Dealing with Drought

A Handbook for Water Suppliers in British Columbia

Updated July 2009

June 2004

BRITISH COLUMBIA
The Best Place on Earth

Ministry of Environment

Cover Photo: Toby Pike, General Manager
SEKID - South East Kelowna Irrigation District

Message from the Minister

For years, British Columbia has had a reputation for having a plentiful amount of clean water to support our quality of life and keep our ecosystems healthy and vibrant. But water is a finite resource. It is paramount that we learn to carefully manage it so we can keep it healthy and secure for the future.

The hot, dry summers of recent years, and 2003 in particular, brought home the message that we shouldn't take our water supply for granted. We need to change our way of thinking about our valuable water resource to ensure we are protecting water for communities, for economic development and for the sustainability of fish and aquatic ecosystems.

That is why I am pleased to offer this update to *Dealing with Drought: A Handbook for Water Suppliers in British Columbia*. Prepared with the support and assistance of the Union of British Columbia Municipalities, this document is designed to assist local water suppliers in dealing with drought management and water conservation planning.

Local governments and water suppliers are responsible for managing community water supplies, so I encourage you to take advantage of the information in this handbook.

By working together, we can better plan for the conservation of our water resource.

Barry Penner
Minister of Environment

BRITISH COLUMBIA
The Best Place on Earth

Ministry of Environment

Acknowledgements

This handbook was initially prepared in 2004 under the direction of the Deputy Ministers' Committee on Drought. Technical content and review was provided by the inter-ministry Task Force on Drought, including: Ministry of Agriculture, Food and Fisheries; Ministry of Community, Aboriginal and Women's Services; Ministry of Forests; Intergovernmental Relations Secretariat; Ministry of Health Services; Land and Water British Columbia, Inc., Ministry of Public Safety and Solicitor General; Ministry of Sustainable Resource Management; and Ministry of Water, Land and Air Protection. The advice and support of the Union of British Columbia Municipalities is gratefully acknowledged.

Legal Disclaimer

The information provided in this handbook is offered as a public service. Many factors may influence water supply availability. Without being limited to the following, several examples might be geography, the existence of microclimates, storage capacity, and population demands. As a result, the information in this handbook is of necessity general in nature and should not be relied upon as specific advice for responding to particular circumstances. You will have to review your particular circumstances and then determine whether the suggestions in this handbook are appropriate to those circumstances.

Water suppliers, such as local governments, improvement districts, and other authorities, should consider the appropriateness of the suggestions in this handbook and adapt them to suit their specific local conditions and requirements. Plans and bylaws should not be put in place by water suppliers without first receiving appropriate professional and legal advice.

While information provided within this handbook is believed to be accurate at the time of publication, we cannot confirm its currency, accuracy, or completeness or its applicability to or suitability for individual circumstances. Therefore, persons using this handbook should take steps to independently verify the information.

Also, the handbook also contains links to web sites of other organizations. As we do not control those websites, we cannot confirm the information provided by them.

British Columbia. Deputy Ministers' Committee on Drought.
Dealing with drought : a handbook for water suppliers in British Columbia.

"July 2009"
Also available on the Internet.
ISBN 0-7726-5199-X

1. Water-supply - British Columbia - Management.
2. Water-supply – Government policy - British Columbia.
3. Droughts - British Columbia. I. Ministry of Environment. II. Title.

TD226.B7 B74 2004 363.6'1'09711 C2004-960096-6

Copies of this report may be downloaded from:
http://www.env.gov.bc.ca/wsd/public_safety/drought_info/index.html

Dealing with Drought

Table of Contents

Introduction 1
- Why Prepare for Drought? 2
- What is Drought? 3
- What are the Effects of Drought? 3
- How is Drought Measured? 4
- How to Prepare for Drought 5
- How to Minimize the Impacts of Drought 5
- For More Information 6

Appendices
- Table of Contents 7
- Overview of Appendices 8
- Appendix 1: Local Drought Management Teams 1-1
- Appendix 2: Planning Templates 2-1
- Appendix 3: Emergency Drought Consequence Plan Template 3-1
- Appendix 4: Example Bylaws 4-1
- Appendix 5: Drought Management Planning Resources for Water Suppliers 5-1

Introduction

The impacts of climate change coupled with the severe drought of 2003 in British Columbia demonstrated that the historical approach of supply management for our water resource is not sufficient. The Deputy Ministers' Committee on Drought was formed in August 2003 to address this issue, followed by the creation of a Drought Management Action Plan. Many of the Plan's long term actions are strategic, and largely focus on examining water management policy and practices for the purpose of recommending revisions. However, the majority of actions concentrate on helping water suppliers to better manage supplies at an operational level. The Action Plan activities also include continual communication efforts to sensitize the people of BC to the ongoing need for water conservation and demand management.

One important component of the Action Plan is the development of the document, *Dealing with Drought: A Handbook for Water Suppliers in British Columbia*. The handbook was prepared for the province and its communities with a two-part vision: 1) to provide proactive drought management goals to help prevent the onset of drought conditions, and 2) to assist and support water suppliers with assessing, planning, and responding to drought conditions and coordinating internal and external communications. The goals and responses outlined in the handbook are based on existing legislation.

The province has taken a lead role in drought management, providing water supply monitoring and forecasting, effective communication, and tools and templates. Water suppliers may use the tools provided by the provincial government and customize their responses and actions to accommodate the major water demands in their area. The handbook is just one part of a comprehensive water management strategy. Additional steps towards protecting drinking water and aquatic ecosystems, and ensuring sustainable community growth are also critical.

While some communities have been making concerted efforts to improve water use efficiency in their areas, a survey conducted by the provincial government in September 2003 found that approximately 25% of the province's water supply systems were stressed last fall, with two-thirds of those systems imposing water restrictions. Unusual or increased expenditures resulting from the drought conditions were experienced by 20% of those surveyed. In terms of drought management planning, the survey findings showed that less than a quarter of the province's water suppliers were well prepared to deal with a long term reduced supply of water (Figure 1). The results of the research have demonstrated the need to improve water supply planning. The *Dealing with Drought* handbook provides a framework and tools for local governments and water suppliers to meet this need.

The July 2009 update to the Dealing with Drought Handbook provides current web links and other references in the document. The primary information and planning templates are otherwise unchanged.

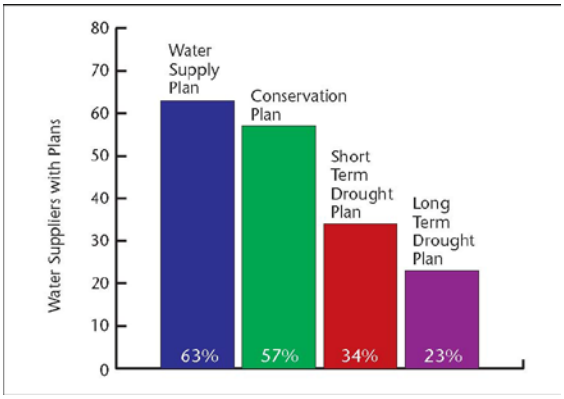


Figure 1.
Summary of water and drought management planning by water suppliers in British Columbia, September, 2003.

Why Prepare for Drought?

Managing community water supplies is a local government and local supplier responsibility. Planning will help your community to:

- protect community supplies for drinking water, sanitation, and fire protection,
- protect fish and aquatic ecosystems, and
- sustain industrial development and economic activity.

What is Drought?

Drought is the result of natural variability of climatic conditions. Dry areas of the Province like the Okanagan and Nicola valleys have challenges supplying sufficient water to meet demand even during normal years. Depending on the severity of the drought conditions these and other areas of the Province may experience significant adverse effects from drought. Drought can occur when there is a combination of sustained low precipitation and high rates of evaporation, resulting in:

- low water flows in streams, and/or
- low water storage levels, e.g. wells, reservoirs.

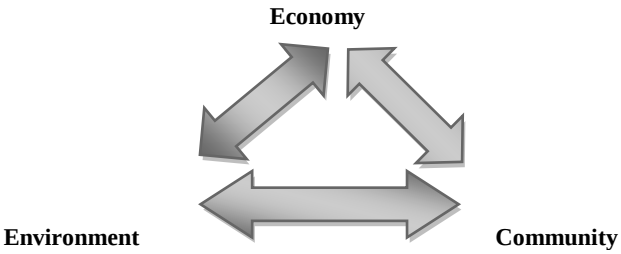
In BC, drought may be caused by natural or climate change impacts resulting in insufficient snow accumulation, hot and dry weather, a delay in fall rain, or by a combination of these factors. In addition to climate, our water supplies are affected by how much we use. With a growing population, increased demands are placed on water supplies, causing greater stress on water resources and intensifying the effects of drought conditions.

Low Snowpack
Hot and Dry
Delay in Fall Rain
Population Growth & Demands

→ **Water Shortages**

What are the Effects of Drought?

Drought affects communities, the environment, and the economy through a reduction of water for communities, agriculture, industry, and forestry. It also affects the sustainability of aquatic ecosystems.



- Lower water levels may increase concentrations of nutrients or contaminants, leading to poor water quality.
- With less available potable surface water, people may make heavier draws on ground water supplies, wells, and springs.
- Water that is necessary for biological or industrial production processes may be reduced, and agriculture and industry users may lose the ability to produce crops or provide goods and services to communities of the province, impacting the health and economy of an area.
- Coping with the effects of reduced supplies may cause chronic stress for some individuals and negatively affect the social fabric of a community.
- Drought conditions will also increase the risk of forest fires and limit water supplies for firefighting.
- Lower stream flows and the corresponding increased water temperatures threaten the survival of many fish and aquatic species.

How is Drought Measured?

By being familiar with local climate and water supplies, a community can anticipate and prepare for drought and "stressed" systems. To determine if your water supplies are "stressed" by drought, examine your supplies for one or more of the following conditions:

- streamflows are significantly lower than the recorded average,
- water quality does not meet water quality standards,
- key habitat factors, such as temperature, quality, cover, substrate, and accessibility – all necessary to sustain a biologically diverse community – are degraded,
- typical seasonal demands cannot be fully met,
- restrictions are currently in place, and anticipation of increasing severity of restrictions exists, or
- water use conflicts have arisen.

To assist suppliers, the provincial government monitors precipitation and streamflows across the province and posts regular updates to the River Forecast centre website at http://www.env.gov.bc.ca/rfc/index.htm . General responses applicable to each stage have been provided in the Drought Stages and Responses Matrix (Appendix 2-1).

How to Prepare for Drought

In order to assess risk and respond to drought, a water supplier may wish to establish a local **drought management team**. Recommendations for the team building process are provided in Appendix 1. Be sure to include people from all the relevant local water user groups on the team. A team may:

- gather all the available drought information for your community,
- identify information gaps,
- target water management needs,
- implement water conservation strategies,
- provide support to local government in managing community water supplies, and
- communicate with the public.

Many steps may need to be taken to accomplish these goals, and suggestions for actions and responses are described below and in Appendices 2 to 5.

How to Minimize the Impacts of Drought

One of the most important ways to maximize the effects of drought is to prepare a **Drought Management Plan** (Appendix 2). In order to plan for and respond to drought, a local drought management team needs to focus on three main goals:

1) get to know your water supplies,
2) improve water use efficiency, and
3) communicate, educate, and participate.

Achieving these goals will require assessment, response, and coordinated communication and conservation education efforts. To assist local governments with reaching these goals, the handbook provides planning templates and example bylaws. These are available in Appendices 2 to 4. Some communities have conducted these studies already, and reviewing their plans may assist your community with deciding upon the most useful approach. For more information, refer to the resources provided in the "Drought Management Planning Resources" (Appendix 5).

Drought Management Goals

1. **Get to Know the Water Supplies – Assess and Plan**
   - Assess your local water supply and demand by preparing a **Water Supply and Demand Analysis Plan**, a **Drought Management Plan** and an Emergency Drought Consequence Plan (Appendices 2,3).
   - Establish a monitoring system including location, frequency of data collection, and reporting tools.
   - Establish a communication plan to reach all people in your community.
2. **Improve Water Use Efficiency…Conserve! Conserve! Conserve!**
   - In addition to the environmental benefits, reductions in water use translate into lower costs for water supply and sewage infrastructure. It makes economic, environmental, and social sense to conserve water 365 days a year.
   - Create a **Water Conservation Plan** (Appendix 2).
   - Establish bylaws for water restrictions (Appendix 4).
   - Communicate and educate – share water conservation and drought management ideas with your community.
   - Stop the leaks! Develop leak detection and repair programs for supply systems in every sector (e.g. irrigation pipelines, municipal distribution systems, residences).
   - Plant drought-tolerant species.
   - Encourage (or regulate through bylaws) the use of water efficient appliances, including washing machines, dishwashers, and ice machines, and water efficient livestock watering systems.
   - Encourage proper design and installation of irrigation systems to increase system efficiency.
   - Schedule irrigation water using soil moisture monitoring devices or evapotranspiration data. Climate data can be found at www.farmwest.com and www.agr.gc.ca/pfra/drought/index_e.htm.
   - Install water meters and implement appropriate water rates and pricing. To read about one successful experience, see the City of Kelowna's website www.getwatersmart.com .
   - Monitor water use to ensure water conservation goals are being achieved.
   - Evaluate impacts of drought on the economy of the region to highlight vulnerable sectors.
   - Develop reclaimed water initiatives for non-potable water supplies.
3. **Communicate, Educate, and Participate**
   - A local **drought management team** can communicate directly with the community about drought management goals, actions, water supply status, and forecasts.
   - Check that the goals of the **Drought Management Plan** correspond to goals of the Water Conservation Strategy (1998), the *Drinking Water Protection Act*, and any other applicable legislation or other local water management plans and bylaws, and communicate the benefits of these plans to the public.
   - Teams can conduct one-on-one meetings with major water users in the community to discuss the goals of your Drought Management Plan and Water Conservation Plan, and their role in implementing these plans.
   - Create water conservation stewardship awards to recognize water saving efforts in your community.

For More Information

Visit BC's Provincial Drought Information website at: http://www.env.gov.bc.ca/wsd/public_safety/drought_info/ .

Appendices

Table of Contents

Appendix 1: Local Drought Management Teams
- Introduction 1-1
- Guidelines 1-1

Appendix 2: Planning Templates
- Introduction 2-1
- 2-1 Drought Stage and Response Matrix 2-2
- 2-2 Drought Management Plan Template 2-3
- 2-3 Water Supply and Demand Analysis Template 2-4
- 2-4 Water Conservation Plan Template 2-9

Appendix 3: Emergency Drought Consequence Plan Template
- Table of Contents 3-1
- 1. Overview 3-3
- 2. Emergency Response Guidelines 3-5
- 3. Position Checklists 3-10
- 4. ISSUE - Loss of Potable Water 3-12
- 5. ISSUE - Loss of Firefighting Water 3-13
- 6. ISSUE - Total Loss of Water 3-14
- Appendices ..... 3-15 to 3-29

Appendix 4: Example Bylaws
- Introduction 4-1
- Examples 4-3

Appendix 5: Drought Management Planning Resources for Water Suppliers
- General Water Management Resources 5-1
- Drought Management Resources 5-1
- Water Conservation Resources 5-2

Overview of Appendices

The resources and templates included in the appendices are intended to assist water suppliers with increasing their knowledge and understanding of local water supplies, implementing conservation measures, and making decisions about appropriate responses to specific stages of drought.

Appendix 1: Local Drought Management Teams – context and guidelines for the establishment of local drought management teams.

Appendix 2:

- **Drought Stages and Response Matrix** – an overview of the stages of drought and appropriate response at each stage, as well as in the event of emergency loss of community water supplies.
- **Drought Management Plan Template** – steps for building an effective drought management plan.
- **Water Supply and Demand Analysis Template** – a framework for the development of a comprehensive water supply and demand analysis.
- **Water Conservation Plan Template** – strategies and tools for reducing water demands on a long term basis.

Appendix 3: Emergency Drought Consequence Plan Template – a general emergency plan template, provided by the Provincial Emergency Program (PEP), that identifies the steps that are necessary when a pending loss of water source exists, and once that water supply is lost. The priorities of potable water, fire protection, and agricultural supplies are a reflection of PEP's mandate, and are not necessarily consistent with the purpose of the handbook.

Appendix 4: Example Bylaws – may serve as a guide for local jurisdictions considering creation of regulatory controls to reduce water demands on the local supply system.

Appendix 5: Drought Management Planning Resources for Water Suppliers – general water management, drought management, and water conservation resources available online.

Appendix 1

Local Drought Management Teams

Introduction

Effective implementation of the drought management practices recommended in the *Dealing with Drought* handbook largely relies on the formation of a local drought management team. The responsibilities of a local drought management team may include:

- acting as an advisory committee to local politicians and staff regarding water conservation and drought management recommendations,
- compiling data on water supplies and users in their own watershed,
- coordinating efforts with various stakeholders (including fisheries, agriculture, industry, and neighbouring communities),
- providing timely information to the public about water supplies, and
- continually encouraging water conservation and appropriate responses to drought conditions.

The team should include representatives from each of the major and relevant user groups served by the supply system. Some communities may choose to develop drought management teams in a combined effort with neighbouring areas if water is drawn from a common watershed. Some watersheds in British Columbia may already have committees to address local water supply issues and in this case may adopt drought management goals as one part of their mandate. Overlap with any existing or proposed drinking water quality, water conservation, and emergency planning activities should be encouraged as a step towards integrating the goals and actions of these related groups.

Guidelines

General guidelines for a **Local Drought Management Team Action Plan** include:

- Establish membership. In addition to the water supplier, involve members from all user groups in the area, including but not limited to: at least one representative from each type of agriculture, one from each type of major industry, as well as fisheries, tourism, and public services.
- Obtain public input and promote public involvement.
- Improve understanding and awareness regarding local government responsibilities for water management.
- Develop mandate, specify roles for members, determine meeting frequency, and identify team needs.
- To reduce potential conflicts among user groups and improve coordinated management efforts, clearly establish water use priorities in the supply system. Consider the following priorities:
  - uses imperative to the protection of public health and basic aquatic ecology,
  - uses important to the social and economic well-being of the area, and
  - uses that may be disrupted or restricted for a short term without considerable impact.
- Identify goals outlined in the handbook (see page 6), and create a timeline to meet those goals, along with a plan outlining members' responsibilities.
- Gather all available relevant drought information and identify gaps and target needs.
- Complete water supply plans based on the recommendations and templates provided by this handbook.

Appendix 2

Planning Templates

Introduction

The templates included in this appendix are intended to assist with water supply planning with the purpose of protecting community supplies for drinking water, sanitation, and fire prevention. They are also intended to assist in protecting water supplies for protecting fish and aquatic ecosystems, and sustaining industrial development and economic activity. The templates highlight the information needs for water supply planning recommended by the Dealing with Drought handbook.

- **Drought Stage and Responses Matrix** – provides an overview of appropriate responses during the different stages of drought (Normal, Dry, Very Dry, and Extremely Dry). An assessment of regional drought stages will be provided online and will inform water suppliers of the surrounding conditions as well as the responses and management actions that are appropriate for those conditions. Updates of regional drought stages will be provided online at: http://www.env.gov.bc.ca/rfc/river_forecast/water-supply.htm

- **Drought Management Plan Template** – the plan includes establishing a local drought management team, identifying drought stages and corresponding responses, and clearly assigning responsibilities, to ensure that the party responsible and the expected actions have been planned and agreed upon among the major users of the watershed.

- **Water Supply and Demand Analysis Template** – provides a framework for conducting a hydrology study to characterize the present supply of water to a local system. The study also assesses current demands and evaluates future growth in demands, examines the adequacy of the supply to meet those demands, and suggests alternative management strategies.

- **Water Conservation Plan Template** – encompasses strategies and tools for reducing water demands on a long term basis.

2-1 Drought Stages and Response Matrix

Stage	Goal/Targets	Action/Response	Communication
Normal	Prevent entrance to Dry Stage	Encourage conservation, stewardship, and education; complete water supply, conservation, drought management, and emergency drought consequence plans	Promote conservation programs through local media
Dry	Prevent and prepare for Very Dry stage, target water use reduction of 10-20%	Voluntary conservation among all users, as well as an increase in monitoring efforts and watering restrictions	Use local media releases to advise of watering restrictions, encourage conservation, update current supply status and share forecasts of future conditions
Very Dry	Prevent and prepare for Extremely Dry, target water use reduction 20-40%	Use sector-specific restrictions based on priority water licence rights; eliminate filling of public fountains and watering of public parks, gardens, medians, and other similar areas; limit new connections or uses. Province may limit the number of, and impose restrictions on, new licences, regulate storage, or invoke conditions on existing licences	Directly contact users, explain priority licensed uses and conservation needs; have local media explain restrictions and enforcement; increase communication between province and local jurisdictions (seek contact information at http://www.env.gov.bc.ca/wsd/
Extremely Dry	Prevent and prepare for possible loss of supplies, maximum possible reductions for all sectors	Regulatory control rather than voluntary – monitor and enforce restrictions and allocations through bylaws; no outdoor or summer usage. Province may restrict use by lower priority licensees or those with conditional clauses, may assist communities seeking alternative sources	Increase frequency of communication with all users, continue reporting to province, forecast future scenarios, and explain the expected responses in the case of a loss of community supplies
Loss of Community Supplies	Ensure health and safety, aim to re-enter lower drought classification	Follow the steps of your Emergency Drought Consequence Plan. Allocate water on a per capita basis, no outdoor or summer usage, no potable water used on landscapes, monitor compliance, seek and use alternative supplies	Declare a state of emergency, provide frequent updates through all forms of media on necessary actions

Appendix 2 2-2 Drought Management Plan Template	
❑	**1. Build a local drought management team** • Include representatives from all major users in water supply area. • Follow the guidelines outlined in Appendix 1.
❑	**2. Document your water system profile** • Base it on information from Water Supply and Demand Analysis study, Appendix 2-3.
❑	**3. Evaluate the impacts of drought on the region's economy** • Consider drought impacts on the public as well as the local economy and on the potential for economic growth, especially in industrial and agricultural sectors.
❑	**4. Monitor water supplies and climate** • Establish data requirements, location, frequency of data collection, and reporting.
❑	**5. Define Drought Stages** • Consider your water supply, all demands on that supply, and climate factors to define the drought stages of Normal, Dry, Very Dry, and Extremely Dry. The provincial Forecast Centre will rank your region according to these stages, but the rank of your local supplies may differ according to storage and regulated flows.
❑	**6. Establish Drought Responses** • Identify the actions required by each user group and water supplier for each drought stage, including activities recommended in your **Water Conservation Plan** or relevant bylaws. • Examples of user groups may include, but are not limited to, industry, agriculture, public utilities, and local fisheries. • Responses may be based on those outlined in the Drought Stages and Response Matrix (Appendix 2-1) but will need to be customized to local needs.
❑	**7. Develop Communications** • Identify the local drought management team representative responsible for documenting necessary communications for each drought stage. • Communicate with provincial government and the public about water management goals, actions, water supply status, and forecasts. As well, review the province's online Drought Information website: http://www.env.gov.bc.ca/wsd/public_safety/drought_info/index.html . • Communicate the benefits of water management plans to the public. • Conduct one-on-one meetings with water users in the community to discuss the goals and responsibilities of your Drought Management Plan and water conservation strategies.
❑	**8. Evaluate your Drought Management Plan** • Confirm that your Drought Management Plan corresponds to the goals of the provincial Water Conservation Strategy (1998), Drinking Water Protection Act, and other local water management plans.

2-3 Water Supply and Demand Analysis Template

(Based on the Nanaimo River Water Management Plan, BC Ministry of Environment, Land and Parks, 1993.)

This template highlights the information needs of a water supply and demand analysis, especially for the purpose of creating a Drought Management Plan. Note that it may not be necessary or possible to complete each section. To access an example online, visit www.crd.bc.ca/water/reports/strategic/.

Note: Real-time data from local climate monitoring stations are available through Environment Canada, Water Survey of Canada at: http://scitech.pyr.ec.gc.ca/waterweb/formnav.asp

1.0 Introduction

Study Area: area served by the supply

Background:

- Location of supply *(name of supply)*
- Historical water use *(indicate average annual, monthly, and daily use in cubic metres for each sector connected to supply and indicate methodology of measurement, e.g. metres, pump log)*
- Fisheries *(describe historical trends with population counts, economic value to region, instream flow requirements in cubic metres and metres per second)*

Water Management Issues and Concerns:

- Population growth trends *(use individual counts and total percent change)*
- Fisheries *(identify potential conflicts, impacts of population growth, water quality and quantity, changes to fish populations)*
- Ground water management *(describe management strategies, including monitoring, total use in cubic metres, location and quality of wells and pumps; also describe conflicts or contamination concerns)*
- Surface water supply *(describe management strategies, including monitoring, total use in cubic metres, location of wells and pumps; also describe conflicts or contamination concerns)*

Purpose and Objectives of Study:

- Address instream uses
- Consider management alternatives
- Resolve potential conflicts

2.0 Basin Description

Location and size:

- Map of basin areas including size of basin *(km^2)*, origin of water source, elevation range

Population:

- Population served *(individual counts)*
- Service connections *(number)*
- Growth trends *(consider past 50 years or maximum time period of data records, in individual counts and total % change)*

Land Use (Agriculture, Forestry, Urban, Future Land Use):

- Discuss effect of each of the following on water resource:
  - Growth trends for each sector (% change)
  - Water supply use
  - Effects of land-use changes on water quality and quantity *(e.g. erosion, release of organic effluent)*

Basin Features:

- Geologic *(% composition, spatial distribution, special features)*
- Vegetation *(instream and riparian, % cover and composition)*
- Climate *(annual, monthly, and daily precipitation in mm, annual, monthly, and daily temperature in °C, and annual, monthly, and daily evapotranspiration using temperature for past 50 years or maximum time period of data records)*
- Soils *(instream and riparian, total % composition, average moisture content)*

3.0 Water Resources

3.1 Surface Waters

- **Streamflow Records:**
  - Drainage area of recorded station *(km^2)*
  - Daily, monthly, annual summaries *(cubic metres/s)*
  - Graphical summaries *(consider maximum time period of data records)*
  - Map showing climate monitoring stations in relation to study area

- **Reservoir and Lake Levels:**
  - Daily, monthly, annual storage summaries *(water levels in metres, volumes in cubic metres, and calculation of cubic metres per day of supply based on average population use)*
  - Stage storage curves and rule curves *(water levels in metres)*

- Effects of Storage and Diversion:
  - Size of storage *(cubic metres, minimum and maximum reservoir storage volume)*
  - Use of reservoirs *(rules and regulations of use, diversion rates in cubic metres/second, comparison of regulated and natural flows if available in % change)*

- **Low Flows:**
  - Critical low flows and probabilities *("chance" that flows will be below a certain period based on a 7 day period, total percent change from mean discharge rates, and flow rates in cubic metres/second)*
  - Historical low flows recorded
  - Potential conflicts among user demands

- **Quantification of system leaks** *(location in system, water loss in cubic metres/day, total % of extracted use)*
  - Drainage area of recorded station *(km^2)*
  - Daily, monthly, annual summaries *(cubic metres/s)*
  - Graphical summaries *(consider maximum time period of data records)*
  - Map showing climate monitoring stations in relation to study area

3.2 Ground water

- **Description of Ground Water Resource:**
  - Map of existing wells *(from section 1.0 of the template, or from the Ministry of Environment:* http://www.env.gov.bc.ca/wsd/plan_protect_sustain/groundwater/wells/gwsmaps.html)

- **Description of Ground Water Resource:**
  - Summary of water level measurements over time (mm) and average volume *(cubic metres)*
  - Ground water withdrawals *(litres/second or cubic metres/second, identify use)*
  - Capacity tests, pumping tests, the aquifer mapping resource, observation well data

- **Ground Water Potential:**
  - Bedrock *(extent of exposure)*
  - Summary of yields over time *(include maximum time period of data records)*
  - Ground water/Surface water relationship

4.0 Water Quality

4.1 Surface Water Quality

- **Data Collection:**
  - Bacteria *(daily total and fecal coliform per 100 mL)*
  - Chlorine residuals *(daily total and free chlorine mg/L or ppm)*
  - Daily temperature *(°C)*
  - Daily pH
  - Daily turbidity *(ppm)*
  - Disinfection by-products *(e.g. Trihalomethanes and Haloacetic acids in ppm measured quarterly)*
  - Heavy metals *(mg/L or ppm)*
  - Nutrient loading *(average concentrations of nitrogen and phosphorus recorded weekly compared to maximum time period of data records)*
  - Heavy metal concentrations *(recorded weekly)*
  - Turbidity *(average annual, monthly, and daily in mm if using a Secchi Disk or NTUs if using turbidity sensors)*
  - E. coli counts *(per 100 mL)*
  - Fecal coliform counts *(frequency as prescribed by the* Drinking Water Protection Act *per 100 mL)*

- **Water Quality Assessment:**
  - By use *(e.g. impact from and upon industrial use, irrigation/stock watering, aquatic life, recreation)*
  - Maximum draw down level of storage *(before water quality is compromised)*

- **Trend Assessment:**
  - Summary of changes in water quality parameters over time *(maximum time period of data records)*

4.2 Ground Water Quality

- **Available Data for all Parameters in 4.1**

- **Ground Water Quality Assessment:**
  - By use *(e.g. drinking water, industrial compared to BC Approved Water Quality Guidelines)*

- **Aquifer Contamination Potential:**
  - Identify upstream and downstream uses, permeability of sediments
  - References to more data: BC Aquifer Classification System, Vancouver Island Vulnerability Mapping Project

5.0 Fisheries

5.1 Fisheries Management (Federal)

- Resource description *(e.g. spawning and rearing habitat for salmon)*
- Summary of returns *(catch in kilograms and economic value, if applicable)*
- Instream water requirements *(cubic metres/second needed to maintain specific water levels, water temperature requirements for each species)*

5.2 Recreational Fisheries Management (Provincial)

- Resource description *(as above)*
- Summary of returns *(as above)*
- Instream water requirements *(as above)*

5.3 First Nations Fisheries Management

- Resource description *(as above)*
- Summary of returns *(as above)*
- Instream water requirements *(as above)*

6.0 Water Resource Uses

6.1 Surface Water Rights

- Details of licensed use (information available on the Ministry of Environment website: http://www.env.gov.bc.ca/wsd/water_rights/index.html).
- Maximum and minimum withdrawals *(convert to cubic metres)*, and
- Average annual, monthly, and daily withdrawals *(cubic metres/second, % extraction out of total use)* for:
  - municipal
  - industrial
  - agricultural
  - domestic
  - storage
  - conservation

6.2 Instream Water Requirements

- First Nations
- Fisheries *(minimum and maximum flows in cubic metres/second)*
- Wildlife *(minimum and maximum flows in cubic metres/second, or life cycle characteristics dependent on water supply)*
- Wetlands preservation
- Recreation uses *(e.g. tourism operator requirements, average annual economic value of recreational services to region)*
- Flow dilution
- Power projects

6.3 Identification of Species at risk by COSEWIC

http://www.sararegistry.gc.ca/default_e.cfm

6.4 Identification of designated sensitive streams

http://www.bclaws.ca/Recon/document/freeside/--%20F%20--/Fish%20Protection%20Act%20%20SBC%201997%20%20c.%2021/05_Regulations/11_89_2000.xml

6.5 Ground water uses *(from section 3.2 of template)*

- municipal
- industrial
- agricultural
- domestic
- average annual, monthly, daily withdrawals

6.6 Downstream uses *(ensure priority water rights and instream requirements are being met)*

6.7 Future Water Resource Requirements

- Future water demands *(based on population growth trends from section 2.0 of template in cubic metres per person per day, month, and year)*
- Future instream requirements *(based on fisheries and wildlife growth trends, and necessity of contaminant dilution)*

7.0 Water Management Analysis

7.1 Natural Flows:

- Estimate inflow in cubic metres/second *(may need to "naturalize" flows from Section 3; that is, assess quantity of water that would flow through the basin if storage structures were not present)*

7.2 Demands: from section 6 of template

7.3 Supply/Demand Comparison

- Balance natural flows versus demands *(daily, monthly, and annual totals)* including future demands such as population growth. Assess if demands can be met in all years, or if a risk exists of not meeting demands in 1:5 years, 1:10 years, 1:25 years. *(Note: local jurisdictions generally need to look at the 1:25 year risk of not meeting demands.)*

7.4 Analysis Results

7.5 Interpretation of Results

- Consider adequacy and reliability of supply to meet existing and future demands based on water rights, previous supply deficiencies if applicable, and restrictions on water use.

7.6 Supplementary Storage Requirements

- Evaluate need for additional storage with respect to present and future demands.

8.0 Conclusions and Recommendations

Summarize findings from the study and report on the following:

- Water resource
- Water quality
- Fisheries resource
- Water resource uses
- Reservoir operations *(evaluate if changes to rule curves for minimum, maximum, and average storage are required)*
- Future storage *(assess need for infrastructure upgrades or new storage sites)*

2-4 Water Conservation Plan Template	
For an example of more detailed planning strategies, please visit: http://www.epa.gov/watersense/pubs/guide.htm	
❑	**1. Existing Conservation Strategies** • Review and report on the conservation measures previously and/or currently in place for each sector in area.
❑	**2. Annual Audit of Water Supply**
❑	**3. Future Projections** • Consider future population projections and potential drought scenarios and implement appropriate conservation measures, restrictions, and supply source identification.
❑	**4. Meters** • If not yet metered, install water meters on all or major service connections and create informative water bills (compare past usage, information on cost and value of water, basic conservation tips).
❑	**5. Testing and Maintenance** • Initiate a regularly scheduled meter testing and maintenance program. • Conduct a system-wide leak detection program and repair any problems.
❑	**6. Conservation Measures Implemented** (examples below) • Retrofitting of water efficient appliances and plumbing fixtures for residential and commercial sectors, possibly through rebate programs • Leak detection program for homeowners, industry, agriculture • Drip irrigation systems and voluntary irrigation start times (reduce peak hour) • Examine water reuse, recycling, and non-potable water opportunities • Xeriscaping • Lawn watering restrictions • Industrial power-washing restrictions • Incentive-based water rates
❑	**7. Conservation Measure Implementation Schedule**
❑	**8. Conservation Measure Evaluation** • Evaluate each measure before, during, and after implementation for: - simple payback period - reliability of water savings - political and legal constraints in implementation, enforcement, or effectiveness - compatibility with municipal, provincial, and federal goals - reduction goals or achievements - useful lifetime - life cycle cost (initial purchase prices and maintenance costs) - impact on level of service - reduction of wastewater and energy savings - environmental impact and success in other jurisdictions
❑	**9. Public Education Program** • Encourage efficient water use through: - workshops for plumbers, landscapers, irrigation service providers, farmers, schools, and First Nations - Drought Information website: http://www.env.gov.bc.ca/wsd/public_safety/drought_info/ - press releases for newspapers and radio - posters, brochures, flyers, special events booths, and volunteer stewardship programs
❑	**10. Technical and Financial Assistance Programs** • Rebates for installation of drip irrigation systems, or low volume plumbing fixtures • Demonstrate cost savings (e.g. average annual expenses on infrastructure maintenance)

Appendix 3

Emergency Drought Consequence Plan Template

Provided by the Provincial Emergency Program

Table of Contents

1. Overview
- 1.1 Introduction 3-3
- 1.2 Purpose and Scope 3-3
- 1.3 Incident Commander 3-4
- 1.4 Contacts and Resources 3-4

2. Emergency Response Guidelines
- 2.1 Plan Activation and Termination 3-5
- 2.2 Notification Procedures 3-5
- 2.3 Three Levels of Response Activation (BCERMS) 3-6
- 2.4 Information Flow / Directions 3-6
- 2.5 Risk Management 3-8
- 2.6 Administration 3-9

3. Position Checklists 3-10
- 3.1 Generic Checklist - For All Positions 3-11

4. ISSUE - Loss of Potable Water 3-12

5. ISSUE - Loss of Firefighting Water 3-13

6. ISSUE - Total Loss of Water 3-14

Appendices
- A. Agreements, Contracts and Mutual Aid 3-15
- B. Bylaws and Legislation 3-16
- C. Contacts and Resources 3-17
  - Emergency Contacts 3-18
  - Community Resources 3-19
- D. Definition and Terms 3-22
- E. Electronic Access 3-25
- F. Forms 3-26
- G. Government Agencies 3-27

1. Overview

1.1 Introduction

This *Drought Consequence Plan* is intended for use by all members of <*Community*> in the event of a loss of potable water, firefighting water or both. Drought consequence and water loss issues should be dealt with as a specific emergency management issue, in Local Authority Emergency Plans in an All Hazards approach. Where no such plans exist, this Drought Consequence Plan can be used by a Water Utility, including an Improvement District or private service provider, as a guide to dealing with fire water loss, potable water loss or complete water loss either as a consequence of drought or as a result of systems failures. In the event of an emergency water loss situation, the Local Authority for an area should provide first assistance. All emergency situations that affect the health and safety of the public should be reported to the Provincial Emergency Program at 1-800-663-3456.

Sections 1, 2 and 3 of this plan apply to "local authorities," which includes municipal governments and those regional districts that have the authority to undertake emergency management. The plan is also a useful response guide to Water Utilities such as suppliers in Improvement Districts or private service providers who are not under a local authority, by using Sections 4 to 6 and the Appendices.

This Plan is an interim plan and should be replaced by an all hazards <*Community*> *Emergency Response and Recovery Plan* or a <*name*>*Water Utility Emergency Plan* when published. Where this Plan refers to <*Community*> you may substitute <*Water Utility*> where appropriate.

1.2 Purpose and Scope

This Plan provides a guide to the response and recovery activities, communications responsibilities, and coordination necessary to provide for effective response to a major loss of water in the <*Community*>. The Plan **does** address response to a water loss incident resulting from a drought or system failure that may be of sufficient severity and magnitude to warrant execution of all or part of this Plan. This Plan **does not** address long term "Drought Management and Planning" or systems growth issues.

1.3 Incident Commander

The term IC (Incident Commander) is used throughout this document. It is a term derived from BCERMS (British Columbia Emergency Response Management System) that identifies the individual charged with managing the site response structure for an event. This may be a Public Works manager in a Local Authority or the Water Utility Manager in a small Water Utility. In either case, the person in charge of the response structure is the IC and has the overall decision making authority.

1.4 Contacts and Resources

All contact numbers and resource lists are found in Appendix C. It is the responsibility of each relevant <*Community*> department to ensure these lists are updated annually.

2. Emergency Response Guidelines

2.1 Plan Activation and Termination

When Should This Plan be Activated
This plan should be activated any time a loss of potable water or fire water, or both is threatened or has occurred.

Who Can Activate the Plan?
Typically one of the following people would be the delegated authority to implement the *Drought Consequence Plan*, in whole or in part:

- Mayor
- City Administrator
- Water Utility Board of Directors
- Water Utility Manager

The appropriate person would be determined by the size and administrative reporting structure of the water utility.

2.2 Notification Procedures

Initial Reports
It is expected that the Water Utility Manager will receive the first notice of the emergency. The Water Utility Manager will designate the Incident Commander.

Once initial assessment of the problem has been undertaken, the Incident Commander in turn should contact the Water Utility Manager, who after receiving the assessment report will provide a report to the administrative authority of the Water Utility.

Call Out and Contact Information
The contact lists in Appendix C contain the emergency contact information for all persons and agencies that may have a role in the response and recovery to this incident. These lists should also identify partner agencies that may be able to supply people or equipment, government agencies with support capabilities or regulatory functions, the contact information for equipment sourcing and sources of bottled or bulk water.

2.3 Three Levels of Response Activation (BCERMS)

This Plan recognizes the BCERMS' three levels of potential activation.

Level 1
A Level 1 response is one in which water levels are declining and voluntary conservation is being practised. There is little or no need to supplement existing water supplies. This level corresponds to Normal and Stage 1 of the Drought Stages and Response Matrix (Appendix 2-1 of the Dealing with Drought handbook).

Level 2
A Level 2 response indicates a larger scale or longer duration and may involve additional or unique resources, adding supply from alternative sources or similar extraordinary support activities. This response is one option for action recommended for Stage 2 of a drought (Appendix 2-1 of the Dealing with Drought handbook).

Level 3
A Level 3 response indicates that the water supply is in imminent failure and extraordinary response and resources are required. This may mean diverting firefighting water to potable supply only, maintaining firefighting water and trucking in of potable water or other similar extreme measures. This level of response may be necessary in Drought Stage 3 or during the emergency loss
of community supp
lies stage (Appendix 2-1 of the Dealing with Drought handbook).

2.4 Information Flow / Directions

Types of Information
Information during an emergency or a potential emergency situation must be managed carefully within a response organization at a single level, among the three BCERMS levels, and with the media and public. In broad terms, there are six types of information transactions common to emergencies:

- Command and Managerial Direction
- Situation Reporting
- Resource Requests
- General Information
- Public Information
- Documentation

Command and Managerial Direction
Managerial directions must follow the lines of authority established for the response organization. In a Municipal Water Utility this reporting and authority structure may be quite formal and it may involve several layers of authority, each with different responsibilities. In a less complex and smaller water utility a single person may have both the Incident Commander position and the managerial authority and may not require any other authorization to act.

Situation Reports
SITREPs
Situation reporting is a function most commonly managed through the EOC Planning Section in larger water utilities. In a small water utility a "Situation Report" may consist of a one page report prepared by the Water Utility Manager. Situation reports should be distributed to those parties who need to be informed. This could include the water user community, the media, partner agencies (including municipal, regional district or provincial governments) and emergency service agencies. The "Situation Report" should provide an update at a point in time that provides the detail of the current status of the event, work in progress and changes which may have occurred since the last report. "Situation Reports" should be issued at regular intervals.

SITREP forms are available on the PEP website: http://www.pep.bc.ca/index.html .

Resource Requests
Resource requests normally flow from site responders to the appropriate agency dispatch centres. However, to avoid duplication the Incident Commander may consolidate all unique/critical resource requests and pass the request to the Operations Section of the EOC, if activated, or to the EOC Director.

See Appendix D for definitions.

The EOC will forward resource requests that cannot be filled at the Site Support Level to the PREOC, and further to the PECC, if required. At each level, Operations, in consultation with the Planning Section, sets priorities for multiple requests with the respective Commander or Director. When required resources are obtained, they are directed to the location identified in the original request, with confirmation among the affected Logistics and Operation functions.

In a smaller water utility, resource requests may be initiated and tracked by a single person.

General and Public Information
General and Public Information may be distributed from a local drought management team, a public information officer in a larger water utility or from the Incident Commander in a small water utility. The Situation Report may be the vehicle for providing this type of information, or formal media releases, media briefings or interviews may be used as a means of keeping the public informed.

Documentation (Very Important)
It is extremely important to accurately document actions taken during emergencies. The following items must be documented:

- Policy decisions
- EOC decisions/direction
- Resource requests
- Personal log
- Functional position log

This will assist in tracking and monitoring the effectiveness of the response and action plans. Documentation is also important for tracking expenditures for cost accounting. The appropriate forms to be completed are available from the PEP website at http://www.pep.bc.ca/index.html .

2.5 Risk Management

Principles
Risk management is the process of planning and implementing decisions that will minimize the adverse effects of accidental or predictable personal and business losses on an organization.

Risk Management Strategies
The EOC shall apply risk management based upon the following strategies:

1. Assess damage and loss. Identify and analyze loss exposures in the categories of:

- Personnel
- Property
- Liability

2. Examine feasible alternative risk management techniques in the following general categories:

- Exposure avoidance
- Loss prevention
- Loss reduction
- Segregation of exposures:
    - Separation
    - Duplication
- Contractual risk transfer
- Risk financing

Risk to Personnel
All supervisory positions at the site and in the EOC shall evaluate the risk to personnel under their supervision with respect to the potential results of their actions in each situation.

In situations where the risk to personnel is excessive, activities shall be limited to defensive and protective operations.

NOTE: All workers subject to Part 3 of the BC Workers Compensation Regulations have the right to refuse work due to an unsafe environment.

2.6 Administration

Staffing
The site and EOC must be capable of functioning on a 24/7 basis from activation until de-mobilization. The Incident Commander and EOC Director will determine appropriate staffing for each activation level based upon an assessment of the current and projected situation. While the immediate solution may be to establish several complete shifts for the duration of operations, there are seldom the resources or facilities to sustain this approach. General and Management Staff positions in the organization should be filled by designated qualified individuals. Initially, all positions may be staffed by the available individual most qualified in the function to be performed. A PREOC will be able to assist in locating BCERMS qualified staff on an emergent basis.

First Aid
First Aid services that meet WCB regulations must be provided for all staff.

3. Position Checklists

This section provides checklists for the site incident management team identified in the organization chart and all functional positions required to staff the EOC in a major emergency. It is important to note that not all positions are required for all emergencies. Only those positions that are needed to effectively handle the emergency should be staffed. These checklists are to be used in conjunction with the hazard-specific checklist provided in Section 4.

Checklists have been proven to be an effective tool during emergencies. They help guide staff that may not be familiar or practised in their function, and provide useful reminders of items that should be done during an emergency. It is important that the entire checklist be read through once first before initiating action items.

As emergencies and exercises are reviewed, the applicability of the checklists should also be reviewed and revised as needed. The responsibility for this review lies with the EOC Director.

3.1 Generic Checklist - For All Positions

Activation Phase:

- ☐ Check in upon arrival at the incident or EOC. Obtain an identification card and vest, if available.
- ☐ If you are a volunteer, register with the Liaison Officer.
- ☐ Report to assigned supervisor.
- ☐ Review your position responsibilities.
- ☐ Establish and maintain a position log that chronologically describes the actions you take during your shift.
- ☐ Determine your resource needs, such as personal protective equipment or computer, phone, plan copies, and other reference documents.

Demobilization Phase:

- ☐ Deactivate your assigned position and close out logs when authorized by your supervisor.
- ☐ Complete all required forms, reports, and other documentation. All forms should be submitted through your supervisor to the Planning Section (Documentation Unit), as appropriate, prior to your departure.
- ☐ Be prepared to provide input to the after-action report.
- ☐ If another person is relieving you, ensure they are thoroughly briefed before you leave.
- ☐ Clean up your work area and provide a contact number before you leave.

4. ISSUE - Loss of Potable Water

Policies

1. The EOC will ensure water supplies are identified for potable water, firefighting, and agricultural use, in that order.
2. In the event of water loss caused by contamination, the Regional Drinking Water Officer of the Health Authority will issue the appropriate advisory. The response level will be determined by the nature of the contamination.

- ☐ Ensure representatives from Local Government, Health Authority, MoE, PEP. (as appropriate) are contacted and requested to attend the EOC.
- ☐ Establish adequate communications and news release systems.
- ☐ Notify the public of the problem and provide advice and seek assistance to ensure public health and safety. Establish public inquiry system.
- ☐ Ensure various systems are involved.
- ☐ Deploy field observers to gather drought impact intelligence.
- ☐ Consider possible major effects:
  - Disruption of agricultural operations
  - Need for water rationing
  - Contamination of normal water supplies
  - Possible business closures due to lack of water
  - Dangers to public health and evacuations
  - Losses to local economy

- ☐ Identify and locate alternative potable water supplies.
- ☐ Seek assistance/advice as necessary from Appendix G.
- ☐ Consider equipment needs and sources:
  - Water storage tanks - Local Businesses, Rail Operators
  - Pumps - Engineering
  - Water Tanker Trucks - PEP/Agriculture Associations

5. ISSUE - Loss of Firefighting Water

Policies

1. The EOC will ensure water supplies are identified for potable water, firefighting, and agricultural use, in that order.
2. In the event of loss of firefighting water caused by a loss of pressure or volume, or need to conserve potable supplies, an immediate Level 3 emergency response is required and a stop water use advisory issued.

- ☐ Ensure representatives from Local Government, Health Authority, Office of Fire Commissioner, MoE, PEP. (as appropriate) are contacted and requested to attend the EOC.
- ☐ Establish adequate communications and news release systems.
- ☐ Notify the public of the problem and provide advice and seek cooperation to reduce consumption. Establish public inquiry system.
- ☐ Ensure various water systems are involved.
- ☐ Triage structures to ensure only critical infrastructure is protected.
- ☐ Ensure firefighting apparatus maintains enough on-board tankage for firefighter safety.
- ☐ Consider possible major effects:
  - Inability to fight sustained action fires
  - Spread of fire to conflagration levels
  - Spread of fire to surrounding vegetation
  - Possible business closures due to lack of water
  - Dangers to public health and evacuations
  - Losses to local economy

- ☐ Identify and locate alternative water supplies and notify mutual aid fire services.
- ☐ Seek assistance/advice as necessary from Appendix G.
- ☐ Consider equipment needs and sources:
  - Water storage tanks - Local Businesses, Rail Operators
  - Pumps - Engineering
  - Water Tanker Trucks - PEP/Agriculture Associations

6. ISSUE - Total Loss of Water

Policies

1. The EOC will ensure water supplies are identified for potable water, firefighting, and agricultural use, in that order.
2. In the event of a total water loss, an immediate Level 3 emergency response is required.

- ☐ Ensure representatives from Health Authority, MoE, Office of Fire Commissioner, PEP. (as appropriate) are contacted and requested to attend the EOC.
- ☐ Establish adequate communications and news release systems.
- ☐ Notify the public of the problem and provide advice on alternate water supplies. Establish public inquiry system.
- ☐ Ensure various water suppliers are involved.
- ☐ Deploy field observers to gather drought impact intelligence.
- ☐ Consider possible major effects:
  - Disruption of agricultural operations
  - Need for water rationing
  - Contamination of normal water supplies
  - Possible business closures due to lack of water
  - Dangers to public health and evacuations
  - Uncontrolled fires
  - Losses to local economy

- ☐ Identify and locate alternative water supplies and notify mutual aid fire services.
- ☐ Seek assistance/advice as necessary from Appendix G.
- ☐ Consider equipment needs and sources:
  - Water storage tanks - Local Businesses, Rail Operators
  - Pumps - Engineering
  - Water Tanker Trucks - PEP/Agriculture Associations

A. Agreements, Contracts and Mutual Aid

Insert copies of any agreements between water suppliers and community as well as mutual aid documents.

B. Bylaws and Legislation

Insert any local bylaws and legislation that pertain to drought management and water loss.

C. Contacts and Resources

EOC Call-Out List

Position/Organization	Name	Work/Day	Home	Cell	Pager
EOC Director					
Information Officer					
Emergency Program Coordinator					
Police					
Elected Official					
Drinking Water Officer					

Emergency Contacts

Agency	Contact Name	Number 24/7	Alternative Contact Number
BC Ambulance			
Amateur Radio Club			
BC Forest Service			
BC Hydro			
Cable Provider			
City Administrator			
Emergency Program Coordinator			
(Deputy) Emergency Coordinator			
Emergency Social Services			
Office of the Fire Commissioner		1-888-988-9488	
Local Fire Department			
Hospital			
Mayor / Regional District Chair			
Ministry of Transportation			
PEP Regional Manager		1-800-663-3456	
Health Authority			
RCMP			
School District			
Telus			
Public Works			
Min of Environment			

Community Resources

The resource database is organized under the following headings:

Resource Category - Resource Category identifies the general category within which the resource falls. The categories used are the following:

- Backup Power Sources
- Communications
- Construction / Repair Material
- ESS Resources
- HazMat Equipment
- Human Resources
- Heavy Equipment
- Rescue Equipment
- Safety Equipment and Supplies
- Specialized Facilities
- Specialized Resources
- Transportation Resources, water tankers
- Water supplies, tanker suppliers, bulk bottled water

Sub-Area - Sub-area identifies where the resource is located within the operational area of the EOC.

Kind - Kind describes the kind of resource within the overall resource category.

Type - Type further describes the type of resource.

Source - Source lists the company or entity who is to be contacted for access.
to the resource

Quantity (Qty) - Quantity contains the number of that specific resource owned or employed by the source.

Contact Name 1 - Contact Name 1 lists the primary person who is to be contacted to acquire the resource.

Contact Number 1 - The phone number for the primary contact.

Contact Name 2 - The alternative person to be contacted if the primary contact is unavailable.

Contact Number 2 - The telephone number for the second contact person

Note: Resource template provided on following pages.

Backup Power Sources

Kind	Type	Source	Qty	Contact Name 1	Contact Number 1	Contact Name 2	Contact Number 2

Communications

Kind	Type	Source	Qty	Contact Name 1	Contact Number 1	Contact Name 2	Contact Number 2

Construction/Repair Material

Kind	Type	Source	Qty	Contact Name 1	Contact Number 1	Contact Name 2	Contact Number 2

Heavy Equipment

Kind	Type	Source	Qty	Contact Name 1	Contact Number 1	Contact Name 2	Contact Number 2

Human Resources

Kind	Type	Source	Qty	Contact Name 1	Contact Number 1	Contact Name 2	Contact Number 2

Safety Equipment and Supplies

Kind	Type	Source	Qty	Contact Name 1	Contact Number 1	Contact Name 2	Contact Number 2

Specialized Resources

Kind	Type	Source	Qty	Contact Name 1	Contact Number 1	Contact Name 2	Contact Number 2

Water Suppliers

Kind	Type	Source	Qty	Contact Name 1	Contact Number 1	Contact Name 2	Contact Number 2

D. Definition and Terms

BCERMS - The British Columbia Emergency Response Management System (BCERMS), is a standardized emergency management system that all provincial agencies are required to use when responding to emergencies. The system is a recommended best practice for local government. BCERMS documentation can
be found on the PEP website (http://www.pep.bc.ca/index.html).

Branch - The organizational level having functional responsibility for major parts of operations. Branches are identified by functional name (e.g. Fire, Engineering).

Critical Incident Stress Debriefing (CISD) - A mental health process designed to assist emergency services workers who have been subjected to extremely traumatic events.

Command - The act of directing and/or controlling resources by virtue of explicit legal, agency, or delegated authority. May also refer to the Incident Commander.

Department Operations Centre (DOC) - A pre-designated facility established by a city department to support the department's response to an emergency.

Disaster - Means a calamity that is caused by accident, fire, explosion, technical failure or by the forces of nature and has resulted in serious harm to the health, safety or welfare of people and widespread damage to property.

Drought - A prolonged shortage of rainfall impacting both ground water and surface water supplies.

Emergency Program Coordinator - The individual within each political subdivision who has coordination responsibility for jurisdictional emergency management.

Emergency Operations Centre (EOC) - A pre-designated facility established by an agency or jurisdiction to coordinate the overall agency or jurisdictional response and support to an emergency.

Event - An occurrence based on one of the 53 identified hazards in BC.

Finance/Administration Section - The Section responsible for all event costs and financial considerations. Includes the Time Unit, Procurement Unit, Compensation/Claims Unit, and Cost Unit.

Function - In ICS, function refers to the five major activities in the ICS, i.e. Command, Operations, Planning, Logistics, and Finance/Administration. The term function is also used when describing the activity involved (e.g. the planning function).

Ground Water - A water sourced from an underground aquifer.

Incident - An occurrence, caused either by human action or natural phenomena, that requires action by emergency service personnel to prevent or minimize loss of life or damage to property and/or natural resources.

Incident Action Plan - Contains objectives reflecting the overall incident strategy and specific tactical actions and supporting information for the next operational period. The Plan may be oral or written. When written, the Plan may have a number of forms as attachments (e.g. traffic plan, safety plan, communications plan, map).

Incident Commander (IC) - The individual responsible for the management of all incident operations at the incident site.

Incident Command Post (ICP) - The location from where the Incident Commander works.

Incident Command System (ICS) - A standardized on-scene emergency management concept specifically designed to allow its user(s) to adopt an integrated organizational structure equal to the complexity and demands of single or multiple incidents, without being hindered by jurisdictional boundaries.

Kind - Descriptor of a Single Resource. Engine (e.g. helicopter, ambulance).

Logistics Section - The Section responsible for providing facilities, services, and materials for the incident.

Management - The act of directing and/or controlling resources at the Site Support level by virtue of explicit legal, agency, or delegated authority.

Management Staff - Advisory positions to the EOC Director. The Risk Management Officer, Information Officer and Liaison Officer comprise the Management Staff.

Management By Objectives - In ICS, this is a top-down management activity which involves a three-step process to achieve the incident goal. The steps are: establishing the incident objectives, selection of appropriate strategies to achieve the objectives, and the tactical direction associated with the selected strategy. Tactical direction includes selection of tactics, selection of resources, resource assignments, and performance monitoring.

Marshalling Area - An area used for collecting and holding resources in reserve or prior to being deployed to incident Staging Areas.

Objectives - Statements of "what" must be accomplished within a given Operational Period.

Operational Period - The period of time scheduled for execution of a given set of objectives as specified in the EOC Action Plan. Operational Periods can be of various lengths, although usually not over 24 hours.

Operations Section - Responsible for the coordination of all operational agencies represented at the EOC. Includes the Air Operations, Fire, Police, Engineering, Utilities, Emergency Social Services, Environment and Health Branches.

Planning Section - Responsible for the collection, evaluation, and dissemination of tactical information related to the incident, and for the preparation and documentation of Incident Action Plans. The Planning Section also maintains information on the current and forecasted situation and on the status of resources assigned to the incident. Includes the Situation, Resource, Documentation, and Demobilization Units, as well as Technical Specialists.

PECC - Provincial Emergency Coordination Centre. An Emergency Operations Centre established and operated at the provincial central coordination level to direct and coordinate the provincial government's overall emergency or disaster response and recovery efforts. Located at the Provincial Emergency Program headquarters in Victoria.

PREOC - Provincial Regional Emergency Operations Centre. An Emergency Operations Centre established and operated at the regional level by provincial agencies to coordinate provincial emergency response efforts.

Single Command - Refers to an Incident Commander at a single agency, single jurisdiction incident.

Single Resource - A major piece of equipment with all of the necessary components and personnel to operate it.

Site - The physical location of an incident where emergency responders are working under the direction of an Incident Commander or Unified Command.

Site Support - When the site level response requires off-site support, an Emergency Operations Centre (EOC) or Department Operations Centre (DOC) may be activated.

Staging Area - A location at the site where resources are held prior to being given a tactical assignment.

Strategies - Methods, or "how" objectives are met.

Surface Water - A water sourced from rivers and lakes.

TEAMS - Temporary Emergency Assignment Management System. The method used by the provincial government to staff Provincial Regional Emergency Operations Centres, the Provincial Emergency Coordination Centre or to provide provincial staff to assist local authorities at their EOCs.

Type - A further descriptor of a Single Resource that defines its capacity or capability. Kind: Engine. Type: 1, 2, 3 or 4

Unified Command - In ICS, Unified Command is a unified team effort which allows all agencies with responsibility for the incident, either geographic or functional, to manage an incident by establishing a common set of incident objectives and strategies. This is accomplished without losing or abdicating agency authority, responsibility, or accountability.

E. Electronic Access

Websites of useful information:

The following websites may contain information that is very general about drought and drought issues or information that is very specific about British Columbia current drought conditions, planning and response tool or contact information.

Provincial Emergency Program:	http://www.pep.bc.ca/index.html
Ministry of Environment:	http://www.gov.bc.ca/env/index.html
Water Stewardship Division:	http://www.env.gov.bc.ca/wsd/
River Forecast Centre:	http://www.env.gov.bc.ca/rfc/
US National Drought Mitigation Center:	www.drought.unl.edu/
US Ground Water Association:	http://www.ngwa.org/
Canadian agricultural site:	www.agri-ville.com/drought/
Canadian Ground Water Association:	www.cgwa.org/index.htm
Ministry of Health Services Publications	www.healthservices.gov.bc.ca/cpa/publications/index.html

F. Forms

Generic forms may be downloaded from the PEP web site: http://www.pep.bc.ca/index.html .

G. Government Agencies

Local Government

In an emergency situation the first line of support should come from the Local Government authority which has jurisdiction for the area. In some cases the Local Authority will also have direct responsibility for the water utility and in other cases the water utility may be an Improvement District or private service provider.

Some local governments use private operators to supply community water services. Those contracts should be consulted for responsibilities both legal and financial for response to and planning for water systems malfunctions, complete or partial water loss or potable water loss.

Provincial Government

Provincial Emergency Program (PEP)
The Provincial Emergency Program provides support to local authorities and provincial government agencies before, during and after major emergencies. PEP maintains six regional offices. PEP is able to identify and coordinate the acquisition of temporary potable water supplies, resources and equipment. and can assist with contacting other provincial and local government agencies. The Provincial Emergency Program can be contacted 24/7 through the emergency contact line at 1-800-663-3456.

Ministry of Environment (MOE)
MOE provides an ongoing assessment of the drought situation in British Columbia which is available on their website. It also provides information and licensing for water users, can expedite new water licences in an emergency situation and help to identify alternative water sources to augment existing sources. The ministry supports local authorities during water shortage incidents as well as flooding and other environmental emergencies. MOE maintains offices throughout the province. MOE is responsible for:

- source water and ground water protection
- bulk water export policy and *Water Protection Act*
- flood hazard management
- water conservation
- fish and habitat protection
- instream flow guidelines
- development standards and best practices
- pollution prevention (point source and non-point source)
- environmental monitoring and reporting
- compliance and enforcement
- Living Rivers Strategy
- surface water allocation
- *Water Act* administration
- dam safety regulation
- water utility regulation
- approval and implementation of water use plans

Office of the Fire Commissioner (OFC)
The Office of the Fire Commissioner provides on site advice to fire departments including the authority to cause evacuations if there is an imminent risk of fire or explosion. The OFC also coordinates firefighting operations during provincially declared states of emergency. If firefighting abilities are impacted due to water loss, the Office of the Fire Commissioner should be notified immediately. The OFC maintains offices throughout the province.

Local Health Authority
The Local Health Authority through the Regional Drinking Water Officer can offer assistance and advice in the health related issues of:

- distribution system protection
- water quality testing program
- health advisory notification

Consult local directories for Health Authority contact information.

Ministry of Agriculture and Lands (MAL)
The Ministry of Agriculture and Lands can provide advice and assistance to farmers and ranchers who may be impacted by water loss.

Ministry of Community and Rural Development (CARD)
The Ministry of Community and Rural Development can provide advice to Local Governments on bylaws, loan authorization approvals and legal authorities with respect to water systems operations.

Federal Government

Indian and Northern Affairs Canada (INAC)
Indian and Northern Affairs Canada is responsible for infrastructure development (including water systems) on First Nations lands. In the event of emergency situations First Nations communities may contact the Provincial Emergency Program directly or through INAC for assistance. For systems maintenance or manageable water supply issues, First Nations communities should deal directly with INAC.

Health Canada
Health Canada can offer assistance to First Nations communities who are experiencing water supply problems with health related issues. If emergency water supply issues occur on First Nations lands, the Provincial Emergency Program and INAC should be notified immediately.

Agriculture and Agri-Food Canada
Agriculture Canada can assist water utilities with provision of emergency water supplies (bulk or bottled water) in the Peace River area.

Appendix 4

Example Bylaws

Encouraging voluntary conservation efforts is an effective method of reducing water use demands. However, to ensure that consistent and coordinated conservation efforts are being made among all users of a water supply during times of diminished supplies, it may be necessary to implement regulatory controls, as suggested in the Drought Stages and Response Matrix in this handbook (Appendix 2-1).

Before bylaws are implemented, the issues surrounding a regulatory approach need to be examined. Firstly, local drought management teams and local governing bodies need to work together to ensure that the goal of creating a bylaw is agreed upon between these groups and is appropriate to the issues of the water supply systems involved. The approach should solve existing problems and work towards preparing communities for reduced supplies more effectively than non-regulatory methods.

Consideration also needs to be given to whether voluntary measures are currently in place, whether previous attempts have been made to create a bylaw, and why the timing for implementing a bylaw now is appropriate. The effects of creating a regulatory control also need to be evaluated with respect to environmental, social, and economic factors to ensure the benefits of the bylaw outweigh the costs. Scale is an important aspect to determine if the impacts of the issue, and the bylaw, affect multiple supply systems or jurisdictions. It may be necessary to work on an inter-basin level rather than within political boundaries for bylaws to be practical and effective.

The authority of municipalities, regional districts, and improvement districts differs considerably in terms of regulating water use or imposing requirements; therefore, following the legal steps appropriate to your area will be necessary before implementing regulatory controls.

To assist local governments with regulatory practices, the Ministry of Community and Rural Development has published a Regulatory Best Practices Guide, available at: http://www.cd.gov.bc.ca/lgd/site_index/publications.htm .

While the guide is intended for municipalities, its general direction may also be helpful to regional districts and improvement districts undertaking the process of creating regulations for water use.

Many communities have already created bylaws to regulate water use and increase water conservation efforts. Two activities that are commonly regulated through bylaws are residential lawn watering and irrigation. Communities planning on creating these types of restrictions may wish to contact jurisdictions that already have similar bylaws, or view other local government websites for examples of published bylaws.

Two excerpts of bylaws that have been successfully implemented are provided on the following pages. Table 1 includes an example of the type of watering restrictions that may be contained within a bylaw, taken from the Capital Regional District Water Conservation Bylaw 3061, www.crd.bc.ca . Note that the term “Stage 1” refers to a stage pre-defined by the Capital Regional District. Table 2 provides an excerpt of the South East Kelowna Irrigation District bylaw No. 579, Irrigation Water Distribution and Regulation Bylaw, www.sekid.ca .

Table 1. Excerpt from the Capital Region District's Water Conservation Bylaw 3061
http://www.crd.bc.ca/bylaws/water_/bl30610000/BL30610000.pdf

OUTDOOR WATER USE RESTRICTION STAGES

1. STAGE 1 – TWO DAYS PER WEEK LAWN WATERING

(1) During Stage 1,

(a) no person shall use a Sprinkler to water a lawn growing on a property with
  (i) an even numbered address, except on Wednesday and Saturday between the hours of 4:00 a.m. to 10:00 a.m. and 7:00 p.m. to 10:00 p.m.; and
  (ii) an odd numbered address, except on Thursday and Sunday between the hours of 4:00 a.m. to 10:00 a.m. and 7:00 p.m. to 10:00 p.m.; and
(b) a person may
(i) water trees, shrubs, flowers and vegetables on any day with a Sprinkler during the prescribed hours for Stage 1 lawn watering and on any day at any time if watering is done by hand-held container or a hose equipped with a shut-off nozzle;
(ii) water newly planted trees, shrubs, flowers and vegetables by any method during installation and for the following 24 hours;
(iii) use Micro-irrigation or Drip- irrigation systems to Water trees, shrubs, flowers and vegetables at any time on any day;
(iv) under the authority of a Permit, water new sod on installation and during the first 21 days after installation, and water newly seeded lawns until growth is established or for 49 days after installation, whichever is less, but only during the prescribed Stage 1 lawn Watering hours;
(v) water all weather playing fields at any time if failure to do so will result in a permanent loss of plant material; and
(vi) wash a vehicle with Water using a hand held container or hose equipped with a shut-off nozzle and at car dealerships or commercial car washes.

(2) As exceptions to the Stage 1 restrictions,

(a) Owners or Occupiers of property who, by reason of physical or mental incapacity, are unable to water their property within the restricted days and times, may water their property on any two days of the week for a maximum of 9 hours per day;
(b) Nurseries, Farms, turf farms and tree farms are exempted from the restrictions;
(c) Public Authorities may water lawns and Boulevards on any day but no more than two days per week; and
(d) owners or operators of golf courses may water
(i) fairways at any time on any day;
(ii) trees, shrubs, flowers and vegetables grown on golf courses in accordance with Section 1(1) (b) (i), (ii) and (iii) of this Schedule; and
(iii) golf greens and tees on any day if failure to do so will result in permanent loss of plant material.

2. STAGE 2 – ONE DAY PER WEEK LAWN WATERING

(1) During Stage 2,

(a) no person shall use a Sprinkler to water a lawn growing on a property with
  (i) an even numbered address, except on Wednesday between the hours of 4:00 a.m. to 10:00 a.m. and 7:00 p.m. to 10:00 p.m.;
  (ii) an odd numbered address, except on Thursday between the hours of 4:00 a.m. to 10:00 a.m. and 7:00 p.m. to 10:00 p.m.;

(b) no person shall use Water to wash sidewalks, driveways or parking lots, exterior windows or exterior building surfaces, except as necessary for applying a product such as paint, preservative and stucco, preparing a surface prior to paving or repointing bricks, or if required by law to comply with health or safety regulations; and

(c) a person may
  (i) water trees, shrubs, flowers and vegetables on any day with a Sprinkler during the prescribed hours for Stage 2 lawn watering and on any day at any time if watering is done by hand-held container or a hose equipped with a shut-off nozzle;
  (ii) water newly planted trees, shrubs, flowers and vegetables by any method during installation and for the following 24 hours;
  (iii) use Micro-irrigation or Drip- irrigation systems to water trees, shrubs, flowers and vegetables at any time on any day;
  (iv) water all weather playing fields at any time if failure to do so will result in a permanent loss of plant material; and
  (v) wash a vehicle with Water using a hand held container or hose equipped with a shut-off nozzle and at car dealerships and commercial car washes.

(2) As exceptions to Stage 2 restrictions,

(a) Owners or Occupiers of property who, by reason of physical or mental incapacity, are unable to water their property within the restricted days and times, may water their property on one day per week for a maximum of 9 hours per day;

(b) Nurseries, Farms, turf farms and tree farms are exempted from the restrictions;

(c) Public Authorities may water lawns and Boulevards on any day but no more than one day per week; and

(d) owners or operators of golf courses may water
  (i) fairways at any time on not more than two days per week;
  (ii) trees, shrubs, flowers and vegetables grown on golf courses in accordance with Section 2(1) (c) (i), (ii) and (iii) of this Schedule; and
  (iii) golf greens and tees on any day if failure to do so will result in permanent loss of plant material;

3. STAGE 3 – NO LAWN WATERING

(1) During Stage 3,

(a) no person shall
  (i) water a lawn or Boulevard;
  (ii) Fill a swimming pool, hot tub or garden pond;
  (iii) Fill or operate a decorative fountain at any time; or
  (iv) wash a Vehicle or a Boat with Water.

(b) a person may
  (i) water trees, shrubs, flowers and vegetables on any day between the hours of 4:00 a.m. to 10:00 a.m. and 7:00 p.m. to 10:00 p.m. if watering is done by hand-held container or a hose equipped with a shut-off nozzle;
  (ii) water newly planted trees, shrubs, flowers and vegetables between the hours of 4:00 a.m. to 10:00 a.m. and 7:00 p.m. to 10:00 p.m. only by hand-held container or a hose equipped with a shut-off nozzle during installation and during the following 24 hours after installation is completed;
  (iii) use Micro-irrigation or Drip- irrigation systems to water trees, shrubs, flowers and vegetables on any day between the hours of 4:00 a.m. to 10:00 a.m. and 7:00 p.m. to 10:00 p.m.;
  (iv) water all weather playing fields at any time, but only if failure to do so will result in a permanent loss of plant material; and
  (v) use Water to wash sidewalks, driveways or parking lots, exterior windows or exterior building surfaces, but only if necessary for applying a product such as paint, preservative and stucco, preparing a surface prior to paving or repointing bricks, or if required by law to comply with health or safety regulations.

(2) As exceptions to the Stage 3 restrictions,

(a) Nurseries, Farms, turf farms and tree farms are exempted from the restrictions;

(b) owners or operators of golf courses may water
  (i) fairways at any time on not more than one day per week;
  (ii) trees, shrubs, flowers and vegetables grown on golf courses in accordance with Section 3(1) (b) (i), (ii) and (iii) of this Schedule; and
  (iv) golf greens and tees on any day if failure to do so will result in permanent loss of plant material;

(c) wading pools may be Filled with Water; and

(d) Vehicles and Boats may be washed with Water only at car dealerships and commercial car washes using less than 57 litres of Water per Vehicle wash or 50% recirculated Water as long as the total amount of Water, excluding recirculated Water, does not exceed 57 litres per Vehicle wash. (www.crd.bc.ca)

Table 2. Excerpt from South East Kelowna Irrigation District's Irrigation Water Distribution and Regulation Bylaw, No. 579. (http://www.sekid.ca/pdf/Bylaws/Bylaw%20579.pdf).

6. (a) No person shall apply irrigation water to the land of any single parcel, or multiparcel irrigation unit, at a rate in excess of the flow rate established for that land.
   (b) The Trustees may require the installation of a flow control device or devices on any irrigation water service or private irrigation system to ensure that water is not applied in excess of the established flow rate and the cost of such device or devices shall by paid by the owner of the irrigation system affected.
   (c) No person shall apply irrigation water to the land of any single parcel, or multiparcel irrigation unit, in excess of the volume established for that land on the current Assessment Roll of the District. The Trustees shall cause the service connection to the land to be shut off when the volume established for that land on the current Assessment Roll of the district has been used.
   (d) Notwithstanding 6. (c), the Trustees may at any time introduce regulations restricting the use of water for irrigation or any other purpose. Upon receiving due notice of such restriction no person shall use water for the purpose forbidden by or in excess of the allotment imposed by such restriction. Due notice of restrictions shall, be given either by publication in a newspaper circulating within the District, by broadcast on local radio stations or by mail.

Schedule "A"
Metered Rate Penalty for Water Use in Excess of Allotment

The following rate is an inclined block rate and applies to water use in excess of the allotment. Each block is a volume of water equal to ten percent of the allotment. For each ten percent block of water use in excess of the allotment the rate per 1 000 US gallons of water increases. The rates are cumulative and only apply to water use within the range of the block/volume of water to which they are attributed" (www.sekid.ca).

Block (percent in excess of water allotment)	>0-10%	>10-20%	>20-30%	>30-40%	>40-50%	>50-60%	>60-70%	>70-80%	>80-90%	>90-100%
Rate per 1 000 US gallons	$0.10	$0.13	$0.16	$0.20	$0.25	$0.31	$0.38	$0.46	$0.55	$0.65

Appendix 5

Drought Management Planning Resources for Water Suppliers

General Water Management Resources

Environment Canada – Water Website:	http://www.ec.gc.ca/default.asp?lang=en&n=76d556b9-1
Environment Canada – Freshwater website	http://www.ec.gc.ca/water/e_main.html
Environment Canada - Water use database:	http://www.ec.gc.ca/water/en/manage/use/e_use.htm
Environment Canada – 2004, Threats to Water Availability in Canada	www.nwri.ca/threats2full/ThreatsEN_03web.pdf
Ministry of Environment, Water Stewardship Division	http://www.env.gov.bc.ca/wsd/
Natural Resources Canada – Climate Change Impacts and Adaptation	http://adaptation.nrcan.gc.ca/index_e.php

Drought Management Resources

Agriculture and Agri-Food Canada – Drought Watch website:	www.agr.gc.ca/pfra/drought/drprecw_e.htm
Capital Regional District – January 2001, Drought Management Action Plan:	http://www.crd.bc.ca/reports/water_/2001_/stage3798/STAGE3798.pdf
Ministry of Agriculture and Lands, British Columbia – Drought Fact Sheets and Other Publications:	http://www.agf.gov.bc.ca/resmgmt/publist/Water.htm#drought
Ministry of Environment – B.C. River Forecast Centre Drought Monitoring:	http://www.env.gov.bc.ca/rfc/index.htm
National Climatic Data Center – North American Drought Monitor:	www.ncdc.noaa.gov/oa/climate/monitoring/drought/nadm/spi.html
National Drought Mitigation Center (USA) – Planning for Drought:	www.drought.unl.edu/plan/plan.htm
Ontario Ministry of Natural Resources – Ontario Low Water Response:	http://www.mnr.gov.on.ca/en/Business/Water/Publication/MNR_E002322P.html

Water Conservation Resources

Canada West Foundation –Drop by Drop Urban Water Conservation Practices in Western Canada:	http://www.cwf.ca/V2/cnt/43eb9a87a1ad09f087256e2e0066d425.php
Canadian Water and Wastewater Association – March, 2004, Water Efficiency Experiences Database:	www.cwwa.ca/WEED/Index_e.asp
City of Kelowna – Get Water Smart Website:	www.getwatersmart.com
City of Richmond - Richmond Water Meter Program:	http://www.watermeter.ca/english/index.html
Greater Vancouver Regional District – November 2003, Five Year Implementation Plan for Capilano, Seymour and Coquitlam Watersheds:	http://www.metrovancouver.org/about/publications/Publications/WSMP-5YearImplementation.pdf
Greater Vancouver Regional District – Use Water Wisely:	http://www.tol.bc.ca/files/web_files/engineering/environment/UseWaterWisely.pdf
Inter-Governmental Partnership – Water Balance Model for British Columbia:	www.waterbalance.ca
Ministry of Agriculture and Lands, British Columbia – Drought Information: Drought Strategies:	http://www.agf.gov.bc.ca/emergency/Drought/

Ministry of Environment and Energy, Ontario – Water Conservation:	http://www.ene.gov.on.ca/en/publications/water/index.php#2
Ministry of Environment – Water-use Efficiency Catalogue for British Columbia:	http://www.env.gov.bc.ca/wsd/plan_protect_sustain/water_conservation/wtr_use_eff_cat_bc/toc.html
POLIS, Oliver M. Brandes and Keith Ferguson – April 2004.The Future in Every Drop: The Benefits, Barriers, and Practice of Urban Water Demand Management in Canada:	http://www.poliswaterproject.org/publication/25
POLIS, Tony Maas – What the Experts Think: Understanding Urban Water Demand Management in Canada:	http://www.poliswaterproject.org/publication/26
POLIS, Oliver M. Brandes with Keith Ferguson – Flushing the Future? Examining urban water use in Canada:	http://www.polisproject.org/node/209
South East Kelowna Irrigation District – February 2003, Agricultural Metering Program Review and Metered Rate Options:	http://www.sekid.ca/pdf/reports/Agricultural%20Metering%20Program%20Review.pdf
Water Use It Wisely:	www.wateruseitwisely.com