliers, with oversight by the BC Ministry of Health and Regional Health Authorities.

### Types of Planning for Protecting Drinking Water Quality

This section of the guide profiles three specific types of plans:

- Well (Aquifer) Protection Plans
- Source Water Assessments and Assessment Response Plans
- Drinking Water Protection Plans



Three types of plans may be developed to assist with the protection of water quality in British Columbia. Drinking Water Protection Plans are established under the provincial Drinking Water Protection Act by the government to prevent a substantial threat to water supplies that would result in a health hazard. Also under the Drinking Water Protection Act, an Assessment Response Plan can be required if a Drinking Water Officer, orders a water supplier to prepare an assessment where potential threats to water quality have been identified, that might adversely impact water supply. Well Protection Plans, which may also be a requirement under the Drinking Water Protection Act, are developed to minimize impacts of land use activities on groundwater supplies that are used by community wells. Well Protection Plans can be expanded to the protection of entire aquifers, or perhaps multiple aquifers. For this reason, these plans are referred to as Well (Aquifer) Protection Plans in this guide. Section 7 of the guide explores the scope and value of water, watershed and storm water management plans, which are also relevant to the protection of water quality.

### Why Plan for Protecting Drinking Water Quality?

In anticipation of and/or response to mounting challenges, pressures and changes in their watersheds, it is important for BC communities to plan for protection of their drinking water. Water planning can help BC communities understand and address current and expected challenges by improving knowledge about threats to water quality. Protecting source water and drinking water quality is primarily about ensuring that point and non-point sources of pollution do not adversely impact water for human consumption. Source water includes surface waters, aquifers, or groundwater recharge areas.

For an overview of roles and responsibilities for the protection of drinking water quality see the Ministry of Health website for Drinking Water Quality.

Considerable time, money and effort go into treating water and wastewater to protect water quality for various uses. Recently, attention has turned to the importance of protecting water sources as a fundamental approach to managing water quality. Source water protection seeks to identify means of preventing, minimizing, or controlling potential sources of water pollution. It is the first step in a multi-barrier approach to drinking water protection, which provides benefits on a watershed scale by protecting public health, ecosystem functions, and a variety of social, economic, cultural and spiritual values. Figure 2 illustrates different components of a multi-barrier approach to protecting drinking water. For information on the multi-barrier approach see the Interior Health Authority website on Drinking Water Source Protection and Multiple Barriers of Drinking Water Health Protection.





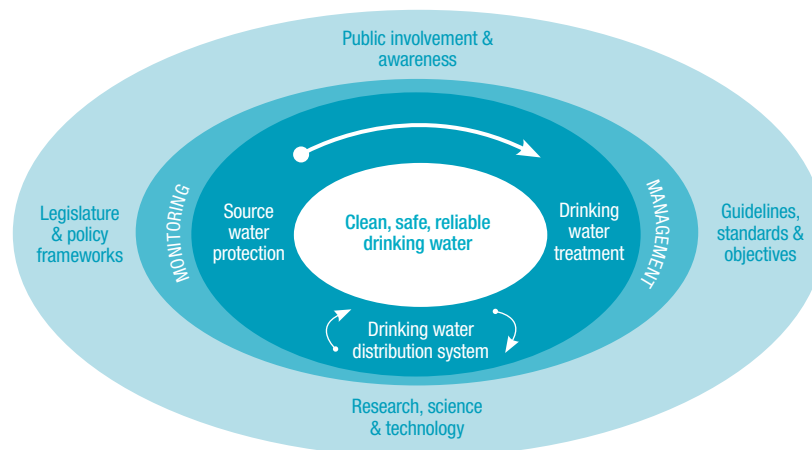


Figure 2. Components of a Multi-barrier Approach to Drinking Water Protection.<sup>1</sup>

In many cases other water uses, such as those related to agricultural, commercial, institutional and industrial operations, are connected to drinking water supplies. In addition, there are many ecological, recreational and other non-consumptive water uses that must be managed along with drinking water supplies. Often, protecting drinking water can have important co-benefits related to environmental, cultural, spiritual and aesthetic values.

Desired outcomes of water quality planning may include:

- Ensuring a safe, secure supply of quality water for a wide variety of uses;
- Ensuring that water supply is robust and resilient to climate change impacts and other factors;
- Managing wastewater discharges to be within the capacity of receiving waters to absorb and assimilate wastes;
- Managing land and resource development practices (and day to day human activities) in ways that maintain and protect water quality;
- Practicing urban and rural development in ways that do not adversely affect natural processes (e.g. Leaving floodplains in natural states and promoting natural functions such as sediment transport); and
- Raising public awareness of the value and importance of fresh water.

Because these planning processes consider threats to water quality, they present opportunities to consider the impacts of climate change along with other pressures on water quality.

Community Watersheds (CWs) are another potential watershed planning unit for consideration in some areas. The province has established 467 CWs in response to the Forest and Range Practices Act, (Government Action Regulation) which provides an added level of protection for water quality in association with forestry operations. However, more research may be required to determine whether there are CWs with completed watershed plans, or there is a desire, capacity and benefits associated with watershed planning at this scale.

## Challenges and Pressures

Water quality is a significant issue in some communities, particularly where there are threats to, or pressures on, community water supplies. In some regions in BC drinking water treatment capacity is limited due to supply issues, and the health of aquatic ecosystems is threatened by point or non-point sources of pollution.

For some local governments meeting provincial drinking water standards is a challenge. All BC Health Authorities are required to meet or exceed the Guidelines for Canadian Drinking Water Quality. The Vancouver Island Health Authority developed its own interpretation of the guidelines with the introduction of the 4-3-2-1 Initiative. This initiative is now used by Health Authorities across BC to ensure compliance. In some communities, compliance with the guidelines will require the installation of new treatment plants, which can be a considerable added cost. Because the pressures on water quality are so diverse, ultimately it is everyone's responsibility to take care of our water resources, including protection of water quality at the source.

### *Boil Water Advisories*

Boil water advisories are issued to residents and other water users when a drinking water source is contaminated or there is a known risk of contamination. Advisories consider the water source, water quality, and distribution and filtration processes. Therefore, the number of boil water advisories issued reflects both the quality of drinking water sources in the area and the adequacy of treatment systems to provide clean water. Over the past decade, the number of boil water advisories in BC has increased. This may be due to several reasons related to actual deterioration of water quality, or greater focus on monitoring and attention to risk. In 2008, the BC Ministry of Health documented 530 boil water advisories. Most of those advisories were on smaller water systems that were serving between 15 and 5000 people.<sup>2</sup>

### *Land Use and Non-Point Sources of Pollution*

Urban, industrial and agricultural activities can pose serious threats to water quality. These land uses are associated with a variety of pollutants including nitrates from manure and synthetic fertilizers applied to agricultural lands, sedimentation from eroding soils and stream banks through urban development, and toxic chemicals from a variety of industrial, commercial and household sources. Development activities near shallow wells or above unconfined aquifers (e.g. aquifers that do not have an impermeable layer above them to protect the water from surface pollutants), increase the risk of contamination, and are of particular concern.

### *Vulnerable Aquifers*

Presently, no permits are required to drill a well or extract well water in BC. This lack of groundwater regulation is a key challenge; however, this may

change with modernization of the Water Act. Drinking water quality concerns may be elevated in communities that rely primarily on groundwater sources. This is because groundwater sources are difficult to clean once contaminated, contamination can more easily occur without anyone knowing about it, and because they require more time for natural recycling and replacement of water than do surface water sources. Therefore, once water quality is degraded, it takes much longer for contaminants to be diluted or removed. This is a concern to communities such as Langley BC, which sources 80% of its drinking water from wells.

### *Source Protection and Upstream Activities*

In many cases, resource-related activities on private and Crown lands, such as forestry, ranching, agriculture and mining, can effect nearby or downstream community water supplies. Often these activities take place "upstream" of community water supplies, and may be outside of the jurisdiction of local or regional governments. Typically, local governments do not have the authority to regulate or stop these resource practices. There is also a limitation of government authority when it comes to agriculture even within local government boundaries. For example, farm bylaws require approval by the Province of BC before coming into effect.

### *Climate Considerations*

Climate change is impacting, and will continue to impact, water quality through a variety of mechanisms throughout BC. Increased frequency and severity of drought and flood events, low summer flows, warmer freshwater temperatures, reduced dilution / assimilative capacity, and increased erosion, turbidity and sedimentation are just a few examples. These and other climate-related impacts should be addressed in plans that consider medium to long-term pressures on water quality. The plans should develop solutions for dealing with those pressures. See sections 3 and 9 of this guide for information, tools and resources about climate change impacts on water, related community vulnerabilities and risks, as well as considerations about how climate impacts can be managed through water and watershed planning as well as adaptation.

## 6.1 WELL (AQUIFER) PROTECTION PLANS

Well Protection Plans can be developed to provide protective measures for minimizing and preventing undesirable impacts from land use activities on subsurface community water sources. Many wells that provide water to communities or municipalities are located in areas where human activities can affect water quality. The impact is most severe where these "community wells" draw water from shallow aquifers that are vulnerable to contamination from land use activities and non-point sources of pollution. Protecting source water through a well protection plan is one of the steps in the multi-barrier approach to drinking water protection. Approximately 40 Well Protection Plans have been established in BC. The Ministry of Environment is the lead agency for the Well Protection Toolkit.

### *Characteristics, Benefits and Applications*

Well or aquifer protection plans focus on protecting groundwater quality from potential pollution sources. These sources of pollution may come from the land above or near to the aquifer or well, or they may infiltrate into the groundwater source from elsewhere. These plans examine water quality threats from a variety of sources, including residential, industrial, commercial, institutional and agricultural land uses as well as natural resource development. Aquifer-wide plans are more likely to be effective and deliver water quality benefits than a plan that is focused on an individual well without looking at the broader connections of multiple wells and pollution sources across an entire aquifer.

In BC, Well Protection Plans may be required under the following circumstances:

- By health authorities when they review an operating permit for a large drinking water system that includes wells;
- By the provincial government as a condition of granting infrastructure funding for new municipal/regional district wells; and,
- As a condition of a provincial environmental assessment for proposed large withdrawals.<sup>3</sup>

Well protection plans are developed for an area that includes the recharge area for a well or aquifer. It is important to consider all land uses and associated threats to groundwater quality. Therefore, the use of a holistic approach to planning is encouraged. A more holistic approach may aim to address multiple aquifers within a region or community and it may also aim to address both quality and quantity issues. Depending on the water and land use pressures, and water-related vulnerabilities, a more comprehensive Groundwater Management Plan may be appropriate in some areas.



## Key Elements and Steps

In partnership with the BC Ground Water Association, the Province of BC published the Well Protection Toolkit, which was updated in 2006. Over the last five years, communities in BC have been using the toolkit to develop protection plans for their wells and aquifers, and to prevent contamination of their groundwater supply. The toolkit presents a six-step approach to developing and implementing a protection plan to prevent well water contamination. The six steps, briefly summarized, are as follows:

1. Form a community planning team;
2. Define the capture zone (recharge area) of the community well or aquifer;
3. Map potential sources of pollution in the capture zone;
4. Develop and implement protection measures to prevent pollution;
5. Develop a contingency plan for any accidents; and
6. Monitor, evaluate and report on the plan annually.

These six steps can be incorporated as a policy commitment into Official Community Plans or as part of Water Management Plans.<sup>4</sup> However, there is some uncertainty about the authority of local governments to invoke the protection measures referred to above, as well as the resource capacity to enforce these protection measures.

## 6.2 SOURCE WATER ASSESSMENTS & ASSESSMENT RESPONSE PLANS

Drinking water source and system assessments are a critical starting point for drinking water protection, and are integral to understanding the state of BC's drinking water supplies, and what needs to be done to improve them. Water providers often do not have any control over land uses in the watersheds from which they get their drinking water. They may not be aware of natural conditions or human activities within a watershed that affect surface and subsurface water quality. Proper assessments can help identify opportunities for preventative or remedial action, and give both the water providers and their customers confidence that source protection is a management priority in the region.

Under Part 3 of the Drinking Water Protection Act, a drinking water protection officer may order a water supplier to complete a water source and system assessment.

The purpose of the assessment is to:

- Assess the drinking water source in relation to land uses within the watershed and activities that may affect the source;
- Inventory the water supply system, including treatment options and operational procedures;
- Assess the monitoring requirements for the drinking water source and water supply system; and;
- Identify current and potential future threats to drinking water.

The Ministry of Health has produced both the Source to Tap Screening Tool, which can be used as a secondary method for assessing risk in drinking water systems, and the Comprehensive Drinking Water Source-to-Tap Assessment Guideline, which serves as a tool to help water system managers develop a better understanding of the risks to drinking water safety and availability. The guideline provides a structured and consistent approach to evaluating and managing risks to drinking water. The outcomes of a Source Water Assessment determine whether or not an Assessment Response Plan is required.<sup>6</sup>

## Characteristics, Benefits and Applications

After reviewing a completed source and system assessment, a drinking water protection officer may order a water supplier to complete an Assessment Response Plan, as outlined under Section 22 of the Drinking Water Protection Act. These plans are intended to identify measures that can be taken to address identified threats to drinking water.

Currently, the regulations do not state when source water assessments will be required; however, the Drinking Water Officer's Guide outlines some of the conditions under which an assessment may be required. It is not yet clear what role, if any, the public will have in this process.

## Key Elements and Steps

Assessment Response Plans are intended to identify reasonable measures that can be taken to address threats to drinking water, as identified in a Source Water Assessment. Some of the provisions that a drinking water protection officer may ask to be addressed in the plan include:

- Increasing public engagement and awareness to encourage the protection of drinking water sources;
- The preparation of guides relating to best management and conservation practices;
- Minor or major infrastructure improvements;
- The initiation of cooperative planning and/or voluntary programs related to water conservation; and
- Recommendations regarding local authority zoning and/or land use regulations.<sup>1</sup>

## 6.3 DRINKING WATER PROTECTION PLANS

Drinking Water Protection Plans (DWPPs) are designed to protect water quality and quantity from a wide range of pressures. The plans are typically developed for a specific source of drinking water supply, such as a watercourse, watershed, reservoir or aquifer. Therefore, they are relevant to area-based planning for both surface water (watersheds) and groundwater (aquifers), where the threats to water quality and quantity are dispersed across a wide landscape. Within these plans, it is important to consider all potential threats to the water source; therefore, a watershed-based approach – at the appropriate scale – is particularly relevant.

As of 2011, no DWPPs had been completed or designated in BC. They are considered to be a last resort because of the stringent requirements associated with them, and should only be considered where it can be established that regulatory tools are required to achieve the planning objectives. DWPPs should only be required when other plans fail to address or prevent a threat to drinking water. However, there are circumstances where threats to drinking water could lead to negative consequences (such as a health hazard) where no other measures under the Drinking Water Protection Act would prevent the health hazard from occurring.

## Characteristics, Benefits and Applications

DWPPs are authorized under Part 5 of the Drinking Water Protection Act and are intended to address concerns about water quantity and water quality. Based on the recommendation of a drinking water protection officer, the Provincial Health Officer may recommend that the Minister of Health designate an area for a DWPP. Drinking

water protection officers are required to consider all other options available under the Drinking Water Protection Act before asking the Provincial Health Officer to consider recommending a plan. To date, no plans have been completed. However, the creation of a Drinking Water Protection Plan has been under consideration for the Comox Valley on Vancouver Island for the past two years. For such plans to be authorized, there would have to be significant impairments to source waters, and an associated health hazard to trigger a planning effort.

Because they are fairly comprehensive, DWPPs have the potential to be very powerful and effective. They can consider threats to water sources, different methods of treatment, and all matters related to the delivery of safe drinking water. DWPPs are similar in scope to Water Management Plans, which are established under Part 4 of the Water Act (see Section 7 in this guide). Because there is potential for the two types of plans to overlap, the Drinking Water Protection Act and Water Act state that if both types are to be initiated within one particular area, they can be developed jointly.<sup>3</sup>

### Key Elements and Steps

Drinking Water Protection Plans are issued by the provincial government (the Lieutenant Governor with advice from Cabinet) to do one or more of the following:

- a) Require other specified provincial government or local authority strategic or operational planning processes, or classes of such processes, to consider the DWPP;
- b) Require the results of specified provincial government or local authority strategic or operational planning processes, or classes of such processes, to be consistent with the DWPP;
- c) Provide that specified provincial government or local authority strategic or operational plans, bylaws, or other planning documents, or classes of such plans, bylaws, or other documents do not have legal effect to the extent of any inconsistency with the DWPP; and
- d) A provision under subsection (1) c) applies despite any other enactment.

Some of the key elements and steps in preparing a Drinking Water Protection Plan are as follows:

- A Provincial Health Officer triggers initiation of the plan, and the plan is customized to address the specific water health hazard identified by the Officer;
- The plans are initiated, and have their terms of reference established by an order issued by the Minister of Health;
- The plans are required to consider existing provincial or local government planning processes. These may include strategic, operational, land use or water use plans;
- Preparation of the plans must include an extensive public consultation process;
- The plans are subject to review by the provincial Cabinet and approval by an order of the provincial Cabinet;
- Water suppliers are legally responsible for putting the plans into action; and
- They are implemented through regulatory actions, which are legally enforceable.

## 6.4 REFERENCES

- <sup>1</sup> Okanagan Water Stewardship Council (2008). Okanagan Sustainable Water Strategy: Action Plan 1.0. Coldstream, BC.
- <sup>2</sup> Eggertson, L. (2008). Investigative Report: 1766 Boil-Water Advisories Now in Place across Canada. Canadian Medical Association Journal. [www.ncbi.nlm.nih.gov/pmc/articles/PMC2335191/](http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2335191/) [Accessed February 2011].
- <sup>3</sup> Okanagan Basin Water Board (2009). Groundwater Bylaws Toolkit: an Appendix to the Green Bylaws Toolkit. Kelowna, BC.
- <sup>4</sup> Ministry of Environment, Water Stewardship Division website: [www.env.gov.bc.ca/wsd/plan\\_protect\\_sustain/groundwater/wells/well\\_protection/wellprotect.html](http://www.env.gov.bc.ca/wsd/plan_protect_sustain/groundwater/wells/well_protection/wellprotect.html) [Accessed May 2010].
- <sup>5</sup> BC Ministry of Environment, Lands and Parks (2001). Drinking Water Protection Plan – a Discussion Document. Victoria, BC.
- <sup>6</sup> BC Ministry of Health Services website: [www.health.gov.bc.ca/protect/source.html](http://www.health.gov.bc.ca/protect/source.html) [Accessed February 2011].
- <sup>7</sup> BC Ministry of Healthy Living and Sport (2007). Drinking Water Officers' Guide. Prepared by the Drinking Water Leadership Council. [www.health.gov.bc.ca/protect/dwoguide\\_updated\\_approved%202007.pdf](http://www.health.gov.bc.ca/protect/dwoguide_updated_approved%202007.pdf).
- <sup>8</sup> West Coast Environmental Law (2009). The BC Guide to Watershed Law & Planning. <http://watershedguide.wcel.org/> [Accessed February 2010].
- <sup>9</sup> Nowlan, Linda and Karen Bakker (2007). Delegating Water Governance: Issues and Challenges in the BC Context. A paper for the BC Water Governance Project. Vancouver, BC: UBC Program on Water Governance.

## 7. Integrating Water, Land & Watersheds

There are many diverse pressures and challenges on water resources and watersheds in BC.

In this section, we examine the full spectrum of water and watershed issues and explore the value of adopting an integrated approach to planning and management. The context for integrated planning includes the breadth of issues that were raised in sections 5 (water supply and demand) and 6 (protecting drinking water quality). In addition, integrated watershed planning considers issues related to watershed functions, ecosystem health, connections between land use and water, as well as water quality within lakes, rivers and streams.

The challenges and pressures associated with watershed health include population growth, community and economic development, and a wide variety of point and non-point sources of pollution. It is also becoming increasingly important to consider the impacts of climate change when developing planning processes, implementing those plans and making water management decisions.

As noted in section 6, healthy watersheds, riparian areas, wetlands, floodplains and natural land covers such as forests provide important habitat for fish and wildlife, help to filter and process pollutants, slow water down, reducing stormwater runoff and flooding while allowing for the deposition of suspended sediments. When the natural functioning of a watershed is compromised by human activities, integrated approaches to water and watershed planning can be helpful, and may well be necessary.

The responsibilities for protecting watershed health and the interconnections between water quantity and quality are widely distributed among federal, provincial, First Nations, and local governments, and other organizations. In many BC communities, the challenge of navigating highly complex water and land use issues is pointing to the need for an integrated and collaborative approach to watershed planning and governance. Integrated planning involves a broad-based analysis of local and regional water quantity, water quality and other watershed issues, as well as the interconnections between these issues.


### Types of Integrated Water & Watershed Planning

The following planning processes encourage more integrated and holistic approaches and can help to address a variety of water supply, demand, and quality issues, and include:

- Water Management Plans (Water Act, Part 4)
- Watershed Management Plans
- Stormwater (Rainwater) Management Plans







## Why Undertake Integrated Planning for Water, Land and Watersheds

BC communities are undertaking integrated watershed planning and are adopting a wide range of strategies to manage a multitude of current and future challenges, pressures and changes in watersheds. Many of these pressures may be effectively addressed within plans that recognize the interconnections within a watershed system, including:

- surface water and groundwater connections;
- water quantity and quality connections;
- land and water connections; and
- community and watershed connections.

Watershed planning can help BC communities understand and address these challenges by improving knowledge about the current and future threats to water quantity and quality for human and environmental uses, and threats to overall watershed health and community sustainability.

The desired outcomes of integrated planning for water, land and watersheds may include:

- Managing water uses and rates of consumption within available water supplies seasonally, annually and over the long term;
- Developing and managing water supplies in ways that do not compromise the health and biodiversity of fish, wildlife, ecosystems and watersheds;
- Managing the allocation of water in ways that support a variety of high-value water uses, including human consumptive and non-consumptive uses as well as instream environmental uses;
- Ensuring a safe, secure supply of water for a wide variety of uses;
- Managing wastewater discharges within the capacity of receiving waters to absorb and assimilate those wastes;
- Managing land development and resource management practices (and day to day human activities) in ways that do not adversely impact water quality;
- Managing human development patterns in ways that stabilize rather than destabilize the hydrologic cycle;
- Managing human development patterns in ways that reduce rather than increase the vulnerability of communities to water-related hazards, such as flooding and erosion; and,
- Maintaining and strengthening community resiliency by preparing for climate change and its impacts on water and aquatic ecosystems.

## Challenges and Pressures

Integrated water and watershed planning is important in communities, particularly where there are multiple threats to, or pressures on, the quantity and/or quality of community water supplies, where infrastructure capacity

is limited in relation to those threats, and where the health of aquatic ecosystems is threatened by multiple pressures on water quality or quantity. Depending on the community or region of the province, and on land and resource uses, climate change impacts and planning can influence these issues in a variety of ways. The following are a few examples of the challenges experienced in communities across BC where integrated approaches to planning may be beneficial or necessary.

### *Growing Demands on Limited Water Supplies*

A variety of land and water uses can impact water supply and demand, stream hydrology, groundwater tables, surface and groundwater quality, and the overall health of watersheds. For example, in the Township of Langley, multiple community wells and private wells withdraw water from the same aquifer. Managing demand within the available supply requires an integrated approach to understand the complexity of the challenges associated with water use and groundwater recharge, particularly in relation to population growth, economic development and climate change impacts.

### *Changes in Land Use and Land Cover*

In many communities across BC, changes in land cover due to activities such as forestry, and increased imperviousness as a result of urban development can result in more “flashy” stream and river hydrology and increased rates of erosion and sediment transport. For example, in watersheds with reduced forest cover or increased impervious surfaces, a greater proportion of rainfall quickly enters storm sewers, drainage ditches and streams, resulting in high peak flows and less groundwater infiltration. In the Central Interior of BC, the mountain pine beetle (MPB) outbreak has resulted in many dead, standing trees, significant salvage logging, and forest fires, all of which have dramatically impacted hydrology, erosion and sedimentation, aquatic habitat, and overall watershed health. Many see the MPB outbreak as being caused or exacerbated by climate change because average winter temperatures have warmed. Historically, cold winters have kept mountain pine beetle populations in check in BC, thereby preventing a significant outbreak. Over the long term, forest cover may return to more natural conditions and watershed health may recover; however, in the interim, communities may need to manage the impacts associated with these pressures. In the case of urban development, human intervention may be required to restore watershed health. With respect to the effects of BC’s MPB infestation on hydrology note the 2008 Ministry of Environment report: Mountain Pine Beetle Infestation: Hydrological Impacts.

### *Climate Considerations*

Climate change is impacting, and will continue to impact, many aspects of water, land and watersheds in BC. Some of the most significant impacts on watersheds expected from climate change include reduced annual and/or seasonal precipitation, reduced snowpack, loss of glaciers, changing surface and groundwater hydrology, increased frequency and severity of drought and flood events, low summer flows, warm freshwater temperatures, reduced dilution / assimilative capacity of receiving waters, and increased erosion, turbidity and sedimentation. These and other climate-related impacts should be addressed in plans that aim to consider medium to long-term pressures on water quantity, quality, and ecosystem health. The plans should develop solutions for dealing with those pressures. See sections 3 and 9 of this guide for information, tools and resources about climate change impacts on water, related community vulnerabilities and risks, as well as

considerations about how climate impacts can be managed through adaptation and water and watershed planning.

The need for a watershed approach is made even more evident when compounded by current and expected impacts of climate change. For example, the Okanagan, Thompson and Cariboo-Chilcotin regions can expect hotter, drier summers; extended growing seasons with the potential for new crop production; and increased demand for irrigation and livestock watering. Because this will occur when stream flows are at their lowest and when fish are particularly vulnerable, this may lead to increased levels of conflict among water users.

Because all three planning processes profiled in this section (water management, watershed management and stormwater management) may consider existing and future watershed processes and functions, they provide opportunities to consider climate change and its impacts, as well as other pressures, on watershed health. It should be noted that although this guide focuses on planning and climate change adaptation for water and watersheds, climate change impacts will undoubtedly have a variety of other impacts on terrestrial ecosystems such as forests, grasslands and alpine ecosystems. These impacts on the landscape will, in turn, influence the health of watersheds. However, these land-based climate impacts are beyond the scope of this guide.

## **7.1 WATER MANAGEMENT PLANS (WATER ACT – PART 4)**

Water Management Plans, which were introduced under Part 4 of the Water Act in 2004, involve a comprehensive and integrated approach to water and watershed planning. This planning process is enabled only if the Minister of Environment determines that such a plan will help resolve conflicts between water users, conflicts between users and instream flow needs, or risks to water quality.

Although the Township of Langley has completed the draft of a WMP, to date there are no approved WMPs in effect in British Columbia. Therefore, the operational compatibility of this planning tool with other Acts and regulations cannot be fully determined, nor can its effectiveness in improving water quality. However, it has been suggested that Water Management Plans hold potential as a mechanism for protecting groundwater, as well as for establishing authority for source water protection. Unlike other water planning tools, when Water Management Plans are implemented, they can place restrictions on the drilling or alteration of groundwater wells and the installation of well pumps. The plans may also affect other statutory decisions. However, there may be exceptions where the application of a WMP could be limited such as the Forest Act, Range Act, Forest Practices Code of BC Act, and the Forest and Range Practices Act.<sup>1,2</sup>

Water Management Plans may provide a good structure for developing valley-wide response plans

for severe water shortages because they provide more authority to bring water licence holders to the table and hold them to the agreements that have been developed. The plans may also be useful for providing water managers with tools to reduce activities and development in watersheds, thereby addressing the common challenge of managing water resources on private as well as Crown lands. In 2009, the Township of Langley submitted a Water Management Plan: Final Report to the Minister of Environment for review. As of 2011, TOL is the only local government that has been designated by the Minister of Environment to do so.<sup>2</sup>

## **Characteristics, Benefits and Applications**

Water Management Plans are applicable to both water quantity and quality issues. In this regard, they are relevant for source water protection and for managing demand in relation to water supply. They may also be relevant to both surface water and groundwater sources.

Water Management Plans are also relevant for area-based planning. They apply to a designated water management plan area where the water interests are dispersed across a wide landscape and where many water licensees, groundwater users and land-based activities may be included in the plan. A Water Management Plan could apply to a watershed, aquifer, or another regional scale that is relevant to managing the water resources of a particular community.

Water Management Plans should be considered where regulatory tools are required and will provide an opportunity to achieve the planning objectives. Upon completion and approval by the provincial Cabinet, Water Management Plans are legally enforceable. However, significant resources may be required to develop and implement this type of plan. Therefore, this approach to planning may not be feasible for some communities.

Water Management Plans are similar in scope to Drinking Water Protection Plans, which are established under Part 5 of the Drinking Water Protection Act (see Section 6 in this guide). Because there is potential for the two types of plans to overlap, the Drinking Water Protection Act and Water Act state that if both types are to be initiated within one particular area, they can be developed jointly.

## **Key Elements and Steps**

The following are some of the key elements and steps in preparing a Water Management Plan:

- The plans are requested by letter to the regional water manager or to the comptroller of water rights;
- The plans require an assessment of preparedness among stakeholders, first nations and the province;
- The plans are initiated & have their terms of reference established by an order of the minister;
- The plans are required to consider existing provincial or local government strategic, operational, and land use or water use planning processes;
- Preparation of the plans must include an extensive public consultation process;
- Consideration must be given to the results or progress of provincial or local government strategic, operational and land use or water use planning processes within the designated area;
- The plans require approval by an order from the provincial cabinet to acquire official status;
- The plans are brought into effect by the creation of a regulation that is designed to implement the plan, approved by the provincial government by the lieutenant governor with advice from cabinet; and,
- The plans are implemented through regulation (the plan implementation regulation) issued by the lieutenant governor in council.

## **7.2 WATERSHED MANAGEMENT PLANS**

A watershed planning approach is a flexible framework for managing water resource quality and quantity within a specific drainage area, or watershed. The approach includes stakeholder involvement and management actions that are supported by sound science and technology. The watershed planning process works within this framework by drawing on a series of collaborative, iterative steps to characterize existing conditions, identify and prioritize problems, define management objectives, develop protection or remediation strategies, and implement and adapt selected actions when necessary. The outcome of this process is a watershed plan, which is a strategy that assesses the state of a watershed and presents detailed management information in terms of analyses, actions, participants and resources required for developing and implementing the plan. Using a watershed approach is considered beneficial because it addresses problems within a watershed in a holistic manner and actively involves stakeholders in identifying management strategies.



BC has no formal requirements or stipulations for undertaking watershed planning processes beyond the provisions under the Water Act to develop a WMP, with approval from the provincial government. There is no standard template to follow. Nonetheless, many communities across the province have taken the initiative to complete watershed management plans by developing their own approach to address key concerns in their respective watersheds.

### Characteristics, Benefits and Applications

Every watershed is unique in terms of its features, and every watershed planning process is unique in terms of the issues being addressed and the people involved. Across the province, watershed management plans take different names and different forms, including watershed strategies, watershed blueprints, watershed recovery plans and water use management plans. Despite these differences, several traits are shared by most watershed planning processes. Typically, watershed planning is:

- An iterative and adaptive process;
- A holistic process;
- Geographically defined;
- Integrated with other planning processes; and
- A collaborative and participatory process.<sup>4</sup>

Conversations with local governments and BC communities suggest that many critical factors work together to enable a watershed-based approach to planning. These include:

- A burning issue within the watershed that demands attention (e.g., Water health issue, community conflict);
- An awareness and recognition of the importance of watersheds
- An understanding of a variety of planning issues;
- A political will that aligns with staff capacity and commitment;
- A willingness to work with neighbouring municipalities in shared watersheds (where appropriate);
- A designated body to coordinate the effort (e.g., Regional district, Okanagan basin water board), with funding from participating municipalities;
- A strong stewardship ethic within the community; and
- A watershed that is at a scale that is practical and reasonable to work with.

### Key Elements and Steps

There is no absolute template to follow for watershed planning. Every planning process and every plan is different. However, many elements are critical to the success of watershed plans. Recommended guidelines for watershed planning processes include the following:

- Develop a clear vision, goals, objectives and action items;
- Seek political endorsement. The relevant decision makers must be willing to consider implementing the plan;
- Ensure full representation of all affected parties, while keeping the size of the process workable;
- Ensure that the planning process is understood, used and broadly supported;
- Provide access to appropriate technical and analytical skills and information resources;
- Obtain sustainable funding;
- Ensure planning is done before further development activities (e.g. urban development) will undermine the effectiveness of the plan;
- Factor in the impacts on future water inflows and recharge of climate change and activities and physical works that intercept water (e.g., farm dams and forestry);
- Include inputs from socio-economic analyses and incorporate consultation to improve the quality of decisions and build community confidence in the fairness of outcomes;
- Ensure that the values and interests of indigenous peoples are considered;

- Develop capacity for learning and improving plans over time and the ability to evaluate the process;
- Provide adequate resources to develop and implement water plans and evaluate their outcomes; and,
- Improve monitoring and compliance of water use.

Ideally, watershed plans and the organizations involved in implementing the plans should emerge from the planning process with:

- improved understanding of the watershed and how it functions;
- clear objectives of how to manage the watershed sustainably and in an integrated manner;
- clearly specified community and environmental outcomes;
- decisions that are based on the best available information;
- adequately resourced management and implementation; and
- good integration with other regional and resource-based plans.<sup>5</sup>

It should be acknowledged that many of these elements, steps and outcomes could also support or strengthen any and all of the other planning processes profiled within this guide.

Because of the complexity of watersheds, including the diversity of interconnections and dynamic change over time, an iterative process is recommended for watershed management planning. The following figure from the U.S. Environmental Protection Agency illustrates this (Figure 3).

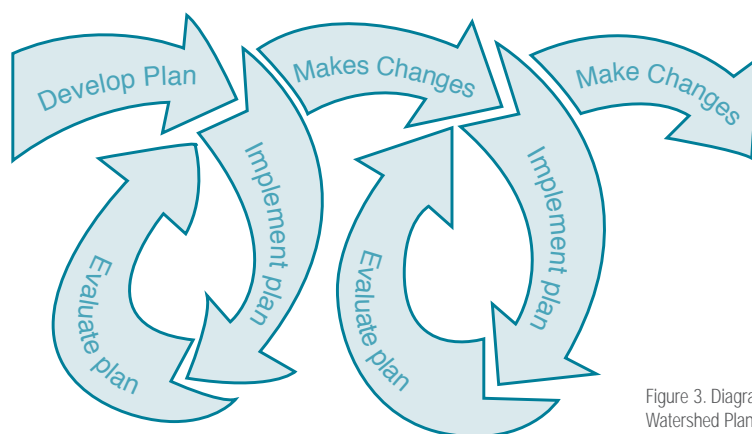


Figure 3. Diagram of the Watershed Planning Process.<sup>4</sup>

### 7.3 STORMWATER (RAINWATER) MANAGEMENT PLANS

Another important aspect of water and watershed planning is the management of rainwater or stormwater. All communities in BC are subject to rainfall events and need to provide adequate drainage to prevent localized flooding. It is widely recognized that urban development can increase impervious surfaces, impacting the hydrology of local streams. Rural resource activities such as forestry can also influence land cover, and thus impact, hydrology.

Projections of increased stormwater runoff as a result of climate change and urban development have led some municipalities to seek additional funds for infrastructure upgrades, while other communities are examining alternative approaches to managing rainwater. In addition to, or instead of, building bigger pipes, ditches and pumps to convey water from bigger storms, some communities are taking the approach of “store it, spread it, and sink it”. Rainwater and stormwater can be viewed as a valuable resource that can be stored in wetlands and detention ponds and infiltrated into the ground to recharge water tables. This can reduce or avoid many of the economic and environmental costs associated with the traditional model of conveying rainwater as quickly as possible from roads, rooftops and parking lots into storm sewers, drainage ditches and streams. Urban stormwater runoff can adversely impact stream hydrology, fish habitat and watershed health by eroding stream banks, by causing water turbidity and siltation of spawning and rearing habitat, and by introducing other pollutants, such as oil from roads, into the system.

Under the Local Government Act, municipalities are responsible for the provision of drainage, and in some cases, Regional Districts may also have associated responsibilities. How we handle stormwater has a huge impact on aquatic ecosystems. Integrated stormwater management planning is a proactive process that utilizes land use planning tools to protect property and aquatic habitat from stormwater flows, while at the same time accommodating urban growth. Ideally, the aim of these plans is to ensure that stormwater runoff resembles natural runoff patterns (i.e., volume and timing of surface water runoff), and does not transport pollutants or sediment from the land into watercourses. Stormwater management plans are typically completed at the local government level, with guidance from the Province.<sup>5</sup>

BC’s Stormwater Planning Guidebook, released in 2002, is premised on the idea that land development and watershed protection can be compatible. It assumes that municipalities exert control over runoff volume through their land development and infrastructure policies, practices and actions.

Integrated Stormwater Management Plans (ISMPs) are required to be developed and implemented by Metro Vancouver’s member municipalities in accordance with the Integrated

Liquid Waste and Resource Management Plan. To help facilitate this, Metro Vancouver developed a comprehensive ISMP Template (consistent with the provincial guide) to guide member municipalities with this process. The updated LWMP is pending approval from the Minister of Environment.

Outdated approaches to stormwater management, which fail to respect natural systems and water cycles, have been accused of being one of the largest water pollution challenges in the province. In recent years, rainwater management has emerged as a new way of thinking about the precipitation that falls on the land. Instead of viewing stormwater as a site-specific problem that is best solved by piping water away from properties into streams, rainwater management considers the dynamics of the entire watershed and identifies how development can use “green infrastructure” to maintain natural systems and protect buildings. Green infrastructure is a concept that emphasizes the importance of the natural environment in decisions about land use planning. For example, the installation of permeable pavements, rain gardens, bioretention ponds and constructed wetlands help reduce the volume of runoff that enters sewer systems and increase absorption. Instead of relying heavily on pipes and concrete, green infrastructure takes advantage of the natural absorption, storage, evaporation and filtration services that nature provides. As opposed to the quick, high-impact flush that comes with traditional approaches to stormwater management, lower impact green development seeks to mimic the natural water cycle by allowing water to infiltrate down through the ground and slowly release into the watershed.

The release of *Beyond the Guidebook: Context for Rainwater Management and Green Infrastructure in British Columbia* in 2007 has helped shift the focus of traditional stormwater management to the integrated, holistic approach that rainwater management embodies.

Climate change—and in particular the potential for more frequent and more intense extreme precipitation events—is an important consideration in this type of planning. Urban flooding is now the leading cause of home insurance claims in Canada, and is a priority of the insurance industry. For more details refer to *Hazard Perceptions: Public Education Can Help Snap Flooding*, from the Institute for Catastrophic Loss Reduction. There is limited science on which to base projections for a specific location; however, some jurisdictions have identified voluntary planning contingencies for extreme precipitation based on the best science available. For example, on Vancouver Island, the Capital Regional District has identified a planning contingency of a 15% increase in frequency and duration of winter storms for the next 100 years. These contingencies should inform decisions about which stormwater management techniques to adopt and what the management goals should be in terms of rate of runoff.

#### Characteristics, Benefits and Applications

Under the Environmental Management Act (Municipal Sewer Regulation), stormwater management planning is a formal requirement of Liquid Waste Management Plans, which is one of several mechanisms used by the Province to regulate stormwater in BC. Although municipalities are generally not required to have Liquid Waste Management Plans, they often opt to complete such plans because the plans allow a suitable length of time to develop and implement effective and affordable solutions.

The outcome of integrated stormwater planning includes regional or watershed level objectives and priorities, integration of these objectives into community planning, and implementation of on-site practices that reduce volume and rate of run-off and improve







water quality. Stormwater management plans need to be integrated with Official Community Plans and zoning bylaws that regulate the location of development and density of use.<sup>5</sup>

Some benefits of undertaking stormwater management planning and implementing completed plans include:

- Protection of the aquatic environment, including water quality and stream flow, and protection from flooding;
- Protection of community assets and infrastructure from localized flooding;
- Protection of water supply (e.g., groundwater recharge areas);
- Management of erosion and sedimentation processes; and
- Protection of aesthetic values and recreational uses of water.

### Key Elements and Steps

The Stormwater Planning Guidebook provides a detailed explanation of the various stages of preparing a plan. It outlines three key steps and associated methods that work towards integrated stormwater management solutions, and five guiding principles to uphold in the process, as outlined below. They include the following:

#### *Stormwater Planning Steps*

1. Identify at-risk catchments;
2. Set preliminary performance targets; and,
3. Select appropriate stormwater management site design solutions.

#### *Guiding Principles of Integrated Stormwater Management (ADAPT)*

1. Agree that stormwater is a resource;
2. Design for a complete spectrum of rainfall events;
3. Act on a priority basis in at-risk catchments;
4. Plan at four scales (regional, watershed, neighbourhood and site); and,
5. Test solutions and reduce costs by adaptive management.

<sup>1</sup> Watershed Watch Salmon Society et al (2009). Fish Out of Water: Tools to Protect British Columbia's Groundwater and Wild Salmon.

<sup>2</sup> BC Ministry of Environment (2010). British Columbia's Water Act Modernization: Discussion Paper. Victoria, BC. [www.livingwatersmart.bc.ca](http://www.livingwatersmart.bc.ca) [Accessed February 2010].

<sup>3</sup> Okanagan Water Stewardship Council (2008). Okanagan Sustainable Water Strategy, Action Plan 1.0, Burnaby, BC.

<sup>4</sup> Environmental Protection Agency (2008). Handbook for Developing Watershed Plans to Restore and Protect Our Waters. EPA 841-B-08-002 [http://water.epa.gov/polwaste/nps/handbook\\_index.cfm](http://water.epa.gov/polwaste/nps/handbook_index.cfm).

<sup>5</sup> West Coast Environmental Law (2009). BC Guide to Watershed Law & Planning <http://watershedguide.wcel.org/> [Accessed February 2010].

<sup>6</sup> McGuire, Gordon, N. Wyper, M. Chan, A. Campbell, S. Bernstein and J. Vivian (2010). Re-inventing Rainwater Management: a Strategy to Protect Health and Restore Nature in the Capital Region. A submission to the Capital Regional District on behalf of the Veins of Life Watershed Society by the Environmental Law Clinic, University of Victoria. Victoria, BC.





## 8. Learning From Experience

This section provides a synthesis of several relevant issues or themes to consider in relation to water and watershed planning.

Several common themes emerged from the literature that was reviewed during the preparation of this guide, from discussions with project advisors, from interviews with practitioners and community representatives and from research about water and watershed planning initiatives. These recurring themes are explored in this section and shared to help communities build a broader understanding of the dynamics of watershed planning. These are important considerations for any water or watershed planning process and for any individual or organization involved in planning processes.

The themes explored in this section of the Guide include:

- Re-thinking Watersheds and Planning
- Community Collaboration and Engagement
- Regional Approaches
- Resourcing Planning Initiatives
- Information and Knowledge.





## 8.1 RE-THINKING WATERSHEDS AND PLANNING

*“When we try to pick out anything by itself, we find it hitched to everything else in the universe”*

– JOHN MUIR, Naturalist, Conservationist

Historically, the traditional approach to water management has been fragmented, not integrated to reflect the connections within a watershed. Water quality and water quantity have been managed separately, and decision making around water resources has been governed more by political boundaries than by natural ones. More recently, however, watersheds have received renewed attention as an important unit for planning, and there is wide acceptance that the management and planning of water should occur at a watershed level. For example, at a national level, Canada’s Federal Water Policy adopts watersheds as the preferred spatial unit for water resource planning.

An integrated approach to watershed planning considers the interactions between the biophysical, constructed and human landscapes within a watershed (Figure 4). An integrated approach recognizes the interdependencies in both natural and human systems, as detailed in the table below.

Integration in the Natural System	Integration in the Human System
Between land and water use	Mainstreaming water in the national economy
Between surface water and groundwater	Ensuring coordination between sectors
Between water quantity and quality	Ensuring partnership between public and private sector management
Between upstream and downstream	Involving everybody
Between freshwater and coastal waters	

Integrated watershed planning provides a means for coordinating decisions among government and private agencies in order to resolve land use and resource management conflicts and issues. The resolution of these issues is typically done through multi-stakeholder collaborative planning; through monitoring, research and consultation; by negotiating consensus; and by ensuring accountability through open communication, education and public access to information. Integrated watershed planning combines scientific and technical information with cultural and social values to resolve conflicts and identify a desirable future outcome.

Integrated watershed management is also referred to in some regions as ecosystem-based management. By this approach, *“instead of managing a watershed as an adjunct to the water supply, maintaining healthy watersheds is considered a prerequisite to water management; water allocations are constrained by the larger need to ensure that the natural processes are maintained”*.<sup>1</sup> More recently, the terms “water centric planning”, “design with nature”, and the “soft path” approach have been used in BC to discuss and promote the concepts embedded in integrated watershed management. Water centric planning is described next. See the web version of this guide for information on design with nature and the soft path approach.

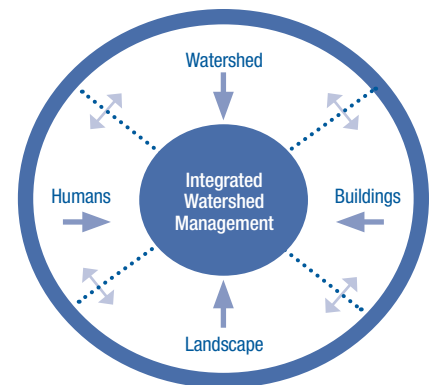


Figure 4 – Components of Integrated Water and Watershed Management

### 8.1.2 WATER CENTRIC PLANNING

Water centric planning refers to planning with a view to water, on any scale. The underpinning premise of water centric planning is that resource use, land use and community design will be done with an eye towards their potential impact on a watershed. This approach puts water stewardship and sustainability at the centre of land use, development, or resource planning initiatives. Water centric decisions consider the amount of water available, the amount of water needed, the use of innovative efficiency strategies, the quality of water leaving an area, how rain and snow water are managed, and the impact of development on the natural environment. As such, it requires that missions, mandates and accountabilities of participating agencies be ultimately integrated.

Water centric planning is founded upon an earlier concept used in BC— the watershed landscape-based approach to planning. Water centric planning can be used at the watershed, sub-watershed, or site level. Its objectives include:

- Protection of people and property from natural hazards;
- Preservation and conservation of self-sustaining ecosystems;
- Continuation and growth of resource-based economic activity; and
- Provision of an affordable, sustainable and maintainable infrastructure.

Many policies and tools are available to local governments to implement water centric planning, including:

- Regional conservation strategies that identify land and water to be protected;
- Official Community Plans that include development permit areas around all types of watercourses and associated habitats;
- Liquid Waste Management Plans that have an increased emphasis on non-point source pollution and water;
- Zoning bylaws that promote high-density developments;
- Regional Growth Strategies;
- Regulatory bylaws, such as watercourse protection bylaws and subdivision bylaws;
- Watershed and Well (Aquifer) Protection Plans;
- Tax incentives for land conservation, brownfield development, infill and low-impact development;
- Infrastructure funding directed to designated growth areas; and,
- Leadership in Energy and Environmental Design (LEED) Green Building Rating System.

The water centric approach also builds on lessons learned from past and recent practices related to integrative planning and implementation of planning decisions. It operates within the context of existing regional and municipal strategies, such as Regional Growth Strategies and Official Community Plans. It can also involve inter-municipal cooperation where watershed boundaries cross local government boundaries.<sup>3</sup>

The South Okanagan Regional District's Regional Growth Strategy (RGS) was used as a pilot for water centric action in BC. The policy clearly recognizes the relationship between land and water, both in terms of water use and water runoff. A toolkit was developed to accompany the RGS and to guide decision making on the ground in terms of how land will be developed and water will be used, and to assist with benchmarking, monitoring and measuring key objectives within the policy.

### 8.2 COMMUNITY COLLABORATION AND ENGAGEMENT

*"The hope for achieving sustainability in water management lies in the establishment of interdependent, community-based partnerships and increased stakeholder involvement."*

*"Simply put, transformational change will result when decision-makers in government collaborate with grass-root visionaries in the community to create a legacy"*

The value of collaboration among, and engagement with, different orders of government, different water use sectors, stewardship organizations, and the multitude of community stakeholders is a recurring theme throughout this guide. Collaboration is often cited as a key success factor in watershed planning. Basically everyone has a role to play, and a responsibility to fulfill when it comes to the use, protection and sustainable management of water resources and healthy watersheds. Specific benefits associated with community engagement and collaboration include:

- Stronger relationships between participants in terms of trust, respect, information sharing, and improved negotiation;
- More comprehensive and widely accepted land use decisions as a result of improved communications, demonstrated commitment, and information sharing;
- Greater likelihood of successful implementation of the plan as a result of the involvement of all stakeholders, whose values and interests are reflected in the plan; and,
- Greater accountability of all community members involved in the planning process with regards to their own actions and behaviours in a watershed.

These benefits of collaboration are considered by many to be critical success factors for effective planning and implementation.

The sections that follow identify some key aspects of collaboration in water and watershed planning in BC. Recommendations for developing collaborative planning processes with local governments in BC are provided, the importance of working with First Nations is discussed, and suggestions for strengthening these critical relationships are profiled. Finally, some of the concerns, challenges and barriers associated with collaborative planning are highlighted, along with some of the opportunities or breakthroughs that BC communities have experienced when navigating through these challenges.

#### Multiple Planning Partners of Local Governments in BC

A growing interest and willingness within BC communities to get involved in watershed planning has emerged over the last two decades. Whether for site-specific issues or for broader regional land use considerations, collaboration is becoming a preferred model of decision making in many parts of the province. At the community level, a greater emphasis on collaborative planning for watersheds has put local governments in touch with a wide range of partners from different government organizations as well as representatives from both the business and stewardship communities. The following are a few examples of the partners that work with local governments in planning as well as some common roles these partners play. This information is from 21 in-depth interviews with local government staff from across BC. See also Section 4 of this guide for information on roles and responsibilities in water planning, management and governance.

- *Federal Departments (Environment; Fisheries and Oceans; Health; Aboriginal Affairs and Northern Development and others)* – Regulatory and/or approval roles; infrastructure funding; advisory roles; monitoring and reporting; research and educational roles.
- *Provincial Ministries (Environment; Health; Forests, Lands and Natural Resource Operations and others)* – Regulatory and/or approval roles; water licenses and allocation; infrastructure funding and planning grants; advisory roles; monitoring and reporting; research and educational roles.
- *First Nations, Municipalities and Regional Districts* – Provision of water services and related infrastructure and/or service agreements (drinking water, wastewater treatment, stormwater/drainage); advisory roles; monitoring and reporting; coordination and liaison; shared planning and co-management; funding partners; information sharing; and research and educational roles.



- *Academic Institutions* – Research roles including research funding and student support roles.
- *Industry and Businesses* – Advisory roles; monitoring and reporting; funding partners; research and educational roles.
- *Community* – Community members are engaging in various aspects of planning and management such as:
  - Attracting landowners to planning tables;
  - Gathering information on watershed history and resource use;
  - Identifying community and watershed values and identifying priorities;
  - Collecting input, feedback and advice on key issues and documents;
  - Organizing special events and open houses;
  - Collecting resource data;
  - Reporting violations; and,
  - Managing communications and media relations.

### Good Practices for Collaborative Multi-stakeholder Processes

Bringing the right people together to discuss the myriad of issues within a watershed is no easy task, but when done well, it can be an efficient, credible, and cost effective means of developing integrated and robust solutions. There is no single approach to designing a multi-stakeholder process; however, a broad set of principles, or good practices, that contribute to successful outcomes of collaborative decision-making processes is emerging. The following table identifies several key elements and expected results of stakeholder engagement for successful watershed planning.

Criterion	Description
Purpose and incentives	The process is driven by a shared purpose and provides incentives to participate and to work towards achieving consensus in the process. All participants should agree on the types of issues to be addressed by the planning process. A clear “terms of reference” may allow groups to decide whether to participate or not.
Stakeholder participation	All parties with a significant interest in the issues and outcome are involved throughout the process. These could include residents, farmers, ranchers, businesses, industries and others. Representatives should be selected in a fair and open manner by each of the groups that have an interest in the outcome. Timelines for the planning process need to accommodate stakeholder participation and engagement.
Voluntary participation and commitment	Parties, who are affected and/or interested, participate voluntarily and are committed to the process.
Self-design	The parties involved work together to design the process to suit the needs of that process and its participants.
Clear ground rules	As the process is initiated, a comprehensive procedural framework is established which includes clear terms of reference and operating procedures. This part of the process can also help to clarify realities and expectations in terms of roles, responsibilities and limitations.
Equal opportunity and resources	The process provides an equal and balanced opportunity for effective participation of all parties.
Principled negotiation and respect	Multi-stakeholder planning proceeds from the assumption that everyone has something to gain by reaching agreement. The process operates according to the conditions of principled negotiation, including mutual respect, trust and understanding.
Accountability	The process and its participants are accountable to the broader public, to their constituents, and to the process itself.
Flexible, adaptive and creative	Flexibility is designed into the process to allow for adaptation and creativity in problem solving.
High-quality information	The process incorporates high-quality information into decision-making. All participants should share information and cooperate to gather what information is needed for effective planning.
Cooperation	Cooperation and working relationships between participating groups is improved both during and after the process is completed.
Time limits	Realistic milestones and deadlines are established and managed throughout the process.
Commitment to implementation and monitoring	The process and final agreement include clear commitments to implementation and monitoring.
Effective process management	The process is coordinated and managed effectively.
Independent facilitation	The process uses an independent trained facilitator throughout. This may not be necessary in all cases, particularly where the planning issues may be less conflicted, where the community is not polarized, or where the lead facilitator of the planning process has established trust and credibility within the community.

## Collaboration with First Nations

Intergovernmental relations around water and watershed management are challenging, and the case is no different with First Nations. A key observation that emerged from workshops held with First Nations in the summer of 2010 is that *“First Nations are often not consulted, not consulted enough, or not consulted soon enough”*. In some cases, this is attributed to existing policies and structures that limit participation by First Nations, and there is a sense that addressing First Nations’ rights can slow down a planning or decision-making process.

There is significant concern among First Nations that *“although First Nations across Canada are already experiencing the impacts of climate change, they are often left out of policy discussions that will affect water health and security in their territories”*.<sup>8</sup> Although stakeholder engagement sessions were conducted specifically for direct First Nations input some Bands have indicated the need for more direct participation in the modernization of BC’s Water Act.

In some cases, limited participation by First Nations relates to limited capacity within their communities. It can be challenging for smaller First Nation communities who have limited resources to keep up with government invitations to participate in a multitude of referrals, and other planning and decision-making processes. There is also concern that participating in such processes can sometimes be misinterpreted as *“representing the First Nation community”*—a mandate that may not actually be afforded to one individual.<sup>8</sup>

Working towards more effective collaboration with First Nations requires building government-to-government relationships that acknowledge Aboriginal title and rights. To foster these relationships, it is important to develop a shared vision that celebrates differences as well as areas of common ground. A shared vision enables the identification of key issues, shared goals, and action plans, and a commitment to shared decision-making. Through trial and error, experiences across BC have culminated in the identification of some beneficial practices for collaboration with First Nations. A series of recommended best management practices for building successful and positive relationships between First Nations and local governments was developed at a workshop with regional districts in 2005. Many of these practices also apply to other relationships within collaborative decision-making processes:

- Establish a relationship before there is a problem;
- Respect each other’s differences (i.e., do not try to change each other);
- Recognize and understand that history and past experiences impact current perceptions and opinions;
- Focus on learning about each other’s history and initiate information-sharing events early in the process to learn about the respective roles, responsibilities and history of each other’s organizations;
- Recognize the importance of a First Nations Chief and Council;
- Focus on slow, incremental steps and recognize that success cannot be measured in the short term;
- Work towards the project agenda after individual relationships are solidified and unified;
- Define the nature and scope of the relationship early (including an understanding of each other’s needs and the reason for interaction);
- Focus on areas of common concern or interest;
- Identify the elements of uncertainty and work towards addressing them before they create friction in the relationship;
- Be prepared to resolve disputes and agreements;
- Establish a process and forum for communication and dialogue;
- Exchange staff lists to allow for quick and effective contact between organizations; and,
- Confirm expectations and assumptions throughout the relationship.

## Leadership and Local Champions

Collaborative planning processes benefit significantly from good leadership. Having a champion behind a planning initiative can really help motivate a group, and keep it focused on the end goal. This can be particularly important to sustaining interest, support and momentum over the long term during the development and implementation of the plan. Planning can take time, patience and persistence, and a committed and passionate champion can help build and maintain the necessary momentum. This is especially important during periods of conflict or other challenges.

A widely respected and credible leader can also inspire broader participation and collaboration within a planning process. For example, someone who has the respect of farmers, business owners and community activists can strengthen the credibility of a planning process, and thus inspire these and other stakeholders to participate in it. A leader may be a mayor, chief, or chair of a regional district or other prominent board. However, local champions can also be highly respected citizens, volunteers, retired professionals, or other community leaders with less official designations.

If there is no apparent single leader within a process, it can be helpful to bring in people from around the region and/or country who have relevant experience and expertise on key issues. For example, in the early stages of developing the planning process for the Coquitlam River Watershed Strategy, people from outside the watershed were invited to share their successes and failures with their roundtable processes. This helped set the bar and create inspiration within the planning group. From this foundation, leadership emerged from different factions of the community, including government and beyond.

## 8.3 REGIONAL APPROACHES

Being proactive by planning for watersheds and climate adaptation can be especially challenging for communities that have limited human and financial resources. Introducing water centric thinking can be particularly challenging when facing common issues such as jurisdictional conflicts or a lack of expertise. Changing the “old way of doing business” does not happen overnight, and achieving water sustainability is less likely to happen if communities work in isolation of each other.

In some cases, local leadership can be supplemented and/or strengthened with collaborative approaches at the regional scale. This can be particularly appropriate when implementing a watershed-based approach and an integrated approach. For example, Convening for Action on Vancouver Island, the Okanagan Basin Water Board and the Fraser Basin Council offer several opportunities to collaborate at regional scales to strengthen community resiliency, protect watershed health, prepare for climate change and advance sustainability.



### 8.3.1 CONVENING FOR ACTION ON VANCOUVER ISLAND

Convening for Action on Vancouver Island (CAVI) is an exciting initiative that has emerged in response to the need to plan for sustainable water resources within the context of a rapidly growing population. CAVI is not a formal organization; rather, it could be considered as an “ad hoc group” designed to provide leadership, coordination, research and education for practitioners, specifically local government administrators, engineers, planners and elected officials.

CAVI’s focus is to build an understanding about how we should be dealing with water as it relates to conservation, development and land use. CAVI does not use a particular planning tool or process. Instead, it uses the informal process of collaboration to build capacity and a network of like-minded individuals across Vancouver Island so these individuals can harness the tools of local government (e.g., Official Community Plans, bylaws) to bring about positive change in local watersheds. Education and communication are other key tools that CAVI uses. Its aim is to move from talk to action by developing tools, providing training and building capacity.

At the heart of the initiative is the concept of water centric planning. Through education and awareness-building initiatives, including learning lunches, CAVI demonstrates how water centric approaches and specific tools can be integrated into existing planning processes.

*“At CAVI, we bring together those who plan and regulate land use (local governments), those who build (developers), and those who provide the legislative framework (the Province). We provide the expertise and support to municipalities and organizations with a focus on achieving water sustainability and then help them to share their ideas and successes so that others can see how they too can get on board”*

Since its launch in September 2006, CAVI has witnessed considerable success in getting its message out, and is seeing mindsets beginning to shift towards water centric thinking, planning and decision-making. Participants in the CAVI process include the BC Water and Waste Association, Real Estate Foundation of BC, Ministry of Environment, Ministry of Community and Rural Development (now Community, Sport and Cultural Development), municipalities and regional districts, POLIS, private consultants, developers, academics, First Nations and citizens’ groups.

Participants attribute some of this success to the fact that “CAVI has no baggage, no requirements, no regulatory authority—it simply provides a forum for people to talk about common problems and solutions, and interact through workshops, the Waterbucket website, conferences, and seminars”. The emphasis on collaboration within CAVI, and focus on integration across the Vancouver Island region have also been critical success factors. Finally, many of CAVI’s activities fulfill the principles of Living Water Smart, British Columbia’s Water Plan, and aligning with these principles has proven beneficial for local governments that are seeking funding to support water planning and management.

*“On Vancouver Island, local governments are demonstrating what can be accomplished through partnerships and collaboration. Success in moving from awareness to action is ultimately keyed to a regional team approach that is founded on the notion of shared responsibility”*

—JOHN FINNIE, CAVI Chair

### 8.3.2 OKANAGAN BASIN WATER BOARD

The Okanagan Basin is one of BC’s fastest growing regions. With increasing demands for water by residents, tourists, and agricultural producers (which accounts for as much as 70% of water use in the basin), it is a region under pressure. Significant water shortages occur in the summer months, and groundwater resources are vulnerable to contamination and drawdown.

In the Okanagan Valley, a regional approach has proven useful for advancing water management decisions. *“The Okanagan Basin Water Board (OBWB) was initiated in 1968 (legislated in 1970) as a water governance body tasked with identifying and resolving critical water issues at the scale of the Okanagan watershed...The overall objective of the organization is to undertake strategic projects and programs at the Basin scale that meet the collective needs of Okanagan citizens for long-term sustainable water supplies while supporting the capacity of member jurisdictions to meet their own water management goals” (www.obwb.ca/about).*

The Board is comprised of representatives from each of the three regional districts in the basin: Okanagan-Similkameen, Central Okanagan and North Okanagan. The Board also has representation from First Nations, the Water Supply Association of BC, and the Okanagan Water Stewardship Council, which was formed in 2006. The Board is unique in its powers to tax and pass bylaws, and is supported through annual property tax assessments within the basin. The Board does not have regulatory authority but seeks to improve water management by providing a basin-wide perspective and improving communications among



regions to reduce fragmentation in policy and planning. The Board also works to improve links between local and senior governments by participating as a partner in Okanagan water research and infrastructure funding.

Whereas municipalities and regional districts continue to plan for local water needs, watershed-scale considerations are addressed at the regional level through the leadership of the OBWB. Some key activities of the Board include:

- Implementing basin-wide programs for millfoil control, sewage infrastructure funding, water science and management;
- Acting as a hub for water information by increasing communication, building partnerships and reducing duplication;
- Acting as a voice for Okanagan water interests by advocating and representing local needs to senior governments;
- Providing science-based information to decision makers;
- Expanding local capacity by providing a stable source of funding and in-kind partnerships, and by being a single organizing body for coordinating watershed projects; and
- Providing a forum for debate about watershed priorities.

Through its work, the OBWB has sought to integrate Okanagan water policy and planning on a basin-scale by bridging the interests of multiple jurisdictions and shifting towards implementing policies and agreements that protect water supplies. The Okanagan Sustainable Water Strategy (2008), which identifies top priorities for implementation in the basin in the coming years, illustrates how a regional approach can be applied to water planning and management. Numerous recommendations made in this action plan are being implemented incrementally, and successes in groundwater monitoring and establishing a

water use reporting process have already been achieved. Many of the actions identified in the plan require inter-jurisdictional arrangements so that communities of the basin can prepare for climate change and population growth in the watershed. The OBWB is the mechanism for bringing these groups together on a regional basin scale to plan and manage water resources.<sup>12</sup>

### 8.3.3 FRASER BASIN COUNCIL

In the Fraser River Basin, the Fraser Basin Council (FBC) strengthens regional and watershed-based approaches to address a wide variety of sustainability issues. Formed in 1997, the FBC is a charitable, not-for-profit organization with a primary mandate *"to advance sustainability in British Columbia with a core focus on the Fraser River Basin."* FBC has a collaborative governance structure, which is led by 37 directors from the four orders of government—federal, provincial, local and First Nations—and from the private sector and civil society.

Well into its second decade of service, the FBC works to bring people together to find practical, common sense solutions to long-standing and emerging sustainability issues, such as community planning, watershed health and climate change adaptation.

To achieve its goals, the FBC serves as an impartial, trusted facilitator operating under a unique model of collaborative leadership. The FBC was founded on the belief that the major sustainability priorities, including management of the Fraser Basin, cannot be effectively addressed by any one jurisdiction but rather by bringing together the diversity of interests and jurisdictions to solve complex problems. The reason so many contentious issues remain unresolved is often because leaders in different sectors are working in isolation of each other.

The overall framework for the Fraser Basin Council's work is the Charter for Sustainability. The charter is a good-faith agreement, signed in 1997, by representatives from multiple sectors across the Fraser Basin who believed in collaborative action for a more sustainable future.

From the charter comes FBC's vision statement and guiding principles, along with a definition of sustainability, described as:

*"Living and managing activities in a way that balances social, economic, environmental and institutional considerations to meet our needs and those of future generations."*

The Fraser Basin Council delivers programs and projects in each of the five regions of the Fraser River Basin: Upper Fraser, Cariboo-Chilcotin, Thompson, Fraser Valley and Greater Vancouver-Sea to Sky.

The following are a few highlights of Fraser Basin Council accomplishments, all of which were undertaken with regional and collaborative approaches. The FBC:

- Worked with more than 100 local governments and 26 first nations across bc on community sustainability planning and climate change adaptation;
- Improved fraser basin salmon habitat, stock management, fisheries information and re-lated outreach with a high level of aboriginal engagement and many working partnerships for the health of bc fisheries;
- Launched and contributed directly to the development of a land use planning process for the shuswap lakes system to encourage development in less sensitive areas of shuswap and mara lakes, to improve waste-water management and to study recreational impacts. Current priorities and next steps include protecting and restoring foreshore habitat, maintaining and improving water quality, informing and educating the public and industry groups, and initiating coordinated development and recreation plans;
- Led a panel of independent experts, result-ing in canada's first provincial legislation on drinking water protection;
- Published four comprehensive sustainabil-ity snapshot indicators reports, and several regional reports, on the health of the fraser basin and province of bc to raise awareness and encourage action across sectors on economic, social and environmental issues; and,
- Developed the strategy for, and created bc's first council on, invasive plants, which has received national recognition.

### 8.4 HUMAN AND FINANCIAL RESOURCES

*"Water is a liquid more precious than oil"* –TONY BLAIR, former British Prime Minister

Integrated water and watershed planning requires a dedicated and skilled team of people. Ongoing involvement in a collaborative planning process is a significant commitment for local governments and others, who often cite inadequate resources and overtaxed staff as primary limitations on being more proactively engaged in certain aspects of watershed protection. Some local governments also note that watershed planning is a specialized skill that is beyond the training of many people. Without the necessary financial and human resources it is challenging for some communities to effectively manage and/or participate in collaborative processes.

Within this challenging context of limited financial and human resources, the BC experience is showing that success in advancing water and watershed planning often comes down to creative initiatives and well-conceived projects. While an increase in both financial and human resources is desirable, it may not be realistic in many communities. Instead, communities are required to work more creatively with both internal and external resources in order to advance their goals for water and watershed protection.





#### 8.4.1 STRENGTHEN HUMAN RESOURCES

Human resources, both in terms of availability and expertise, can be a limitation to water and watershed planning and to climate adaptation. Both areas require a strong team of experts with specialized knowledge, expertise and skill sets. Contracting out portions of the work to supplement or complement staff skills and expertise may be possible in some circumstances; however, this option is not always available to local governments, which often have limited funds.

Capacity may be limited in smaller BC communities, where there may be only one or two municipal staff to cover planning responsibilities, and where funds may be too limited to cover the costs of hiring consultants. This may be a particular challenge for proactive initiatives, such as water and watershed planning, and for integrating climate change adaptation into such plans.

First Nations also have limited capacity to undertake water planning, management and governance due to small staff sizes and limited resources for training community members in key water planning and management skills. Compounding these challenges are circumstances where there are many other priorities for First Nations that compete for limited resources and staff capacity.

In contrast, larger local governments, such as Metro Vancouver and the Capital Regional District, which have greater staff capacity, are able to attract more funds, and advance planning and management initiatives. These larger communities are also better able to interact with other initiatives and institutions, which can lead to more learning opportunities.

#### The Value of a Coordinator

Many communities have found that having a project coordinator is often key to the success of water and watershed planning initiatives. In the case of the Bowker Creek Urban Watershed Renewal Initiative, having a part-time Coordinator, whose salary is cost-shared by all three participating municipalities, has been key to securing project funding. This person is able to dedicate time to writing grant applications, and having a Coordinator has given the project greater credibility. A Watershed Coordinator has also helped secure funds for the Theodosia Stewardship Roundtable and Watershed Recovery Plan, and as a result, he is able to focus on both land and water management within the watershed.

#### 8.4.2 STRENGTHEN FINANCIAL RESOURCES

Resourcing can significantly influence the success of planning, and is commonly cited as a limiting factor in planning processes. Resources are needed to establish and manage a planning process, and to implement its outcomes (i.e., the plan's recommendations). Effective strategies for resourcing water and water planning arrangements include:

- Working with the financial resources that you and your partners have;
- Using consultants only when necessary (often best for technical work);
- Writing the plan with in-house staff can save money; and
- Hiring a coordinator to oversee the planning process.

Whether a planning initiative is just beginning, in mid process, or ready for implementation, financial resources play a significant role in the timing, momentum, and in some cases, the outcomes of the process. The funding environment for water and watershed planning in BC is challenging and competitive. Funds are limited; therefore, competition for grants is high. Local governments indicate that funds are available for infrastructure work but are more difficult to obtain for watershed based planning work unless the work relates specifically to drinking water. Local governments also have limited human resources for developing project proposals and writing and submitting grant applications.

The situation is similar for climate adaptation planning processes. While funds may be available for climate adaptation planning, it is more difficult for local governments to secure funds to implement adaptation measures. Even in communities that have been actively developing climate adaptation plans, it is difficult to justify spending substantial sums of money on implementing those plans. For example, making proactive choices to upgrade municipal utilities may make sense on one level, but when there may be no immediate, tangible benefits, it can be difficult to persuade taxpayers and elected officials to commit to large investments.

#### Develop a Financial Strategy

Planning processes invariably take longer than expected. Thinking the process through in terms of phases and how those phases will be financed is an important step. It is first necessary to know what needs to be accomplished and what the measurable objectives are for the various aspects of the project. For each objective, consider:

- When will the money be needed?
- Where will it come from?
- How will it be directed?

*"If you wait until you have enough money, you'll never do it."*

– TOM RUTHERFORD, Georgia Basin Living Rivers Program

When developing a funding model or strategy it is important to be creative. There is no single, certain way of securing funds for a watershed project. Each community has its own set of challenges and opportunities. A successful financial strategy will take both challenges and opportunities into consideration. The following are recommendations, gathered from various communities across the province, for successfully obtaining project funding:

- Be strategic; look at the bigger picture. Design your project so that it can advance multiple objectives, such as climate change mitigation and/or adaptation and environmental enhancement. Recently, the integration of climate change adaptation into planning projects has become strategic from a funding perspective. Local governments, such as the Capital Regional District, intend to draw on this to the best of their abilities by tapping into funds for pilot initiatives. Another "big picture approach" is to integrate watershed planning within land use decisions. This may open up new opportunities by diversifying funding sources.
- Align with common objectives. Identifying how various departments and/or external organizations can contribute to project objectives is important for moving a project forward, both within the planning process and during implementation. The approach adopted within the Whistler 2020 Plan was intended to allow the community to use community resources in a more strategic and coordinated way. The community of Whistler invested time in identifying common goals and a shared vision across organizations within the community. Rather than requiring new resources, the Whistler 2020 approach is based on the alignment of existing budgets and resources to ensure that all relevant organizations and individuals are dedicated to moving toward a shared goal rather than working inefficiently or at cross-purposes. This approach seeks to make the best use of existing resources.
- Be realistic about project timelines and budgets. The Bowker Creek Initiative adopted a 100-year timeline because the work that needs to be done in the watershed is too costly to be funded all at once. Rather than getting bogged down in the high costs of implementation, the team developed a long-term plan that focuses on specific reaches of the creek and on achieving incremental progress. Municipalities can agree in principle about the scope and direction of the plan without being held responsible for spending a specific amount of money. The idea behind this strategy is not to deflect responsibility and "do nothing"; rather, once the regional district saw past the financial challenges, they committed to moving the plan forward by working on key short-term actions now that would set them up for bigger things in the future.

- Leverage funds. Grant leveraging entails using one source of funds to attract and match funds from other sources. It is an effective means of bringing in additional money to support an expanding project or one with an extended timeline.
- Consider what can be accomplished without financial contributions. Participants in the Theodosia Stewardship Roundtable state that planning groups do not need a lot of money to initiate watershed planning. In-kind contributions can be a significant source of resources for getting a project started. Once successes start to be demonstrated through the use of these contributions, it becomes easier to attract funds from other sources. Participants in the Theodosia planning process expect that down the road, when they have established a good mechanism for making watershed-based decisions, their Roundtable will actually attract money rather than cost money. They expect that outside funders will see value in the process, and will want to support it.

### Consider Alternative Sources of Funds

Various means of generating funds for water management projects have been tried in different communities. Some of these are listed below. It is important to consider the potential that these may bring, within the context of each community. Conducting an economic analysis of which mechanisms are most appropriate to a community would be beneficial, as would an assessment of public and political support for those mechanisms.

- Development Cost Charges (DCCs) have been used in some BC communities to support operational initiatives in water management. As a pilot project, the town of Oliver, BC received approval to use DCC funds collected from new development to help establish water meters for existing homes with the resulting water savings becoming available to provide water services to new homes. DCCs have also been a key part of the City of Surrey's strategy to build sustainable drainage infrastructure. Surrey has used the funds to pay for a roadside storm water management swale/multi-use greenway in a new development, rather than the usual purchase of 5-6% of the area for the purposes of a detention pond.
- Volume-based Water Use Fees can be applied either to individuals or water suppliers to target heavy-use water consumers and to provide incentives for water conservation. The fee structure needs to be equitable to avoid creating economic hardship for low-income residents and the agricultural community.
- Municipal Drainage Utilities can be formed as an alternate source of raising funding. This approach can help ensure dedicated funding for drainage and stormwater planning, infrastructure and operations.

- Water Licence Fees collected by the Ministry of Forests, Lands and Natural Resource Operations currently go into provincial general revenue. In theory, a portion of these funds could be directed to specifically support water and watershed planning. If local government becomes actively involved in licence administration at any level, some of these funds could be used to fund water conservation and management projects at the local level.<sup>16</sup>
- Recreational User Fees applied to powerboat or off-road vehicle rentals are a means of targeting polluting activities of tourists or seasonal residents who do not otherwise contribute funds to water management in a region.<sup>16</sup>
- Reserve Funds can be established by implementing changes in service delivery systems (e.g., contracting out a regional service), which can sometimes translate into savings for a local government. In the Region of Peel, in Ontario, such a savings translated into a permanent, annual cost reduction of 1.5% on water rates. Staff commitment and forward thinking leadership enabled these savings to be channeled into a fund, which is not constrained by the normal budget cycle. The City of Toronto directed revenue from property sales into the "Toronto Atmospheric Revolving Fund", which finances innovative greenhouse gas emission reduction projects. Interest and royalties from these projects are returned to the fund. One merit of this approach is that it does not require any additional taxation.

## 8.5 INFORMATION AND KNOWLEDGE

The importance of accurate, relevant and meaningful data, information and knowledge cannot be underestimated in relation to water and watershed planning. Although subtle nuances differentiate data from information and knowledge, for the purposes of this section of the guide, the term "information" will be used explicitly, and data and knowledge will be considered as being related implicitly.

Information is critical to water and watershed planning in a variety of ways. Information about current (or historical) water issues, challenges and conflicts alerts communities and decision makers about the need for planning, policy and/or operational management actions. Information about future scenarios, such as population projections or climate change scenarios, can help inform planners and others about possible issues they may need to address. Information about the effectiveness of management options can be used to assess recommended actions in response to current or future challenges.

### 8.5.1 INFORMATION NEEDS AND SOURCES

The following are some examples of data and information that may be beneficial or necessary to inform a water and watershed planning process:

Current and projected future water supply:

- Seasonal and annual streamflow (volume and timing);
- Surface and groundwater reserves (extent and volume);
- Changes to precipitation and evapotranspiration as a result of climate change; and,
- Changes to storage and distribution capacity associated with water supplies.

Current and projected future water demand:

- Current water use by all human consumptive and non-consumptive uses;
- Current instream flow requirements for fish, wildlife, habitat and ecosystem functions; and,
- Changes to water demand as a result of population growth, community and economic development and/or climate change.

Current and projected future threats to water quality:

- Changes to settlement patterns, land use and associated pollutants; and,
- Changes to hydrology and geomorphology as a result of land use, land cover and/or climate change.

Data and information are also needed to monitor and measure performance in relation to the objectives and desired outcomes of a water or watershed plan (or related regulatory requirements). For example, it may be necessary to monitor compliance with water licences, instream flow requirements, water use restrictions, wastewater discharges, riparian area regulations and/or water quality standards or objectives. If performance measures are not established and assessed, it may not be possible to determine if the goals and objectives of a water or watershed plan are being achieved.



Some examples of information sources to support water and watershed planning are listed below (in alphabetical order). In many cases, further analysis of available information and/or more detailed local information will be necessary to support planning processes. See Section 9 of this guide Tools and Resources for more information (including web links) about where to go for relevant information on water, watershed and climate science.

- BC Hydro – Regional Hydromet Data
- BC Ministry of Environment – Environmental Protection Division, Water Quality
- BC Ministry of Environment – Groundwater Wells and Aquifer Database
- BC Ministry of Forests, Lands & Natural Resource Operations  
– River Forecast Centre
- Environment Canada – Meteorological Service
- Environment Canada – Real-Time Hydrometric Data
- Pacific Climate Impacts Consortium – Plan2Adapt

### 8.5.2 INFORMATION GAPS AND LIMITATIONS

Data for water, watershed and climate change planning is not available consistently across the province. Numerous information gaps present a challenge to water and watershed planning. For example, there may be gaps or limitations in:

- Spatial coverage (e.g., available information may not cover a particular river, stream, lake or watershed);
- Temporal coverage (e.g., a full range of historical or current information, or future projections may not be available); and,
- Measured parameters (e.g., information may be available for only a subset of the necessary water quantity or quality variables).

Basic hydrological information is not available for many streams, lakes and aquifers in BC. Similarly, water quality information is limited. Although there are requirements for measuring and reporting on drinking water quality, there are many information gaps on instream water quality for waterbodies that are not used for drinking water.

In some regions, such as the Capital Regional District, where communities are close to academic institutions, there is a relatively good supply of data and information to inform planning efforts. However, in small to mid-sized communities, less data is available both for climate and water and watershed planning. Also, in some cases, local governments do not always know what data are available or how to source or use the data.

While it is widely recognized that in many regions of the province aquifers are vulnerable to multiple sources of depletion and pollution, groundwater data are relatively limited. The submission of well log information, which is housed by the Province, is voluntary, and people are often slow in submitting the data or they provide incomplete information. Accessing data for privately held upland areas in watersheds is another significant challenge for local governments. Forest companies are required to file detailed environmental plans for every cutblock; however, this information typically is not made available.

Communities may be able to acquire data, but in many cases it is not in an accessible format. Local governments have experienced considerable challenges related to the format and completeness of data. Often, data are developed for specific purposes and are not compatible with other purposes or a particular study area. In other cases, available data may not be specific enough for developing plans for a particular region or watershed. Regional districts report that it is sometimes challenging to work with data from various member municipalities because there is no standardized format for the data. Finally, the level of detail in which data are presented is not always useful. For example, in a community such as Tofino, which has very localized weather cells, it is difficult to use general climate data because the nearest weather station is not representative of the weather in Tofino.

Information gaps and limitations grow significantly when it comes to understanding the complexity of watershed resources, health and function. In an ideal scenario, a watershed inventory and assessment is undertaken to build a broad understanding of the full resources, functions and characteristics of a watershed. In many cases, watershed inventories and assessments have not

been undertaken or they have been limited in scope. There is no single, comprehensive source of watershed data.

Information resources should be considered in a similar light as financial and human resources. As with funding and people, information is a critical element to support a water or watershed planning process. However, there can be significant limitations and constraints that need to be understood and addressed in order to acquire and use the information necessary to develop and implement watershed plans.

### 8.6 REFERENCES

- <sup>1</sup> Brandes, Oliver et. al. (2005). At A Watershed: Ecological Governance and Sustainable Water Management in Canada. The POLIS Project on Ecological Governance. Victoria, BC.
- <sup>2</sup> Global Water Partnership (2007). Integrated Water Resource Management At A Glance (Brochure). Stockholm: Sweden. [www.gwp.org](http://www.gwp.org).
- <sup>3</sup> Stephens, Kim (2010). "Water Centric Planning: Looking At Water Quality and Quantity In All Aspects". [www.waterbucket.ca](http://www.waterbucket.ca) [Accessed September 2010].
- <sup>4</sup> Okanagan Water Stewardship Council (2008). Okanagan Sustainable Water Strategy: Action Plan 1.0. Coldstream, BC.
- <sup>5</sup> Stephens, Kim (2007). South Okanagan Regional Growth Strategy: Pilot for Water-Centric Action in British Columbia. [www.waterbucket.ca/cfa/redirect.asp?sid=51&id=185&type=single](http://www.waterbucket.ca/cfa/redirect.asp?sid=51&id=185&type=single) [Accessed January 2011].
- <sup>6</sup> Wallace, M., L.E. Woo and S. Boudreauet. (1997). Involving the Public: Learning from Watershed Planning in Ontario. In D. Shrubsole and D. Tate (Eds.).
- <sup>7</sup> Stephens, Kim (2010). Shared Responsibility: Community Perspectives on Developing and Implementing the 100-Year Action Plan for Watershed Restoration. Community Values Influence Bowker Creek Blueprint Process and Outcome. Story #3. Published on Water Bucket website, February 2010. [www.waterbucket.ca](http://www.waterbucket.ca).
- <sup>8</sup> Centre for Indigenous Environmental Resources (2010). First Nations Water Security and Climate Change: Workshop Report.
- <sup>9</sup> UBCM. (2005). Regional District and First Nation Governments: Building Effective Relationships: Summary Report of June 29, 2005 Workshop in Richmond, BC.
- <sup>10</sup> AVI (2007). CAVI: Convening for Action on Vancouver Island—Leadership in Water Sustainability. [www.waterbucket.ca/cfa/?sid=19&id=176&type=single](http://www.waterbucket.ca/cfa/?sid=19&id=176&type=single).
- <sup>11</sup> Nowlan, Linda and Bakker, Karen (2007). Delegating Water Governance: Issues and Challenges in the BC Context. A paper for the BC Water Governance Project. Vancouver, BC: UBC Program on Water Governance.
- <sup>12</sup> Okanagan Basin Water Board (2008). OBWB Backgrounder. [www.livingrivers.ca](http://www.livingrivers.ca).
- <sup>13</sup> Fraser Basin Council. 1997. Charter for Sustainability. [www.fraserbasin.bc.ca/publications/charter.html](http://www.fraserbasin.bc.ca/publications/charter.html) [Accessed Feb. 2011].
- <sup>14</sup> Water Policy and Governance Group (2010). Water Challenges and Solutions in First Nations Communities: Summary of Findings from the Workshop "Sharing Water Challenges and Solutions: Experiences of First Nations Communities, April 15-16, 2010, Kitchener-Waterloo, Ontario.
- <sup>15</sup> Rutherford, Susan (2007). Green Infrastructure Guide: Issues, Implementation, Strategies and Success Stories. Published by West Coast Environmental Law.
- <sup>16</sup> Okanagan Water Stewardship Council (2008). Okanagan Sustainable Water Strategy: Action Plan 1.0. Coldstream, BC.



## 9. Tools & Resources

This section of the guide provides a listing of tools and resources that are available to assist organizations with water and watershed planning as well as climate change adaptation.

In addition to this guide, there are numerous other guides, reports, research papers, web sites and other tools that are available from a wide range of sources. Several tools and resources that have been identified as being particularly relevant to the audiences of this guide are profiled here. These range from guides on specific types of planning processes, to more general references on watersheds, planning and climate science.



## 9.1 ONLINE RESOURCES

BC Groundwater Association [www.bcgwa.org/](http://www.bcgwa.org/).

BC Hydro's Regional Hydromet Data – Provides near real-time hydro meteorological data from automated collection stations in or near our reservoir systems across the province. [www.bchydro.com/about/our\\_system/hydrometric\\_data.html](http://www.bchydro.com/about/our_system/hydrometric_data.html).

BC Ministry of Environment's Environmental Protection Division, Water Quality – Provides information about water quality in BC, including water quality guidelines, water quality objectives reports, water and sediment quality monitoring reports, area-specific studies and links to other relevant information. [www.env.gov.bc.ca/wat/wq/](http://www.env.gov.bc.ca/wat/wq/).

BC Ministry of Environment's Groundwater Wells and Aquifer Database (WELLS) – Displays information related to the water resources of the Province of BC, such as watersheds, water quantity and quality monitoring sites, aquifers water wells and flood protection works. [www.env.gov.bc.ca/wsd/data\\_searches/wells/index.html](http://www.env.gov.bc.ca/wsd/data_searches/wells/index.html).

BC Ministry of Environment's River Forecast Centre – Provides access to, and interpretations of, snow, meteorological and streamflow data to provide warnings and forecasts of stream and lake runoff conditions around the province. <http://bcrcf.env.gov.bc.ca/>.

Canadian Council of Ministers of the Environment. Source To Tap National website where you can learn about protecting Canada's water quality, and what governments across the country are doing in terms of research, monitoring, and guidelines. [www.ccme.ca/sourcetotap/](http://www.ccme.ca/sourcetotap/).

Columbia Basin Trust, Communities Adapting to Climate Change. This site is a regional planning and action initiative to help local governments and First Nations start to prepare for climate change impacts. An excellent publication for a general understanding of the issues in a specific location. [www.cbt.org/Initiatives/Climate\\_Change/](http://www.cbt.org/Initiatives/Climate_Change/)

Environment Canada's Canadian Weather Data Services Provides Canadians with up-to-date information on past, present and future weather conditions and offers multiple data access services to specialized users. [www.weatheroffice.gc.ca/canada\\_e.html](http://www.weatheroffice.gc.ca/canada_e.html).

Environment Canada's Real-Time Hydrometric Data – Provides public access to real-time hydrometric (water level and streamflow) data collected at over 1700 locations in Canada. [www.wateroffice.ec.gc.ca/index\\_e.html](http://www.wateroffice.ec.gc.ca/index_e.html).

InfraGuide – National guide to sustainable infrastructure. [www.sustainablecommunities.fcm.ca/infraguide/](http://www.sustainablecommunities.fcm.ca/infraguide/).

Know Your Watershed– Searchable website from which you can generate a map of your local watershed. <http://map.ns.ec.gc.ca/kyw/>.

Living Water Smart– Living Water Smart is the provincial government's plan to keep our water healthy and secure for the future. This site also includes information on the modernization of the Water Act in BC. <http://livingwatersmart.ca/>.

The province maintains a Drought Information page and may initiate Drought Management Advisories and Directives for certain areas of the province. [www.livingwatersmart.ca/drought/news.html](http://www.livingwatersmart.ca/drought/news.html).

Municipal Sustainable Bylaw Collection– A resource published by Federation of Canadian Municipalities highlighting excellent examples of bylaws, policies and procedures implemented by small and large Canadian municipalities in each sector of activity supported by the Green Municipal Fund. [http://gmf.fcm.ca/Capacity\\_Building/Municipal-sustainable-bylaw-collection/default.asp](http://gmf.fcm.ca/Capacity_Building/Municipal-sustainable-bylaw-collection/default.asp)

Pacific Climate Impacts Consortium (PCIC), Plan To Adapt– This tool is designed to help assess climate change in a region by providing information on maps and in graphs and data tables based on a standard set of climate model projections. Users can view the information online as well as download data for further analysis, reporting and presentation. <http://plan2adapt.ca/>.

Partnership for Water Sustainability in BC and Waterbucket–The Partnership is helping the Province of British Columbia implement the Living Water Smart and Green Communities initiatives. We are doing that through shared responsibility in delivering the Water Sustainability Action Plan. Waterbucket is a rich, highly interactive 'designation location' for timely and provocative information about water sustainability in British Columbia. [www.waterbucket.ca](http://www.waterbucket.ca).

Re-Tooling for Climate Change–The ReTooling for Climate Change website is a first stop for elected officials and staff of local governments, First Nations, and everyone else interested in learning about climate change adaptation. [www.retooling.ca/](http://www.retooling.ca/)

Water Balance Model–The vision for the Water Balance Model (WBM) as a practical decision support tool that bridges engineering and planning. The WBM provides a continuous simulation of the runoff from a development area, or from a watershed with multiple land uses, given the following inputs: continuous rainfall data, evapotranspiration data, site design parameters, source control information, and soils information. Historic rainfall data can be modified to create climate change scenarios within the WBM. [www.waterbalance.ca/](http://www.waterbalance.ca/). For an example of how the WBM can be used to guide planning and design decisions about source controls for low impact development see [www.waterbalance.ca/sql/tutorial/Demonstration.html](http://www.waterbalance.ca/sql/tutorial/Demonstration.html).

Water Conservation Calculator– The Water Conservation Calculator is an on-line user-friendly tool geared for water purveyors of smaller communities. Its purpose is to illustrate how specific conservation measures yield both fiscal and physical water consumption savings. Smaller communities often cannot allocate resources to traditional infrastructure projects or cannot budget for the development of professional water conservation/efficiency plans. Water purveyors can use the tool to assist in presenting their conservation case to council and other decision makers. [www.waterconservationcalculator.ca](http://www.waterconservationcalculator.ca).

## 9.2 CLIMATE CHANGE

In order to identify and manage climate-related risks in the context of water and watershed planning, communities need easy-to-understand information about past and future climate change and its impacts on water, watersheds, and aquatic ecosystems across British Columbia. This section provides links to up-to-date information on climate change and impacts on water. Those resources created in easy-to-understand language for non-technical users are identified with an asterisk (\*).

\*Black, R.A., J.P Bruce and M. Egener (2010). Adapting to Climate Change: A Risk-Based Guide for Local Governments in British Columbia. Volume 1. [http://adaptation.nrcan.gc.ca/projdb/pdf/212\\_e.pdf](http://adaptation.nrcan.gc.ca/projdb/pdf/212_e.pdf).

\*British Columbia Ministry of Environment (2007). Environmental Trends: Climate Change Indicators. [www.env.gov.bc.ca/soe/et07/04\\_climate\\_change/overview.html](http://www.env.gov.bc.ca/soe/et07/04_climate_change/overview.html). This document includes information on changes in air temperature, ocean temperature, precipitation, and sea level in BC. It is similar to Fraser, 2002 (listed below), but includes more detail on some indicators.

\*Columbia Basin Trust (2006). Climate Change in the Canadian Columbia Basin - Starting the Dialogue. Columbia Basin Trust, BC. [http://pacificclimate.org/docs/publications/Columbia\\_Basin\\_Climate\\_Change\\_Dialogue\\_Brochure.pdf](http://pacificclimate.org/docs/publications/Columbia_Basin_Climate_Change_Dialogue_Brochure.pdf).

Dawson, R.J., A.T. Werner, and T.Q. Murdock (2008). Preliminary Analysis of Climate Change in the Cariboo-Chilcotin. [www.pacificclimate.org/docs/publications/CaribooChilcotinClimate.08Sept08.pdf](http://www.pacificclimate.org/docs/publications/CaribooChilcotinClimate.08Sept08.pdf).

\*Fraser, J. (2002). Indicators of Climate Change for British Columbia, 2002. BC Ministry of Environment, Victoria. [www.env.gov.bc.ca/cas/pdfs/indcc.pdf](http://www.env.gov.bc.ca/cas/pdfs/indcc.pdf). (22 December 2010). Although somewhat dated, this document describes in plain language historic changes in climate, potential future changes, and the impacts on water and aquatic ecosystems.

Murdock, T.Q., J. Fraser, and C. Pearce, editors, (2007). Preliminary Analysis of Climate Variability and Change in the Canadian Columbia River

Basin: Focus on Water Resources. Pacific Climate Impacts Consortium, University of Victoria, Victoria BC.

<http://pacificclimate.org/docs/publications/CBT.Assessment.pdf>.

Pearce, C. (2011). Pathways to Climate Resilience – A Guidebook for Canadian Forest-based Communities. This aims at helping small, rural communities prepare for climate change. [www.modelforest.net/](http://www.modelforest.net/)

Pike, R.G., K.E. Bennett, T.E. Redding, A.T. Werner, D.L. Spittlehouse, R.D. Moore, T.Q. Murdock, J. Beckers, B.D. Smerdon, K.D. Bladon, V.N. Foord, D.A. Campbell, and P.J. Tschaplinski (2010). Climate Change Effects on Watershed Processes in British Columbia. Chapter 19 from Compendium of forest hydrology and geomorphology in British Columbia. Forum for Research and Extension in Natural Resources (FORREX). The Compendium consolidates current scientific knowledge and operational experience into 19 peer reviewed chapters. Chapters in the Compendium summarize the basic scientific information necessary to manage water resources in forested environments, explaining watershed processes and the effects of disturbances across different regions of British Columbia. [www.for.gov.bc.ca/hfd/pubs/Docs/Lmh/Lmh66.htm](http://www.for.gov.bc.ca/hfd/pubs/Docs/Lmh/Lmh66.htm).

\*Pike, R.G., D.L. Spittlehouse, K.E. Bennett, V.N. Egginton, P.J. Tschaplinski, T.Q. Murdock, and A.T. Werner (2008a). A Summary of Climate Change Effects on Watershed Hydrology. BC Ministry of Forests and Range, Research Branch, Victoria BC. Extension Note 87. [www.for.gov.bc.ca/hfd/pubs/Docs/En/En87.htm](http://www.for.gov.bc.ca/hfd/pubs/Docs/En/En87.htm). This 4-page document summarizes information in Pike et al 2008b and 2008c.

Pike, R.G., D.L. Spittlehouse, K.E. Bennett, V.N. Egginton, P.J. Tschaplinski, T.Q. Murdock, and A.T. Werner (2008b). Climate change and watershed hydrology Part I – Recent and projected changes in British Columbia. Streamline Watershed Management Bulletin. Vol. 11. No 2. [www.forrex.org/streamline/ISS37/streamline\\_vol11\\_no2\\_art1.pdf](http://www.forrex.org/streamline/ISS37/streamline_vol11_no2_art1.pdf).

Pike, R.G., D.L. Spittlehouse, K.E. Bennett, V.N. Egginton, P.J. Tschaplinski, T.Q. Murdock, and A.T. Werner (2008c). Climate change and watershed hydrology Part II – Hydrologic implications for British Columbia. Streamline Watershed Management Bulletin. Vol. 11. No 2. [www.forrex.org/streamline/ISS37/streamline\\_vol11\\_no2\\_art2.pdf](http://www.forrex.org/streamline/ISS37/streamline_vol11_no2_art2.pdf).

Richardson, G. R. A. (2010). Adapting to Climate Change: An Introduction for Canadian Municipalities. Ottawa, Ont. Natural Resources Canada. [http://adaptation.nrcan.gc.ca/mun/index\\_e.php](http://adaptation.nrcan.gc.ca/mun/index_e.php).

Rodenhuis, D. et al. (2009). Climate Overview 2007: Hydro-climatology and Future Climate Impacts in British Columbia. <http://pacificclimate.org/docs/publications/PCIC.ClimateOverview.Revised.March2009.pdf>.

\*Walker, I.J. and Sydneysmith, R. 2008. British Columbia: in From Impacts to Adaptation, Canada in a Changing Climate 2007. Edited by D.S. Lemmen, F.J. Warren, J. Lacroix and E. Bush. Government of Canada, Ottawa, ON. [http://adaptation.nrcan.gc.ca/assess/2007/pdf/ch8\\_e.pdf](http://adaptation.nrcan.gc.ca/assess/2007/pdf/ch8_e.pdf).

### 9.3 WATER AND WATERSHEDS

BC Ministry of Community Development. A Guide to Green Choices: Ideas and Practical Advice for Land Use Decisions in British Columbia Communities. [www.cd.gov.bc.ca/lgd/planning/greenchoices.htm](http://www.cd.gov.bc.ca/lgd/planning/greenchoices.htm).

BC Ministry of Environment (1999). Water Conservation Strategy. [www.env.gov.bc.ca/wsd/plan\\_protect\\_sustain/water\\_conservation/wtr\\_cons\\_strategy/toc.html](http://www.env.gov.bc.ca/wsd/plan_protect_sustain/water_conservation/wtr_cons_strategy/toc.html).

BC Ministry of Environment (2001). Drinking Water Protection Plan: A Discussion Document. Victoria, BC. [www.watershed-watch.org/publications/](http://www.watershed-watch.org/publications/).

BC Ministry of Environment (2002). Stormwater Planning: A Guidebook for British Columbia. Victoria, BC. [www.env.gov.bc.ca/epd/epdpa/mpp/stormwater/stormwater.html](http://www.env.gov.bc.ca/epd/epdpa/mpp/stormwater/stormwater.html).

BC Ministry of Environment (2006). Develop With Care: Environmental Guidelines for Urban and Rural Land Development in British Columbia. Victoria, BC. [www.env.gov.bc.ca/wld/documents/bmp/dewithcare2006/develop\\_with\\_care\\_intro.html](http://www.env.gov.bc.ca/wld/documents/bmp/dewithcare2006/develop_with_care_intro.html).

BC Ministry of Environment. (2008). Living Water Smart: British Columbia's Water Plan. [www.livingwatersmart.ca](http://www.livingwatersmart.ca).

BC Ministry of Environment (2009). Dealing With Drought: A Handbook for Water Suppliers in British Columbia. Victoria, BC. [www.livingwatersmart.ca/](http://www.livingwatersmart.ca/).

BC Ministry of Environment (2010). British Columbia's Water Act Modernization: Discussion Paper. [www.livingwatersmart.bc.ca](http://www.livingwatersmart.bc.ca).

BC Ministry of Environment (2011). Water Allocation Plans. [www.env.gov.bc.ca/wsd/water\\_rights/wap/](http://www.env.gov.bc.ca/wsd/water_rights/wap/).

BC Ministry of Environment, Environment Canada, BC Groundwater Association (2006). Well Protection Toolkit. [www.env.gov.bc.ca/wsd/plan\\_protect\\_sustain/groundwater/wells/well\\_protection/wellprotect.html](http://www.env.gov.bc.ca/wsd/plan_protect_sustain/groundwater/wells/well_protection/wellprotect.html). Note this includes a fictional example of Well Protection Plan For Pumphanle, BC).

BC Ministry of Health Services (2002). Action Plan for Safe Drinking Water in BC. Victoria, BC.

BC Ministry of Health Services and Ministry of Water Land and Air Protection (2004). BC Drinking Water Source To Tap Screening Tool. [www.health.gov.bc.ca/protect/water.html](http://www.health.gov.bc.ca/protect/water.html).

BC Ministry of Healthy Living and Sport (2010). Comprehensive Drinking Water Source To Tap Assessment Guideline. [www.health.gov.bc.ca/protect/source.html#water2](http://www.health.gov.bc.ca/protect/source.html#water2).

Bowker Creek Initiative (2010). Bowker Creek Blueprint. Prepared with assistance from Westland Resource Group Inc., Kerr Wood Leidal Associates Ltd., and Murdoch de Greef Inc., Victoria, BC. [www.bowkercreekinitiative.ca/](http://www.bowkercreekinitiative.ca/).

Brandes, Oliver M., Tony Maas, and Ellen Reynolds (2006). Thinking Beyond Pipes and Pumps: Top Ten Ways Communities Can Save Water and Money. University of Victoria. <http://poliswaterproject.org/publications>.

Brandes, Oliver, Renzetti, Steve, and Kirk Stinchcombe (2010). Worth Every Penny: A Primer on Conservation-Oriented Water Pricing. Victoria, BC: University of Victoria, POLIS Project on Ecological Governance. [www.waterdsm.org/publication/344](http://www.waterdsm.org/publication/344).

Canadian Council of Ministers of the Environment. Source To Tap. [www.ccme.ca/sourcetotap/](http://www.ccme.ca/sourcetotap/).

Cox, Robert K, and Judith Cullington (2009). Wetland Stewardship Partnership (2009). Wetland Ways: Interim Guidelines for Wetland Protection and Conservation in British Columbia. Prepared for the Wetland Stewardship Partnership, Vancouver, BC.



[www.env.gov.bc.ca/wld/documents/bmp/wetlandways2009/wetlandways\\_docintro.html](http://www.env.gov.bc.ca/wld/documents/bmp/wetlandways2009/wetlandways_docintro.html).

Curran, Deborah (2007). Green Bylaws Toolkit for Conserving Sensitive Ecosystems and Green Infrastructure. Prepared for the Wetland Stewardship Partnership, Ducks Unlimited Canada, Grasslands Conservation Council of BC, Environment Canada, and The Province of BC. [www.greenbylaws.ca](http://www.greenbylaws.ca).

Drinking Water Leadership Council (2007). Drinking Water Officers Guide. Victoria, BC. [www.health.gov.bc.ca/protect/dwpublications.html](http://www.health.gov.bc.ca/protect/dwpublications.html).

Fraser Basin Council (2005). Authorities Affecting Source Water Protection in British Columbia: Research Paper. Prepared for Environment Canada. Vancouver, BC.

Heathcote, Isobelle W., Integrated Watershed Management, Principles and Practice. John Wiley & Sons Inc., 1998.

Inter-Governmental Partnership (2007). Beyond the Guidebook: Context for Rainwater Management and Green Infrastructure in British Columbia. [www.waterbucket.ca/rm/?sid=43&id=486&type=single](http://www.waterbucket.ca/rm/?sid=43&id=486&type=single).

Kerr Wood Leidal Associates Ltd. (2005). Template for Integrated Stormwater Management Planning. Prepared for Metro Vancouver. Burnaby, BC. [www.metrovancouver.org/about/publications/Pages/default.aspx](http://www.metrovancouver.org/about/publications/Pages/default.aspx).

McGuire, Gordon, N. Wyper, M. Chan, A. Campbell, S. Bernstein and J. Vivian (2010). Re-inventing Rainwater Management: A Strategy to Protect Health and Restore Nature in the Capital Region. A Submission to the Capital Regional District on behalf of the Veins of Life Watershed Society by the Environmental Law Clinic, University of Victoria. Victoria, BC.

Okanagan Basin Water Board (OBWB) (2009) Groundwater Bylaws Toolkit: An Appendix to the Green Bylaws Toolkit. Kelowna, BC.

Okanagan Water Stewardship Council (2008) Okanagan Sustainable Water Strategy: Action Plan 1.0. Coldstream, BC.

POLIS Water Sustainability Project (2010) Action H2O Water Sustainability Charter and WaterSmart Toolkit. Victoria, BC.  
Available at: [www.poliswaterproject.org/toolkit](http://www.poliswaterproject.org/toolkit).

Province of BC (1998). Water Use Plan Guidelines. Victoria, BC. [www.env.gov.bc.ca/wsd/plan\\_protect\\_sustain/water\\_use\\_planning/index.html](http://www.env.gov.bc.ca/wsd/plan_protect_sustain/water_use_planning/index.html).

Rosenau, Dr. Marvin L and Angelo, Mark (2000). Water Use Planning: A Tool to Restore Salmon and Steelhead Habitat in British Columbia. Prepared for the Pacific Fisheries Resource Conservation Council. Vancouver, BC.

Rutherford, Susan (2009). Bill 27: Opportunities and Strategies for Green Action by BC Local Governments. West Coast Environmental Law, Vancouver, BC.

US Environmental Protection Agency (2008). Handbook for Developing Watershed Plans to Restore and Protect our Waters.

Water Sustainability Committee of the BC Water and Waste Association (2004). Water Sustainability Action Plan for British Columbia: Framework for Building Partnerships.

Watershed Watch Salmon Society et al (2009). Fish Out of Water: Tools to Protect British Columbia's Groundwater and Wild Salmon. Vancouver, BC.

West Coast Environmental Law, BC Guide to Watershed Law and Planning. <http://watershedguide.wcel.org/>.

Wetlands Stewardship Partnership (2007) Green Bylaws Toolkit for Conserving Sensitive Ecosystems and Green Infrastructure. (Environmental Law Clinic, University of Victoria).

Wong, Jennifer, Porter-Bopp, Susanne and Oliver M. Brandes (2009) Water Conservation Planning Guide For British Columbia's Communities. The POLIS Project on Ecological Governance. University of Victoria. Victoria, BC.

## 9.4 WATERSHED PLANNING AND FIRST NATIONS

Centre for Indigenous Environmental Resources (2011). First Nation Watershed Management Tool. Winnipeg, Manitoba. "This three-year project will result in a First Nation Watershed Management Tool, comprised of a relevant and integrated framework, citizen workbooks and in-person and online training workshops to implement the framework and the management cycle for watershed planning, developed and piloted with our First Nation partners." [www.cier.ca/protecting-lands-and-water/current-initiatives.aspx?id=1658](http://www.cier.ca/protecting-lands-and-water/current-initiatives.aspx?id=1658)

Coastal Guardian Watchmen – on line support, resources and networking opportunities for BC coastal First Nations Guardian Watchmen Programs to monitor, steward and protect their lands and waters. <http://coastalguardianwatchmen.ca>.

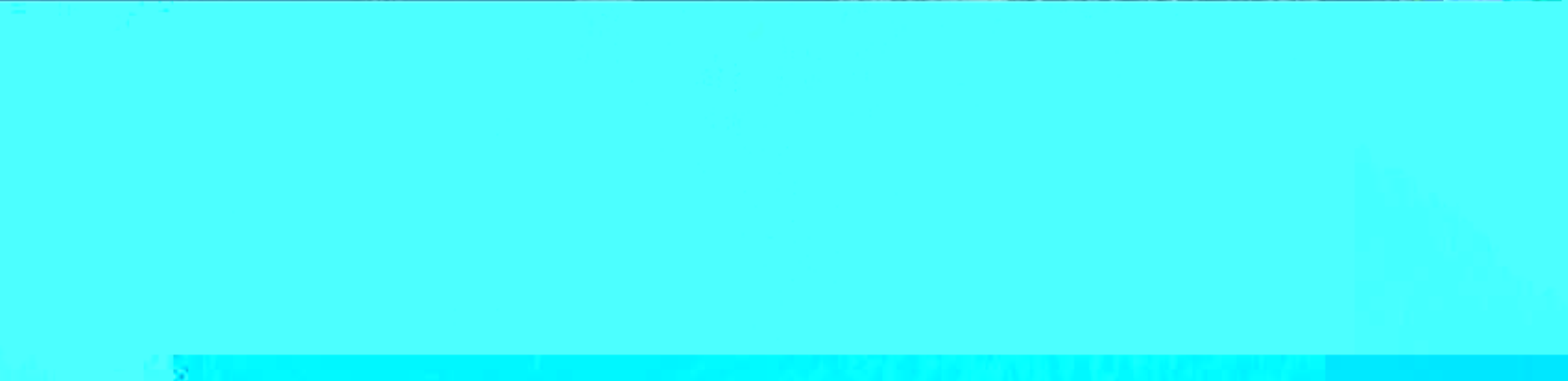
FORREX Watershed Planning Toolkit for First Nations – Forrex is in the process of developing a watershed planning toolkit for First Nations. The toolkit focuses on 100-150 agreements between the Province of BC and First Nations in forestry, looking at issues relating to economic access agreements, logging, forest tenure etc.

Lower Mainland Treaty Advisory Committee (LMTAC) – provides support services to member local governments dealing with broader Aboriginal issues, including land management, servicing, inter-governmental relations, and communications with First Nations (in addition to coordinating the interests of 26 municipalities and regional governments in the Lower Mainland treaty negotiations).

New Relationship Trust Fund – In March 2006, the BC government enacted the New Relationship Trust Act as part of an overall initiative to start a new relationship between government and First Nations. The Trust holds a fund that is designed to provide First Nations with tools, training, and skills so they can participate in land and resource management as well as land use planning processes, and also to develop social, economic, and cultural programs for their communities. The independent Board of Directors is appointed by the First Nations Summit, Union of BC Indian Chiefs, the BC Assembly of First Nations, the First Nations Leadership Council, and the BC Government.

Union of BC Municipalities – On line Policy Documents and Initiatives for local governments and First Nations relating to Treaty, Governance, Memoranda and Protocols, and Building Relations. [www.ubcm.ca/EN/main/resolutions/policy-areas/first-nations-relations/policy-documents-initiatives.html](http://www.ubcm.ca/EN/main/resolutions/policy-areas/first-nations-relations/policy-documents-initiatives.html).





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Environment  
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