



Osoyoos Lake Water Science Forum
Forum Summary Report
September 16-18, 2007

Prepared for

Osoyoos Lake Water Science Forum Organizing Committee
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Executive Summary

The Osoyoos Lake Water Science Forum, held September 16-18, 2007 in Osoyoos, British Columbia, was attended by over 190 enthusiastic and concerned presenters, panelists and participants representing the scientific community, government, business and residents from both Canada and the United States. The Forum reflected the growing public concern for the sustainability of Osoyoos Lake, its water quantity and quality, and the growing sense among area residents that their quality of life is threatened.

The following is a very brief summary of the concerns, threats and needs raised at the Forum and further documented in this report.

Water quality

- Nutrients from fertilizers and septic tanks negatively impact water quality and can lead to algal blooms.
- Renewed concerns over fecal coliform levels in Osoyoos Lake.
- Uncertainty over toxic chemical accumulations from urban stormwater run-off and lake recreation. Monitoring of toxics in food fish is essential to the health of First Nations people and Tribes.
- There is a lack of historical data with which to reference current water quality status.

Water quantity

- Weak water use regulations and licensing policies combined with climate change and ongoing large increases in the Okanagan Basin population are setting the valley and neighboring watersheds up for “water wars” in coming decades.
- Future water storage additions and diversions may be necessary and useful to meet human needs, but they need to be planned, designed and operated to mitigate ecological consequences much more than they have in the past.

Land-use planning and agriculture

- The continuing “population wave” must be more responsibly planned for and managed to reduce its water quality and quantity footprint. These plans should not rely on voluntary measures.
- A reasonable level of agriculture and food production self-sufficiency should be highlighted in this plan, as global population rises and other trading regions begin to experience reductions in their food generation surpluses.
- Agricultural water use efficiency should be pursued aggressively, including directions and incentives to arrive at best practices.

Restoration, monitoring and endangered species protection

- Ecological restoration activities on the Okanagan River and other areas require more coordination and funding support.
- The Okanagan River sockeye run faces a temperature/oxygen squeeze in Osoyoos Lake and other flow management stressors that significantly threaten the population. The continued operation of Okanagan Lake Dam in a more “fish friendly” manner through use of the Okanagan Fish/Water Management tool is important.

Bi-lateral and local governance

- Voluntary behavioral change alone will not occur rapidly enough to motivate solutions on the issues above. Tough, unpopular (but just) regulatory changes will have to be made.
- A basin-wide focus on water issues is critical, including coordination and information sharing among all government entities and regulatory groups in both Canada and the United States.
- First Nations and Tribes must be involved.

Climate change

- Climate change will accelerate and compound the water supply crunch and aggravate some water quality issues.

In developing a strategy to respond to these issues and challenges, the following success elements solidified during the Forum:

- the need for improved leadership, multi-jurisdictional collaboration and cooperation;
- basin-wide, cross-border, regional thinking instead of looking only at individual, narrow jurisdictional zones;
- reinforcing and emphasizing the importance of science based (rather than political) decision making; and
- measurable actions and progress.

Section 4 of the report lays out a total of 16 candidate actions that regulators, planners and politicians should consider to promote Osoyoos Lake (and the Okanagan Basin's) environmental sustainability. Similarly, Section 4 provides 12 specific actions and steps for further scientific investigation. Potential leaders for these actions are identified, along with possible success factors or benefits.

The thoughtful participants of the Osoyoos Lake Water Science Forum are part of a growing water sustainability movement in the Okanagan, a movement that will hopefully inspire governments, planners and regulators to move more purposefully and more rapidly on the issues.

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1. Osoyoos Lake Water Science Forum Background

The Osoyoos Lake Water Science Forum (OLWSF) was held September 16-19, 2007 in Osoyoos, British Columbia. 40 presenters and panelists gave 35 presentations and held two round-table discussions over these three days. The Forum was attended by over 190 participants from both Canada and the United States.

The impetus for the Osoyoos Lake Water Science Forum (OLWSF) was the growing public concern for the sustainability of Osoyoos Lake. Osoyoos Lake – and the entire Okanagan (spelled Okanogan in the U.S.) basin – experience multiple stressors that impact water quality, quantity and ecosystem health. Water resources are one of the most important factors governing quality of life, large sectors of the economy and ecological values in the Osoyoos region and indeed the whole Okanagan. It is past time to increase efforts to sustainably manage water resources and rehabilitate and protection aquatic and riparian ecosystems.

Powerpoint presentations delivered at the Forum are available at the Okanagan Basin Water Board website (www.obwb.ca/olwsf/). In addition, an ongoing “blog” has been set-up to help advance and track ideas stemming from the Forum (osoyooslake.blogspot.com), including feedback on this report.

Goal of the Forum

The goal of the OLWSF was “...to provide an opportunity to learn, share and develop strategies to work together to improve Osoyoos Lake and promote its future sustainability.”

The Forum program¹ identified that the meeting was intended to be interactive, a unique opportunity for dialogue amongst local residents, scientists, planners and politicians in order to:

- develop a common understanding of public concerns juxtaposed beside insights gained from local scientific investigations;
- explore the implications of these scientific findings for basin area residents;
- identify research gaps and needs;
- incorporate public concerns and scientific findings into concrete next step actions to improve and sustain Osoyoos Lake; and
- identify specific ways basin residents, politicians and researchers can become further involved in seeing that these needed future actions actually take place.

The Forum Organizing Committee emphasized the interactive nature of the proceedings. Audience members were encouraged to participate in the question periods that followed each presentation, and to actively guide the content of the roundtable discussions.

¹ Osoyoos Lake Water Science Forum. 2007. Osoyoos Lake Water Science Forum program. Town of Osoyoos, Osoyoos, BC. 43 pp.

Participants

The Forum make-up was highly diverse – a unique feature for a water resource conference of its kind. It was attended by approximately 190 registered participants comprising local residents, government officials, not-for-profit association members and independent and government scientists from Canada and the United States. Approximately 45% of participants were from government agencies. Approximately two-thirds of the participants were from Canada and one-third from the US.

A full list of Forum presenters and panelists is provided in [Appendix A](#).

Focus and organization of this report

Boiling down the Forum goals listed above, the following three priorities were identified as needing outcomes:

1. needed responses and actions from regulators, planners and politicians;
2. specific actions and steps for further scientific investigation;
3. greater clarity on ways citizens can become more involved in seeing these actions take place.

This report attempts to address these three priorities as well as the broader Forum goals. The first two goals are addressed in detail in [Section 4](#). The third goal is addressed in [Section 5](#).

During the three days of the Forum a great deal of detailed information was presented and discussed. This report does not attempt to recreate this wide array of information and discussion. Instead, this report attempts to synthesize information and dialogue, focusing on take home messages and next step actions. Specifically, we approach Forum synthesis in the following manner:

- [Section 2](#) provides an overview of the breadth of issues that were discussed.
- [Section 3](#) organizes the ideas and insights from the Forum presenters and panelists – particularly those that Forum facilitators felt had the most audience resonance. Questions and feedback on presentation material from the audience is summarized in a similar fashion.
- [Section 4](#) contains specific actions and next steps that were identified during or logically emerge from [Section 3](#).
- [Section 5](#) addresses how residents can become more involved in the water planning process, including providing a more consolidated listing of agencies involved in different water resource management activities.
- [Section 6](#) provides concluding summary remarks.
- [Appendix A](#) provides a list of presenters and panelists along with their contact information.
- [Appendix B](#) contains a link to the abstracts of the Forum presentations
- [Appendix C](#) contains a full list of all Internet links mentioned during the Forum.

2. Breadth of Forum Issues

For a Forum emphasizing issues surrounding a modest sized lake, a wide breadth of topics were discussed. Many if not all of these issues involved complex scientific and/or societal subjects with far-reaching implications. Most participants, presenters and panelists acknowledged that there were no quick fix solutions to many of the concerns. However, many of the participants acknowledged that due to projected rates of development and population growth, status quo approaches to management are insufficient to maintain quality of life for Osoyoos Lake residents. Addressing the matters in this summary report will require sustained energy and dedication, including working through the various complexities and value trade-offs.

During the Forum, many participants expressed a feeling of “information overload” from being exposed to such an array of issues and ideas at one time. Figure 1 attempts to categorize and group the issues raised at the Forum in a single picture.

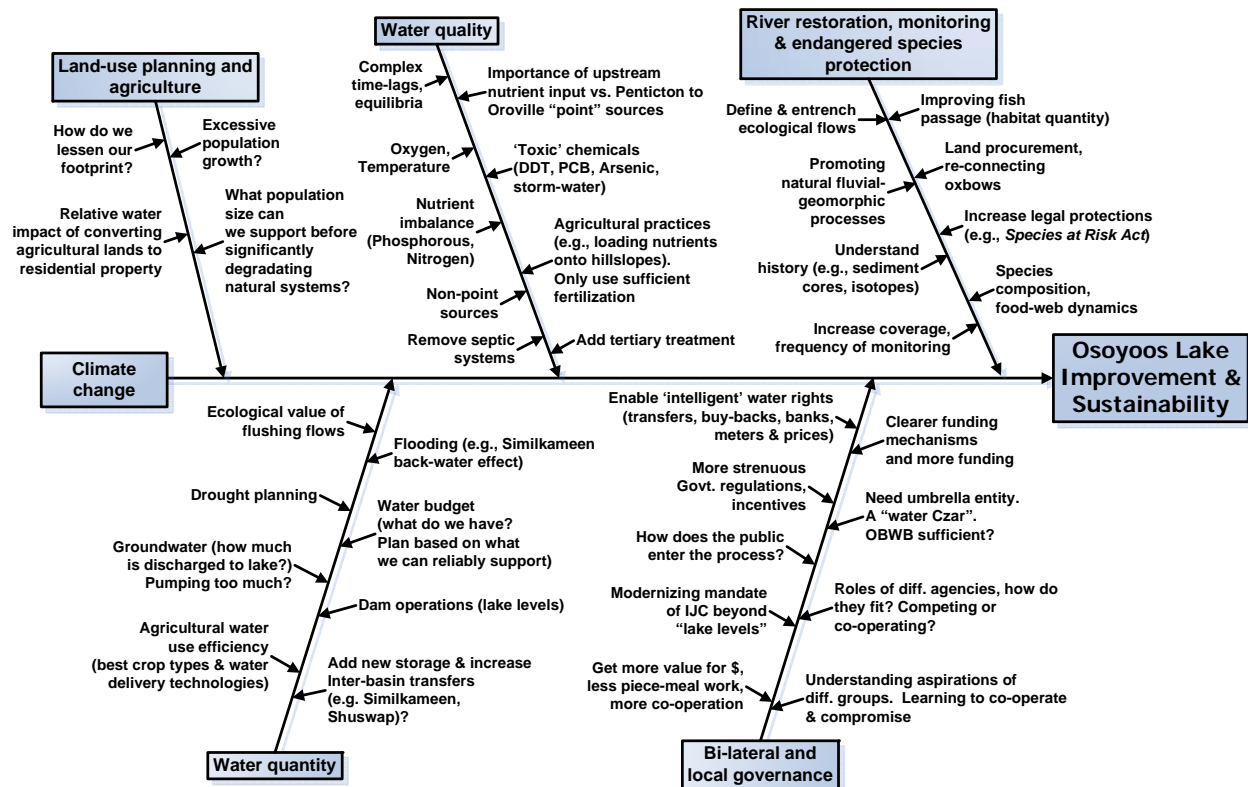


Figure 1. “Fish-bone” diagram categorizing the range of issues explored and questions raised during the Forum. SARA = Species at Risk Act. OBWB = Okanagan Basin Water Board. IJC = International Joint Commission.

3. Major Points of Discussion, Key Questions and Information Gaps

For purposes of summary, we've reduced the ten Forum sessions into the following six areas: (i) *water quality*, (ii) *water quantity*, (iii) *land-use planning and agriculture*, (iv) *ecological restoration, monitoring and endangered species protection*, (v) *bi-lateral and local governance*, and (vi) *climate change*. With over 190 participants, 35 science presentations and nearly 3 days of discussion, the reader will appreciate that synthesizing the information down to only a few points is impractical: such an attempt would be in the eye of the beholder. It should be understood that many of these topics so grouped are interdependent and interrelated. We note that some of these problems apply to Osoyoos Lake specifically, but many apply to the Okanagan Basin as a whole. Further, the context is transboundary, affecting both the Canadian and US portions of the lake. In each topic area the points raised are grouped into three columns:

1. key points made by presenters and panelists;
2. focus of audience interest and feedback; and
3. information gaps and questions identified by presenters, audience members or panelists.

Each of the six major topic areas are further subcategorized as follows:

Water quality

- Nutrients and bacteria
- Toxic contaminants
- Groundwater quality

Water quantity

- General
- Flow management
- Zosel Dam – Osoyoos Lake levels
- Groundwater quantity
- Flow augmentation

Land-use planning and Agriculture

- General
- Land use planning – Osoyoos
- Land use planning – Oroville
- Agricultural water use
- Regional Districts

Ecological restoration, monitoring & endangered species protection

- Restoration
- Monitoring
- Fish Habitat
- Endangered species

Bi-lateral and local governance

- Cooperation and leadership
- Changing perspectives
- First Nations and Tribes

Climate change

- Impacts
- Adaptation options

Water quality

Key points made by presenters and panelists	Focus of audience interest and feedback	Information gaps and needs identified by presenters, panelists and participants
<p>Nutrients and bacteria</p> <p>Eutrophication (a process where water bodies receive excess chemical nutrients that stimulate excessive plant growth, decay and oxygen depletion) remains one of the main water quality concerns for Osoyoos Lake in the near future.</p> <p>Source protection of water is lacking in Okanagan and Osoyoos area. In Vancouver, water quality is better (despite vastly higher population total) because potable water sources are protected from urban encroachment and recreation. As a consequence, they do not have concerns over fecal coliform levels and nutrients as in Osoyoos Lake because there are fewer pollution pathways at source.</p> <p>Phosphorus targets are set by looking at historical patterns and express a reasonable expectation for water quality. Shallow lakes should be expected to (naturally) have much more phosphorous because there is more littoral area and vegetation.</p> <p>All lakes' nutrient loadings in the Okanagan are strongly influenced by climate (e.g., higher flows/floods lead to higher nutrient inputs in those years).</p> <p>Lake to lake (Okanagan, Skaha, Osoyoos) nitrogen and phosphorous trends are generally the same, but with seasonal differences and differences in nutrient concentrations.</p> <p>In the north basin of Osoyoos Lake there is a decrease in phosphorus, slight increase in water clarity and slight improvement in trophic status relative to the 1960s/1970s.</p> <p>It's recommended that septic tanks be serviced every 3-5</p>	<p>In Osoyoos Lake spot monitoring has revealed there are high coliform counts. Is this perception or fact? There is not enough attention being paid to this.</p> <p>Are Osoyoos Lake phosphorous (and nitrogen/nitrate) standards consistent with community water quality goals (e.g., in terms of lake clarity and other aesthetic properties)?</p> <p>Water quality: need targets, but targets alone are useless if not attached to policies designed to achieve them. Without concrete measures to effect changes, targets are merely "aspirational" and evidence of change will remain illusive.</p> <p>Are algal blooms likely to become a problem again? A//: not in the near term, but depends on nutrient loadings and climate variation.</p>	<p>Are Osoyoos Lake fecal coliform levels a perceived or real concern? In actuality nearing/surpassing acceptable standards?</p> <p>A significant amount of phosphorous is coming into Okanagan River and Osoyoos Lake that is not accounted for by concentrations in Okanagan Lake. Where is it coming from? What are the major point and non-point sources between Penticton and Oroville and what actions would best reduce these nutrient sources? Are wastewaters transported through groundwater aquifers responsible for the reduced water quality in Osoyoos Lake? Septic tanks? Golf courses? Agricultural fertilization?</p> <p>The value and usefulness historical data was a topic that was brought up repeatedly throughout the Forum. It was generally acknowledged by presenters that there is not enough historical data on Osoyoos Lake. This data is important for setting expectations on the inherent water quality characteristics of the lake and its trajectory (improving or worsening). New sediment cores were considered particularly valuable.</p> <p>Given that "tap" protection through wastewater treatment is the focus in the Okanagan rather than source protection – is water treatment infrastructure keeping pace with the growing population footprint and cumulative effects?</p> <p>How much does the summer tourist season add to the nitrogen and BOD load of the Osoyoos Lake area?</p>

Key points made by presenters and panelists	Focus of audience interest and feedback	Information gaps and needs identified by presenters, panelists and participants
<p>years, but one survey showed that 22% of people in the Oliver/Osoyoos area never had their tanks serviced, and 10% had no idea of the field location. Need education program to encourage proper septic tank operation.</p> <p>Nitrogen and phosphorus ratios influence aquatic food web composition as well as the competitive strengths of different trophic levels and species. This has a bearing on the relative abundance of <i>Mysis relicta</i>, kokanee, sockeye, whitefish and other species.</p> <p>In addition to nutrient loadings, dissolved oxygen levels in Osoyoos Lake are an important water quality problem affecting fish (namely rearing sockeye). The anoxic layer in the north basin is being actively monitored. The central and south basins are essentially unusable by fish during the late summer and fall in many years.</p>		
<p>Toxic contaminants</p> <p>The latest Osoyoos Lake sediment core appears have a typical DDT pattern compared to other agricultural areas (except for a spike in 1998). DDT is higher in Lake Osoyoos than in the lower Okanogan River – perhaps due to dilution of sediments with ‘cleaner’ Similkameen River sediments. PCB levels were low in both cores but similar – may point to low-level PCB sources such as stormwater and wastewater treatment plants.</p> <p>Stormwater is a growing source of toxic and persistent contaminant loads in the urban environment (trace metals, organic pollutants).</p> <p>Toxics in food fish are monitored by the Okanagan Basin Monitoring and Evaluation Program (OBMEP) (Okanagan Nation Alliance and Colville Confederated Tribes).</p> <p>Preliminary studies on contaminant levels in oxbow sediments suggest concentrations are not that different from Osoyoos Lake sediments. More data is needed, however.</p>	<p>Is it safe to eat the fish I catch in Osoyoos Lake?</p> <p>Monitoring contaminant levels in fish is essential requirement to safeguard First Nations people.</p> <p>Are sediments in disconnected oxbows holding disproportionate amount of soluble contaminants? Will re-connecting them lead to contaminant waves traveling downstream during high flow events?</p>	<p>Are toxic contaminants in Osoyoos Lake <i>currently</i> an important concern or are they expected to worsen? What are the primary loading pathways and rates? If so, what is the plan for reducing them?</p> <p>More data on toxics in fish tissue is essential to public health.</p> <p>Better data is required on urban stormwater runoff contaminant in the Okanagan.</p> <p>We need more data on how the lagoon water treatment systems are working.</p> <p>Do not know why there was a sudden spike in DDT in South Osoyoos Lake in 1998-1999? Did the floods of 1997 wash the contaminants from upstream and upslope areas?</p>

Key points made by presenters and panelists	Focus of audience interest and feedback	Information gaps and needs identified by presenters, panelists and participants
<p>Groundwater quality</p> <p>Aquifers are vulnerable to contamination, and local aquifers contribute groundwater flow to Osoyoos Lake.</p> <p>Aquifers have been mapped on the Canadian west side of the lake. Maps are available online at the BC Water Resource Atlas.</p> <p>Groundwater nitrate levels have been moderating over time at some wells.</p> <p>A few pesticides (mainly herbicides) detected at very low concentrations.</p> <p>Long-term aquifer monitoring is important in terms of implications to drinking water quality and lake water quality</p>	<p>The number of monitored wells seems desperately low relative to the number of aquifers and importance of this water source.</p>	<p>Groundwater nitrate info is mostly from the west side of the Canadian part of lake – need data from other areas too, esp. Osoyoos Indian Band lands.</p> <p>Data are lacking for nutrients from domestic wastewater transported through groundwater</p>

Water quantity

Key points made by presenters and panelists	Focus of audience interest and feedback	Information gaps and needs identified by presenters, panelists and participants
<p>General</p> <p>Since we do not have an up to date basin-wide water budget, are our local and regional land-use plans and water regulations inadvertently leading us into a “corner” beyond which our water problems will become intractable?</p> <p>Development, land-use practices and water extraction activities in the north and central basin will exert ever greater effects on water availability in the southern Okanagan, particularly under projected future climate. Do not plan water resource management strategies in isolation of others going on throughout the entire Okanagan watershed.</p>	<p>Should water supplies be further augmented by increasing interbasin diversions?</p> <p>What are the benefits and risks associated with potential new dams and diversions?</p> <p>By focusing on supply side solutions, are we merely looking for ways to continue our wasteful ways instead of looking seriously at demand management (which may cut into our lifestyle)?</p>	<p>Updated basin wide water budget against which to approve/reject new water extraction activities</p> <p>Water rights – how do you begin to move them around?</p>
<p>Flow management (including floods/droughts)</p> <p>Normal summer range of water in Osoyoos Lake is between 911.0 and 911.5 feet elevation. In the 1894 flood the lake reached 919.6 feet, because high water of the Similkameen created a backwater effect. There is little managers can do to affect this situation when it occurs.</p> <p>Any time you regulate lake level, it affects ecological processes and fish.</p> <p>Okanagan Fish Water Management Tool (OKFWM): A decision support system to balance water objectives in real time. Supports “fish friendly” water management and adds forecasting tools so water managers can better ward off flooding and drought problems.</p> <p>Okanagan Lake water managers must plan for the spring freshet, so that the water is properly managed and flood is avoided. Long list of competing goals and</p>	<p>Are we doing enough to plan for floods and droughts? How can they be predicted?</p> <p>What is the success of OKFWM in sockeye survival? A:// We used a 25 year retrospective analysis with past annual data, and ran the system as if it’s happening all over again except with the benefit of the tool. The analysis indicated that you could improve sockeye fry survival by over 50%. OKFWM will go until 2012 or13. At that date the sponsor (Douglas County Public Utility District) will evaluate the actual fish benefits. There is some evidence that it’s</p>	<p>Flood and drought prediction is tricky – even with the best meteorological and hydrological science it is difficult to predict for certain when a flood or drought will occur.</p> <p>We need to understand how we can manage backflows from the Similkameen on Osoyoos Lake – it’s an important factor even though it’s a relatively rare event.</p> <p>The extent to which flow pulses from Okanagan Lake dam (in July-September) mitigate temperature-oxygen squeeze problems in Osoyoos Lake.</p> <p>The Osoyoos Lake Board of Control drought declaration criteria will be examined in the upcoming changes to the Osoyoos Lake Orders (Zosel Dam operating orders).</p>

Key points made by presenters and panelists	Focus of audience interest and feedback	Information gaps and needs identified by presenters, panelists and participants
<p>“rules” come into play. When you add uncertainty about snowpack melt, it’s a challenge to make decisions.</p> <p>OKFWM Decision Support System management philosophy:</p> <ul style="list-style-type: none"> • balances consideration of multiple objectives (i.e. social, economic, ecological) • recognizes inflow forecast uncertainties, • uses “rich” information sources refreshed in real-time (i.e. annual to daily data imports), • facilitates input by limited pool of regional experts, • accelerates training & access to diagnostics, • provides common, “transparent” framework for “team” collaboration, synthesis & decisions, • allows managers to “measure twice” & “cut once”, • provides record of annual strategy & outcomes to assess performance against multiple objectives. 	<p>delivering those benefits. If it does, they will likely pay for the operations for a 50 year interval.</p>	
<p>Zosel Dam – Osoyoos Lake levels</p> <p>The Osoyoos Lake Orders of 1982 and 1985 relate to Zosel Dam—owned by the Washington State Department of Ecology—which controls water releases from Osoyoos Lake (and thus Osoyoos Lake’s elevation). The Orders were issued by the International Joint Commission, and are overseen by the Commission’s Board of Control.</p> <p>In non-drought years, Osoyoos Lake summer water levels remain between 911.0 and 911.5 feet.</p> <p>The Orders allow more water to be stored during a drought. At the Board’s public meetings, residents are resolute on three major issues related to the Order: water quality, water levels, and water availability. Since the current Orders expire in 2013, and the Applicant (State of Washington) has indicated the intent to reapply, the Board expects that these issues may be</p>	<p>The effects of Zosel Dam operations on water quality have not received enough attention. (Dam is a “plug” preventing sediment transport).</p> <p>Canadian Okanagan left out of Columbia River Treaty; There is the perception amongst some members of the public that storing Osoyoos water to help realize downstream benefits with insufficient funding returned to Canada.</p>	<p>To what extent does Zosel Dam limit the downstream transport of nutrients and contaminants?</p> <p>To what extent does Zosel Dam influence water quality events that affect fish or algal populations in Osoyoos Lake?</p>

Key points made by presenters and panelists	Focus of audience interest and feedback	Information gaps and needs identified by presenters, panelists and participants
<p>brought forward during formal Hearings when the Commission considers a revised Order.</p> <p>Zosel Dam Plan of Study is prioritizing 7 issues for the new dam order:</p> <ol style="list-style-type: none"> 1. An assessment of the most suitable water levels for Osoyoos Lake during drought years 2. An evaluation of the criteria used to declare drought 2. A review of the dates for switching between summer and winter operation 3. An investigation of the effects, if any, of water regulation on water quality in Osoyoos Lake 4. An investigation of methods for including ecosystem requirements in Orders of Approval 5. An investigation of methods for including climate change information in Orders of Approval 6. A demonstration of the factors that govern lake levels during floods 7. An assessment of methods used to monitor flow capacity in the Okanogan River <p>Next steps:</p> <ul style="list-style-type: none"> • build study teams (2007-2010) • conduct studies (2008-2011) • hold hearings on Orders • approve new Orders • current approval terminates in 2013 		
<p>Groundwater quantity</p> <p>Aquifers have been mapped on the Canadian west side of the lake. Maps are available online at the BC Water Resource Atlas.</p> <p>Groundwater flow rates differ depending on geology (e.g., the size of the sediment grains). Local aquifers</p>	<p>Are groundwater aquifers around Osoyoos Lake being over-pumped? When will we have enough data to know?</p> <p>Will we be able to find out what</p>	<p>The aquifers on the east side of the north basin of Osoyoos Lake need to be mapped, esp. Osoyoos Indian Band lands.</p> <p>For the areas that are mapped, we don't know enough about specific aquifer properties (size of</p>

Key points made by presenters and panelists	Focus of audience interest and feedback	Information gaps and needs identified by presenters, panelists and participants
<p>outflow to Osoyoos Lake.</p> <p>Groundwater flow is relatively slow (1-10 yr residence time) compared to surface run-off.</p>	<p>the water budget is so that we can stop pumping the aquifer before the natural recharge is exceeded and there are bad consequences for lake and stream levels?</p>	<p>sediment grains) to predict actual aquifer flows.</p> <p>We don't have enough data to support a good estimate for how much groundwater is discharged into Osoyoos lake.</p>
<p>Flow augmentation</p> <p>Interbasin diversions or transfers can increase the water available within the receiving basin but generally decrease water in source basin (may “rob Peter to pay Paul”). Some of the (numerous) factors to consider include:</p> <ul style="list-style-type: none"> • Impact of reduced flows in source basin water supplies • Fisheries and other ecological considerations (downstream <u>and</u> in the reservoir created upstream of the dam site) • How to achieve low mortality two-way fish passage for multiple species and life-history stages • Broader ecological benefits in terms of energy (carbon) footprint • Water quality impacts • Social considerations including displacing First Nations and other citizens • Economic benefits • Legal constraints or requirements • Engineering feasibility <p>Dams, and their role in flow management are an import tool in mitigating ecological consequences of climate change. Their value in this regard depends on whether fish passage needs are seriously built into the construction of the dam, and whether ecosystem flow requirements are entrenched in the operating plan for the project.</p>	<p>Why is the IJC, Canadian Federal and BC Provincial government not more actively engaged in planning and negotiations around the proposed Shakers Bend dam on the Similkameen? Is the proposal being “ignored” on the Canadian side of the border?</p> <p>Canadians in the southern Okanagan-Similkameen valley’s are not paying enough attention to these proposals.</p> <p>Once you start diverting water, how do you decide to stop?</p> <p>Why not take surplus Okanagan Lake water into storage in the wintertime? A:// we already do, but there is only so much we can store behind Okanagan Lake dam without creating spring flooding problems.</p> <p>Why not raise the level of Enloe Dam instead of building a new dam at Shakers Bend?</p>	<p>The project impacts of dams, ecological, social and economic require many years of pre-study, including decades of post-project monitoring to be understood.</p> <p>To what extent should the Similkameen River be considered “part” of or “in” the Okanagan Basin from the perspective of future water supply planning? Strictly limit to flood management associated with the Similkameen backwater effect or also including potential water diversion and transfer resulting from Dams and tunnels?</p>

Key points made by presenters and panelists	Focus of audience interest and feedback	Information gaps and needs identified by presenters, panelists and participants
<p><i>Shuswap River – Okanagan Lake Water Supply Canal:</i> In the 1960s the province researched a number of options to augment water supplies in the Okanagan during dry years by diverting water from Shuswap River upstream of Enderby into the north end of Okanagan Lake. Due to economic, social and environmental considerations the project has never proceeded beyond this stage. It remains a possibility in the future.</p> <p><u>Shanker's Bend</u>: This dam project has been proposed on and off since 1948. It has recently resurfaced. <u>Okanogan PUD</u> has applied for a Preliminary FERC Hydropower permit for the Shanker's Bend dam site. Discussions are currently underway with project sponsor, Okanogan PUD, for Columbia River Grant agreement.</p> <p>The project work is part of an investigation taking place on both sides of border. The Interim Steering Committee overseeing investigation has contributors on both sides of Canada/US Border.</p> <p>The Kruger Mountain Drift proposal may make sense in the future. It involves tunneling through Kruger Mountain to supply approximately 200 cfs of cold water entering the Okanagan River above Osoyoos Lake.</p>		

Land-use planning and Agriculture

Key points made by presenters and panelists	Focus of audience interest and feedback	Information gaps and needs identified by presenters, panelists and participants
<p>General</p> <p>The present population of the Okanagan basin (~308,000) will be doubled within the next 50 years. What are the water resource requirements to support the coming “population wave” under different types of land-use practices and climate scenarios?</p>	<p><silence></p>	<p>Basin wide water budget factoring in future climate change and demand scenarios</p>
<p>Land use planning – Osoyoos</p> <p>The Town of Osoyoos recognizes that controlling stormwater outflows into the lake is crucial, and has developed guidelines and plans.</p> <p>Watermark Beach Resort has onsite storm water management as well as off site storm water management that catches some town water as well.</p> <p>The Town’s policies are to require all new developments to follow, to the greatest extent possible, the Town’s Development Services Bylaw. The Town will continue to:</p> <ul style="list-style-type: none"> • pursue provincial guidelines to reduce impervious areas resulting in stormwater discharge into receiving watercourses; • assess treatment options for all existing stormwater outfalls; and • pursue opportunities to improve existing stormwater systems for new developments, with financial participation from their proponents. 	<p>There are at least three jurisdictions associated with Osoyoos Lake, what difference do your regulations make if they are not being followed upstream?</p> <p>Need a higher green tax for beach side developments. Direct this money to water resource projects not general revenues.</p> <p>Building set-backs from lake shore – are they appropriate?</p>	<p>Is the rate of growth outstripping improvements in stormwater quality?</p>

Key points made by presenters and panelists	Focus of audience interest and feedback	Information gaps and needs identified by presenters, panelists and participants
<p>Land use planning - Oroville</p> <p>City boundaries have grown by annexation, because water connections can't be grown outside of city boundaries.</p> <p>Oroville growth management programs and initiatives underway:</p> <ul style="list-style-type: none"> • water management and planning • water rights and resource acquisition • critical areas ordinance updates to include best available science • flood management plan updates • comprehensive plan updates (partly funded) <ul style="list-style-type: none"> - joint count/city public participation - updates to both county/city plans reviewed and reconciled. • shoreline master program updates (funded) <ul style="list-style-type: none"> - county-wide policy development, inventory and analysis in progress - county/city master program development and adoption <p>Initiatives and projects on the horizon:</p> <ul style="list-style-type: none"> • storm water management planning and implementation • wastewater treatment facility upgrades • water resource development • annexation of urban growth area • riparian restoration <p>Major emphasis in planning and implementation</p> <ul style="list-style-type: none"> • best management practices in all development. • slow things down when necessary to ensure wise decisions. 	<p>What is Oroville's current and projected domestic and agricultural wastewater load to Osoyoos Lake?</p>	

Key points made by presenters and panelists	Focus of audience interest and feedback	Information gaps and needs identified by presenters, panelists and participants
<ul style="list-style-type: none"> • maximize utilization of existing regulatory tools to avoid non-reversible consequences. • sustainable economic vitality <p>Development potential is highest in the lands that are currently orchards. Unlike British Columbia, there is no agricultural land reserve to protect the agricultural lands.</p>		
<p><i>Agricultural water use</i></p> <p>The region south of Vaseaux Lake currently uses around 20% of the total basin water consumed by agriculture. A 15-20% increase in demand is projected by 2050 due to climate change. Current irrigation license for the south Okanogan is large enough to meet demand, but years of high demand and low supply must be planned for.</p> <p>Current estimated total irrigated land in the Canadian Okanogan Basin is 189,000 hectares. In 2001 we needed 2.15 million hectares for overall food sufficiency and 217,000 hectares of irrigated land in BC to be self sufficient in fruit, vegetables and dairy. By 2025 we will need 2.78 million hectares and 281,000 hectares of irrigated land.</p> <p>Annual water demand varies with crop type.</p> <p>To improve on-farm water management and reduce drainage losses to groundwater and nutrient loading to Osoyoos Lake requires:</p> <ol style="list-style-type: none"> 1. irrigation water be based on climate, soil and crop type; 2. fertilizers are applied at the minimum optimal levels not overused; 3. use of high-efficiency irrigation systems; 4. more efficient irrigation scheduling (e.g., not watering during rain storms). 	<p>How can excess nitrogen and phosphorous from agricultural fertilizer (and septic tanks) be reduced?</p> <p>How can agricultural water-use efficiency be further improved and made more wide-spread?</p>	<p>In reality, is an acre of farmland (of crop type x) a more efficient “water user” than the same acre of land having density y of human dwellings and their related water consumption activities?</p>

Key points made by presenters and panelists	Focus of audience interest and feedback	Information gaps and needs identified by presenters, panelists and participants
<p>Most of the crops grown around Osoyoos Lake require relatively small amounts of nitrogen. Nitrogen leaching to groundwater and Osoyoos Lake can be prevented by requiring that nitrogen applications are made: a) at the correct rate for the crop; b) at a time when the plant will most readily take it up; and c) in conjunction with best practices for water management.</p>		
<p>Regional Districts</p> <p>The work that the Regional Districts are doing began with the regional growth strategy about 8 years ago. Local government is involved in water management planning. Water in the Okanagan basin is a finite resource, and is soon to be the most limiting factor for development in the Okanagan.</p> <p>There are 30 community water utilities in the Central Okanagan District.</p> <p>Westside Water Management Plan: 7 drainage basins. Under current demand scenarios the water supply will not sustain projected development.</p> <p>Westside Joint Water Committee for Westside Water Management Plan.</p> <p>Sensitive Habitat Information Mapping to map exactly where the streams are, the intakes, the top of the bank, and the condition of the habitat.</p> <p>Okanagan Lake Foreshore Planning: a group of policies that are currently being updated. Can regulate development on the lake (i.e. docks)</p>	<p>Are the Regional Districts truly integrated at the basin-wide level? Where does the mandate of Regional Districts and the Okanagan Basin Water Board begin and end in regards to sustainable water resource management?</p> <p>Docks sometimes seem to receive a disproportionate amount of attention. "Private" beachfront land is probably a bigger issue; there is supposed to be public access on all foreshore properties.</p>	

Ecological restoration, monitoring & endangered species protection

Key points made by presenters and panelists	Focus of audience interest and feedback	Information gaps and needs identified by presenters, panelists and participants
<p>Restoration</p> <p><i>Okanagan River Restoration:</i> The Okanagan River is excessively channelized, dyked and dammed. Restoration goal: a semi-natural state. Okanagan River Restoration Initiative (ORRI). Construction on Phase 1 channel should happen within 1 year. Benefits of the 2km Okanagan River Restoration Initiative:</p> <ul style="list-style-type: none"> • reduction in flood stage in the area • Fine sediment deposition on floodplains • increased stability and quality of spawning gravel • improved water quality • improved aquatic habitat for sockeye, kokanee, chinook, rainbow trout, and whitefish • improved riparian habitat for wide range of terrestrial species <p><i>Osoyoos Oxbows Restoration Society:</i> Oxbows are an important component of natural habitat and ecological function. They were cut off during artificial channelization of the river in the 1950s. They can be rehabilitated. The Osoyoos Oxbows Restoration Society hired consultants to investigate the oxbows and recommend a rehabilitation plan.</p> <p>They are collecting data on three of the oxbows: Shippet, Thompson and Quintal. Overbank flooding would have stored sediment but can't do that in the current canal condition.</p> <p>Potential benefits include restored riparian processes, improved water quality in Osoyoos Lake, reduced chemical treatment needed to address West Nile-hosting mosquitoes.</p> <p>Phase 1 was completed in 2006 and included a</p>	<p>What is the difference between ORRI and the Oxbow Society's projects and goals? A:// The Okanagan River Restoration project's focus is restoring fish habitat, and keeping the dykes (but set-back). The Osoyoos Oxbows Restoration project is hoping to create overbank flooding to restore some natural riparian processes. Also the two projects are focused on different locations.</p> <p>Assuming there wasn't anything impeding the opening of the oxbows, would those oxbows hold the silt and sediment that currently comes down the canal?</p>	<p>What are the geomorphic and biological benefits of re-connected oxbows if they are not allowed to flood or migrate? By artificially continuing to pass floods through the channelized section of Okanagan River, are we merely creating a "non-linear flume" cut-off from the fluvial-geomorphic benefits of periodic high flow events that drive oxbow function?</p> <p>How far can we go in rehabilitating Okanagan River and its tributaries to a more natural (unchannelized) state? Does 2-3 km of restored habitat really amount to a detectable improvement in biological performance, or is it more aesthetic?</p> <p>Are chemicals in oxbow sediments soluble or bound-up in something? Need mineralogical study.</p> <p>Will reconnection of Oxbows have negative impacts on production or survival of sensitive species like sockeye salmon (hypotheses that in some species complexes oxbows can increase competitive strengths for introduced predators targeting traditional species such as migrating sockeye fry).</p>

Key points made by presenters and panelists	Focus of audience interest and feedback	Information gaps and needs identified by presenters, panelists and participants
<p>business plan, consultation with local landowners, fundraising, and a preliminary hydraulic feasibility study.</p> <p>Phase 2 is now in process with ongoing business planning, fundraising and consultation, and the beginning of long-term feasibility study. The feasibility study is intended to thoroughly assess and test the risks, potential benefits, constraints, and costs, and develop one or two preferred options to the conceptual design stage.</p>		
<p>Monitoring</p> <p>Okanagan Basin Monitoring and Evaluation Program (OBMEP) is a 20-year transboundary monitoring project initiated by the Okanagan Nation Alliance and Colville Confederated Tribes. The project tests contaminant levels in Okanagan Basin resident food fisheries. As resident fish are a significant part of local First Nation diet and water quality issues are increasing, monitoring the contaminants is essential to preserve the health of the First Nations people. (Note: this program includes other types of monitoring that were not discussed at the Forum).</p>		<p>Need data that helps us understand how the basin works as a dynamic entity. It's a very complicated system. Cause and effect models are required – data too often presented as a set of disembodied facts.</p>
<p>Fish Habitat</p> <p>Juvenile sockeye: Temperature and oxygen extremes operate together to restrict the useable water volume for juvenile sockeye in Osoyoos Lake. The south basin is known to be wholly unsuitable for rearing through summer and fall. Sockeye avoid this basin or die. Central basin is unsuitable for summer rearing although some sockeye may survive. North basin is suitable for rearing but still poses a challenge for sockeye in late summer and fall in some years.</p> <p>The depth of warm surface water temperatures increase with increases in summer wind velocity. Average (Jun-Sept) wind velocities in the Okanagan have increased in recent years. Global climate models predict general</p>	<p>What kind of competition is there between mysids and fish?</p> <p>Kokanee is considered a sentinel species: if kokanee are doing well then we're doing well with other fish species.</p> <p>How can water be managed in a more ecologically friendly way?</p> <p>What is the relative role of habitat rehabilitation vs. improving fish passage and</p>	<p>What needs to be changed for Osoyoos Lake to support and sustain healthy population levels of anadromous and resident fish species?</p> <p>How will the temperature oxygen squeeze respond to increased flows from Okanagan Lake dam? How do we alleviate the temperature oxygen “squeeze” in Osoyoos Lake and therefore provide habitat for threatened juvenile sockeye?</p> <p>We do not have enough detailed information about Kokanee in Osoyoos Lake.</p> <p>We need more isotope work in historic sediment</p>

Key points made by presenters and panelists	Focus of audience interest and feedback	Information gaps and needs identified by presenters, panelists and participants
<p>increases in wind velocity fields. If so, the temperature/oxygen “squeeze” on sockeye fry in Osoyoos Lake will increase in severity. Managers have no control over wind, however temperature/oxygen squeeze may be mitigated by:</p> <ul style="list-style-type: none"> • increasing July-September discharge during dry/hot years, • reducing point source phosphorus loading, • oxygenating the deeper, cooler water in some safe, efficient and cost effective manner. <p>Okanagan sockeye migration, spawning, hatching and fry have predictable temperature based “rules” that can be used to develop fish friendly flows (see OKFWM).</p> <p>Okanagan Sockeye Skaha Project is a 12-year (2004-2016) program initiated by the Canadian Okanagan Basin Technical Working Group (COBTWG), in particular the Okanagan Nation Alliance, that will potentially double sockeye production in Skaha Lake.</p> <p>Salmon Creek rehabilitation (Okanagan Irrigation District and Colville Confederated Tribes). The project goal is to restore sufficient stream flows to lower Salmon Creek to support migrating anadromous fish and continue delivery of a full water supply to the Okanagan Irrigation District</p> <p>McIntyre Dam Fish Passage project: (Colville Confederated Tribes) is looking to evaluate fish passage at McIntyre Dam and reconnect 11 km mainstem habitat.</p> <p>Omak Creek habitat rehabilitation (Colville Confederated Tribes) restored important habitat to the recovery of steelhead.</p>	<p>increasing overall habitat quantity?</p>	<p>cores – this will help make inferences about historical trophic dominance by different species.</p> <p>How can Osoyoos Lake water temperatures be managed for the betterment of endangered fish populations? Is flow management the only way?</p>

Key points made by presenters and panelists	Focus of audience interest and feedback	Information gaps and needs identified by presenters, panelists and participants
<p><i>Endangered species</i></p> <p>Four plants, listed as Endangered in Canada, occur on Osoyoos Lake shorelines (scarlet ammannia, toothcup, small-flowered lipocarpha, Short-rayed Aster). In addition to these federally listed plants, 14 provincially Red or Blue listed plants occur here.</p> <p>Current water level regulation has allowed the plants to persist but we do not know optimal water level requirements.</p> <p>Okanagan River chinook salmon were petitioned for listing under the Species at Risk Act.</p> <p>Okanagan River sockeye salmon are the only sockeye run to return to Canada through the Columbia River system.</p>	<p>Given the unique ecological characteristics of the area (only desert ecosystem in Canada), isn't it crazy that so much development is allowed right up to the edge of the Lake?</p>	<p>Monitoring of endangered plant life history inventories is required. Endangered plants research requires clarification of impacts related to:</p> <ul style="list-style-type: none"> • water level changes (height and frequency) • timing of water level changes (seasonal) • seed bank viability over time <p>Integrated approaches to restoration of multiple plant and animal species at risk in aquatic, wetland and riparian ecosystems.</p>

Bi-lateral and local governance

Key points made by presenters and panelists	Focus of audience interest and feedback	Information gaps and needs identified by presenters, panelists and participants
<p>General</p> <p>What regulatory changes are required to lessen water consumption? Is it realistic to expect to achieve these changes on the back of voluntary “individual choices” alone?</p> <p>First Nations perspectives and issues should be central to this discussion. First Nations people must be involved.</p> <p>We are in a race between climate change and the bureaucratic process. Will we have fish at the end or not. We need a triage system for our water/fish management options.</p>	<p>What evidence do governments have that instituting bylaws, regulations, water rights, and water pricing will be poorly received by the majority of the electorate?</p>	<p>Who needs to be at the table in order to make a decision on topic ‘x’?</p> <p>How do I access funding for water related projects?</p>
<p>Cooperation and leadership</p> <p>Under the Okanagan Basin Water Board, the Okanagan Basin Water Stewardship Council are rolling and are finding a lot of support around the basin, and are able to communicate with a lot of different groups and help with events. Very optimistic and inspired by how involved people are. Water Stewardship Council has broad representation, and the people who are there have built up a level of trust and that’s essential. Within the group there’s a can do spirit, the group is demonstrating leadership.</p> <p>There is support from local government to take on water initiatives. People have realized that Okanagan water is in crisis and that development presents sustainability problems.</p> <p>Water source protection is very important, but it's not easy to protect an entire watershed. There’s a complex web of jurisdictions that all share in water resource management decision-making.</p>	<p>How can we get involved and influence <i>action</i> around improved water resource management for Osoyoos Lake?</p> <p>How do we coordinate among all the different government entities and groups so that the information we already have is better used across the entire Okanagan basin? An important part of the problem is that there is no common language, no common priority among jurisdictions and government ministries. Too much buck passing.</p> <p>How are we going to get the information out to the majority of people who didn’t attend this Forum?</p>	<p>Because sound water resource management responsibility does not lie with any single organization, what processes can be created to promote more cooperation and information sharing between groups?</p> <p>How can we better develop the leadership required to address the issues and create positive change?</p> <p>How do we further increase public awareness and to what extent will this drive positive behavioral change?</p>

Key points made by presenters and panelists	Focus of audience interest and feedback	Information gaps and needs identified by presenters, panelists and participants
<p><i>Changing perspectives</i></p> <p>Water licenses – most people are very selfish about their water rights. How will Vernon react if Osoyoos runs out of water? Will they keep using their licenses? It is clear that water licensing changes must be applied to entire watersheds (the entire Okanagan Basin), not just within artificial political jurisdictions of Regional Districts, irrigation districts and other arbitrary municipal boundaries.</p> <p>Citizens should hold agencies and institutions accountable for their mandates and insist that the current legislations are upheld.</p> <p>Okanagan Basin residents are one of the highest per capita consumers of water in Canada. Considering both agricultural and residential users, a tremendous amount of water is wasted with unmetered and unpriced irrigation. More meters should be installed, because efficiency comes when you start charging.</p> <p>We shouldn't underestimate that we're talking about cultural change in a profound way. A big positive effect would come from leadership of local governments and public sector and show what the priorities are for water conservation. This is a priority of the local governments.</p>	<p>What is the upper limit on growth in the Okanagan Basin?</p> <p>The amount of science is impressive but scientists aren't helping to make policy and can't make decisions about what we should do. The citizens and the politicians are the ones who can make decisions. We are still procrastinating rather than taking serious action. Our leadership should insist on types of outdoor landscaping, list of permitted species of trees and plants; mandate use of low flush toilets and other water saving devices. People here are ready for tougher regulations.</p> <p>What are we talking about – a <i>sustainable</i> Osoyoos Lake or just a <i>less unsustainable</i> Osoyoos Lake? What sustainability means is no increase in water diversions, no increase in energy use, control population. I don't see that being discussed here. And with climate change on top of that, the future looks gloomy. What can be done about discouraging or reducing the rate of population growth or consumption?</p>	
<p><i>Organizations</i></p> <p>In June 2007 the British Columbia/Washington Environmental Cooperation Council (ECC) signed a memorandum of understanding on Pacific Coast Collaboration to Protect our Shared Climate and Ocean. This includes study on climate change to do detailed analysis of climate change in the Columbia Basin, which is being done at the University of Washington.</p>	<p>The ECC would be very open to talking about the local issues, and the way to start is to start a discussion with the ECC about who should be at the table to start work on the problems. Partnership is already started here, and maybe the ECC can add value to that.</p>	

Key points made by presenters and panelists	Focus of audience interest and feedback	Information gaps and needs identified by presenters, panelists and participants
<p>Okanagan Basin Water Board provides \$2 million a year in water conservation and quality grants.</p> <p>Okanagan Basin Water Supply and Demand Study is updating a water budget for the Okanagan Basin and will be completed in 2009.</p> <p>Okanagan Basin Stewardship Council brings together stakeholders, reviews the state of water in the Basin, develops a Sustainable Water Strategy and enhance communication, cooperation and trust.</p> <p>In the US, the Okanagan Conservation District provides local leadership on conservation issues. Provides regional planning to create a focused approach. Public recognition of benefits of stewardship, create a local dialogue. Coordinate multiple funding sources.</p> <p>BC Lake Stewardship Society: Province wide organization located in Kelowna. Coordinates volunteers for lake water quality monitoring, field observations, visual observations, climate change indicators. Currently into the 5th year of the program.</p>	<p>Osoyoos Lake water quality standards should be part of the IJC priorities – water quality is the highest priority issue of Osoyoos Lake.</p>	
<p><i>The Okanagan Nation Alliance overview</i></p> <p>The Okanagan Nation Alliance adheres to a concept called “Ks p’el’k’stim,” which is defined as “balancing indigenous and western science to manage, protect and restore fisheries resources and aquatic habitat.”</p> <p>Okanagan Nation Alliance Fisheries Program prioritizes: planning; defensible scientific data and information; access to funding and developing partnerships; accountability; building on successes; and communication, education & public awareness</p> <p>ONA is involved in a number of projects including:</p> <ul style="list-style-type: none"> • cultural and public awareness • collaborative partnerships 		

Key points made by presenters and panelists	Focus of audience interest and feedback	Information gaps and needs identified by presenters, panelists and participants
<ul style="list-style-type: none"> • salmon stock restoration - reintroduction of sockeye into Skaha Lake • habitat restoration: Fish Water Management Tools, and Okanogan River Restoration Initiative • Okanagan Basin Monitoring and Evaluation Program (OBMEP) 		
<p><i>Colville Tribes overview</i></p> <p>The greater Okanogan River system has great cultural and social significance. The Colville Tribes are committed to recovering resources of the Okanogan River, and will continue cooperation and collaboration in rehabilitation efforts throughout the Okanogan River basin.</p> <ul style="list-style-type: none"> • Salmon Creek rehabilitation • McIntyre Dam Fish Passage project • Omak Creek habitat rehabilitation • Bonaparte Pond 		

Climate change

Key points made by presenters and panelists	Focus of audience interest and feedback	Information gaps and needs identified by presenters, panelists and participants
<p>The Okanagan is speeding towards a tipping point. We can seriously prepare now or react in panic later (but by then the problem will be intractable). The actions needed will not be “popular”; bold leadership & more awareness is required.</p> <p>Washington State takes climate change seriously, and is trying to outline a strategy to respond to that.</p> <p>Climate change models predict an increase in migration delay for sockeye stocks from 40 days to 75 days by 2050 (between Wells and Osoyoos). This means a difference from September 12 to November 5.</p>	<p>Climate change merely further ramps up the importance of getting on with mitigation, education and awareness raising.</p> <p>What will be the hydrologic and soil erosion effects caused by an even more widespread Mountain Pine Beetle epidemic?</p>	<p>Are our planning processes keeping up with climate science and readying us for climate change effects on our water supplies and the quality of life in the Okanagan?</p> <p>What will be the effects of climate change on water quantity, water quality and fish and wildlife habitat?</p> <p>What are the best adaptation strategies?</p> <p>It’s not clear whether salmon have sufficient life-history flexibility to accommodate large changes to their reproduction schedules (for example, a large increase in migration delays).</p>

4. Potential Next Steps and Actions

*“I know scientists like to find out things, but I’ve been coming to these kinds of meetings for 50 years, and we need to **do** something!”*

– anonymous audience member

At the end of the Forum IJC Commissioner Irene Brooks emphasized that the IJC remains committed to the process of pursuing Osoyoos Lake sustainability and is committed to giving those involved in the process the IJC’s support to further international dialogue and action. Ms. Brooks stated that the next step is to develop a strategy for moving forward.

The following possible success elements solidified during the Forum:

- the need for improved leadership, multi-jurisdictional collaboration and cooperation;
- basin-wide, cross-border, regional thinking instead of looking only at individual, narrow jurisdictional zones;
- science-based (rather than political) decision making; and
- measurable actions and progress.

The tables on the following pages consolidate candidate suggestions for future actions by topic area. Candidate actions are further grouped according to (i) responses and actions needed from regulators, planners and politicians, and (ii) specific actions and steps for further scientific investigation. Potential leaders for these actions are identified, along with possible success factors or benefits. These suggested success factors are not comprehensive but are meant to inspire further thought. It is beneficial to have success factors in mind when measuring progress.

Candidate responses and actions needed from regulators, planners and politicians

Topic area	Potential leader(s)	Possible success factors or benefits
Water quality and quantity		
<p>1. Form a storage-flow management joint task force to monitor all <i>proposed</i> and active water storage projects in the full Okanagan / Similkameen / Shuswap region.</p>	<p>Okanagan Basin Water Board: outreach and coordinating entity</p> <p>IJC if transboundary component (e.g., Shankers Bend)</p> <p>BC Ministry of Environment: Water Stewardship</p> <p>BC-Washington co-operation council</p>	<ul style="list-style-type: none"> • Wider public awareness of proposals and activities. • IJC invited by Canadian and US Federal Governments to monitor water storage investigations on the Similkameen. • Canadian position on trans-border plans clearly stated and public. • Canadian agencies are “early entrants” to weigh in on direction of planning (instead of last to the party). • Report card (e.g., # acre-ft regulated storage added per year; total regulated storage, fish-passage properties, ecological flow criteria defined or not, generating capacity, etc.). • Hold semi-annual inter-governmental inter-agency status meetings.
<p>2. Provide coordinated input on the 2013 Osoyoos Lake Board of Control replacement Order, including feedback from local residents.</p>	<p>International Joint Commission and the International Osoyoos Lake Board of Control</p> <p>Options include:</p> <ul style="list-style-type: none"> • Citizens, governments and stakeholders providing input through the IJC's formal hearing process for Orders renewal; • The IJC implementing a pilot watershed initiative for the basin; and/or • The Government of Canada and the US State Department jointly requesting a reference study on how to combine water quality and other 	<ul style="list-style-type: none"> • New order addresses water quality guidelines (including nutrients, contaminants and water temperatures). • New order addresses endangered riparian plant needs and recovery. • New order allows for pilot (not necessarily permanent) adaptive pulse flow experiments for alleviation of temperature-oxygen squeeze. • New order clarifies provisions/guidelines for meeting ecological flow needs downstream of Zozel dam (steelhead, chinook, sockeye). • Attached to Order specific funding to support certain types of monitoring, designed to reduce uncertainties (Canadian and US side of the border).

Topic area	Potential leader(s)	Possible success factors or benefits
	environmental issues with the existing water level limits in the Order.	
<p>3. Ensure Okanagan Basin Water Supply/Demand Study Phase 2 results are widely disseminated and appreciated by regional planners authorizing development and new water extraction as well as by sr. officials in water licensing.</p>	<p>Okanagan Basin Water Board, BC Ministry of Environment: Water Stewardship Division</p>	<ul style="list-style-type: none"> • Findings and tools become engrained in regional planning consciousness. • New water extraction activities approved/rejected based upon this information. • Recognized as a key tool helping define the upper limit to population growth in the valley. • Use to inform water license buy-backs with eye to alleviating pinch points. • Ensure water budget accounts for ecosystem “rights” to water (i.e., explicitly remove water from the ‘surplus’ supply considered available for allocation).
<p>4. Universal water licensing including restrictions; full review of surface water licenses throughout the Okanagan leading to development of future buy-back/transfer plan and revisions to water license policy. > Pilot this effort in Okanagan.</p>	<p>BC Ministry of Environment: Water Stewardship Division Okanagan Basin Water Board (advocacy)</p>	<ul style="list-style-type: none"> • Bold leadership (“right thing to do” rather than popular). • Develop consultation plan. • Explore “willing sellers”. • Planning horizon of 10-30 years. • Technically informed by Okanagan Water Budget – not politics. • Form independent legal wing of the BC Provincial Government capable of assessing fair compensation in cases where existing license terms need to be changed. • Establish and begin to fund a water license settlement account. • Priority for re-acquired licenses is conservation not re-allocation to other economic sectors.
<p>5. Define specific natural habitat refuges around Osoyoos Lake foreshore to serve as seed banks and make these off limits to development and off-road vehicles.</p>	<p>Regional District of South Okanagan / Similkameen Town of Osoyoos / Oroville</p>	<ul style="list-style-type: none"> • Sites are representative of habitats required by endangered plants (rather than low-value development sites). • May involve land buy-back / procurement. • Sites are marked, public education component.

Topic area	Potential leader(s)	Possible success factors or benefits
<p>6. Plan and implement additional water treatment between Oliver and Osoyoos, phasing out (draining and filling in) septic fields.</p>	<p>Regional District of South Okanagan / Similkameen Town of Oliver / Osoyoos</p>	<ul style="list-style-type: none"> • Concrete action plan. • Realistic scheme to collect requisite fees to pay for infrastructure. • In immediate term, implement a concrete plan requiring regular servicing of septic tanks (e.g., property tax break if demonstrate service).
<p>7. Concrete plan and timeline to implement universal water metering with block pricing structure (retrofit existing buildings + new developments).</p> <p>> Introduce at a townhall Osoyoos Council meeting – challenge people to accept this and other new regulations and best practices (e.g., xeriscaping, low-flush toilets, etc.).</p>	<p>Regional District of South Okanagan / Similkameen and Town of Oliver and Osoyoos</p>	<ul style="list-style-type: none"> • Bold leadership. • An appropriately escalating (or staged) cost per cubic meter will ensure market dominance for high efficiency technologies and change behaviors. • Define new “green taxes”, development charges, levees, property taxes. • Strengthen local bylaws and building codes to require higher efficiency designs and technologies (e.g., list of permitted landscaping types, low flush toilets).
<p>8. Arrange funding to have an interviewer (e.g., a ‘Mike Roberts’ type person) and film crew professionally record a discussion with Web Hallauer on the history of Osoyoos Lake and its future.</p>	<p>Local contacts with grant funding from IJC?</p>	<ul style="list-style-type: none"> • Permanently captures rich encyclopedic historical knowledge and insights from a unique person.
<p>9. Hold a follow-up Osoyoos Lake Water Forum in Oroville in fall of 2009/2010.</p> <p>> Thematically a “report card” following up on the 2007 OLWSF</p> <p>> Provide an update on IJC Osoyoos Lake Board of Control task force composition.</p>	<p>City of Oroville and Town of Osoyoos; IJC and other 2007 OLWSF Organizing Committee sponsors.</p>	<ul style="list-style-type: none"> • Encourage ongoing accountability towards fulfilling actions identified in this report. • More input on issues from residents of the city of Oroville.

Topic area	Potential leader(s)	Possible success factors or benefits
10. Develop a bi-lateral, "Osoyoos Lake Management Plan". A coherent vision for the lake to help track progress.	BC Ministry of Environment Washington State Department of Ecology Fisheries and Oceans Canada	<ul style="list-style-type: none"> • A focused research based management plan. • Review and recommend water quality and other objectives to be included in new 2013 Board of Control replacement Order. • Created by local community and governments • is used to inform senior governments in Canada and the US of priorities.
11. Fund public education campaign around recommended water saving technologies and outdoor landscaping.	Town of Osoyoos and/or Regional District of South Okanagan / Similkameen	<ul style="list-style-type: none"> • Simple to the point, widespread delivery. • Tax rebates for demonstrating certain practices and retrofits, etc.
Land-use planning and agriculture		
1. Concrete programs and incentives that improve on-farm water management and reduce nutrient loading to Osoyoos Lake.	Agriculture and Agri-food Canada	<ul style="list-style-type: none"> • Irrigation water is based on climate, soil and crop type. • Fertilizers are applied at the minimum optimal levels, not overused. • Use high-efficiency irrigation systems. • More efficient irrigation scheduling (e.g., not watering during rain storms). • Certified designs, irrigation assessments. • More real-time data on the above factors to measure progress.
Ecological restoration, monitoring and endangered species protection		
1. Establish a comprehensively integrated ecological monitoring program based on priority needs (beyond OBMEP). > Initial pilot for Osoyoos Lake and Okanagan River only? > There is need for more coordinated Okanagan Basin monitoring and reporting program, involving the Okanagan Nation Alliance, stewardship groups,	Joint: Fisheries and Oceans Canada, BC Ministry of Environment, Washington Department of Ecology, ONA, Colville Confederated Tribes	<ul style="list-style-type: none"> • Fewer disembodied facts held disparately by multitude of agencies (less "my data, your data"). • Test specific hypotheses, improve synthesis of knowledge. • Okanagan Lake, Okanagan River, Skaha, Vaseaux, Osoyoos Lakes, Similkameen River and Okanogan River. • Expand the South Okanagan Similkameen Conservation Program to include the entire basin.

Topic area	Potential leader(s)	Possible success factors or benefits
provincial and federal governments, UBCO, and municipal governments.		
2. Establish partnerships aimed at raising additional funding for land procurement to support ongoing and new riparian and river restoration.	Joint: Osoyoos Lake Oxbow Society + Okanagan River Restoration Initiative	<ul style="list-style-type: none"> • Attract significant new funding from NGOs like The Nature Conservancy of Canada, Ducks Unlimited. • Establish a land area goal beyond restoring only 2-3km of habitat. • Ensure biological effectiveness monitoring built into these restoration efforts (granting bodies need to be convinced \$ are providing benefits). An effectiveness measure is <i>not</i> something administrative that says “we paid for this many fish screens” or “we inserted x kilometers of riffles.”
3. Strengthen endangered species legislation in British Columbia and Canada.	Environment Canada	<ul style="list-style-type: none"> • Process is science based, law triggers decisive responses by government based on advice of independent scientific panels. • Very limited discretion left in hands of individual ministers. • Development activities, practices that on ‘balance of probabilities’ are likely harmful to the recovery and persistence of species receive swift legal action and fines. These fines large enough that cannot be absorbed into the cost of doing business.

Candidate actions and steps for further scientific investigation

Topic area	Potential leader(s)	Possible success factors or benefits
<i>Water quantity and quality</i>		
1. Work hard to ensure Okanagan Basin Water Supply/Demand Study Phase 2 is a success, and is fully funded to address any significant residual data gaps	Okanagan Basin Water Board, BC Ministry of Environment: Water Stewardship Division, Environment Canada and partners	<ul style="list-style-type: none"> • Successfully updates basin-wide water budget. • Include impacts of water routing, north-south. • Comprehensive, including groundwater supplies. • Takes into account both current situation as well as future climate and demand scenarios. • Once results available, far reaching road-show to raise awareness.
2. Take a more detailed sediment core sample in the north and south basins of Osoyoos Lake. Reconstruct history of nitrogen/phosphorous ratios as well as contaminants entering Osoyoos Lake back to early 1900s. Secondarily, take sediment cores in one or more oxbows to determine if they are holding a disproportionate amount of contaminants or nutrients that would be released upon re-connection with main channel.	Colleges and Universities seeking grant funding for students	<ul style="list-style-type: none"> • Full continuous core to a depth pre-dating European settlement. • Looks at both toxic chemicals (DDT, PCBs, trace metals, etc.) and nutrient isotope ratios. • Collaborate successfully with Oxbow Restoration Society and other groups looking at sediment histories.
3. Establish water quality monitoring in wells below settling lagoons around Osoyoos Lake	Colleges/Universities	<ul style="list-style-type: none"> • New data on seasonal pattern of nutrient loading from this point-source to Osoyoos Lake.
4. Invite university faculty and students to review township of Osoyoos stormwater management plan in context of larger nutrient / toxics footprint assessment	Ken Hall + College/University students	<ul style="list-style-type: none"> • Further independent review of plans set inside broader nutrient/contaminant footprint study. • Includes nutrient impact of summer tourist visits. • New regulations and guidelines for residents and developers.

Topic area	Potential leader(s)	Possible success factors or benefits
5. Map groundwater aquifers on the East side of Osoyoos Lake, in the Osoyoos Indian Band territory.	Osoyoos Indian Band in collaboration with BC Ministry of Environment	<ul style="list-style-type: none"> • Fill this data gap (aquifer morphology, geological information, connectivity). • Establish new monitoring wells that address well levels and ground water quality).
6. Research on total groundwater discharge into Osoyoos lake. > More work needed to improve current estimates of aquifer properties and overall groundwater discharge.	BC Ministry of Environment and Environment Canada Washington State Department of Ecology	<ul style="list-style-type: none"> • Fill this data gap
7. Improved inflow forecasting for Okanagan and Similkameen basins	BC Ministry of Environment (RFC), Washington State Department of Ecology Natural Resources Conservation Service (USDA NRCS) <i>For Similkameen:</i> USDA Natural Resources Conservation Service, NWS NW River Forecast Center	<ul style="list-style-type: none"> • Demonstrate increased predictive accuracy under changing land-use and climate.
8. Continue to support and track outcomes of investigations looking at changing hydrology caused by Mountain Pine Beetle epidemic	BC Ministry of Environment	<ul style="list-style-type: none"> • Quantify water supply impacts.
<i>Land-use planning and agriculture</i>		
1. Increase profile of and access to agricultural water demand modelling results that show optimal water requirements for different crop and soil types.	Agriculture and Agri-food Canada / Pacific Agri-Food Research Centre	<ul style="list-style-type: none"> • Simple web application tool that can be accessed by different water purveyors. • Organize series of workshop for agricultural community. • Build on information available on the Farm West website.

Topic area	Potential leader(s)	Possible success factors or benefits
<i>Environmental restoration, monitoring and endangered species protection</i>		
1. Adaptive management experiments on mitigating temperature-oxygen squeeze mortality for juvenile sockeye salmon in the north basin of Osoyoos Lake	Fisheries and Oceans Canada	<ul style="list-style-type: none"> • Define conditions when should “go for it”; recognize one off experiments may result in sub-optimal lake levels. Achieve buy-in from water managers and others that this is an acceptable short-term consequence. • Define minimum amount of water required. • Perform more than once (not all water years are equal; confounding factors likely exist).
2. Continue to investigate population rebuilding potential and competitive interactions amongst kokanee, sockeye, mysis shrimp and other resident fish species – understand implications of sockeye re-introduction to Skaha Lake	ONA, Fisheries and Oceans Canada, BC Ministry of Environment	<ul style="list-style-type: none"> • Concrete, testable hypotheses. • Consensus on suitability of continuing with sockeye re-introduction. • Identify new management actions (e.g., trophy fisheries, etc.).
<i>Climate change</i>		
1. Continue to support and track outcomes of investigations looking at regional climate change; build into water budgets and inflow forecasting models	BC Ministry of Environment, Washington State Department of Ecology	<ul style="list-style-type: none"> • Alternative probability weighted scenarios.

5. Becoming More Involved – “Who should I contact”?

At the end of the Forum, Forum chairperson and Osoyoos Councillor Stewart Wells stated that he felt the Forum had been highly successful due to the large amount of public interest and the range and quality of information made available. Mr. Wells challenged all Forum participants to take their insight and information away to their homes and businesses and do whatever they can to share information, effect change and get more people involved.

The following list provides some practical ways local citizens can remain engaged in promoting sustainable water resource management in the southern Okanagan.

Suggested ways for local citizens to become involved

- Hold elected officials accountable. Let them know that people care about water sustainability issues. Insist on more potent regulations, more funding for water issues, and change to water licensing legislation.
- Hold developers and the real estate industry more responsible to plan and develop with sensitivity to the ecological needs of Osoyoos Lake and long-term quality of life for its neighboring residents.
- Developers and planners should take more responsibility to enhance their understanding of ecosystem sensitivities and limits.
- Insist on better coordination of water planning and scientific efforts – stay abreast of activities of the Okanagan Basin Water Board and Water Stewardship Council ensure they remain active in this area.
- Consider running for public office.
- Promote regional thinking – water sustainability is an Okanagan basin issue not a regional and municipal one. Everyone needs to think about the basin as a whole because actions in one area of the basin affect downstream areas.
- Stay abreast of developments and contribute to the IJC Board of Control’s review of Osoyoos Lake Orders.
- If you are a student, professor, or parent of a student – encourage your College or University to take on one of the potential projects for students listed above.
- If you own property with a septic system, ensure it is regularly serviced. Lobby municipal governments to expand modern wastewater treatment facilities.
- Replace household water hogging toilets with low flush or dual flush versions.
- If you own property, convert lawns to xeriscaped landscaping. 80% of municipal water consumption in the Okanagan is used outside the home. Anything that you plant other than grass is less water intensive.
- Track and ensure municipal, provincial and federal officials are engaged and considering public concerns related to plans around new dams and reservoirs, especially the Shanker’s Bend proposal on the Similkameen.
- Write a letter to your Federal Member of Parliament requesting they invite the IJC to act as a bridge between Canadian and US governments on projects on the Similkameen River.

- Volunteer, become involved in fundraising or monitoring for a non-profit association or society such as:
 - Osoyoos Oxbow Restoration Society;
 - Okanagan River Restoration Initiative;
 - [BC Lake Stewardship Society](#);
 - [South Okanagan-Similkameen Conservation Program](#); or
 - [Osoyoos Lake Water Quality Society](#). (See the Society's [list of ways residents can prevent abuses of Osoyoos Lake](#)).
- Become more informed about the activities of the [Canadian Okanagan Basin Technical Working Group \(COBTWG\)](#), which is involved in scientific and technical issues associated with managing salmon stocks and habitat in the Canadian portions of the Okanagan River basin (including the Okanagan Fish/Water Management tool and the Skaha Lake sockeye reintroduction projects)
- Contribute your feedback on this summary report to the Osoyoos Lake blog: osoyoolake.blogspot.com

List of organizations, agencies and groups working on projects related to Osoyoos Lake sustainability

Not-for-profit groups

Osoyoos Lake Water Quality Society

P.O. Box 1382
Osoyoos, B.C. V0H 1V0

www.olwqs.org

Phone: Lionel Dallas at 250-495-3341
Alicia Osland at 250-495-3134

Meetings are 3rd Wednesday of each month
(except July, August and December) at 7.30pm at
the Osoyoos United Church

BC Lake Stewardship Society

www.bclss.org

#4-552 West Avenue
Kelowna, BC V1Y 4Z4

Phone: 250-717-1212
Toll-free: 1-877-BCLAKES

Canadian Okanagan Basin Technical Working Group

www.obtwg.ca

Email: information@obtwg.ca

Link to newsletters: www.obtwg.ca/newsletter.html

Osoyoos Oxbow Society Restoration Society

Contact Eike Scheffler
Phone (250) 495-7891

South Okanagan Similkameen Conservation Program

www.soscp.org

102 Industrial Ave.
Penticton, BC. V2A 7C8

Phone: (250) 490-8225

Email: bryn.white@gov.bc.ca

Okanagan Basin Water Board

www.obwb.ca

9848 Aberdeen Road
Coldstream, BC V1B 2K9

Phone: (250) 550-3700

South Okanagan-Similkameen Conservation Program

www.soscp.org

102 Industrial Ave.
Penticton, BC. V2A 7C8

Tel: (250) 490-8225

Agencies

International Joint Commission

www.ijc.org

234 Laurier Avenue West, 22nd Floor
Ottawa, ON K1P 6K6

Phone: 613-995-2984

1250 23rd Street, NW, Suite 100
Washington, D.C. 20440

Colville Tribes Fish & Wildlife Department

nrd.colvilletribes.com

23 Brooks Tracts Road
Omak, WA 98841

Phone: 509-634-2200

Okanagan River Restoration Initiative

Contact: Steve Matthews, Fish and Wildlife
Science and Allocation Section Penticton, BC
Ministry of Environment,
steve.matthews@gov.bc.ca

Water Stewardship Council

www.obwb.ca/wsc/

Monthly meetings in Kelowna. Contact the
Okanagan Basin Water Board for information

Regional District Okanagan-Similkameen

www.rdos.bc.ca

101 Martin St.
Penticton, BC V2A 5J9 Canada

Phone: (250) 492-0237

Toll free: 1 877 610 3737

E-mail: info@RDOS.bc.ca

Okanagan Nation Alliance Fisheries Department

www.syilx.org/naturalresources-fisheries.php

3255C Shannon Lake Road
Westbank, British Columbia

Phone: (250) 707-0095

**BC Ministry of Environment
Regional Operations Penticton**

wlapwww.gov.bc.ca/okr/

102 Industrial Place
Penticton, BC V2A 7C8
Phone: (250) 490-8200

Environment Canada BC office

401 Burrard Street
Vancouver, BC 6C 3S5
Phone: (604) 664-9100

Okanogan Conservation District

ocd.scc.wa.gov

1251 2nd Ave. South, Room 101
Okanogan, WA 98840
Phone: (509) 422-0855, ext. 5

Governments

Confederated Tribes of the Colville Reservation

www.colvilletribes.com

Phone: (509) 634-2200

Town of Osoyoos

www.osoyoos.ca

8707 Main Street
Osoyoos BC, V0H 1V0
Phone: (250) 495-6515

Washington State Department of Ecology

www.ecy.wa.gov

15 West Yakima Avenue, Suite 200
Yakima, WA 98902
Phone: (509) 575-2800

**Agriculture and Agri-food Canada
Pacific Agri-Food Research Centre**

sci.agr.ca/parc-crapac/

4200 Highway 97
Box 5000
Summerland BC V0H 1Z0

Okanagan Nation Alliance

www.syilx.org

3255C Shannon Lake Road
Westbank, British Columbia
Phone: (250) 707-0095

City of Oroville

orovillewashington.com

P. O. Box 2200
Oroville, WA 98844
Phone: (509) 476-2926

6. Concluding Remarks

“Just going less unsustainable is not really sustainable development is it?”

– anonymous audience member

During the Forum, a tension surfaced as local residents and government officials jockeyed back and forth over the means of achieving more potent water management **regulations**. The vast majority of participants at the Forum were telling their government leaders they were prepared to accept tougher regulations aimed at sustainable water resource use, while many planners and political figures shrugged this off saying governments cannot do it for you – “there is no knight on a white horse”. This area of discussion had strong audience resonance but in the end was left in ideological limbo.

Several authors² have emphasized the ineffectiveness of voluntarism in helping shape effective climate policy, a conclusion we believe applies equally well to water resource management. That is – voluntarism *alone* will not bring about the significant changes needed in the face of rapidly growing population and changing climate. If politicians and regulators insist on voluntary behavioral change by individuals to solve water resource management problems – it is safe for the public to assume failure.

This is not to say that raising public awareness is unimportant and individual action doesn’t matter. To the contrary, it will *help* overcome the reluctance of political and business leaders to respond. With greater public awareness and education, it is easier to follow-up with meaningful regulations, incentives, credits and other policies. Further, from this more educated public more informed leaders around water resource issues are more likely to emerge. However, public education and voluntary behavioral change is insufficient to drive the rate and magnitude of policy and regulatory changes that are needed to realize sustainable water resource use in the Okanagan basin. Instead, it takes bold leadership based on doing “the right thing” for the future electorate – our children and grandchildren.

As one example, take the sometimes unpopular idea of universal water metering. Some argue (forcefully) that metering does little to reduce water use. This is contrary to economic studies that prove that a sufficiently escalating cost per m³ will ensure market dominance for high efficiency technologies and cut-backs on overall use (e.g., “I can do something other than grow Alfalfa in this desert”, or, “my lawn doesn’t really need to be growing mushrooms in August”). Political figures and planners – not the public – are in the business of devising and passing by-laws, approving building applications, and setting regulations and taxes. However, everyone appreciates that radically unpopular ideas shorten political lives. So clearly it is a marriage – both public pressure and regulatory action work hand-in-hand.

In conclusion, the thoughtful participants of the OLWSF have the power to catalyze a broader water sustainability movement by helping their elected representatives and fellow citizens move through the change-path in Figure 2. An ecologically, socially and economically vibrant future is possible in the Okanagan if we move more purposefully and more rapidly through this emotional and intellectual evolution.

² e.g., Jeffrey Simpson , Mark Jaccard and Nic Rivers, authors of “Hot Air: Meeting Canada's Climate Change Challenge”.

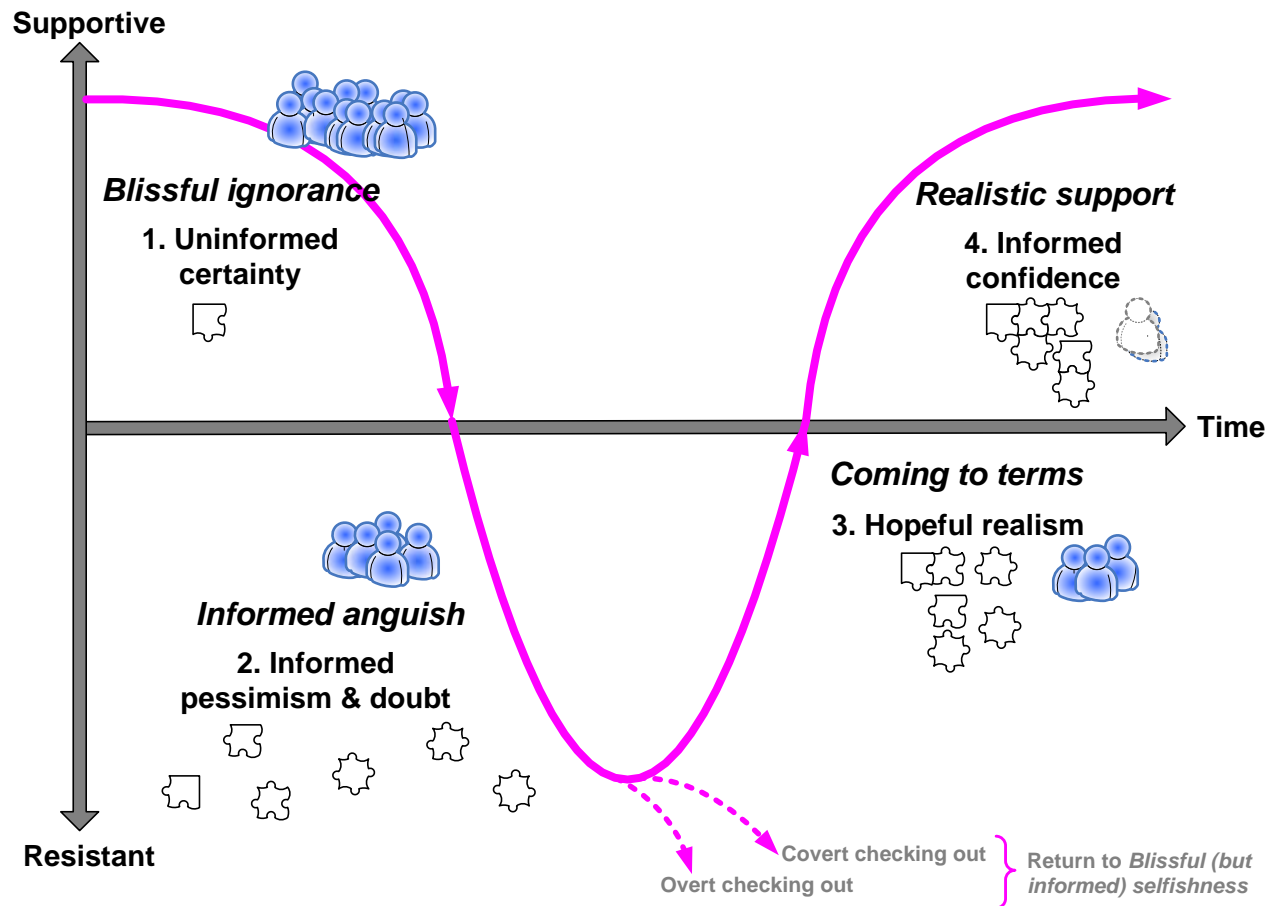


Figure 2: Typical human behavioral change pathway and associated emotional and intellectual states. In relation to water resource management, most Osoyoos Lake Water Science Forum participants belong either in stage 2 and 3. A large fraction of the public at large are members of stage 1. Realizing significant real-world change around water resource management requires moving a much larger fraction of society from stage 1 to stage 4.

Appendix A: Contact Details for Presenters and Panelists

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Appendix B: Presentations, Abstracts and Forum Program

Powerpoint presentations delivered at the Forum are available at the Okanagan Basin Water Board website (www.obwb.ca/olwsf/).

The Forum Program (including all presentation abstracts) are available at www.obwb.ca/fileadmin/docs/Osoyoos_Lake_Water_Science_Forum_Program.pdf

Appendix C: Internet Links

Online data

Environment Canada

Government of Canada - sustaining the environment and resources for Canadians (general information portal) environmentandresources.ca

Species at Risk Act public registry: www.sararegistry.gc.ca/default_e.cfm

spOKE: spoke.pyr.ec.gc.ca (full site will be launched in November 2007)

Real-time hydrologic data for B.C. <http://scitech.pyr.ec.gc.ca/waterweb/formnav.asp?lang=0>

U.S. Geological Survey

Real-time hydrologic data for Washington waterdata.usgs.gov/wa/nwis/current/?type=flow

Washington Department of Ecology

Ecology's Environmental Information Management (EIM) database www.ecy.wa.gov/eim

Washington State Department of Ecology Water Quality www.ecy.wa.gov/programs/wq/wqhome.html

Washington State Department of Ecology Water Quality Assessment (303[d]) & Water Quality Improvement Projects (TMDLs) www.ecy.wa.gov/programs/wq/links/wq_assessments.html

Water Quality Assessment for Washington, Interactive Mapping Tool
apps.ecy.wa.gov/wqawa/viewer.htm

Okanagan River at Oroville, Similkameen River at Oroville Water quality data
www.ecy.wa.gov/apps/watersheds/riv/stationlistbywria.asp?searchterm=oroville

Washington State Department of Ecology Ground and Surface Water Quality Information
www.ecy.wa.gov/programs/wq/links/standards.html

Washington State Department of Ecology River and Stream Water Quality monitoring data
www.ecy.wa.gov/programs/eap/fw_riv/rv_main.html#4

Washington State Department of Ecology Environmental Information Management Database search
www.ecy.wa.gov/eim/

BC Ministry of Environment

The Water Resource Atlas, an excellent GIS application for public use
www.env.gov.bc.ca/wsd/data_searches/wrbc/

A-Z Water Index, access to a variety of water information sites www.env.gov.bc.ca/wsd/a-z_index.html

Water quality and quantity web sites

BC government water quality guidelines, objectives, attainment reporting, and area specific studies
www.env.gov.bc.ca/wat/wq/

Trends in water quality of the main Okanagan lakes
wlapwww.gov.bc.ca/kor/epd/pdf/water_quality/ok_large_lakes_wq.pdf

Snow, river and groundwater level information www.env.gov.bc.ca/rfc/river_forecast/water_supply.htm

Information archive web sites

Environmental Information Repository System
aardvark.gov.bc.ca/apps/eirs/enterEirs.do?repository=EPD

EcoCat: Ecological Reports Catalogue srmapps.gov.bc.ca/apps/acat/

Development and pollution prevention web sites

Best Management Practices to reduce Non-point Source Pollution
www.env.gov.bc.ca/wat/wq/nps/BMP_Compendium/Municipal/Municipal_Home.htm

Develop with Care: Environmental Guidelines for Urban and Rural Land Development in British Columbia www.env.gov.bc.ca/wld/documents/bmp/devwithcare2006/develop_with_care_intro.html

Geographical information

US Geological Survey geography discipline geography.usgs.gov

Natural Resources Canada online Atlas atlas.nrcan.gc.ca

Sensitive Habitat Information Mapping www.shim.bc.ca

Societies and co-operative initiatives

BC Lake Stewardship Society & the BC Lake Stewardship & Monitoring Program www.bclss.org

Osoyoos Lake Water Quality Society www.olwqs.org

Canadian Okanagan Basin Technical Working Group obtwg.ca

Okanagan Fish/Water Management Tool www.ok.fwmt.net

Okanagan River Restoration Initiative obtwg.ca/initiatives.html#restore

Osoyoos Oxbow Restoration Society www.olwqs.org/oxbows.html

Okanagan Basin Monitoring and Evaluation Program nrd.colvilletribes.com/obmep/

South Okanagan Similkameen Conservation Program www.soscp.org

Governing bodies

Okanagan Nation Alliance syilx.org

Okanagan Nation Alliance Fisheries Department syilx.org/naturalresources-fisheries.php

Colville Confederated Tribes www.colvilletribes.com/

Colville Confederated Tribes Natural Resources Department nrd.colvilletribes.com

Water Stewardship Council www.obwb.ca/wsc/

Okanagan Basin Water Board www.obwb.ca

Westside Joint Water Committee www.wjwc.ca

City of Oroville orovillewashington.com

Town of Osoyoos www.osoyoos.ca

Osoyoos Indian Band www.oib.ca

British Columbia - Washington Environmental Cooperation Council www.env.gov.bc.ca/spd/ecc/

International Osoyoos Lake Board of Control
www.ijc.org/conseil_board/osoyoos/en/osoyoos_home_accueil.htm

International Joint Commission www.ijc.org

Washington State Department of Ecology www.ecy.wa.gov

BC Ministry of Environment Water Stewardship division www.env.gov.bc.ca/wsd/

BC Ministry of Environment Environmental Protection Division www.env.gov.bc.ca/epdiv/

BC Ministry of Environment Environmental Stewardship Division www.env.gov.bc.ca/esd/

Regional District of the Central Okanagan www.regionaldistrict.com

Regional District Okanagan-Similkameen www.rdos.bc.ca

Regional District of North Okanagan www.nord.ca

Plans

IJC Osoyoos Lake Plan of Study that will be used to inform a new "Order" from the Commission for the operation of Zosel Dam beginning in 2013 www.ijc.org/rel/boards/osoyoos/final_pos_060811.pdf

Town of Osoyoos Official Community Plan 2007 www.osoyoos.ca/upload/dcd279_OCP_Bylaw.pdf

Shanker's Bend dam project website: www.okanoganpud.org/shankers/shankersmain.htm

Reports and publications

Report on the sediment core that was taken from Osoyoos Lake as part of the Okanogan River DDT and PCB TMDL conducted in 2001 www.ecy.wa.gov/biblio/0303013.html

Ambient monitoring data for lower Okanogan stations
www.ecy.wa.gov/apps/watersheds/riv/stationlistbywria.asp?searchterm=oroville

TMDL Technical Assessment of DDT and PCBs in the Lower Okanogan River Basin (June 2003)
www.ecy.wa.gov/biblio/0303013.html

Lower Okanogan River Basin DDT and PCBs Total Maximum Daily Load (October 2004)
www.ecy.wa.gov/biblio/0410043.html

DDT in Osoyoos Lake Fish (December 1998) www.ecy.wa.gov/biblio/98337.html

Washington State Pesticide Monitoring Program: 1994 Fish Tissue and Sediment Sampling Report (December 1996) www.ecy.wa.gov/biblio/96352.html

BC Ministry of Environment Environmental Protection Division Water quality reports
www.env.gov.bc.ca/wat/wq/

BC Ministry of Environment Environmental Protection Division Okanagan Large Lakes Water Quality Monitoring Program wlapwww.gov.bc.ca/kor/epd/pdf/water_quality/ok_large_lakes_wq.pdf

International Joint Commission publications
www.ijc.org/php/publications/biblio_library.php?language=english

Adaptations and Impacts Research Division, UBC www.ires.ubc.ca/aird/publications.html

Washington State Department of Ecology publications search www.ecy.wa.gov/pubs.shtm