Dealing with Drought

A Handbook for Water Suppliers in British Columbia

Updated July 2016

BRITISH COLUMBIA

Acknowledgements

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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.

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. The most current update and information provided is current as of July 2016.

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Introduction

The impacts of climate change coupled with severe droughts in 2003 and 2015 has led to the creation of the *BC Drought Response Plan* and this document, *Dealing with Drought: A Handbook for Water Suppliers in BC*. This 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 requirements brought in under the *Water Sustainability Act* (WSA) in February 2016 and the *Drinking Water Protection Act*.

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. This 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.

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 actions and responses to specific drought levels as defined in the *BC Drought Response Plan*. It is important to note that the Province's ability to regulate water during drought is not dependent on an area's drought level.

What is Drought

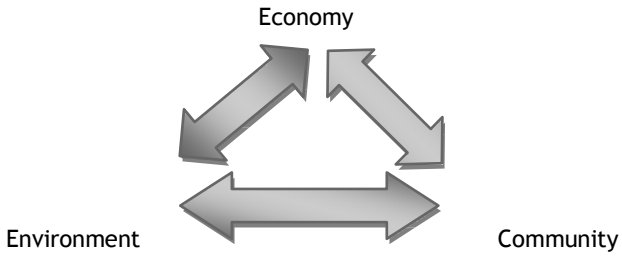
Drought is the result of natural variability of climatic conditions. Dry areas of the Province like the Okanagan and Nicola valleys and Gulf Islands have challenges supplying sufficient water to meet demand even during normal years. Depending on the severity of the drought conditions these and other 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, lakes.

In BC, drought may be caused by natural influences resulting from low snowpack, hot and dry weather, a delay in spring or fall rains, 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.

What are the Effects of Drought

Drought affects communities, the environment, and the economy through a reduction of water for communities, agriculture, and industry. Drought 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 groundwater 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 ambient water quality guidelines,
- 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,
- water 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 and Drought website. The drought levels and their corresponding objectives and suggested water use targets are summarized in Table 1. General responses applicable to each level have been provided in the Drought Levels and Responses Matrix (Appendix 2-1).

Table 1. Drought Levels Summary

Level	Conditions	Significance	Objective	Target
1 (Green)	Normal Conditions	There is sufficient water to meet human and ecosystem needs	Preparedness	Ongoing reductions in community water use
2 (Yellow)	Dry Conditions	First indications of a potential water supply problem	Voluntary conservation	Minimum 10% reduction
3 (Orange)	Very Dry Conditions	Potentially serious ecosystem or socioeconomic impacts are possible	Voluntary conservation and restrictions	Minimum additional 20% reduction to a minimum total of 30%
4 (Red)	Extremely Dry Conditions	Water supply insufficient to meet socio-economic and ecosystem needs	Voluntary conservation, restrictions and regulatory action as necessary	Maximum reduction
Loss of Supply		Potential loss of a community's potable or fire fighting supply	Emergency response	Ensure health and safety

Why Prepare for Drought

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

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

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 1 to 5.

How to Minimize the Impacts of Drought

One of the most important ways to minimize the impacts of drought is developing or becoming a part of a local drought management team (Appendix 1). 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 AND PLAN FOR FUTURE DROUGHTS
   - Assess your local water supply and demand by doing a Water Supply and Demand Analysis (Appendix 2-3), prepare a Drought Management Plan (Appendix 2-2), and/or prepare an Emergency Response and Contingency Plan (Appendix 3).
   - Establish a water monitoring system including location, frequency of data collection, and reporting tools.

2) IMPROVE WATER USE EFFICIENCY
   - 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 2-4).
   - 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.
   - 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 the *BC Drought Response Plan*, the *Drinking Water Protection Act*, and any other applicable legislation or other local water management plans and bylaws. 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.

Achieving these goals will require assessment, response, and coordinated communication and conservation education efforts. For more information, refer to the Drought Resources (Appendix 5).

Government Agencies Role in Drought

Local Government

In an emergency situation, the first line of support should come from the Local Government authority that 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

Emergency Management BC (EMBC)

The Provincial Emergency Program provides support to local authorities and provincial government agencies before, during and after major emergencies. Emergency Management BC can be contacted 24/7 through the emergency contact line at 1-800-663-3456.

Ministry of Forests, Lands and Natural Resource Operations (FLNR)

FLNR is the lead agency responsible for coordinating drought response in BC. They provide an ongoing assessment of the drought situation and set the drought levels in British Columbia. FLNR also issues water authorizations, provides information to users and guidance to local authorities during water shortage events. FLNR maintains regional offices throughout the province.

FLNR is also responsible for regulating water use under the WSA. The Province's ability to regulate water during drought is not dependent on an area's drought level. The authorities in the WSA operate independently of an area's drought level and can be used to deal with conflicts and concerns in a single water source or with significant water shortages in a specific area.

Ministry of Environment (ENV)

ENV leads development of legislation and policy related to drought management in BC. They oversee and coordinate the science required to assess impacts and monitor water before, during and after droughts.

Regional Health Authorities

The Regional Health Authorities, through the Regional Drinking Water Officer can offer assistance and advice related to:

- distribution system protection
- water quality testing program
- health advisory notification
- threats to loss of water supply

First Nations Health Authority

The First Nations Health Authority plans, designs, manages, and funds the delivery of First Nations health

programs and services in BC. These community-based services are largely focused on health promotion and disease prevention and include drinking water matters. The First Nations Health Authority collaborates, coordinates and integrates with the BC Ministry of Health and Regional Health Authorities.

Ministry of Agriculture (AGRI)

The Ministry of Agriculture can provide advice and assistance to farmers and ranchers who may be impacted by water loss during drought.

Ministry of Community, Sport and Cultural Development (CSCD)

The Ministry of Community Sport and Cultural Development can provide advice to Local Governments on bylaws, funding options for planning and infrastructure and legal authorities with respect to water systems operations.

Federal Government

Indigenous and Northern Affairs Canada (INAC)

Indigenous 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 Emergency Management BC or INAC for assistance. For systems maintenance or manageable water supply issues, First Nations communities should deal directly with INAC.

Appendix 1: Local Drought Management Teams

Effective implementation of the drought management practices recommended in this handbook largely relies on the formation of a local drought management team. The responsibilities of a regional 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.

Local authorities that may be involved in the drought management team include local governments, water suppliers, First Nations and other regional agencies with responsibilities for water (e.g. the Okanagan Basin Water Board, the Columbia Basin Trust, the Salmon River Watershed Roundtable, Cowichan Water Board, Nicola Water Use Management Plan etc.). 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.

The structure of governance arrangements for water varies from region to region, as do climatic and geographic conditions, so it is appropriate that there will be different organizational approaches to drought preparedness and response. In certain areas, the local drought management team could provide a linkage between the Provincial regional drought team and water suppliers, while in others the Provincial regional drought team may connect directly with the water supplier. There is no "one size fits all" solution for BC.

Recommended Guidelines

General guidelines for developing and implementing a Local Drought Management Team include:

- determine what regional or local drought management teams currently exist. Would it make sense to join these teams? If not, establish membership for a local drought management team. 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 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 in this handbook.

Appendix 2: Drought Planning Templates

Introduction

These templates are 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 fish and aquatic ecosystems, and sustaining industrial and economic activity.

2-1 Drought Level and Responses Matrix – provides an overview of appropriate responses and communication actions at the local level during the different stages of drought. An assessment of regional drought stages will be provided on the Provinces drought website. It is important to note that the Province's ability to regulate water during drought is not dependent on an area's drought level.

2-2 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.

2-3 Water Supply and Demand Analysis Template – provides a framework for conducting a water supply 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.

2-4 Water Conservation Plan Template – encompasses strategies and tools for reducing water demands on a long term basis.

2-1 Drought Level and Response Matrix

Level	Goal/Targets	Action/Response*	Communication
1	Ongoing reductions in community water use	Encourage conservation, stewardship, and education; complete a water supply and demand analysis, and a conservation, drought management, and emergency response and contingency plan	Promote conservation programs through local media
2	Target water use reduction of minimum10%	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 local current supply status and share forecasts of future conditions
3	Minimum additional 20% reduction to a minimum total of 30%	Emphasis continues to be on voluntary conservation and curtailing unauthorized use, while water suppliers may impose increasing watering restrictions. If serious impacts are occurring in an area, the provincial government may consider regulatory action.	Directly contact users, explain priority licensed uses and conservation needs; have local media explain restrictions and enforcement; increase communication between province and local authorities
4	Maximum possible reductions for all sectors	Likely regulatory control rather than voluntary – monitor and enforce restrictions and allocations through bylaws. Voluntary measures and increasing use of watering restrictions will continue but may be augmented by regulatory action by the provincial government.	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	Follow the steps of your Emergency Response and Contingency 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 emergency situation, provide frequent updates through all forms of media on necessary actions

*The Province's ability to regulate water is independent of drought level. These actions and responses and likely actions at each drought level.

2-2 Drought Management Plan Template

▫	Build a local drought management team • Include representatives from all major users in water supply area. • Follow the recommended guidelines outlined in Appendix 1.
▫	Document your water system profile • Base it on information from Water Supply and Demand Analysis study, Appendix 2-3.
▫	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.
▫	Monitor water supplies and climate • Establish data requirements, location, frequency of data collection, and reporting.
▫	Define Drought Stages • Consider your water supply, all demands on that supply, and climate factors to determine your local watering restrictions as influenced by storage and regulated flows. The Province will determine the drought level in your region (Level 1, 2, 3 or 4) based on stream flows in your region. Your local water restriction level may be different than the provincial drought level.
▫	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.
▫	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 drought website. • 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.
▫	Evaluate your Drought Management Plan • Confirm that your Drought Management Plan corresponds to the *Water Sustainability Act, Drinking Water Protection Act*, and other relevant local water management plans.

2-3 Water Supply and Demand Analysis Template

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.

Note: Real-time data from local climate monitoring stations are available through the BC River Forecast Centre and Environment Canada, Water Survey of Canada.

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 m^3 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 $m^3$and m/s)*

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)*
- Groundwater management *(describe management strategies, including monitoring, total use in m^3, location and quality of wells and pumps; also describe conflicts or contamination concerns)*
- Surface water supply *(describe management strategies, including monitoring, total use in m^3, location of wells and pumps; also describe conflicts or contamination concerns)*

Purpose and Objectives of Study:
- Address all instream uses
- Consider management alternatives
- Resolve potential conflicts

Water Supply Description

Location and size:
- Map of water supply areas including size of basin *(km^2)* or aquifer, 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)*

Water Supply Area 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)*

Water Resource Characteristics and Hydrology

Surface Water

- Streamflow Records:
  - Drainage area of recorded station *(km^2)*
  - Daily, monthly, annual summaries *(m^3/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 level: m, volume: m^3, and use: m^3/d based on average population use)*
  - Graph storage level summaries *(is the water level normal for a particular time of year)*

- Effects of Storage and Diversion:
  - Size of storage *(m^3, minimum and maximum reservoir storage volume)*
  - Use of reservoirs *(rules and regulations of use, diversion rates in m^3/s, and comparison of regulated and natural flows if available in % change)*

- Low Stream Flows:
  - Critical low flows and percentiles
  - Historical low flows recorded
  - Potential conflicts among user demands

- Quantification of System Leaks *(location in system, water loss in m^3/d, total % of extracted use)*
  - Drainage area of recorded station *(km^2)*
  - Daily, monthly, annual summaries *(m^3/s)*
  - Graphical summaries *(consider maximum time period of data records)*
  - Map showing climate monitoring stations in relation to study area

Groundwater

- Description of Groundwater Resource:
  - Map of existing wells
  - Summary of water level measurements over time *(mm)* and average volume *(m^3)*
  - Groundwater withdrawals *(L/s or m^3/s, identify use)*
  - Capacity tests, pumping tests, the aquifer mapping resource, observation well data

- Groundwater Potential:
  - Bedrock *(extent of exposure)*
  - Summary of yields over time *(include maximum time period of data records)*
  - Groundwater/surface water connectivity

Water Quality

Source Drinking Water Quality and Treated Water (Surface Water and Groundwater)

Data Collection:

- Daily temperature *(°C)*
- Daily pH
- Daily turbidity *(ppm)*
- Metals *(mg/L or ppm)*
- Nutrients: Phosphorus and Nitrogen
- Clarity *(average annual, monthly, and daily using a Secchi Disk)(surface water source only)*
- Microbiological *(E. coli, fecal coliforms, total coliforms)*
- Chlorine residuals *(daily total and free chlorine mg/L or ppm) (treated water only)*
- Disinfection by-products *(e.g. Trihalomethanes and Haloacetic acids in ppm measured quarterly) (treated water only)*

Water Quality Assessment:

- Water uses *(drinking water, aquatic life, irrigation etc.)*
- Any waste discharges in and around source
- Identify aquifer contamination potential by examining uses around well and the permeability of sediments
- 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)*

Fisheries

Fisheries Management (Federal)

- Resource description *(e.g. spawning and rearing habitat for salmon)*
- Summary of returns *(catch in kg and economic value, if applicable)*
- Instream water requirements *(m^3/s needed to maintain specific water levels, water temperature requirements for each species)*

Recreational Fisheries Management (Provincial)

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

First Nations Fisheries Management

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

Water Resource Users and Uses

Surface Water Rights

- Details of authorized use,
- Maximum and minimum withdrawals *(m^3)*, and
- Average annual, monthly, and daily withdrawals *(m^3/s, % extraction out of total use)* for:
  - municipal
  - industrial
  - agricultural
  - domestic

- storage
- conservation

Instream Water Users and Uses

- First Nations
- Fisheries *(minimum and maximum flows in m^3/s)*
- Wildlife *(minimum and maximum flows in m^3/s 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

Identification of Species at risk by COSEWIC:
http://www.sararegistry.gc.ca/default.asp?lang=En&n=24F7211B-1

Identification of designated sensitive streams:
http://www2.gov.bc.ca/gov/content/environment/air-land-water/water/water-licensing-rights/sensitive-streams

Groundwater uses

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

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

Future Water Resource Requirements

- Future water demands
- Future instream requirements *(based on fisheries and wildlife growth trends, and necessity of contaminant dilution from any waste discharges)*

Water Management Analysis

Natural Flows:

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

Demands and Uses: From Water Resource Users and Uses section.

Supply/Demand Comparison

- Balance natural flows versus demands *(daily, monthly, and annual totals)* including future demands. 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)*

Analysis of Results

Interpretation of Results

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

Supplementary Storage Requirements

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

Conclusions and Recommendations

Summarize findings from the study and report on the following:

- Water resource characteristics and hydrology
- Water quality
- Fisheries
- Water resource users and uses
- Reservoir operations
- Future storage

2-4 Water Conservation Plan Template

This guide contains suggestions for developing a water conservation plan template. For a more comprehensive guide to developing a water conservation plan for your water system, see the *Water Conservation Guide for British Columbia*.

☐	Existing Conservation Strategies • Review and report on the conservation measures previously and/or currently in place for each sector in area.
☐	Annual Audit of Water Supply
☐	Future Projections • Consider future population projections and potential drought scenarios and implement appropriate conservation measures, restrictions, and supply source identification.
☐	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).
☐	Testing and Maintenance • Initiate a regularly scheduled meter testing and maintenance program. • Conduct a system-wide leak detection program and repair any problems.
☐	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
☐	Conservation Measure Implementation Schedule
☐	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
☐	Public Education Program • Encourage efficient water use through: - workshops for plumbers, landscapers, irrigation service providers, farmers, schools, and First Nations - Drought website - press releases for newspapers and radio - posters, brochures, flyers, special events booths, and volunteer stewardship programs
☐	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 Planning

Emergency Response and Contingency Planning for Small Water Systems

Section 10 of the *Drinking Water Protection Act* requires all prescribed water supply systems to have an **emergency response and contingency plan**. The document *Emergency Response and Contingency Planning for Small Water Systems* provides a step-by-step guide to creating an emergency response and contingency plan for your small water system. Although this document is not specific to drought planning, it offers templates and information to help with planning for water scarcity events in your 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, the Province may implement regulatory controls as per Table 1. However, the authority for the province to implement regulatory controls under the WSA is independent of the drought level in an area.

Bylaws could be an option for a local regulatory control. 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 bylaw 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 a bylaw.

To assist local governments with regulatory practices, the Ministry of Community Sport and Cultural 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 bylaws 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. Example 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. Example 2 provides an excerpt of the South East Kelowna Irrigation District bylaw No. 579, Irrigation Water Distribution and Regulation Bylaw, www.sekid.ca.

Example 1

STAGE 1 – TWO DAYS PER WEEK LAWN WATERING

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
  (iii) a person may 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;
  (i) water newly planted trees, shrubs, flowers and vegetables by any method during installation and for the following 24 hours;
  (ii) use Micro-irrigation or Drip- irrigation systems to Water trees, shrubs, flowers and vegetables at any time on any day;
  (iii) 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;
  (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 or commercial car washes.

As exceptions to the Stage 1 restrictions,

(b) 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;
(c) Nurseries, Farms, turf farms and tree farms are exempted from the restrictions;
(d) Public Authorities may water lawns and Boulevards on any day but no more than two days per week; and
(e) 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

STAGE 2 – ONE DAY PER WEEK LAWN WATERING

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.

As exceptions to Stage 2 restrictions,

(d) 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;
(e) Nurseries, Farms, turf farms and tree farms are exempted from the restrictions;
(f) Public Authorities may water lawns and Boulevards on any day but no more than one day per week; and
(g) 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

STAGE 3 – NO LAWN WATERING

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.

As exceptions to the Stage 3 restrictions,

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

(d) 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;

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

(f) 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)

Example 2

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 Resources

Environment Canada: Water	http://www.ec.gc.ca/eau-water/default.asp?lang=En&n=65EAA3F5-1
BC Drought Information	http://www2.gov.bc.ca/gov/content/environment/air-land-water/water/drought-flooding-dikes-dams/drought-information
BC Drought Portal	http://bcgov03.maps.arcgis.com/apps/MapSeries/index.html?appid=9042807690964463b268dfd91949d65b
BC Drought Response Plan	http://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/drought-info/drought-response-plan-update-june-2015.pdf
BC River Forecast Centre	http://www.env.gov.bc.ca/rfc/index.htm
Agriculture and Agri-Food Canada: Drought Watch	www.agr.gc.ca/pfra/drought/drprecw_e.htm
2012 Strategic Plan for the Greater Victoria Water Supply System	https://www.crd.bc.ca/docs/default-source/water-pdf/2012strategicplanforthegvwss.pdf?sfvrsn=2
BC Agriculture and Drought	http://www2.gov.bc.ca/gov/content/industry/agriculture-seafood/agricultural-land-and-environment/water/drought-in-agriculture
BC Wildfire	http://bcwildfire.ca/Weather/Maps/danger_rating.htm
BC Ministry of Community, Sport & Cultural Development: Infrastructure Planning Grant Program	http://www.cscd.gov.bc.ca/lgd/infra/infrastructure_grants/infrastructure_planning_grant.htm
Union of BC Municipalities: Local Government Program Services	http://www.ubcm.ca/EN/main/funding/lgps.html
Irrigation Industry Association of BC	www.irrigationbc.com
North America Water Watch	http://watermonitor.gov/naww/index.php
U.S. Drought Portal	http://www.drought.gov
National Drought Mitigation Centre	http://drought.unl.edu/DroughtBasics/WhatisDrought.aspx
Ontario: Low Water Response Program	https://www.ontario.ca/page/low-water-response-program
Greater Vancouver Water Shortage Response Plan	http://www.metrovancouver.org/services/water/WaterPublications/WaterShortageResponsePlanFeb2016.pdf#search="drought"
Okanagan Basin Water Board Drought Updates	http://www.obwb.ca/category/drought/