DEALING WITH DROUGHT

Presentation to:
Okanagan Water Stewardship Council
14 December 2006
Wenda Mason
Water Stewardship Division
Ministry of Environment

OVERVIEW

- What is Drought?
- Provincial Response
- Lessons Learned
- Some suggestions for OWSC

Concept of “Drought”

- A normal, recurrent feature of climate
- Caused by a lack of precipitation resulting in a water shortage that has impacts
- Humans can exacerbate drought by increasing demands during dry periods
- Vulnerability due to drought may increase with time if demand increases

Kinds of “Drought”

- **Meterological – dryness vs normal**
- **Agricultural – low precipitation linked to ag impacts**
- **Hydrological – streamflows compared to “normal”**

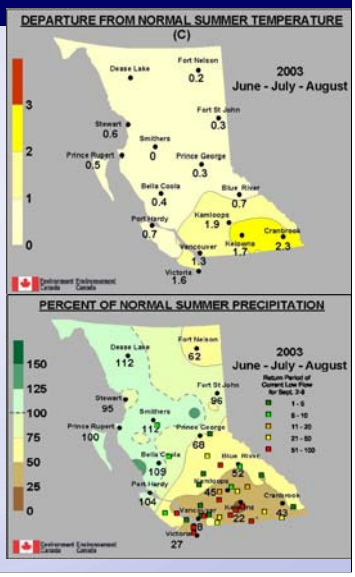
•Defining drought is difficult since there is no clear onset or end, and its occurrence, duration, magnitude and severity are all uncertain.

•In addition, drought can be defined in a number of ways:

- •Meterological (dryness vs normal)
- •Agricultural links low precip to ag impacts (eg. Northern BC right now) e.g. soil moisture deficits, low groundwater levels, dry dugouts
- •Hydrological – streamflows expressed relative to “normal”

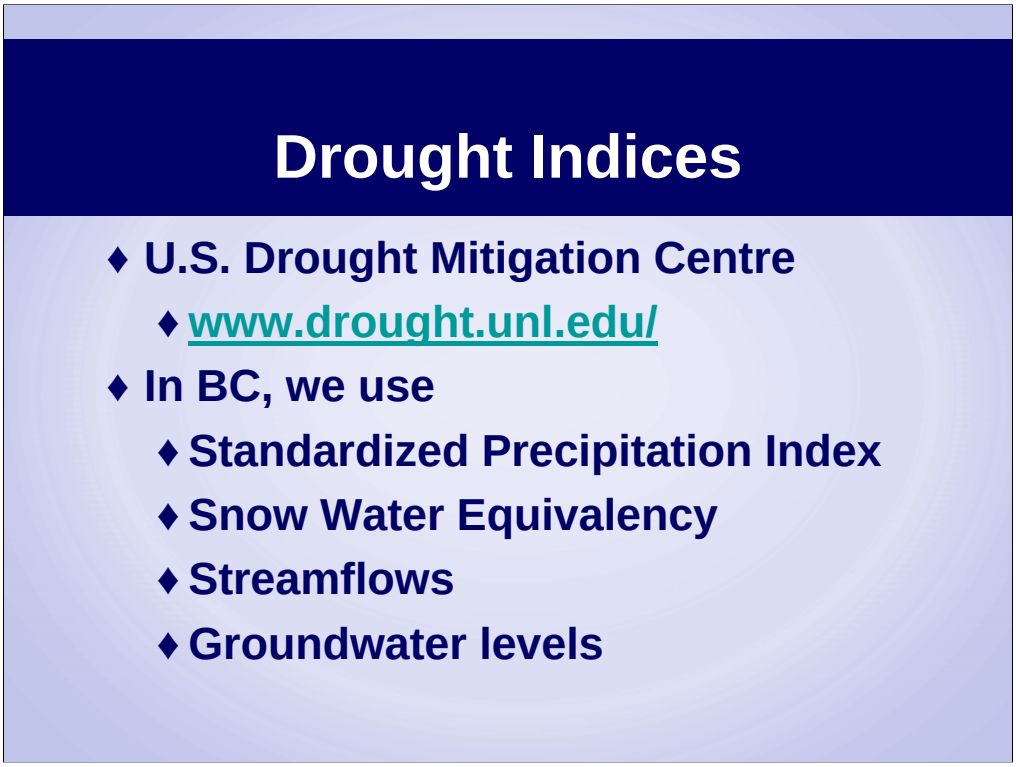
What is “Drought”?

- ↓ **Precipitation**
- ↑ **Evapotranspiration**
- ↓ **Streamflows**
- ➢ **Health, socio-economic & aquatic ecosystem impacts**



The provincial “Dealing with Drought” handbook uses the definition of sustained low precipitation and high evaporation resulting in low streamflow &/or low groundwater levels and/or storage with health or socio-economic impacts resulting from one or more of these conditions.

The top map, from Environment Canada, shows the increases in summer temperatures that were observed from June to August 2003. The lower provincial map shows the decreased precipitation and overlayed on that are dots that show streams with lower than average flows during the first week of September in 2003. Clearly, all of the factors were there for drought in the southern part of BC in 2003.



Drought indices help determine the severity of drought.

There are a variety of drought indices available, and there are pros and cons to each and situations in which some are better than others.

US Drought Mitigation Centres website provides a review of drought indices such as the Standardized Precipitation Index (SPI) and the Palmer Drought Severity Index which uses soil moisture content as the index.

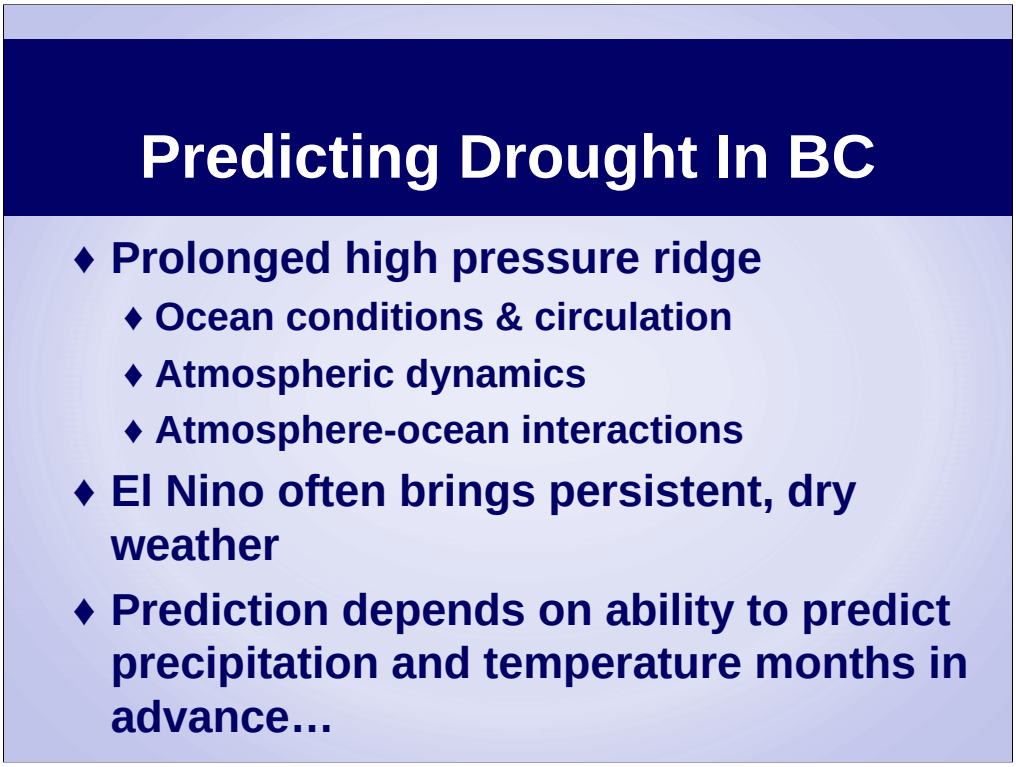
In BC, we use

Standardized Precipitation Index (SPI)

Snowpack (% of normal, used January 1 to June 15) – snowpacks work well as an indice in BC because in many areas our summer water supplies are dependent on good snowpacks. If we do not get “normal” snowpacks in Jan – Mar and if spring melt does not occur “normally” (ie melt occurs too quickly), then we need to watch the summer weather closely…no rain could mean dry conditions.

Streamflow (% of normal)

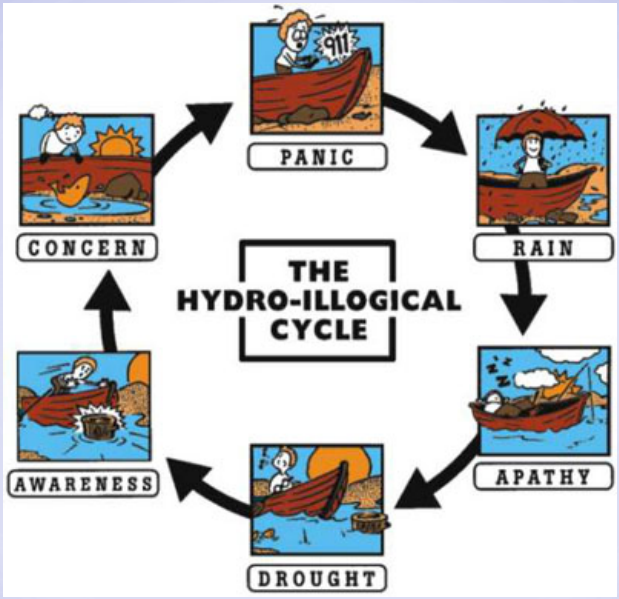
Groundwater levels (relative to normal)



Predicting drought in BC requires more than the 4 indices (Standardized Precipitation Index, snowpack, streamflow, groundwater levels), it also requires monitoring of weather and ocean conditions and watching how the weather & ocean conditions behave & change over extended periods of time.

Prediction of drought is challenging and that is also why it is better to be prepared in advance.

Even when we are prepared, we always walk the delicate balancing act of when do we use the “d” word – when do advise water licensees that stream flows are getting low and that they need to start moderating their use – what if we send out an advisory and then it rains…how many times can you do that and still maintain credibility?



Reference: I.R. Tannehill, *Drought: Its Causes and Effects*, Princeton University Press, Princeton, New Jersey, 1947

A question for the Okanagan Water Stewardship Council – When is the Okanagan Basin in drought? At what point do we move from planning into action…when do we take the drought management plan off the shelf and start implementing it…what are the triggers? Can it be done on a Basin wide-basis, or is it better left to the local water suppliers. How can the WSC support local water suppliers in dealing with drought?

Unlike other natural disasters, drought does not have a clearly defined beginning and end. As a result, our reaction to drought traditionally has not been timely.

"We welcome the first clear day after a rainy spell. Rainless days continue for a time and we are pleased to have a long spell of such fine weather. It keeps on and we are a little worried. A few days more and we are really in trouble. The first rainless day in a spell of fine weather contributes as much to the drought as the last, but no one knows how serious it will be until the last dry day is gone and the rains have come again."

(from I.R. Tannehill, *Drought: Its Causes and Effects*, Princeton University Press, Princeton, New Jersey, 1947)

CONSEQUENCES OF DROUGHT

- **Water Supply**
- **Non-irrigated agriculture**
- **Irrigated agriculture**
- **Forestry**
- **Fish & other aquatic resources**

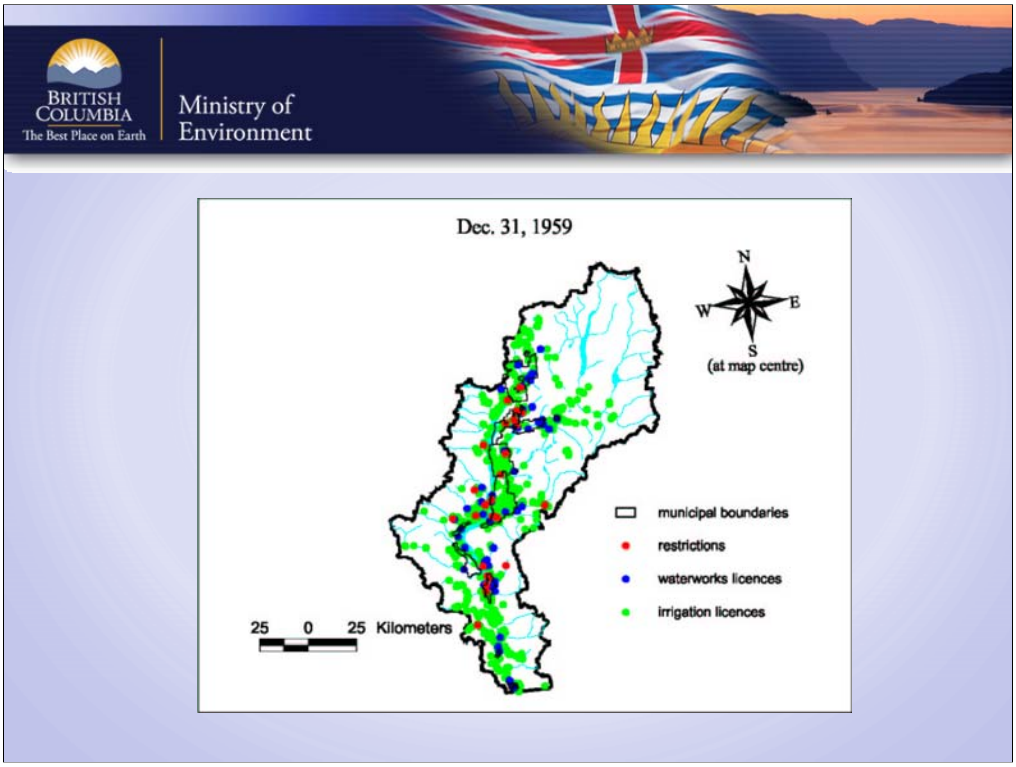
Water Supply – reservoirs are impacted when there are insufficient snowpacks or rainfall – quality & quantity are affected. Where streams are the primary water supply, low flows can impact quantity & quality. Upstream users can impact those downstream…conflicts

Non-irrigated agriculture relies on adequate supplies of soil moisture, again lack of adequate winter snow and rainfall at other times concurrent with high evaporation rates impacts the viability of these crops

Irrigated agriculture – dependent on the source water supply as per #1

Forestry – vulnerability to forest fires as soil moisture content decreases and forest cover dries out. Affects availability of water for forest fire fighting.

Aquatic resources – low snowpacks mean long low flow periods in summer. Low flows result in higher stream temperatures creating stress and mortality in fish. Low streamflows in winter, as we are seeing this year in some areas, can lead to freezing of refuge areas and loss of habitat.

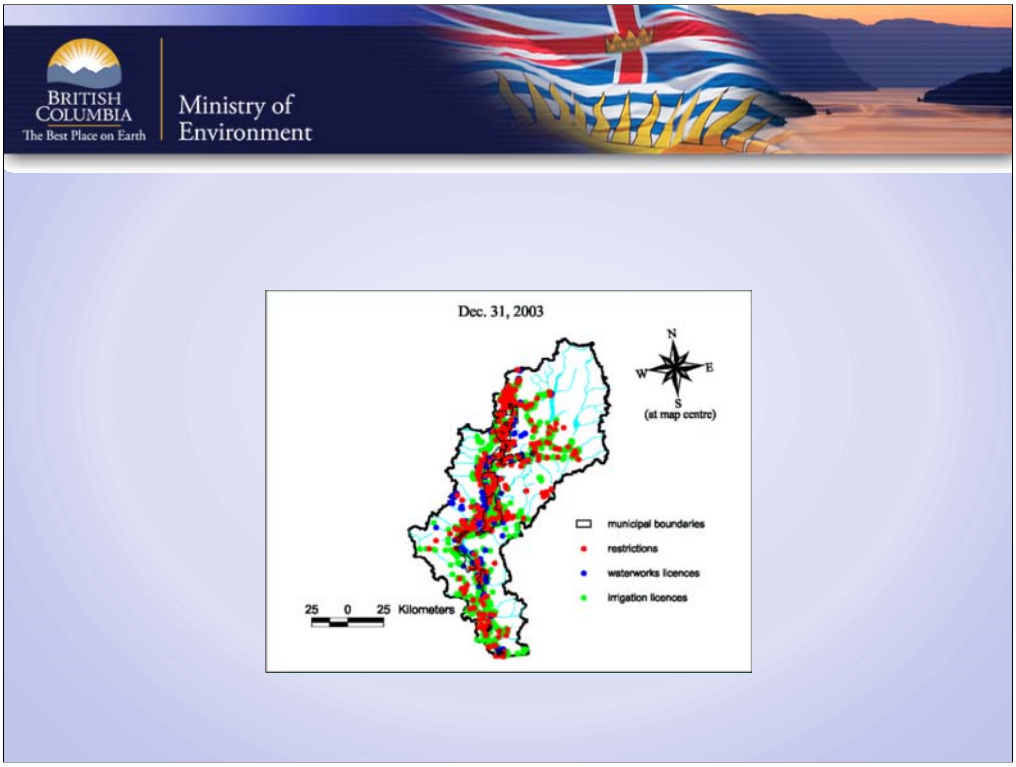


•Explanation of the picture: this is the locations of the licensed water intakes at the end of the 1950s.

•Green dots are irrigation intakes

•Blue dots are waterworks for municipalities

•Red dots are restrictions on water use



•As the population grows, the demands on the water supply also increase. Over the past 50 years, we have seen a dramatic increase in the licensing in this area.

•Not many new intakes have been installed over the last 15 to 20 years, but increased withdrawals are occurring at the existing intakes, leading to increased restrictions.

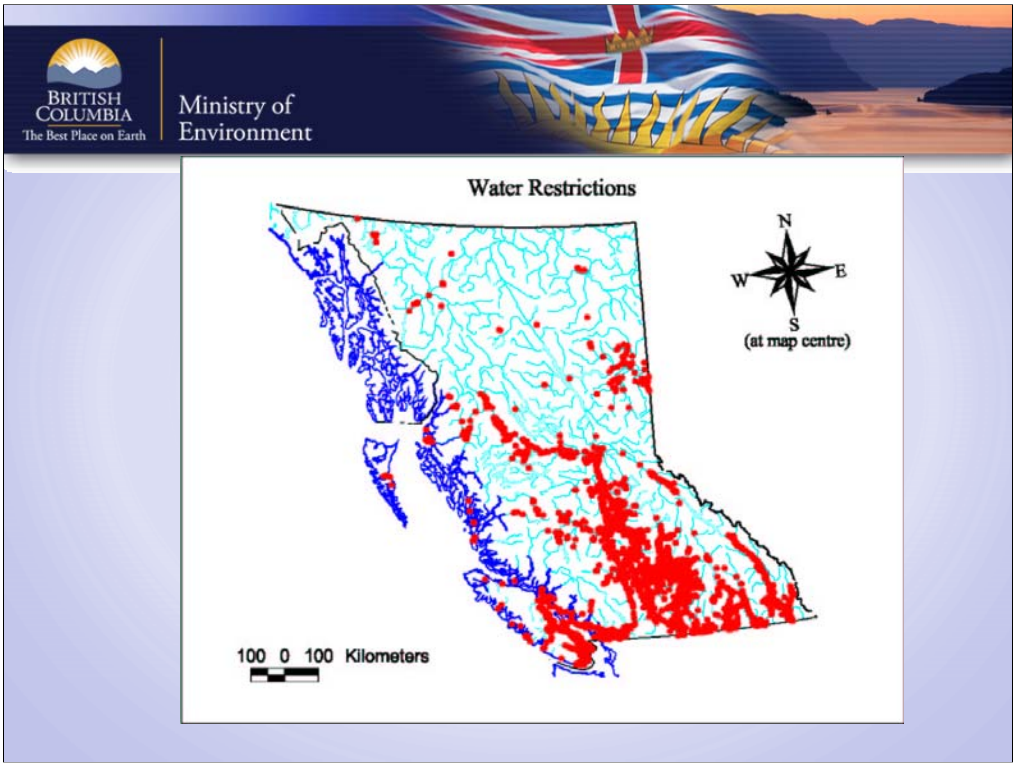
•The number of restrictions indicate exceptional vulnerability to drought.

•Explanation of the picture: these are the locations of the licensed water intakes 2003.

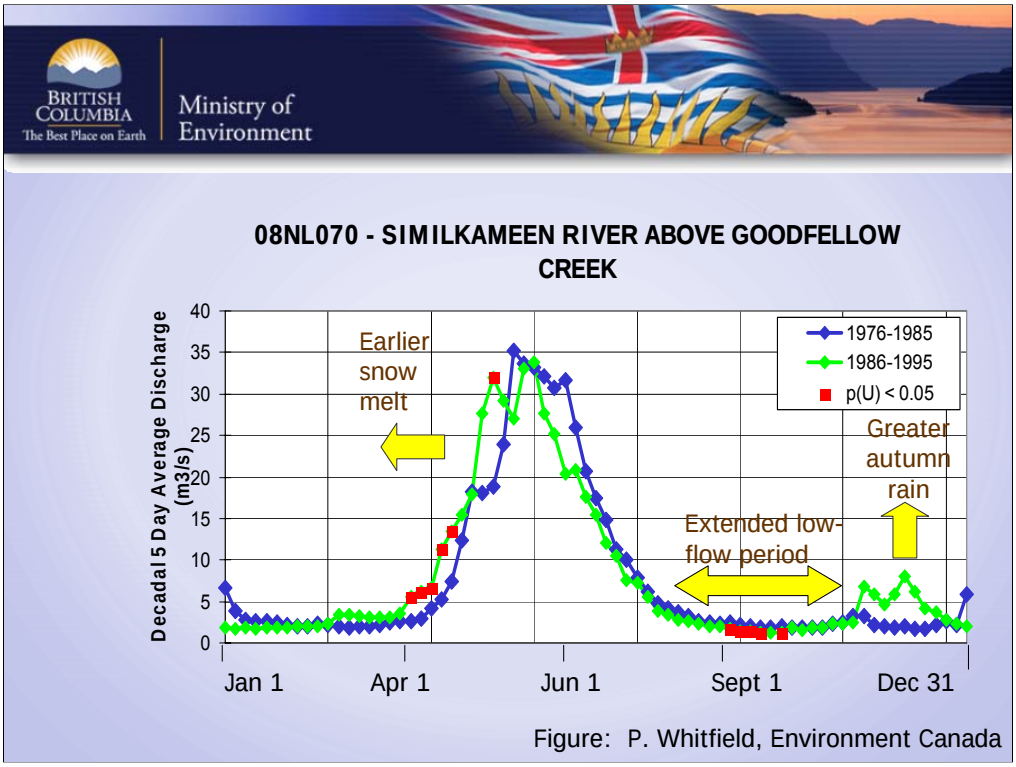
•Green dots are irrigation intakes

•Blue dots are waterworks for municipalities

•Red dots are restrictions on water use



•In actual fact, 17% of our surface waters have reached, or are nearing, their maximum capacity for extraction and we have records of water shortages or have stopped licensing on over 4,000 sources in our efforts to ensure our management and use of our water is sustainable. Map as of 2003.



•The warmer conditions being observed are causing spring freshet to occur earlier in many areas.

•The earlier the snow melts and enters our waterways, the longer the period of summer low flow.

•Using the Similkameen as an example, the blue represents conditions 20-30 years ago, the green line represents more contemporary conditions. Red indicates statistical significance for selected time periods.

•Measurements taken in BC and Washington State show similar trends.

Reference: Paul H. Whitfield, Meteorological Service of Canada, Environment Canada, Vancouver, BC

Gundaroo, Australia

Water bandits strike drought-hit farmers

October 25, 2006

Water bandits strike drought-hit farmers

October 25, 2006 - 4:06PM

Drought-ravaged Australian farmers heading into summer are facing a new and previously unknown threat: water bandits.

Police at tiny Gundaroo village near the Australian capital Canberra today said they were hunting thieves who used crowbars to crack open water tanks and steal the precious contents.

"I came to the tap to get a glass of water and all I got out was mud. I couldn't really believe it had happened," said farmer Lindy Hayman.

In nearby Bungendore, water has been stolen from village dams and tanks, while 50 kilometres away in Yass police have reports of theft from the city's near-dry river.

In the past two weeks, Australia's government has announced more than $900 million in drought relief as farmers face the driest period for a generation and with the hottest summer months still ahead.

More than 90 per cent of the most populous state of New South Wales is in drought, with many farmers enduring five continuous years of below average rainfall.

The area around Gundaroo and the nearby town of Goulburn have been particularly hard-hit, with Goulburn's main dam having run dry.

Hayman said she and partner Zed Zawalski lost 75,000 litres from their small Gundaroo olive grove and cattle farm while they were out.

Nearby, in the village main street, Kerry Wagstaff said thieves emptied two 30,000 litres water tanks, used to provide water for the house and for their vegetable garden.

"With things the way they are, we are down to asking visiting friends if they really need a shower," Wagstaff said.

Police in the regional Goulburn headquarters said they were investigating several incidents of water theft and advised people to lock their water stores as summer draws closer.

"But I think things are not yet that desperate that it's happening a lot and people need to go round stealing water," Acting Inspector Doug Pilkington said.

Reuters

PROVINCIAL RESPONSE

- **Establish Drought Task Force**
- **Assess the preparedness of water suppliers to deal with drought & provincial ability to respond**
- **Develop an Action Plan**
- **Implement the Plan**
- **Apply lessons learned**
- **Communications throughout**

•In 2003, as a result of ongoing dry conditions in some areas of the province and the potential impacts on the economy, the environment and society, the Government of BC recognized that provincial leadership was necessary to assist local water suppliers deal with the situations that they were facing. Interestingly the process that the Prov Govt undertook is not unlike what we recommend that local governments do:

- •Establish local drought mngt team
- •Assess their water supplies & preparedness to respond
- •Plan
- •Respond
- •Apply lessons learned
- •Communicate throughout

The Province established a Drought Task Force with representatives from a dozen different provincial agencies and Ministries and that group developed an Action Plan.

The purpose is to ensure that a conscious effort is being put forth by the Province and all of its communities to protect drinking water supplies, enable continued growth and economic development with finite water supplies, and maintain the health and integrity of aquatic ecosystems for fish and wildlife.

ASSESS

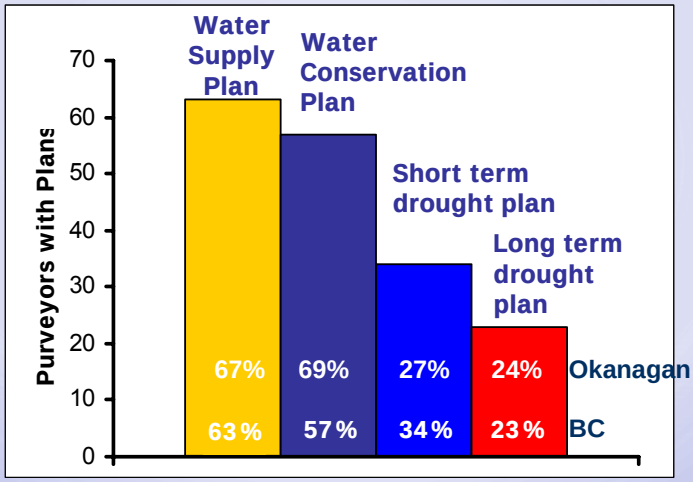
OBJECTIVES

- Protect drinking water supplies
- Limit adverse economic impacts
- Protect fish & fisheries
- Increase awareness to the ongoing need for water conservation

  …developing the "water ethic"

- The first task was to conduct a survey and from that the report "Status of Community Water Supplies in BC" was produced. This provided government with an understanding of the extent of the impacts of drought on local water supplies and the preparedness of local water suppliers to deal with drought.
- The report is available on-line at: http://www.env.gov.bc.ca/wsd/public_safety/drought_info/index.html

ASSESS



•One of the most effective ways to manage our demands, is to first understand the capacity of our supply systems, and then to practice proactive water management with these supplies, using planning tools.

•Several types of plans exist, including: a **water supply plan**—this is important as it analyzes current supplies of the system, and projects future water supplies and future demands while exploring alternative options available to develop a reliable supply of water to meet these demand. This plan should also have a technical, financial and economic cost/benefit analysis.

•**Water Conservation Plans** which encourage consumers to maximize water use efficiency using a variety of tools.

•**Drought Management Plans** are extremely helpful planning tools. This plan would describe what you monitor, how you monitor, and what steps you take in response to the monitoring information. For example, you may monitor your reservoir levels and rates of consumption, and impose outdoor sprinkling restrictions or even a watering ban when your reservoir level drops to some predefined level and consumption remains high.

•The question that was on every water manager's mind during the 2003 drought was, are BC's water suppliers prepared to deal with a reduced supply during drought conditions?

•From these results we realized that less than a quarter of the province is well prepared to deal with a long term reduced supply of water.

GOVERNANCE

- **Priority date**
- ***Environment Management Act* (1981) – Environmental Appeal Board**
- **Regional Water Managers**
- **Fish Protection Act (1997)**

•The Water Act makes use of the Priority Date system, which means that in times when a supply is insufficient to meet all licensed demands that exist, the most recently issued water licences are required to stop diverting water first. These are called “stop diversion orders”.

Some additional tools to the Water Act also exist:

•Among them includes the Environment Management Act (in 1981) which established the Environmental Appeal Board. Licensees now had two levels of appeal - to Comptroller then Appeal Board.

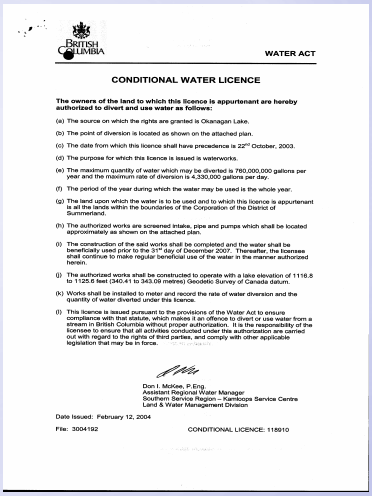
•Regional Water Managers were also defined, providing them with the authority to grant Approvals, licences, amendments, and transfer of appurtenancy (1982).

•Appeals from decisions of both Comptroller or Regional Water Manager go to Environmental Appeal Board

•Fish Protection Act (1997) led to no new bank to bank dams on specified rivers and licensing restraints on identified sensitive streams.

MANAGEMENT CHALLENGES

- "Stop diversion orders"
- Licensee conflicts
- Instream demands
- Monitoring
- Compliance



BRITISH COLUMBIA

WATER ACT

CONDITIONAL WATER LICENCE

The owners of the land to which this licence is appurtenant are hereby authorized to divert and use water as follows:

(a) The source on which the rights are granted is Okanagan Lake.

(b) The point of diversion is located as shown on the attached plan.

(c) The date from which this licence shall have precedence is 22nd October, 2003.

(d) The purpose for which this licence is issued is waterworks.

(e) The maximum quantity of water which may be diverted is 760,000,000 gallons per year and the maximum rate of diversion is 4,330,000 gallons per day.

(f) The period of the year during which the water may be used is the whole year.

(g) The land upon which the water is to be used and to which this licence is appurtenant is all the lands within the boundaries of the Corporation of the District of Summerland.

(h) The authorized works are screened intake, pipe and pumps which shall be located approximately as shown on the attached plan.

(i) The construction of the said works shall be completed and the water shall be beneficially used prior to the 31st day of December 2007. Thereafter, the licensee shall continue to make regular beneficial use of the water in the manner authorized herein.

(j) The authorized works shall be constructed to operate with a lake elevation of 1116.8 to 1125.6 feet (340.41 to 343.09 metres) Geodetic Survey of Canada datum.

(k) Works shall be installed to meter and record the rate of water diversion and the quantity of water diverted under this licence.

(l) This licence is issued pursuant to the provisions of the Water Act to ensure compliance with that statute, which makes it an offence to divert or use water from a stream in British Columbia without proper authorization. It is the responsibility of the licensee to ensure that all activities conducted under this authorization are carried out with regard to the rights of third parties, and comply with other applicable legislation that may be in force.

Don I. McKee, P.Eng.
Assistant Regional Water Manager
Southern Service Region – Kamloops Service Centre
Land & Water Management Division

Date Issued: February 12, 2004

File: 3004192 CONDITIONAL LICENCE: 118910

But the ability to govern does not come without its challenges:

•For example "stop diversion orders" can be problematic as the most recent licences are typically for small volumes for domestic purposes.

•The impact of "shutting off" those licences has an immediate significant impact on people, and a minimal positive impact on the resource.

•This type of scenario can also have a significant negative impact on some licensees if they are required to stop diverting water for certain types of agriculture . For example, if vineyards and orchards lack water too early in the fall, not only is that season's harvest affected, but vines or trees can be lost, and entire operations can collapse.

Licensee conflicts:

•Typically development has started in valley bottoms, closest to the mainstem. As growth continues, there is a progression of development to higher elevations.

•This results in the newer priority licences being located upstream of the older and higher priority licensees.

•Essentially, the newer licensees have access to available supplies first (due to geography) which leads to conflicts between users.

•Many licensed users have concerns regarding their water rights during a drought or low flow conditions. To clarify, the Province generally follows this procedure:

- •1) Water Manager encourages individual licensees to resolve local disputes themselves, recommending discussing concerns with neighbours first
- •2) If a group of water users on a single source have an issue, together they can approach their MOE regional office who will then consider appointing a water bailiff to assist in managing the resource. The water users are required to pay the fee of the water bailiff.

Instream & off stream demands:

•At the federal level, the Fisheries Act is a reactive legislation that allows DFO to authorize stop diversions once fish are impacted.

•The problem is that by this time, it is often too late and a stream cannot recover fast enough.

•Under the Provincial Water Act, the regional water manager cannot issue stop diversions to conserve flows for fish.

•However, the Province often includes a fish protection clause in licences on sources that have a past history of low flow problems. This clause allows the regional water manager to restrict or stop diversions of those specific licensees.

•DFO will often work with the Province to issue letters ***requesting*** that licensees reduce diversions to protect fish. But these letters are not orders, and compliance is strictly voluntary.

Monitoring:

•In terms of monitoring, we do require utilities to supply annual water usage data to the Province.

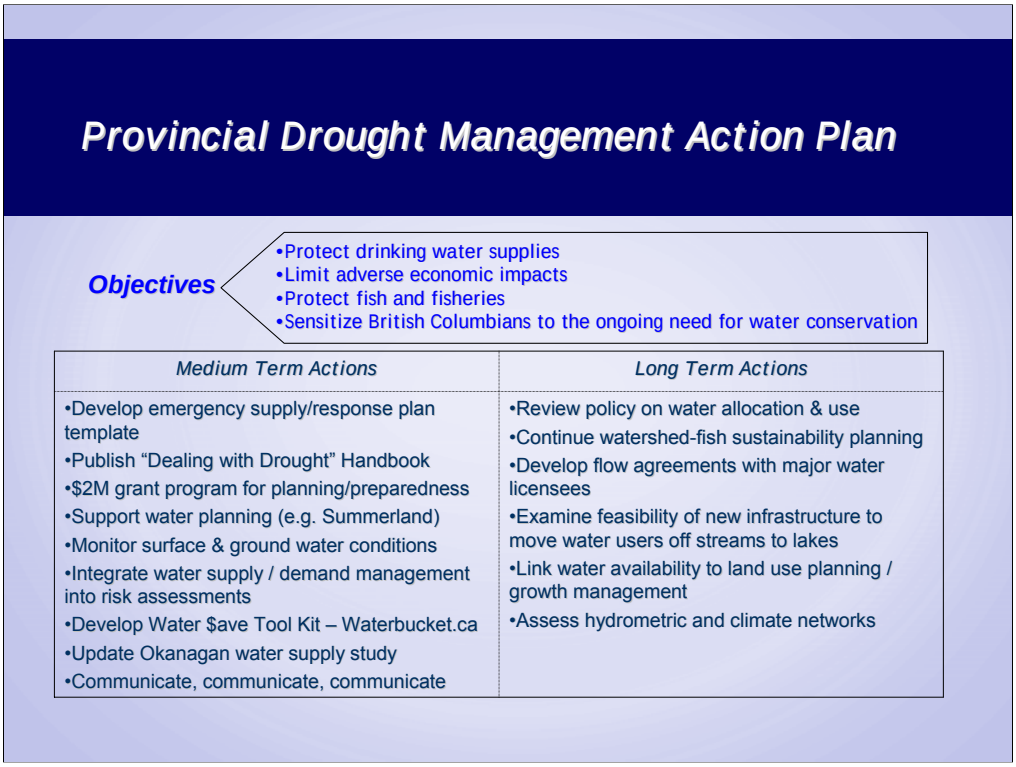
•However, this requirement does not apply to other licences, such as irrigation.

Compliance:

•In terms of compliance, if there is a water bailiff on a source or a manager of a water users' community, they can provide day-to-day regulation of withdrawals.

ROLES & RESPONSIBILITIES

- Identified Ministry/Agency roles & responsibilities
- Identified local experts in “hot” areas
- Identified “elevation” process within Provincial & Federal government
- Identified local water suppliers role



The purpose is to ensure that a conscious effort is being put forth by the Province and all of its communities to protect drinking water supplies, enable continued growth and economic development with finite water supplies, and maintain the health and integrity of aquatic ecosystems for fish and wildlife while increasing the awareness of BC to the ongoing need for water conservation – developing the "water ethic"

COMMUNICATION PLAN

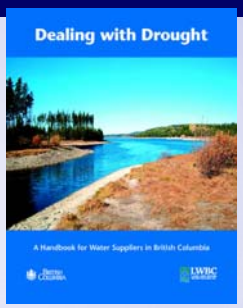
Purpose: To build public understanding

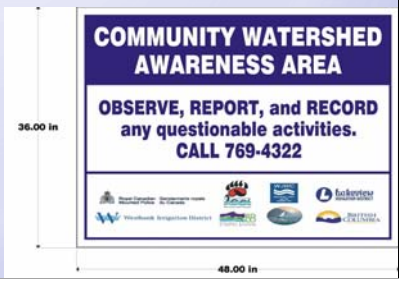
Key Messages:

- **Abundance is a myth**
- **Individuals can make a difference**
- **Communities need to conserve**
- **Province will provide support**
- **Even if rains, conservation steps are prudent**

$2M GRANT PROGRAM & TRAINING WORKSHOPS

- Supply & demand studies
- Plans for Drought Management, Water Conservation, Contingencies, and Emergencies
- Staff training and set-up of drought management teams
- Draft Bylaws to regulate water use
- Educational Materials for water conservation





OKANAGAN COMMUNITIES WITH FUNDING

- Westbank Irrigation District
- Lakeview Irrigation District
- District of Peachland
- District of Summerland
- City of Penticton
- Town of Oliver
- Osoyoos Irrigation District
- City of Kelowna
- Kaleden Irrigation District
- District of Lake Country
- Village of Lumby
- Black Mountain Irrigation District
- Glenmore Ellison Improvement District
- Rutland Waterworks District
- South East Kelowna Irrigation District
- South Okanagan Mission Improvement District
- RD Central Okanagan
- RD North Okanagan
- RD Okanagan-Similkameen
- Okanagan Falls Irrigation District
- West Bench Irrigation District

The Okanagan received about 20% of the funding.

OKANAGAN SUPPLY & DEMAND STUDY

Best estimate of the current and future available water supply and demand in the Okanagan Basin

Phase 2 Objectives:

- Determine existing water supplies in tributaries, groundwater & lakes
- Quantify current water demand
- Estimate future supply & demand under a range of possible conditions
- Recommend an approach to future allocation decision making

►Must be scientifically defensible & credible with public

•The overall goal of the study currently underway is to determine the best estimate of the current and future available water supply and demand in the Okanagan Basin, taking in to account the influence of growth, climate, and other relevant factors.

•Phase 1 was completed in 2005 through a contract with Summit Environmental Consultants. Data sources were evaluated and consideration was given to whether there is sufficient & adequate data to complete a supply & demand study for the Basin. The conclusion was 'yes' but there is a need for some specific data that doesn't exist – for example, evaporation data for the Lake.

•Due to the complexity and potential cost of doing the study, the Province and the Okanagan Basin Water Board have partnered together along with the Federal government to embark on Phase 2.

•The objectives of Phase 2 are:

- •To identify the current status of water supplies including the tributaries, groundwater, and mainstem lakes,
- •Identify current water use in the Basin,
- •Estimate future supply and demand under a range of possible future conditions of climate, economic development and growth, and
- •Recommend an approach to future allocation decision-making.

•We would like to achieve this through the use of a model that can be run through different scenarios to account for present and future climate, population, land use and other factors.

•Meetings have been held to discuss the structure of the project and to explore and clarify various components of Phase 2. There are a few missing representatives that are being invited to participate on the Steering Committee and Working Group – these are primarily representatives of the Okanagan Nation Alliance and UBC Okanagan

•We are hiring a consultant who will be the project manager and technical coordinator – the RFP has been posted to BC Bid by the OBWB and it closes January 9th.

• The project is expected to be completed in 2008.

•We are piecing this complex project into "bite size" pieces to ensure that it is manageable, that the end products meet our needs and that the project does not balloon out of control into something beyond what was originally required. Ultimately, this is simply a water balance – how much water do we have, how much is being used, and what is left for allocation, but it is being done for a complex environment.

OKANAGAN SUPPLY & DEMAND STUDY

Challenges:

- **Getting momentum & keeping it**
- **Filling the critical data gaps**
- **Not getting hung-up on insatiable data gathering**
- **Linking all of the pieces to produce a credible product**
- **Multiple stakeholder interests**
- **Staying focused on the end goal**

•One of the challenges with this study is, given the timelines we would like to finish this in, and the resources available, filling all of the existing data gaps may not be possible.

•What we need to determine then is, how sensitive are the results to these data gaps? Do they affect the accuracy of our conclusions?

•We want to minimize the cost of gathering additional data, especially if field work is required, but we will gather new data if it is need to achieve an acceptable level of accuracy.

•Also, we recognize that there is enormous interest in the results of this study and ultimately, we would like the results to be useful, not just to the province for allocation decisions, but to your water suppliers and municipal planners.

•In order to do this, we know from the Phase 1 workshop findings that we need to make this a public process and consult with the many stakeholders.

LONGER TERM INITIATIVES

- Review policy on allocation & use
- Continue watershed-fish sustainability planning
- Develop flow agreements with major licensees
- Feasibility of new infrastructure to move users off streams to lakes
- Link water availability to land/growth planning
- Assess hydrometric & climate networks

In the Provincial Drought Action Plan, these are the tough nuggets that we continue to work on at every opportunity, often making small inroads at a time.

- Review policy on water allocation & use
- Continue watershed-fish sustainability planning
- Develop flow agreements with major water licensees
- Examine feasibility of new infrastructure to move water users off streams to lakes
- Link water availability to land use planning / growth management
- Assess hydrometric and climate networks

LESSONS LEARNED

- Every drought is different
- Every community responds to drought differently
- Drought Management Plans must be specific to the community
- Local Drought Management Team is key
- Drought Management Plans must contain sufficient detail that anyone can follow it
- Drought Management Plans must be practiced to find the flaws

PROVINCIAL RESPONSE

- Provide information
- Proactive planning templates & tools
- Broad communication
- Funding & in-kind support
- Legislative, Regulatory & Policy support

•Ongoing Drought Working Group

•Ongoing assessment & provision of information on steamflows, snow packs, groundwater and the standardized precip index

•Plan

•Respond

•Apply lessons learned

•Communicate throughout

As you can see from what has been presented, there is a full range of government responses that are available, with increasing amount of provincial government involvement from very light to fully involved.

IDEAS FOR THE OWSC

- Build broad-based support across all sectors
- Cultivate basin-wide thinking & culture
- Instil the water ethic – everyone has a stake, responsibilities & accountabilities for their actions
- Link grants to specific conditions
- Hold a “Drill Day” – challenge all water suppliers to test their Drought Management Plan…find the flaws
- Explore opportunities for basin-wide water management planning

•Some ideas for the Okanagan Water Stewardship Council.

BRITISH COLUMBIA
The Best Place on Earth

Ministry of Environment

Water for BC; Safe, sustainable & valued by all.

www.env.gov.bc.ca/wsd/public_safety/drought_info/index.html

Adopting [a water ethic] would represent a historic philosophical shift away from the strictly utilitarian, divide and conquer approach to water management and toward an integrated, holistic approach that views people and water as related parts of a greater whole.

It would make us stop asking how we can further manipulate rivers, lakes and streams to meet our insatiable demand, and instead to ask how we can best satisfy human needs while accommodating the ecological requirements of healthy water systems.

Sandra Postel
Director of the Global Water Policy Project
"The Last Oasis – Facing Water Scarcity"
1997


BRITISH
COLUMBIA
The Best Place on Earth
Ministry of
Environment