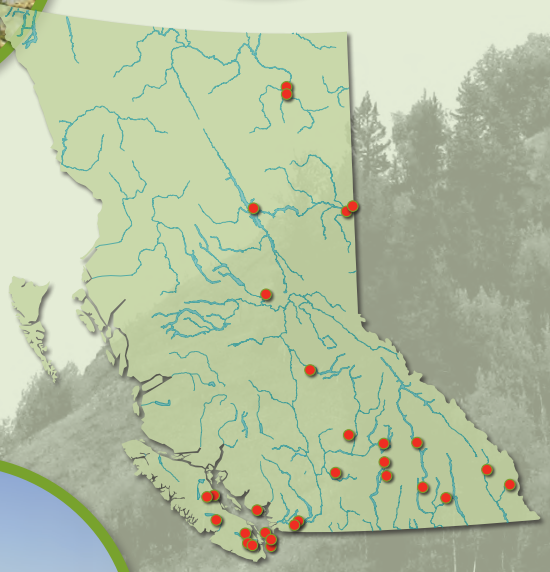
Top 5 Water Challenges

THAT WILL DEFINE BRITISH COLUMBIA'S FUTURE

Rosie Simms
Oliver M. Brandes



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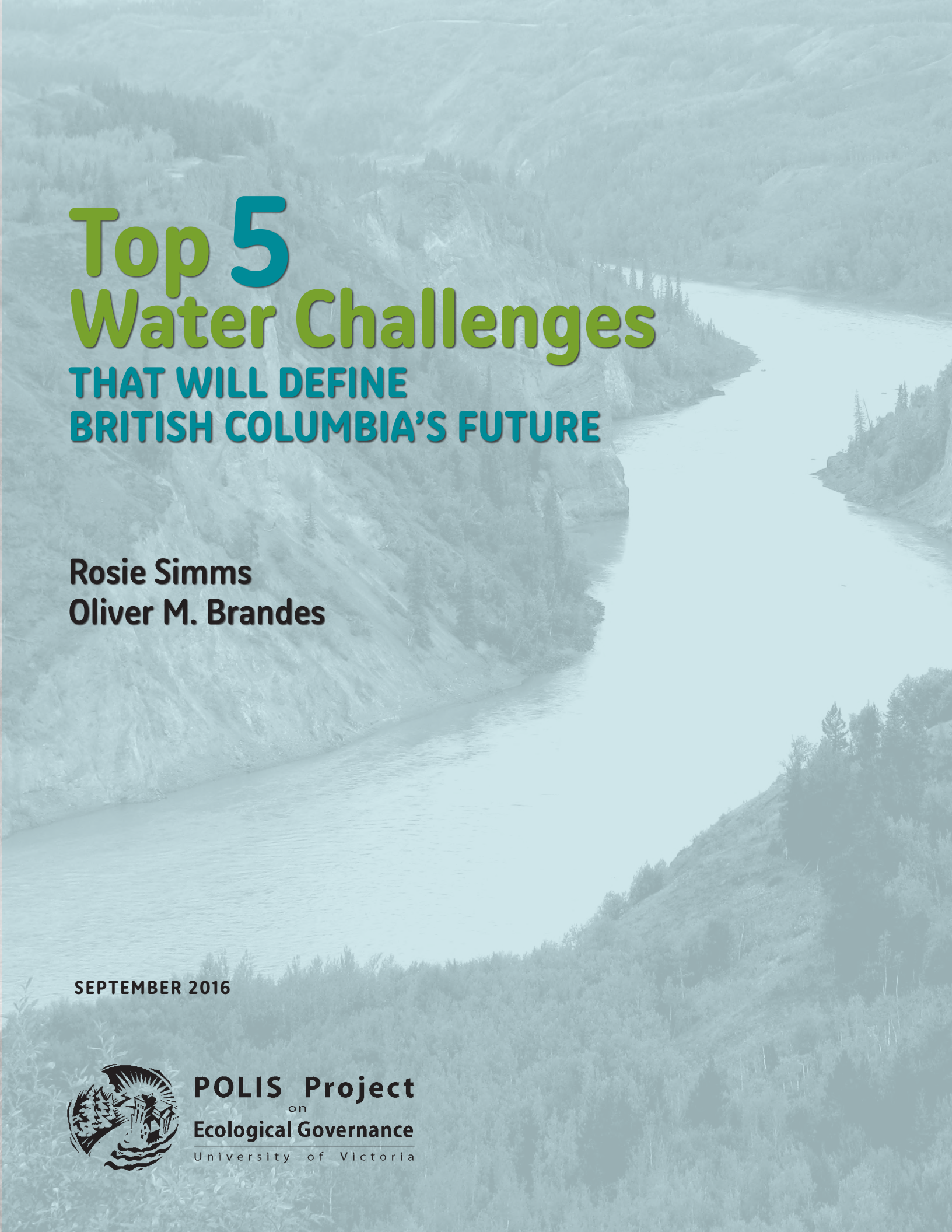

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POLIS Project on Ecological Governance
Centre for Global Studies, University of Victoria
PO Box 1700 STN CSC
Victoria, BC V8W 2Y2 Canada
Tel: 250.721.8800
Email: water@polisproject.org
polisproject.org | poliswaterproject.org

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REPORT HIGHLIGHTS

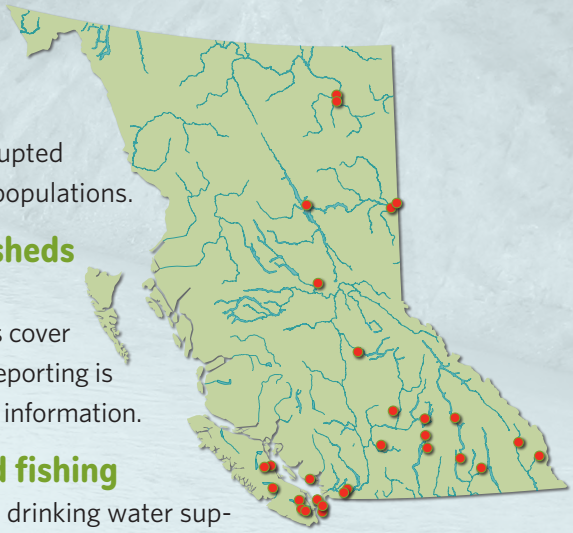
A community on the Sunshine Coast coming within two weeks of running out of water. Rivers running so low on Vancouver Island salmon have to be trucked upstream. Rivers contaminated from tailings spills and lakes stagnating with algal blooms. These are just a few of the examples of the stories emerging across British Columbia's watersheds showing that fresh water—the foundation of the province's ecosystems, communities, and economies—is under growing pressure. Climate change and shifting hydrological conditions are rapidly ushering British Columbia into an increasingly uncertain water future.

This report identifies emerging water challenges that will define the province's future. These challenges, and associated opportunities, must be addressed in the context of a changing water cycle, evolving water laws, and new forms of decision-making. The report documents specific examples of where the issues are unfolding, and suggests some initial solutions. **British Columbia's top five water challenges are:**

#1: Building resilience to droughts and floods

Communities across British Columbia are already witnessing increased frequency and intensity of droughts and floods, and climate change is projected to exacerbate these extremes. Communities and their water supplies are vulnerable to these incidents of shortages and excesses of water.

#2: Sustaining water for nature



Rivers' natural flow regimes, also known as environmental flows, operate as a "master variable" in ecological systems and are critical to ecosystem function and resilience. Environmental flows have been fundamentally disrupted in many watersheds, with detrimental consequences for habitats and fish populations.

#3: Understanding the state of British Columbia's watersheds

Data are sparse on many essential aspects of British Columbia's freshwater: aquifers mapping is only partially complete; hydrometric monitoring stations cover just a fraction of the province's watersheds; and regular state of watershed reporting is non-existent. This leads to decisions being made without a basis of accurate information.

#4: Protecting water quality for drinking, swimming, and fishing

Degraded water quality in rivers, lakes and aquifers is affecting community drinking water supplies, fish and ecosystem health, First Nations' harvesting access, and recreation. Groundwater is at risk of contamination from overlying land use practices and saltwater intrusion.

#5: Reconciling the water energy nexus

Water and energy are tightly interlinked: both hydroelectricity, which provides 90 per cent of British Columbia's electricity, and liquefied natural gas extraction, a cornerstone of the Province's economic strategy, are water intensive. Both may be impacted by projected fluctuations in water supplies due to climate change.

British Columbians benefit tremendously from the province's freshwater resources; proactive action on these emerging challenges is needed to prepare for an increasingly uncertain water future.

SHAPING THE FUTURE OF BRITISH COLUMBIA'S WATERSHEDS

WATER AS A PRIORITY AND IMPERATIVE

British Columbia's past, present, and future are intertwined with water. Lakes, rivers, aquifers, and glaciers were—and remain—critical to Indigenous populations in all aspects of life, and were important to early settlers for transport and resource development. More recently, development in British Columbia has included the damming of rivers and creation of a vast network of hydropower—now the source of 90 per cent of the province's electricity.

Water shapes British Columbia's landscapes, communities and economies today, and will define our future. Fresh water in the province is already under pressure in several regions, with urban expansion, resource extraction, and licensed diversions driving many of the changes. Fresh water also faces an increasingly uncertain future from land use changes and a climate in flux: new patterns of precipitation and more frequent and intense droughts and floods are all part of British Columbia's reality today, and will be increasingly so in the years ahead.

British Columbia is entering an era of water insecurity. In response, the legal and institutional rules that govern water management are shifting to challenge the current approach. The province is in the midst of a transition to modernize water management and develop new approaches to First Nations and community engagement in critical decisions. This shift includes changes to the legal framework—the long-awaited *Water Sustainability Act* (*WSA* or "Act") replaces the former 107-year-old *Water Act* and enables new approaches to water governance and planning.[i] Recent Supreme Court decisions affirming Aboriginal rights and title and First Nations' water law declarations are setting new precedents for how decisions about water management are made in British Columbia, and shifting expectations about water protection and stewardship.

Problems related to water scarcity are accelerating across British Columbia at an alarming rate. 2015 saw severe drought conditions across much of the province: in June 2016, Southern Vancouver Island experienced Stage 4 drought—the earliest date this designation has ever been applied, and for the second year in a row. These escalating issues demand urgent action to proactively prepare for an uncertain future. Unlike many parts of the world facing state or even country-level water shortages and crises, British Columbia still has time to do things better before crippling widespread crisis hits.

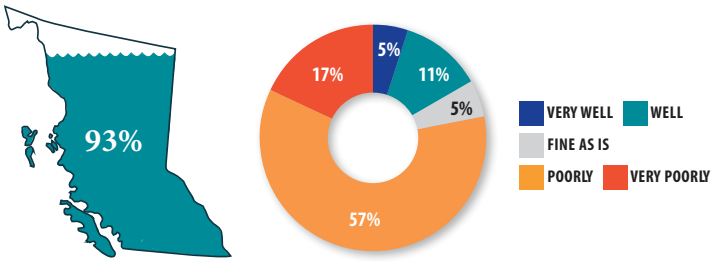


Figure 1: Freshwater attitudes in B.C. *In recent public opinion research, 93% of British Columbians agreed that fresh water is "Our Most Precious Natural Resource." Yet, a province-wide survey found that 74% of respondents believe that B.C.'s water is managed poorly or very poorly.*[1] *British Columbians are clearly signalling that new approaches to managing and governing water are needed.*

i For further details on the *WSA* and recommendations for core regulations, see: Brandes, O.M., Carr-Wilson, S., Curran, D. & Simms, R. (2015, November). *Awash with Opportunity: Ensuring the Sustainability of British Columbia's New Water Law*. Victoria, B.C.: POLIS Project on Ecological Governance. Retrieved from http://poliswaterproject.org/awashwithopportunity

REPORT PURPOSE, METHODS & OVERVIEW

This report identifies emerging water challenges that will define the province's future. These challenges, and associated opportunities, must be addressed in the context of a changing water cycle, evolving water laws, and new forms of decision-making. The five key water challenges unfolding in British Columbia's watersheds are:

#1 Building resilience to drought and floods;
#2 Sustaining water for nature;
#3 Understanding the state of British Columbia's watersheds;
#4 Protecting water quality for drinking, swimming, and fishing; and
#5 Reconciling the water energy nexus.

Through documenting examples of pressing water challenges in the province, including why and where they are happening and the consequences, this report supports the many groups working to protect fresh water in British Columbia (government; First Nations; professionals; stewardship and watershed organizations; NGOs; and business). This analysis aims to stimulate dialogue between water users, communities, and policy- and decision-makers about innovative solutions.

This report flows from recent research compiled in *Awash With Opportunity: Ensuring the Sustainability of British Columbia's New Water Law*, a report that includes documentation of a wide range of water issues and conflicts across the province in the past decade. As part of this ongoing research, we continue to monitor the media, and court and tribunal cases, and have been part of over 100 presentations, workshops, webinars, and conferences related to water issues in the province over the past two years. This work, which included a review of recent relevant literature, the Outdoor Recreation Council's annual classifications of British Columbia's most endangered rivers, and responses to a province-wide "water issues" contest,[ii] informs our collective understanding of the water challenges—and opportunities—facing British Columbia.

This introductory section provides an overview of the cross-cutting drivers of change related to each of the five challenges presented. Each challenge is explored in more detail, including:

- Examples of where and how the challenge is manifesting in British Columbia;
- Discussion of the implications and consequences of each, including how the drivers of change relate to the particular challenge; and
- Initial proposed responses to each challenge.

The concluding section reflects on the themes identified, foreshadows next steps to further develop solutions, and considers the broader shift needed to ensure British Columbia's watersheds thrive into the future.

A Note on the Proposed Solutions

The proposed solutions (or responses) outlined in this report are not prescriptive, exhaustive, or final, but rather a starting point for dialogue on *what needs to happen* to begin to substantially address these pressing challenges. The solutions taken together ultimately help create water security: "sustainable access, on a watershed basis, to adequate quantities of water, of acceptable quality, to ensure human and ecosystem health."[2] Solutions offered in each section are based on recommendations from expert sources, and were pre-tested with report reviewers. This report does not prioritize the responses, but rather recognizes that more work is needed to identify the path forward, and that each solution should be uniquely adapted to the diverse social, ecological, and economic conditions across British Columbia's watersheds. POLIS anticipates further research and continued dialogue through a series of roundtables in 2016 and 2017 to further develop solutions to each of the five challenges presented.

ii In 2016 POLIS and the Canadian Freshwater Alliance hosted a "What's Your Water Problem & What's Your Solution?" contest, a survey in which organizations and First Nations submitted brief descriptions of the most pressing freshwater issues in their local watersheds.

CROSS-CUTTING DRIVERS OF CHANGE

Three cross-cutting drivers of change emerge across each of the five challenges:

- Land use change and a climate in flux;
- First Nations rights and title; and
- Conflict between users and legal challenges.

These three drivers already influence how water is governed and managed in British Columbia, and will increasingly be at the forefront of shaping both the state of water as a resource and how decision-making approaches and solutions are developed.

Land use change and a climate in flux

Land use changes have fundamental impacts on the hydrological cycle. Urban expansion and an increase in impervious surfaces, for instance, lead to more surface runoff and increased flooding. From forests transformed into cut-blocks, to wetlands replaced with industrial farming operations, cumulative land use changes profoundly affect how water moves through British Columbia's watersheds. Climate change projections for the province indicate an array of changing hydrological patterns for different regions, including changes in the timing and amount of precipitation, water temperature, water quality, and storage in snowpacks and glaciers.[3] Hydrological uncertainty, instability, and extremes will be the "new normal" as climate change takes effect across the province.

First Nations rights and title

Because few treaties were signed historically, and only a small number have been finalized through the modern treaty process, the majority of British Columbia is unceded Indigenous traditional territory. Through a series of legal decisions, most recently the 2014 *Tsilhqot'in* case, the Supreme Court of Canada has clearly established that Aboriginal rights and title cannot be ignored and that First Nations must have an explicit role in decision-making in their territories.[4] Canada's recent announcement that it will embrace and implement the United Nations Declaration on the Rights of Indigenous Peoples, with its provisions regarding self-determination and Free, Prior and Informed Consent to land-use decisions, will further evolve this model of co-governance.[5] In the water context specifically, aspects of this are already coming to fruition, including First Nations developing water plans and exerting Indigenous water laws. For example, the Nadleh Whut'en and Stellat'en First Nations recently enacted water laws in their traditional territory, which will be used as standards to hold government and industry to account.[6]

Conflicts among users and intensifying legal challenges

Conflicts between water users, and among water users, industry, First Nations, and other levels of government are on the rise in many watersheds in British Columbia. Examples include concerns over water bottling companies extracting groundwater from poorly understood aquifers;[7] legal challenges over the placement of a toxic soil dump and fears over water quality contamination in Shawnigan;[8] and disruption of streamflow from logging on a ranch in the Cariboo.[9] The Province faces numerous challenges to its water allocation and land use decisions in tribunals and in the courts—a costly, protracted way of dealing with disputes.

The discussion that follows highlights the interplay between each challenge and the drivers of change.

THE PROBLEM & CONSEQUENCES

In June 2012 almost 700 British Columbians were forced to evacuate their homes, and over 1000 more given evacuation warning, when rapid snowmelt and heavy rains led to rampant flooding across the Interior, Kootenay, and Fraser Valley regions.[10] Only a few years later, in the summer of 2015, these same regions faced Stage 4 drought conditions[iii]—with raging wildfires, wells running dry, declining reservoirs, and widespread water restrictions.[11]

These extreme swings from *too much* to *not enough* water may seem like rare events, but instead are the "new normal" in British Columbia. Climate change is altering rain and snow patterns, changing the timing and amount of precipitation, increasing water temperatures, and shrinking snow packs and glaciers, with snowmelt occurring earlier in the spring.[12] Altogether, this means less water available to sustain flows in the summer and a higher likelihood of water-stressed communities and increased conflicts. Recent tree-ring research demonstrates that combined with the impacts of climate change and deforestation, the coastal regions of Southern British Columbia are likely to be hit by a worse drought within the coming decades than any in the past 350 years.[13]

The problem isn't just that uncertain water conditions will be the new reality, but also that communities in British Columbia and their water supplies are vulnerable to the increased intensity and frequency of both droughts and floods. Drought vulnerability is exacerbated by the fact that surface water is fully (and sometimes over-) allocated in many regions of the province. Groundwater, often envisioned (mistakenly[iv]) as a safety net during times of shortage, is not in the best health either: one-fifth of provincial observation wells show a moderate or large decline in water levels.[14] Floods happen every year in British Columbia, and more extreme high flow events will increase with a changing climate. Dense and growing populations and more built infrastructure within flood plain areas magnify communities' susceptibility to floods.

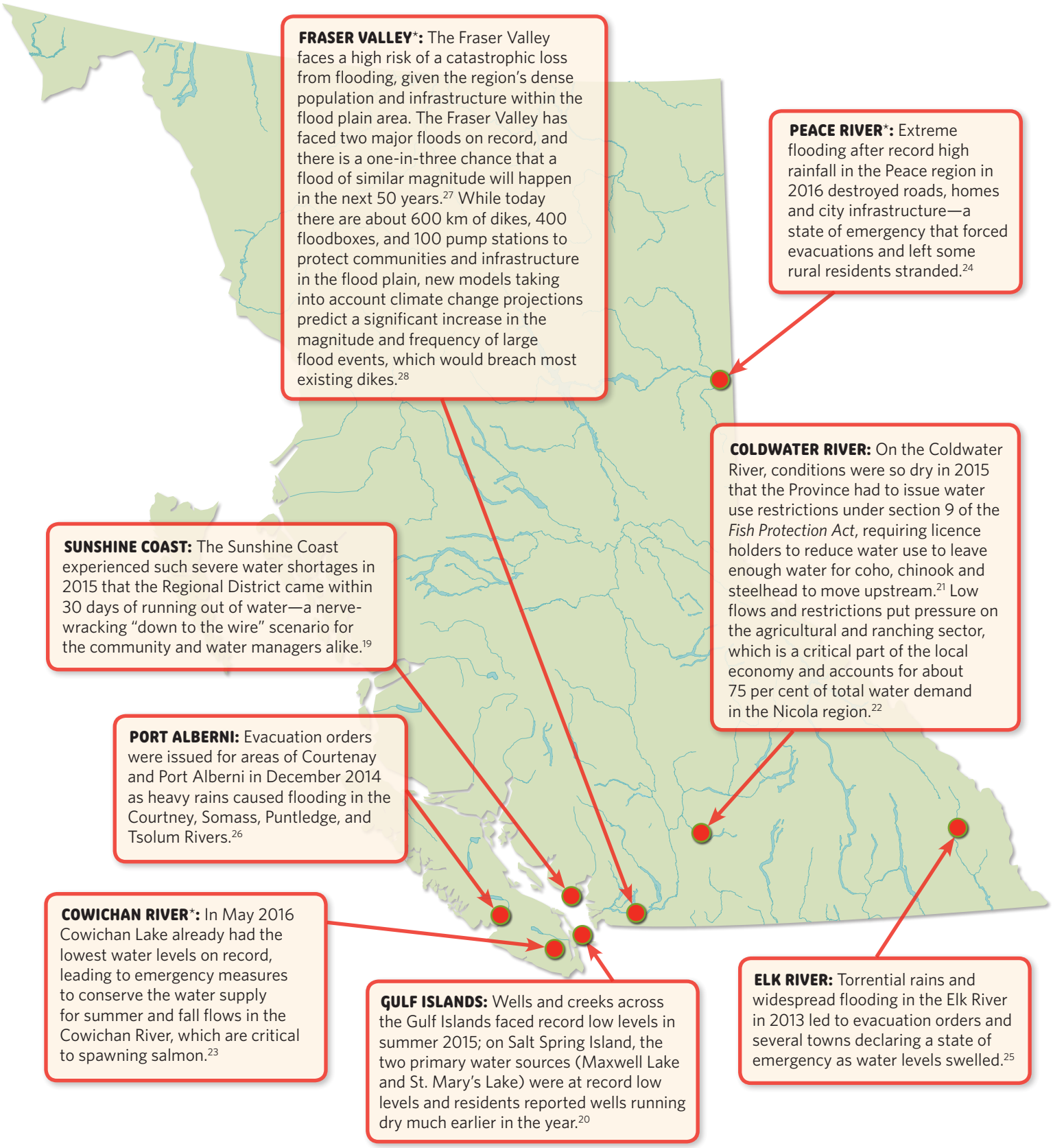
Regional droughts and floods can have significant effects on many different sectors, including agriculture, energy production, fisheries, and tourism. During the 2015 drought in British Columbia, for instance, there was reduced water for irrigation and feed supplies, contributing to below-average production of grain, forage, oilseed and livestock.[15] Fishing was temporary closed in several regions, including Vancouver Island, Kootenays, and Okanagan,[16] and British Columbia Hydro ran some hydroelectric facilities below capacity to save water for fish (see Water-Energy nexus section).

Severe weather events have resulted in rising costs to all levels of government in Canada.[17] The Calgary flood of 2013 was a clear warning of the massive losses flooding brings in its wake; with 100 000 Albertans evacuated from their homes, and losses and recovery costs estimated at $6 billion, this was Canada's costliest natural disaster.[18]

iii Stage 4 drought means "extremely dry conditions" where water supply is insufficient to meet socio-economic and ecosystem needs. Stage 4 drought calls for voluntary conservation restrictions and regulatory response. See: B.C. Ministry of Environment. (2015). British Columbia Drought Response Plan. Retrieved from: http://www2.gov.bc.ca/gov/content/environment/air-land-water/water/drought-flooding-dikes-dams/drought-information

iv A pivotal 2015 study found less than six per cent of groundwater in the upper two kilometres of the Earth's landmass is renewable within a human lifetime, meaning most groundwater is essentially a non-renewable resource and not a sustainable backup supply. See: Gleeson, T., Befus, K., Jasechko, S., Luijendijk, E. & Bayani Cardenes, M. (2015). The global volume and distribution of modern groundwater. *Nature Geoscience* 9: 161-167.

EXAMPLES OF WHERE IT IS HAPPENING



FRASER VALLEY*: The Fraser Valley faces a high risk of a catastrophic loss from flooding, given the region's dense population and infrastructure within the flood plain area. The Fraser Valley has faced two major floods on record, and there is a one-in-three chance that a flood of similar magnitude will happen in the next 50 years.[27] While today there are about 600 km of dikes, 400 floodboxes, and 100 pump stations to protect communities and infrastructure in the flood plain, new models taking into account climate change projections predict a significant increase in the magnitude and frequency of large flood events, which would breach most existing dikes.[28]

PEACE RIVER*: Extreme flooding after record high rainfall in the Peace region in 2016 destroyed roads, homes and city infrastructure—a state of emergency that forced evacuations and left some rural residents stranded.[24]

COLDWATER RIVER: On the Coldwater River, conditions were so dry in 2015 that the Province had to issue water use restrictions under section 9 of the *Fish Protection Act*, requiring licence holders to reduce water use to leave enough water for coho, chinook and steelhead to move upstream.[21] Low flows and restrictions put pressure on the agricultural and ranching sector, which is a critical part of the local economy and accounts for about 75 per cent of total water demand in the Nicola region.[22]

SUNSHINE COAST: The Sunshine Coast experienced such severe water shortages in 2015 that the Regional District came within 30 days of running out of water—a nerve-wracking "down to the wire" scenario for the community and water managers alike.[19]

PORT ALBERNI: Evacuation orders were issued for areas of Courtenay and Port Alberni in December 2014 as heavy rains caused flooding in the Courtney, Somass, Puntledge, and Tsolum Rivers.[26]

COWICHAN RIVER*: In May 2016 Cowichan Lake already had the lowest water levels on record, leading to emergency measures to conserve the water supply for summer and fall flows in the Cowichan River, which are critical to spawning salmon.[23]

GULF ISLANDS: Wells and creeks across the Gulf Islands faced record low levels in summer 2015; on Salt Spring Island, the two primary water sources (Maxwell Lake and St. Mary's Lake) were at record low levels and residents reported wells running dry much earlier in the year.[20]

ELK RIVER: Torrential rains and widespread flooding in the Elk River in 2013 led to evacuation orders and several towns declaring a state of emergency as water levels swelled.[25]

* These rivers are also on the Outdoor Recreation Council of British Columbia's 2016 endangered rivers list. See Outdoor Recreation Council of British Columbia. (2016). The 2016 Endangered Rivers List for BC. Retrieved from http://orcbc.ca/pro_endangered.htm

WHAT THESE EXAMPLES TELL US

These examples make it clear that the province is growing increasingly familiar with the costly consequences of regional droughts and floods, and that both of these extremes—an excess or shortage of water on the landscape—are damaging infrastructure, disrupting communities, and posing risks to human health and safety. If governments and communities act now rather than waiting and being overcome by a crisis response approach, the province can avoid the experiences of California and other jurisdictions around the world reeling from the impacts of devastating state or even country-level droughts and floods.

Extreme low flows in the Coldwater River, 2015.

PROPOSED SOLUTIONS

➤Plan in advance

Ensure capacity exists for local governments to develop community climate adaptation policies and practices, including drought and flood response plans. Governments at all levels must identify current vulnerability to drought and floods, with risk-based priority actions and clear roles and responsibilities.[29] Examples include drought agreements at the watershed scale on how water will be used and shared during times of scarcity, and floodplain mapping and zoning to limit new development and infrastructure in risk areas.[30]

➤Use less

Reduce water demand through comprehensive conservation measures that include metering and conservation-oriented pricing regimes that encourage water use efficiency and conservation,[31] and adopt a soft path planning approach to drive innovation and increase local water resilience.[32]

➤Build it better

Invest in climate-smart water infrastructure improvements,[33] such as efficient irrigation systems for agriculture,[34] integrated rainwater management in urban spaces,[35] and large-scale reuse and recycling.

DROUGHTS AND FLOODS AND THE 3 CROSS-CUTTING DRIVERS OF CHANGE

LAND USE AND CLIMATE CHANGE: A changing landscape (e.g. increased impervious surfaces and intensive logging), changing precipitation patterns, and warmer temperatures amplify the impacts of droughts and floods, both of which are projected to intensify in British Columbia in the future.

FIRST NATIONS RIGHTS AND TITLE: In times of scarcity, water diversions and disrupted streamflows pose a greater risk of infringing Aboriginal rights, such as fishing, and ceremonial and spiritual water uses.

CONFLICT: Experiences from other countries suggests that when scarcity occurs, collaboration is possible, but without structural and institutional change this initial goodwill can evaporate and conflict may increase over access to water.

THE PROBLEM & CONSEQUENCES

Imagine standing on a riverbank in coastal British Columbia over the course of a full year. In the spring the river roars with water overflowing the banks and sweeping out woody debris in its wake. Over the hot and dry summer months flows decrease to a trickle, swelling again with the occasional storm passing through. Fall rains bring another pulse of water—and life—to the system, triggering salmon to move in from the ocean and upstream to spawn.

This imaginary year on a riverbank represents the river's environmental flow regime: the volume, timing, and water flow patterns critical to ecosystem functioning. Environmental flows are essential to British Columbia's rivers, lakes, aquifers, and wetlands, connecting upstream and downstream habitats, and sustaining fish and wildlife populations, commercial industries, and some of our most beloved recreation activities such as fishing, canoeing, and whitewater rafting.

In many places in British Columbia environmental flows have been fundamentally altered, with severe ecological consequences. Several different threats contribute to compromised environmental flows across the province:[36]

- **Flow regulation:** Dams and diversions drastically alter timing, storage, and volume of flows in many river systems.
- **Water licences:** Surface and groundwater withdrawals over-allocate water for human use at an increasing cost to ecosystem health. In 2010 the Ministry of Environment reported that 5000 water sources in British Columbia have identified water shortages or restrictions.[37]
- **Land use changes:** Change on the landscape including logging, urbanization, and destruction of riparian areas, change vegetation and soil cover, altering how water moves through and over land, increasing water temperature, and undermining the structural integrity of rivers.[38]
- **Climate change:** Climate change and changing hydrological patterns only exacerbate these existing issues, with periods of prolonged and intensified drought in some regions of the province, degraded water quality, and increased flooding, further eroding ecosystem function.

The consequences of disrupted streamflows are already apparent across watersheds in British Columbia: from salmon disconnected from their spawning grounds because of hydroelectric dams, to the loss of upwards of 70 percent of wetlands (and the vital ecosystem services they provide) in the Fraser Valley from draining and water diversion schemes.[39] British Columbia had a glimpse of some of the consequences of depleted environmental flows linked to drought and current levels of licenced water use in summer 2015—streams drying up, rivers at historically low levels, and fish in distress.[40]

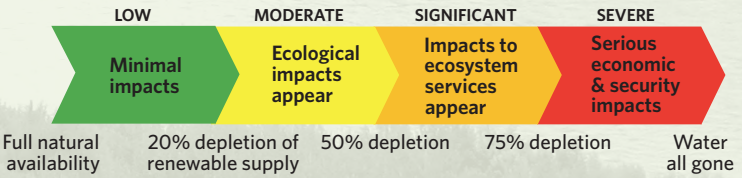


Figure 2: Impacts of increasing water depletion or flow alteration. *With increasing depletion of natural flow regimes there are increasing impacts to ecosystems, ecosystem services, economies, and communities. See: Brian Richter (2015) webinar presentation: Environmental Flows and Healthy Watersheds: Towards Protection in Canada and B.C. Available: http://poliswaterproject.org/webinar/857*

EXAMPLES OF WHERE IT IS HAPPENING

NECHAKO RIVER: Alcan constructed the controversial Kenney Dam on the Nechako River in the 1950s to power its aluminum smelter in Kitimat. This dam has permanently altered flows and ecosystems downstream on the Nechako River.[41] In 2011 the company was charged with one count each of harmful alteration of fish habitat and destruction of fish under the federal *Fisheries Act*.[42] First Nations have also launched legal challenges against Alcan for impacts stemming from disrupted environmental flows.[v]

THOMPSON RIVER*: The Thompson River steelhead run has been steadily declining, and the 2016 return is estimated to be an all-time low. There are many threats to the steelhead, including low water conditions in the Thompson River caused in part by diversions for agriculture, and pollution from agricultural run-off and industrial development.[43]

BEAVER LAKE RESERVOIR SYSTEM: Although some of the water bodies that make up the Beaver Lake (Swalwell Lake) reservoir system were deemed fully allocated in 1931, the Province issued 500 additional licences on the reservoirs since then, including 14 in 2012 for domestic purposes.[49]

COWICHAN* & PUNTLEDGE RIVERS: Due to extreme low flows in the Cowichan River in 2012, spawning salmon had to be trucked up river when sections of the river became too shallow for fish passage.[44] The same thing is happening again in 2016 and is eroding the long-term health of the river.[45] A similar scenario unfolded on the Puntledge River in 2012: B.C. Hydro set a conservation flow lower than the minimum requirement for salmon spawning and migration, and fish were trucked up river.[46]

FRASER VALLEY*: A 2016 study found that the hundreds of small floodgate structures in the lower Fraser River are destroying habitat and habitat connectivity for salmon and native fish species, and creating conditions favourable for non-native fish species.[47] The Nooksack dace, an endangered species found in only four streams in Canada in the Fraser Valley, also faces dwindling habitat due to water quality degradation from intensive agricultural land use, and streamflow disruption from diking on the Fraser River.[48]

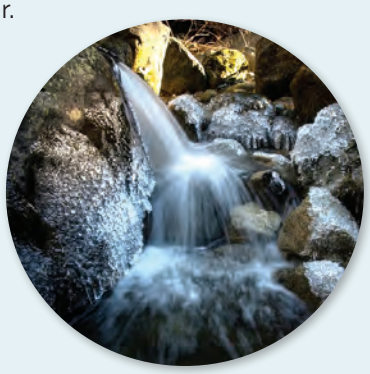
v In September 2011, the Saik'uz and Stellat'en First Nations filed an action in the B.C. Supreme Court claiming that Alcan's operation of the Kenney Dam harmed the Nechako river and fisheries, and that these actions constituted private nuisance, public nuisance, and a breach of the First Nations' riparian rights. While the Supreme Court agreed with Alcan to dismiss the case, the First Nations appealed this decision and won—they will now advance their claims again in the B.C. Supreme Court. See Mandell Pinder. (2015, April 17). Saik'uz First Nation and Stellat'en First Nation v. Rio Tinto Alcan Inc, 2015, BCCA 154 – Case Summary. Retrieved from http://www.mandellpinder.com/2015-bcca-154-case-summary

* These rivers are also on the Outdoor Recreation Council of British Columbia's 2016 endangered rivers list.

WHAT THESE EXAMPLES TELL US

From land use changes, drought conditions, licensed withdrawals, and dams and diversions, many rivers and streams in British Columbia no longer sustain natural flow regimes. While ecological damage is often the most immediately stark impact—salmon unable to reach spawning grounds—the social and economic consequences of disrupted flow regimes are also increasingly apparent.

"Approximately one-third of the world's rivers have been heavily depleted; trust me, you don't want British Columbia to join that category." One of the world's leading experts on environmental flows gave this clear warning at a recent *Forum on Environmental Flows in British Columbia*.[vi] With 5000 water sources already facing shortages or restrictions, the province must heed this warning: leaving enough water for nature from the outset is clearly preferable to having to claw back licensed uses later.



PROPOSED SOLUTIONS

➤Use the law to protect water for nature

Establish a precautionary minimum environmental flow standard for streams, rivers, and aquifers in binding provincial regulation under the new *Water Sustainability Act* until detailed site-specific environmental flow studies are completed.[50] Reinstate habitat protections in the federal *Fisheries Act* with an emphasis on environmental flows, including the strong prohibition on altering, disrupting or damaging fish habitat.[51]

➤Work with First Nations, and other water users and communities

Co-create local processes to establish environmental and critical flows thresholds and objectives that inform all levels of environmental flow decisions. Engage with existing water users to plan for future water reductions and adapt water licence terms to better reflect nature's water needs.[52]

➤Get to know British Columbia's flow regimes

Improve understanding of groundwater and surface water interactions and increase hydrometric station coverage to improve data availability on environmental flows.[53]

ENVIRONMENTAL FLOWS AND THE 3 CROSS-CUTTING DRIVERS OF CHANGE

LAND USE AND CLIMATE CHANGE: Landscape change and a warming climate have the potential to further alter flows—changing the timing and amount of precipitation, water quality, water temperatures, etc. This can push streams and rivers over irreversible ecological thresholds.

FIRST NATIONS RIGHTS AND TITLE: Aboriginal rights to fish for food, social, ceremonial and commercial purposes are inherently tied to adequate flows to sustain those fish and the basic health of the watershed.

CONFLICT: In times of reduced flows, there is potential for greater conflicts between water users for limited water, and increased tension between users and ecosystem needs.

vi For details on this forum see http://poliswaterproject.org/environmentalflowsforum

THE PROBLEM & CONSEQUENCES

The answers to seemingly basic questions about fresh water in British Columbia are hard to come by. How much water does a river need? How much water is taken from creeks and rivers? How much water is in the major aquifers? How do surface water and groundwater interact? We rarely have the answer to these questions due to our limited understanding of watershed dynamics:

- **Groundwater:** Until 2016 British Columbia did not regulate groundwater, and large gaps exist in the current understanding of groundwater use and aquifer sustainability.[54] Although groundwater is now being brought into the regulatory regime, the province lacks comprehensive aquifer mapping and classification,[55] and significant knowledge gaps exist.[56]
- **Water use:** With some exceptions,[vii] the Province only knows how much licence holders are *authorized* to use but not how much they *actually* use.
- **Streamflows and environmental flow needs:** A 2003 adequacy review found that climate and hydrometric networks in British Columbia are "substantially smaller than even the most lenient criteria developed by the World Meteorological Organization."[57] This was reiterated at a recent environmental flows forum, where discussions highlighted that current flow data are insufficient to support fully informed decisions, particularly those related to multiple, smaller allocation requests in smaller stream systems.[58]
- **Water quality:** Surface water quality status and trends are currently monitored at 40 locations across the province (bi-weekly or monthly), and 186 observation wells monitor groundwater quality. Again, these cover a fraction of the province's 291 000 unique watersheds,[59] and generally do not measure water temperature, a critical variable for fish populations.
- **Cumulative impacts and whole-of-watershed health:** A 2015 Report of the Auditor General found that British Columbia does not adequately manage the cumulative effects of natural resource development, noting that no requirement exists for decision-makers to consider cumulative effects, nor do decision-makers have the necessary information to manage for cumulative effects.[60]

Watershed stewardship organizations and other entities have responded to this information deficit by implementing independent or community-based water monitoring programs.[viii] This monitoring supports local decision-making, but the data are not always comparable or reliable, nor does a clear process always exist for compiling the wide range of methods and results into a broader, integrated information network, so efforts may be duplicated.[61] A further concern is that existing approaches to monitoring aquatic health are often done without understanding of cultural and archaeological values of First Nations and without regard for Indigenous knowledge.[ix]

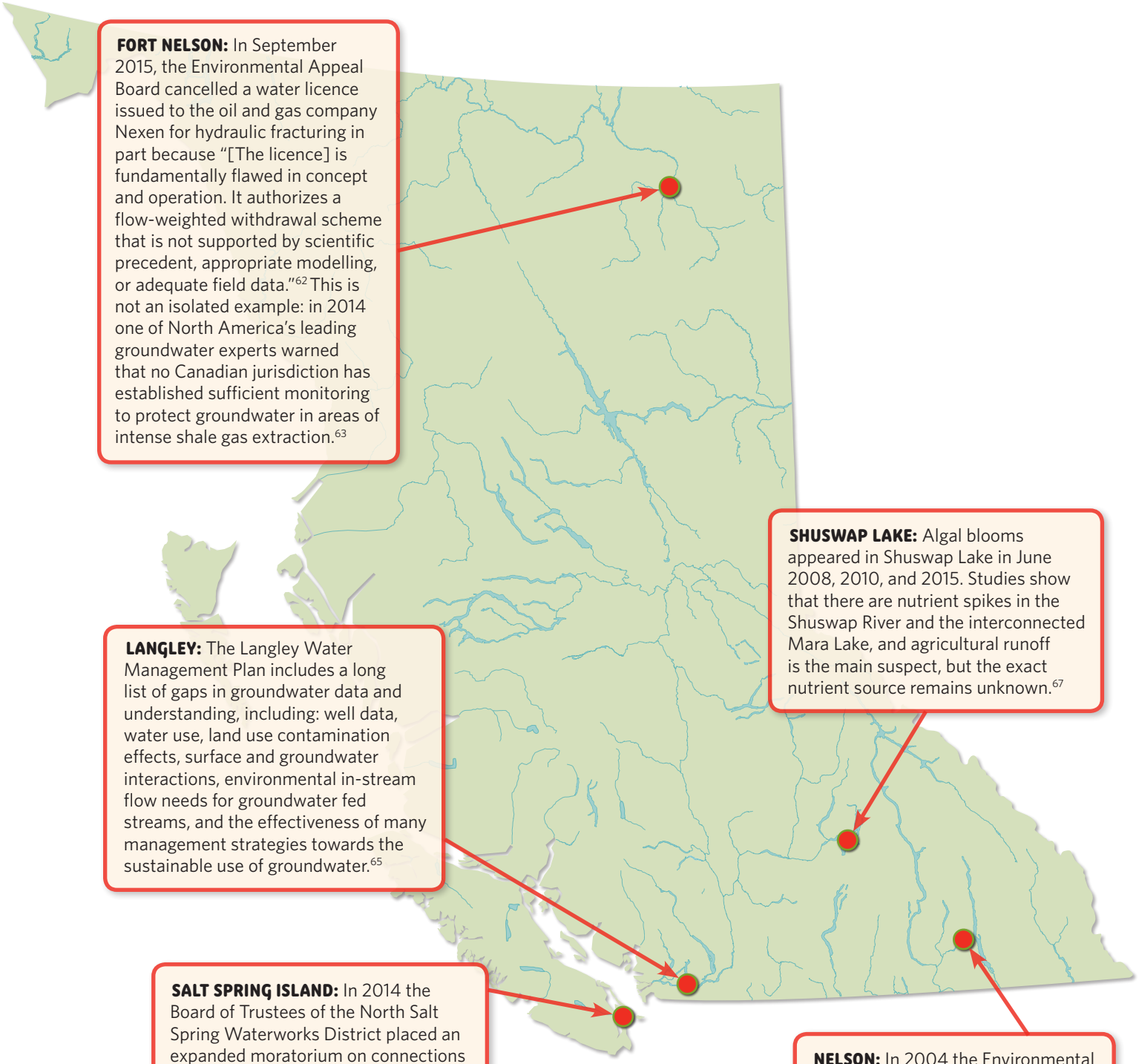
It is not hard to imagine the potential for over-allocation and conflict that can arise from decision-makers issuing groundwater licences for yet unmapped aquifers, or determining a stream's environmental flow needs based on data from hydrometric stations many kilometers away. Yet this " decision-making in the dark" is the current situation in many watersheds in British Columbia. It is not a small number of decisions at stake, either: decision-makers issue an estimated 1000 water authorizations annually, and 20 000 groundwater users must be brought into the regulatory system by 2019. This is in addition to all of the other decisions that impact on water, from forestry, to residential and commercial developments, to mining and oil and gas development.

vii The Oil and Gas Commission requires mandatory water use reporting on withdrawals for oil and gas in Northeast British Columbia. See: B.C. Oil and Gas Commission. (2014). Water use for oil and gas activity 2014 annual report. Retrieved from https://www.bcogc.ca/2014-annual-report-water-use-oil-and-gas-activityprint-version

viii For instance, the Kootenay Lake Partnership has conducted sensitive shoreline habitat inventory mapping, which informs lakeshore development decisions (see http://www.friendsofkootenaylake.ca/initiatives/lake-planning/). The Okanagan Basin Water Board leads several inter-governmental monitoring and modelling projects, including the Environmental Flow Needs Project and the Okanagan Water Supply and Demand project

ix The Kootenay Lake Partnership is setting new precedents for how to respectfully incorporate the cultural and archeological values of First Nations into a foreshore inventory and mapping of ecological values around Kootenay Lake.

EXAMPLES OF WHERE IT IS HAPPENING



FORT NELSON: In September 2015, the Environmental Appeal Board cancelled a water licence issued to the oil and gas company Nexen for hydraulic fracturing in part because "[The licence] is fundamentally flawed in concept and operation. It authorizes a flow-weighted withdrawal scheme that is not supported by scientific precedent, appropriate modelling, or adequate field data."[62] This is not an isolated example: in 2014 one of North America's leading groundwater experts warned that no Canadian jurisdiction has established sufficient monitoring to protect groundwater in areas of intense shale gas extraction.[63]

SHUSWAP LAKE: Algal blooms appeared in Shuswap Lake in June 2008, 2010, and 2015. Studies show that there are nutrient spikes in the Shuswap River and the interconnected Mara Lake, and agricultural runoff is the main suspect, but the exact nutrient source remains unknown.[67]

LANGLEY: The Langley Water Management Plan includes a long list of gaps in groundwater data and understanding, including: well data, water use, land use contamination effects, surface and groundwater interactions, environmental in-stream flow needs for groundwater fed streams, and the effectiveness of many management strategies towards the sustainable use of groundwater.[65]

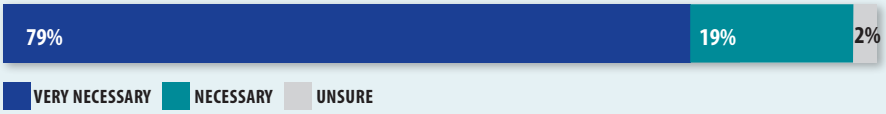
SALT SPRING ISLAND: In 2014 the Board of Trustees of the North Salt Spring Waterworks District placed an expanded moratorium on connections on St. Mary's Lake (including on unserviced lots) because the lake was deemed fully allocated. Yet, in April 2016, the Board of Trustees relaxed the moratorium despite the fact that there is still no conclusive information demonstrating that raising the weir on the lake will provide enough water for the additional connections.[66]

NELSON: In 2004 the Environmental Appeal Board accepted the fact that the government had relied on creek flow records dating from the 1920s to 1930s in making a decision to grant a conditional water licence for domestic purposes on a creek near Nelson. This decision validated using 100-year-old data as a basis for a modern water allocation decision.[64]

WHAT THESE EXAMPLES TELL US

You can't manage what you don't measure: good information provides the basis for sound decisions. These examples reveal a persistent lack of knowledge for even basic decision-making related to watershed management. They also demonstrate the consequences of decision-making based on sparse data; namely inappropriate water allocations, and numerous Environmental Appeal Board challenges related to decision-making with outdated or inaccurate information.[x]

Figure 3: Consensus that B.C. needs improved water monitoring. *Recent research found that 98 per cent of 439 survey respondents indicated that improved monitoring and reporting on water is necessary or very necessary in the next 10 years in British Columbia. See Brandes, O.M., Morris T., Archer, J.L., Brandes, L., Moore, M.L., O'Riordan, J., & Overduin, N. (2016, June).* Illumination: Insights and Perspectives for Building Effective Watershed Governance in B.C. *Victoria, Canada: POLIS Project on Ecological Governance, University of Victoria. Retrieved from poliswaterproject.org/illumination*



PROPOSED SOLUTIONS

➤Collect consistent data

Require all licence holders to monitor and regularly report on their actual water use and water quality and quantity parameters as conditions of their licences.[xi] Develop common processes for community water groups to standardize and harmonize how freshwater data are collected, and integrate this data into decision-making around land and water use.

➤Share data

Facilitate data sharing that compiles data from an integrated network of all community-based monitoring initiatives and groups.

➤Communicate data and information

Establish a publically accessible water use database and portal; publish a province-wide "state of our water" report, including regional high-priority assessments.

UNDERSTANDING B.C.'S WATERSHEDS AND THE 3 CROSS-CUTTING DRIVERS OF CHANGE

LAND USE AND CLIMATE CHANGE: Informed land and water use decisions are based on reliable information, including data. This knowledge base is only more critical during periods of change and uncertainty. Substantial monitoring and information is needed to adapt to climate-related changes in watersheds, starting with accurate picture of current status and a reliable method of tracking changes.

FIRST NATIONS RIGHTS AND TITLE: The recent Nexen Environmental Appeal Board decision demonstrates that decision-making with faulty information can lead to inappropriate water allocations and infringe on rights. Future monitoring and information systems must also include traditional knowledge.

CONFLICT: Several licensing and other resource decisions have already been appealed on the basis that the decisions were made with inaccurate information, wasting time and resources for government, communities, and proponents.

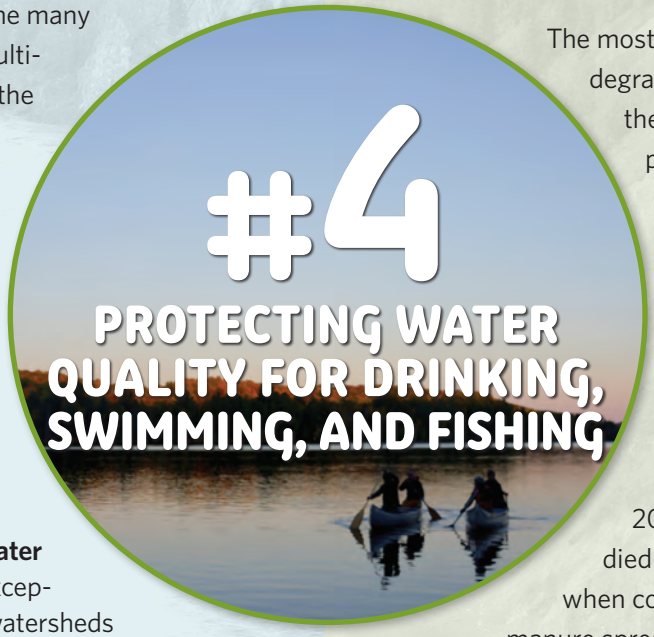
x Other examples of Environmental Appeal Board cases related to decisions based on inaccurate or inadequate information include: *Chief Gale and the Fort Nelson First Nation v Assistant Regional Water Manager 2015; Peter and Joan Sanders v Assistant Regional Water Manager 2011; Helmer v Assistant Regional Water Manager 2012; Fulford Creek Holdings v Assistant Regional Water Manager 2010.*

xi As the Oil and Gas Commission currently does in Northeast B.C.

THE PROBLEM & CONSEQUENCES

It is too easy to take for granted that when you turn on the tap clean running water will flow, that you can dive into the local lake for refreshing summer swims, or pull fish from the river to put on the dinner table. Yet, for many British Columbians, access to clean water sources for drinking, recreating, and fishing is not guaranteed. Certainly for the many communities living with multi-year boil water advisories, the basic promise of potable water in the home remains elusive.[xii]

Watersheds in British Columbia are vulnerable to persistent and mounting water quality issues for a few key reasons, including:



- **Unprotected drinking water watersheds:** With the exceptions of fully protected watersheds supplying drinking water to the Metro Vancouver and the Greater Victoria areas, drinking water sources in British Columbia are at risk from activities like forestry, mining, and recreational activities. Although the Province has had the power to create legislative drinking water source protection plans, none have been completed to date. A 2014 Forest Practices Board investigation of community watersheds designated under the *Forest and Range Practices Act* found that the protections of this designation are inadequate.[68]
- **Resource extraction and land use changes:** Forestry, hydraulic fracturing, and residential and industrial development, among other land use changes, have detrimental cumulative impacts on water quality. There is no binding requirement for land and resource use decision-makers to consider impacts on water in their individual decisions, and certainly not *in a consistent way across sectors.*[xiii]
- **Groundwater:** As the source of drinking water for one in four British Columbians, groundwater is vulnerable to particular water quality threats. For instance, excessive groundwater withdrawals in coastal areas results in salt water intrusion and degraded water quality; this is a major concern on the Gulf Islands.[69] Groundwater is susceptible to non-point contamination sources, including animal waste, chemical fertilizers, and pesticides combined with excessive irrigation practices.[70]

The most dire consequences of degraded water quality are the short- and long-term public health impacts. Canadians have learned this sobering lesson from several large-scale water quality crises across the country, including the *E. coli* outbreak in Walkerton, Ontario in 2000. Seven people died and thousands fell ill when contaminated water from manure spread on a nearby farm leached into the groundwater and moved through the drinking water system.[71] In 2001 a water contamination outbreak in North Battleford, Saskatchewan saw 5,800 residents falling ill with cryptosporidiosis. And in 2005 in Northern Ontario, 500 members of the Cree community of Kashechewan were evacuated after *E. coli* were discovered in the drinking water supply system.

Water quality contamination brings other profound losses for both communities and the environment: for ecosystems, eutrophication and fish kills;[72] for First Nations, the loss of ability to harvest from certain sites;[73] and for other British Columbians, a lack of access to local water bodies when favourite backyard lakes and streams stagnate or fill with algae.

xii The 2016 Royal Bank of Canada *Canadian Water Attitudes Survey* found that almost a quarter of Canadians have experienced living in an area under a boil water advisory. See http://www.rbc.com/community-sustainability/environment/rbc-blue-water/water-attitude-study.html

xiii British Columbia has existing water quality guidelines and objectives; however these are not binding. The *WSA* water objectives are a new tool to better integrate water issues into land and resource use decisions.

EXAMPLES OF WHERE IT IS HAPPENING

FRASER VALLEY*: In April 2016 a mushroom farm was charged for discharging contaminated waste directly into Abbotsford creeks.[79] This same company also faced charges in 2008 for depositing harmful substances into the water, violating the *Fisheries Act*. Groundwater quality is a major concern in the Fraser Valley; water quality studies in the Hopington Aquifer in Langley, for instance, have consistently shown elevated levels of nitrates during the last decade.[80]

MT. POLLEY: In August 2014 a tailings pond breach from the Mount Polley mine released 25 million cubic meters of contaminated water and mining waste into creeks and rivers in the Quesnel watershed. The mine began operating again one year later with a conditional permit, still without a long-term water management plan in place.[81]

COMOX: Residents of Comox have faced recent boil water advisories due to high sedimentation and turbidity in the water. While no conclusive links have been established, some residents attribute the sediment flows to extensive logging in the watershed.[75] The Vancouver Island Health Authority is proposing an $80 million water filtration plant to address the problem, while the Comox Lake Watershed Protection Plan suggests an alternative source protection approach, which is not only cheaper, but ultimately more sustainable.[76]

SPALLUMCHEEN: The Steele Springs Waterworks District has been under a "do not drink" advisory since March 2014. Nitrate levels in the Hullcar Aquifer, which lies beneath farm fields and provides drinking water for Spalumcheen residents, exceed the maximum allowed under the Canadian Drinking Water Guidelines.[78] In May 2016, the Ministry of Environment issued several Pollution Abatement Orders to farms overlaying the aquifer to address the storage and spreading of agricultural waste.

SHAWNIGAN LAKE*: In a highly controversial scenario, the Ministry of Environment issued a permit for South Island Aggregate to dump contaminated waste soil into a quarry located in the headwaters of Shawnigan Lake, a source of drinking water for local residents. In March 2016 the B.C. Supreme Court ruled that contaminated soil treatment is not a permitted use for the property.[74]

GULF ISLANDS: A recent analysis of groundwater chemistry data collected on the Gulf Islands between 1963 and 2012 found that saltwater intrusion impacted 17 per cent of the 795 wells sampled. This same study assessed vulnerability and risk of saltwater intrusion, finding that pumping hazards are significant on many islands, in particular Gabriola and Mayne Islands, which have high well density ratings.[77]

ELK RIVER VALLEY: There has been active coal mining in the Elk River area for over 100 years, resulting in high concentrations of selenium in the water system, which affects bird and fish development and survival. According to the Auditor General, the Ministry of Environment has been monitoring selenium levels in the Elk Valley for over 20 years and has noted dramatic annual increases of selenium in the watershed's tributaries. Only recently did the Ministry take substantive action to control pollution through permits under the *Environmental Management Act*.[82]

* These rivers are also on the Outdoor Recreation Council of British Columbia's 2016 endangered rivers list.

WHAT THESE EXAMPLES TELL US

Almost every month, media headlines in British Columbia announce new water quality problems: algal blooms in lakes, toxic mine tailings pond spills, and contaminated drinking water sources. These examples show not only prevalent water quality issues across the province, but also inconsistent enforcement or regulation of the activities—like mining and agricultural practices—driving the problems. Further, lack of transparency around the cause and severity of water quality issues fuels public mistrust and controversy, and water quality issues are making their way into British Columbia courts, with all of the associated costs.

Most of British Columbia's drinking water watersheds are mixed-use, making sourcewater protection planning that much more important as part of a multi-barrier approach to providing clean drinking water.

PROPOSED SOLUTIONS

➤Use legal plans to protect source water

Drinking source water protection is a critical component of a multi-barrier approach,[83] which requires enforceable plans under both the new *Water Sustainability Act* and the *Drinking Water Protection Act*. These plans should be implemented first in high-risk watersheds and aquifers such as watersheds with regular boil water advisories, or with high levels of development, agriculture, or resource extraction.[84]

➤Manage for cumulative effects

Set water objectives under the *Water Sustainability Act* to protect water quality and better integrate land and water use activities. Implement the Auditor General's nine recommendations to improve cumulative effects management, and recommendations for enforcement of mine operations and management, including:[85]

- Introducing legislation and policy that will enable all of the natural resource sector ministries and agencies in British Columbia to coordinate cumulative effects management across all the sectors;
- Considering cumulative effects when authorizing natural resource development and documenting the rationale for these decisions.

➤Protect groundwater quality

Complete aquifer classification; expand the Provincial Groundwater Observation Well Network; ensure compliance and enforcement of the *Groundwater Protection Regulation.*

WATER QUALITY AND THE 3 CROSS-CUTTING DRIVERS OF CHANGE

LAND USE AND CLIMATE CHANGE: Climate and land use change negatively impact water quality; warmer water temperatures, for instance, have been linked to eutrophication. Land use changes impact water through increased run-off of particulates, chemicals, and pollutants.

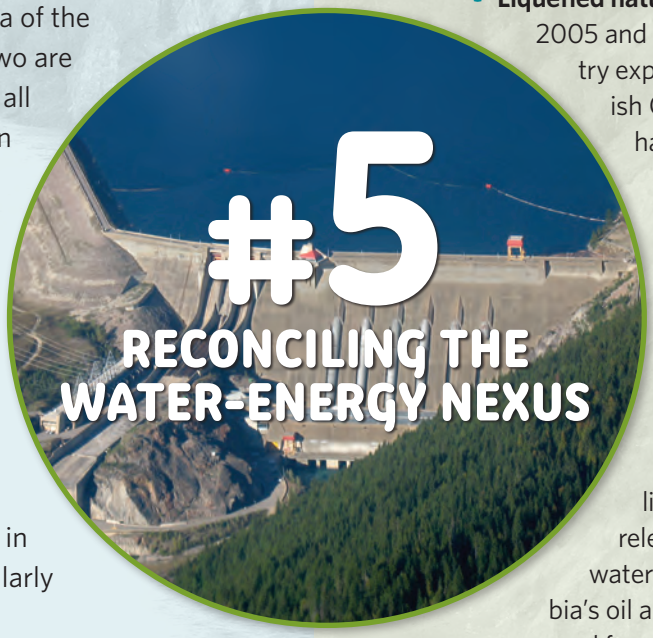
FIRST NATIONS RIGHTS AND TITLE: Degraded water quality impinges on basic access to drinking water and other rights to harvest for food, social, ceremonial, and commercial purposes.

CONFLICT: Industrial activities have increasing impacts on local drinking water sources; recent examples on Vancouver Island and Spallumcheen demonstrate this widespread problem and the community conflicts it creates.

THE PROBLEM & CONSEQUENCES

Here is a riddle: what two things does this statement describe? *You can't have the one without the other. In fact, you typically can't have one without a large quantity of the other. Both are vital to functioning communities and economies in British Columbia.*

The answer is energy AND water, and this in a nutshell is the dilemma of the water-energy nexus: the two are tightly interlinked. Almost all forms of energy production require water, which permanently removes water from ecosystems (to extract fossil fuels) or fundamentally disrupts water flows (to generate hydropower). Moving and treating water also demands energy. Energy production in British Columbia is particularly water intensive:



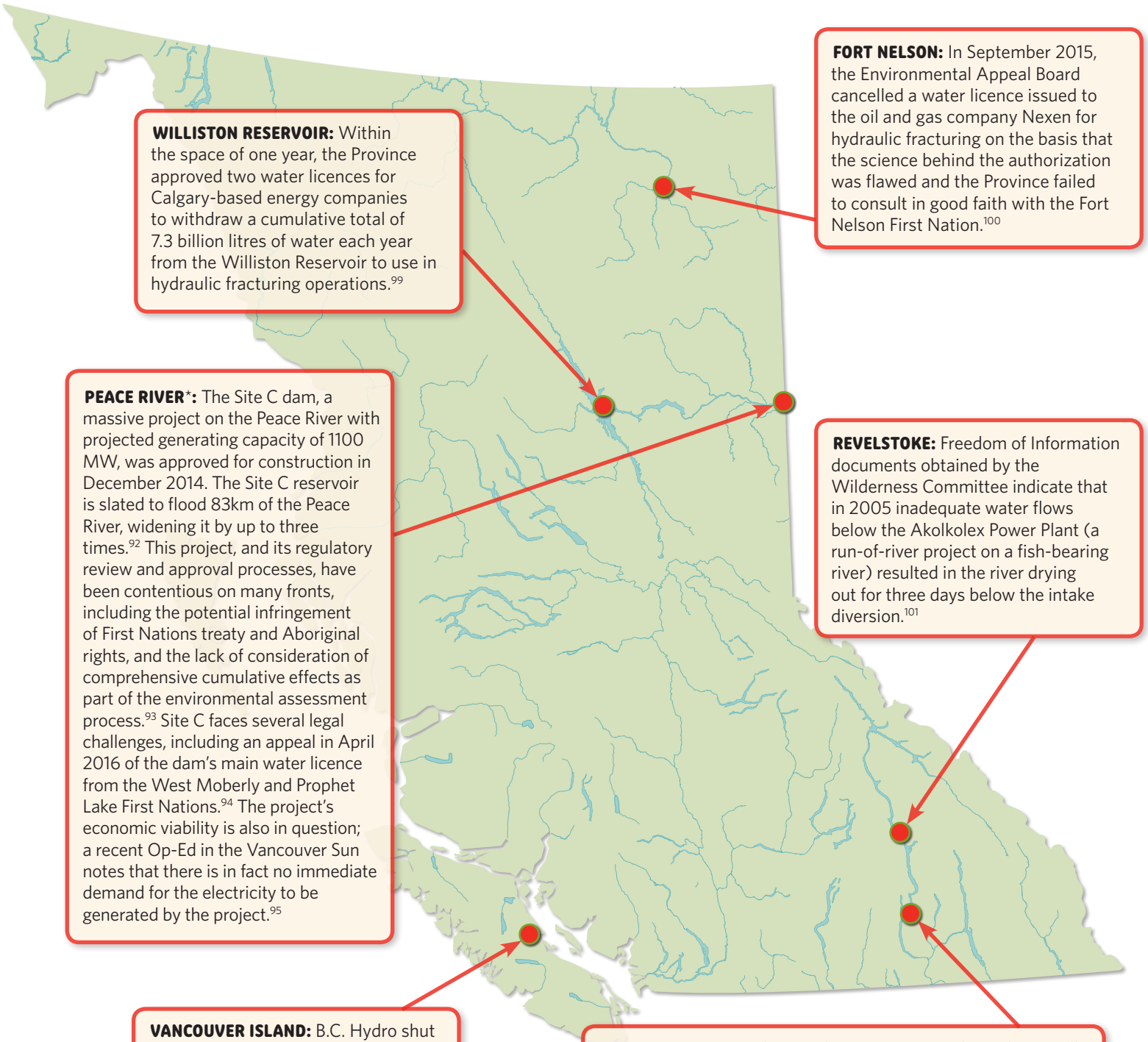
- **Large-scale hydroelectricity:** Hydropower produces 90 per cent of electricity in British Columbia.[xiv] The Peace and Columbia River systems are the primary hydropower sources, producing a combined 77 per cent of B.C. Hydro's total capacity.[86] Reservoirs impound massive amounts of water for hydroelectric generation; for instance, the Williston reservoir, which feeds the W.A.C. Bennett Dam, British Columbia's largest, stores more than 70 km^3 of water.
- **Run-of-river hydro:** Most new hydropower developments in British Columbia are privately operated run-of-river projects, which divert a river's flow into a tunnel or pipeline to power turbines, and return the water back to the river downstream.[87] While run-of-river hydro is generally perceived as less environmentally damaging than large-scale projects, the cumulative impacts of the 1000+ run-of-river projects slated for creeks and rivers in the province can be severe. On the length of river where water is diverted, for instance, flows may drop to two to five per cent of the natural flow regime, with associated loss of ecosystem functions and habitat.[88] In many cases little historical data exists on the streams and ecosystems where run-of-river projects are proposed.
- **Liquefied natural gas (LNG):** Between 2005 and 2009 the LNG industry expanded rapidly in British Columbia. Although it has substantially slowed recently, the provincial LNG strategy pushes for an expanded industry and export to overseas markets.[89] Hydraulic fracturing, an extraction technique that involves injecting hydraulically pressurized liquid into shale rock to release natural gas, is very water intensive: British Columbia's oil and natural gas sector was approved for approximately 20 million litres of surface water per year through water licence allocations in 2014.[90] While the *total* water demand for hydraulic fracturing is proportionally small relative to annual total surface flow in some regions, the use is intensive and can create water stresses at times of high demand, and in dry seasons.[91]

Water and energy security are just as closely interconnected as the resources themselves. If water resources were infinite, the nexus might not have issues associated with it. However, the projected fluctuations in snowpacks and water supplies due to climate change may compromise the ability to meet future growing energy demands,[xv] particularly in drought years. A warming planet will also increase energy demands.

xiv For instance, in the Montney Basin shale gas play there were 1100 active horizontal wells drilled between 2005 and 2012. B.C. Oil and Gas Commission (2012). Montney Formation Play Atlas NEBC. Available from: http://www.bcogc.ca/node/8131/download?documentID=1286&type=.pdf at 4.

xv B.C. Hydro estimates electricity demand will increase 20 to 40 per cent in the province the next two decades. B.C. Hydro. (2016). *Meeting Energy Demand.* Available from: https://www.bchydro.com/energy-in-bc.html

EXAMPLES OF WHERE IT IS HAPPENING



FORT NELSON: In September 2015, the Environmental Appeal Board cancelled a water licence issued to the oil and gas company Nexen for hydraulic fracturing on the basis that the science behind the authorization was flawed and the Province failed to consult in good faith with the Fort Nelson First Nation.[100]

WILLISTON RESERVOIR: Within the space of one year, the Province approved two water licences for Calgary-based energy companies to withdraw a cumulative total of 7.3 billion litres of water each year from the Williston Reservoir to use in hydraulic fracturing operations.[99]

PEACE RIVER*: The Site C dam, a massive project on the Peace River with projected generating capacity of 1100 MW, was approved for construction in December 2014. The Site C reservoir is slated to flood 83km of the Peace River, widening it by up to three times.[92] This project, and its regulatory review and approval processes, have been contentious on many fronts, including the potential infringement of First Nations treaty and Aboriginal rights, and the lack of consideration of comprehensive cumulative effects as part of the environmental assessment process.[93] Site C faces several legal challenges, including an appeal in April 2016 of the dam's main water licence from the West Moberly and Prophet Lake First Nations.[94] The project's economic viability is also in question; a recent Op-Ed in the Vancouver Sun notes that there is in fact no immediate demand for the electricity to be generated by the project.[95]

REVELSTOKE: Freedom of Information documents obtained by the Wilderness Committee indicate that in 2005 inadequate water flows below the Akolkolex Power Plant (a run-of-river project on a fish-bearing river) resulted in the river drying out for three days below the intake diversion.[101]

VANCOUVER ISLAND: B.C. Hydro shut down its turbines at the hydroelectric dam on the Puntledge River and ran the John Hart generating station on the Campbell River at 20 to 25 per cent capacity to save water for fish.[96]

COLUMBIA RIVER: Climate change is projected to substantially change the hydrology of the Columbia River region, with melting glaciers, earlier spring melt and lower flows in summer and fall, and overall less predictability.[97] The Columbia River Treaty, a US-Canada agreement governing the development and operation of dams on the Columbia River, is being revised; experts have recommended that ecosystem health and climate change impacts be priorities in any modern treaty, to bring enough flexibility to adapt to changing hydrological conditions.[98]

* This river is also on the Outdoor Recreation Council of British Columbia's 2016 endangered rivers list.

WHAT THESE EXAMPLES TELL US

These examples show that energy production has a substantial and growing impact on British Columbia's water landscape, and that water availability in turn impacts the viability of different forms of energy production. The Province is already embroiled in serious legal quagmires around water and energy use, and recent research has further demonstrated that there is an outstanding lack of trust in decisions being made around water use for hydraulic fracturing.[102]

The water-energy nexus challenge also presents opportunities. British Columbians benefit immensely from the hydroelectric energy systems that power most of the province, and we are fortunate to have a primary energy source that is not fossil-fuel based. Reconciling the water-energy nexus means ensuring that British Columbians continue to derive these benefits while addressing emerging issues.

PROPOSED SOLUTIONS

➤Engage with those affected before any decisions are made

Water and energy infrastructure inevitably involve large and significant impacts on the local and regional environment. A foundation of effective and credible environmental assessment and public engagement processes is urgently needed; respect for Aboriginal rights and title is a critical starting point. Other actions include:

- Revise the British Columbia Environmental Assessment process and associated decision-making process to: reconsider the thresholds and triggers for environmental assessment; improve opportunities for public participation and access to information; and uphold the Crown's obligations to First Nations;[xvi]
- Commit adequate staff, training, and resourcing for community engagement and relationship-building with First Nations

➤Address water issues in all energy developments

Develop strategic planning process for run-of-river hydro projects focussed on cumulative and individual project impacts;[103] explicitly address the water-energy nexus including ecosystem restoration and protection provisions in key agreements like the Columbia River Treaty; and conduct cumulative effects assessment and ensure adequate monitoring and enforcement in all regions where hydraulic fracturing exploration or hydroelectric development is occurring or proposed.[104]

➤Save water and energy

Require conservation and demand-side management for both energy and water.[105] Many well-established approaches to saving both water and energy exist, but driving innovation and change requires incentives and regulatory requirements. For example, involve local governments in energy security by:

- Updating the B.C. Building Code to require greater energy and water efficiency; and
- Requiring alternative energy sources such as heat recovery from sewage or use of solar power on commercial and public buildings.

WATER-ENERGY NEXUS AND THE 3 CROSS-CUTTING DRIVERS OF CHANGE

LAND USE AND CLIMATE CHANGE: Changing temperature and precipitation patterns already alter water availability, reservoir capacity, and the amount of water available for resource extraction and energy production; this variability will only increase in the future.

FIRST NATIONS RIGHTS AND TITLE: First Nations are challenging water use for hydroelectric and natural gas expansion based on impacts to traditional territories and their Aboriginal rights.

CONFLICT: Water-energy issues are already highly contentious; multiple groups are pushing back against plans to expand the LNG industry and build more large-scale hydroelectric dams in British Columbia, in part based on the impacts on water and inconclusive evidence that the energy is needed.

xvi For a detailed review and recommendations to strengthen environmental assessment in British Columbia, see Haddock, M. (2010). Environmental Assessment in British Columbia. Environmental Law Centre, University of Victoria. Available from: http://www.elc.uvic.ca/documents/ELC_EA-IN-BC_Nov2010.pdf

LOOKING TO THE FUTURE OF BRITISH COLUMBIA'S WATERSHEDS

British Columbia faces a daunting set of complex water challenges that will shape the province's future. Individuals and communities will experience the changing waterscape in diverse ways—from communities preparing to adapt to increasingly severe weather events like droughts and floods, to the Province and First Nations learning to better work together in government-to-government relationships on water-related challenges, to statutory decision-makers faced with maintaining natural flow regimes while also supporting social and economic water needs, and the private sector, which faces new operational challenges and increasing social expectations for water stewardship, including enhanced monitoring.



This report increases understanding about British Columbia's water and stimulates dialogue about the emerging challenges. We also identify some of the possible solutions and where to start addressing these challenges before they become crises. While this report does not to delve into the details of these responses, it does recognize that further research, dialogue, and action are required to contribute to solving the water challenges facing British Columbia. As next steps, the POLIS Water Sustainability Project will:

1. Develop a virtual "water issues atlas" as a tool to engage government, communities, professional associations, and citizens to continue to identify and track the issues; and
2. Host a series of solutions roundtables in 2016 and 2017 with experts, decision-makers, First Nations, and other water leaders. The ultimate goal will be to develop a series of detailed solutions briefings for each of the five water challenges, with specific actions for the key players, including governments at all levels, communities, First Nations, and professionals.

British Columbia's biggest challenge is to move beyond managing water alone toward managing water as part of larger systems. Adopting and integrating a "whole watershed" perspective into institutions and decision-making is vital if we as a society want to move beyond a crisis response. A watershed perspective shifts the focus from managing water and watersheds to managing *our actions* on the landscape and in the water. This shift means working with nature in our communities, and in all aspects of our laws and governance systems. Beyond the proposed solutions in this report, what is needed to ensure water security into the future is nothing short of a renewed water ethic, based on conservation, stewardship, and valuing water as the lifeblood of our communities and ecosystems.

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POLIS Project on Ecological Governance

Created in 2000, the POLIS Project on Ecological Governance is a research-based organization that is part of the Centre for Global Studies at the University of Victoria. Researchers who are also community activists work to make ecological thinking and practice a core value in all aspects of society and dismantle the notion that the environment is merely another sector. Among the many research centres investigating and promoting sustainability worldwide, POLIS represents a unique blend of multidisciplinary academic research and community action.
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Centre for Global Studies

The Centre for Global Studies (CFGS) was formally established at the University of Victoria in 1998 with a mandate to promote collaborative, multidisciplinary, and cross-regional research and engage in connecting research in the field of global studies to local, national, and international communities. Activities at the Centre are designed to promote critical citizenship in a complex and rapidly changing global environment. The CFGS has a rich history of producing cutting edge research and disseminating it in concise and accessible ways for policy and decision makers and the broader community.
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POLIS Project on Ecological Governance
University of Victoria

POLIS Project on Ecological Governance
Centre for Global Studies, University of Victoria
PO Box 1700 STN CSC
Victoria, BC V8W 2Y2 Canada
Tel: 250.721.8800
Email: water@polisproject.org

POLIS Water Sustainability Project

The POLIS Water Sustainability Project (WSP) is an action-based research group that recognizes water scarcity is a social dilemma that cannot be addressed by technical solutions alone. The project focuses on four themes crucial to a sustainable water future:

- Water Conservation and the Water Soft Path;
- The Water-Energy Nexus;
- Watershed Governance; and
- Water Law and Policy.

The WSP works with industry, government, civil society, environmental not-for-profits, and individuals to develop and embed water conservation strategies that benefit the economy, communities, and the environment. The WSP is an initiative of the POLIS Project on Ecological Governance at the Centre for Global Studies, University of Victoria. **poliswaterproject.org**

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