Osoyoos Lake Water Science Forum

We gratefully thank our sponsors, without whom this event could not have taken place.

Fisheries and Oceans Canada | Pêches et Océans Canada

OSOYOOS INDIAN BAND DEVELOPMENT CORPORATION

WASHINGTON STATE DEPARTMENT OF ECOLOGY

OSOYOOS — THE HOME OF CANADA'S ONLY DESERT

INTERNATIONAL JOINT COMMISSION • COMMISSION MIXTE INTERNATIONALE — 1909

OROVILLE

USGS science for a changing world

BRITISH COLUMBIA The Best Place on Earth | Ministry of Environment

watermark BEACH RESORT

indigo LAKE OSOYOOS

BRITISH COLUMBIA The Best Place on Earth | Ministry of Community Services

Osoyoos Credit Union www.ocubc.com

Destination OSOYOOS TOURISM & COMMUNITY ECONOMIC DEVELOPMENT

REGIONAL DISTRICT RDOS OKANAGAN-SIMILKAMEEN

OSOYOOS LAKE WATER QUALITY SOCIETY

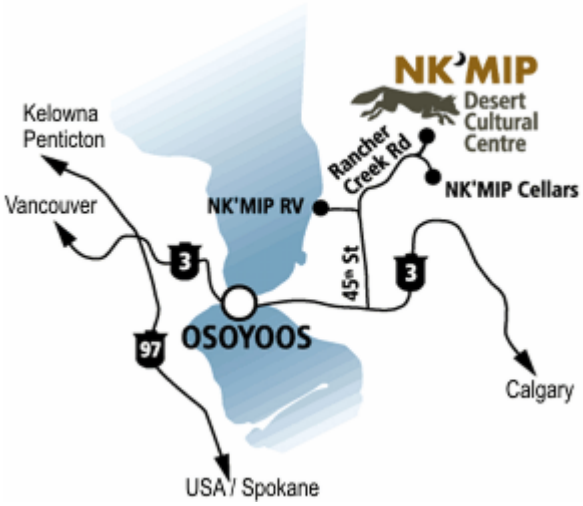
Okanagan Basin WATER BOARD

Venues:

Nk'mip Desert Cultural Centre
1000 Rancher Creek Road, Osoyoos BC, Phone: (250) 495-7901

Sonora Community Centre
8505 68th Avenue, Osoyoos BC, Phone: (250) 495-6562

Nk'mip Desert Cultural Centre



Sonora Community Centre (arrow on inset map)

Welcome

Welcome to beautiful Osoyoos, B.C., and to Osoyoos Lake! This beautiful lake spanning the Canada-United States border in the Okanagan River basin is subject to a wide array of challenges to sustainability in the 21st century. Osoyoos Lake presents, in a sense, a microcosm of global concerns. The Osoyoos Lake Water Science Forum is an important step in focusing attention on the needs and challenges involved in sustaining the ecological health of the lake along with the related well-being of the basin's residents and visitors. Lake sustainability will depend on the actions of all who work, live or visit the basin, and all those involved in governance.

To help meet this need, many collaborating organizations have developed a comprehensive two day program emphasizing a local and regional watershed approach to discuss the sustainability of Osoyoos Lake aimed at developing a common understanding of science findings, and identifying research gaps and needs. Further, another focus of the OLWSF is, in collaboration with all OLWSF participants, to incorporate science findings and research needs into next step actions to help sustain Osoyoos Lake. The OLWSF is designed to be interactive. Implications for basin area residents and the foundation for identifying next steps is to be driven by ideas coming from basin residents and involved researchers and will be presented in the outcome report of the forum.

We have a full slate of great presentations, panelists and roundtable discussions for which we want you to be an active participant. We certainly appreciate you taking the time out of your busy schedule to join us and share your experiences, ideas and exchange information with other conference participants. On behalf of the OLWSF Organization Committee, I would like to say "Welcome to Osoyoos!"

Stu Wells, Chair, OLWSF Local Arrangements Committee

Our goal

Our goal is to provide an opportunity to learn, share and develop strategies to work together to improve Osoyoos Lake and promote its future sustainability.

Background

This forum is your opportunity to share your experiences, learn and provide input on issues pertaining to water sustainability in Osoyoos Lake, as well as the Okanagan Basin. Public concerns regarding existing water quality and the sustainability of Osoyoos Lake continue to be expressed. To address this concern, the Town of Osoyoos – working collaboratively with many local, state, provincial, federal and bi-national organizations – is holding a bi-national water science forum focused on this basin straddling the Canada-US border.

Come join us to learn, share your experiences and provide input on various aspects influencing the sustainability of Osoyoos Lake. One forum outcome proposed is a facilitated citizen and agency leader round table discussion concluding in defining possible action items and next steps to be incorporated in the final forum report. The report will be made available to forum participants and the public.

The forum will emphasize a local and regional watershed approach to sustainable water resources by geographically focusing on the Lake's biological, chemical and physical integrity within the context and as it may be influenced by factors taking place within the larger Okanagan.

The Okanagan basin, including Osoyoos Lake has the least water per capita of all Canadian basins (Statistics Canada) and consistently ranks at or near the top in lists of Canada's most threatened rivers. The river and lake provide essential spawning and rearing habitat to one of the two remaining Sockeye runs in the Columbia basin.

Tuesday "exit" door prize – Spirit Ridge Spa Resort

There will be a door prize draw on Tuesday afternoon during the forum closing remarks. All registered forum participants be eligible for the prize, but must be present at the draw in order to claim it.

The prize includes one night accommodation in a luxury suite at Spirit Ridge Vineyard Resort and Spa, two 9-hole rounds of golf at the Sonora Dunes Golf Course and dinner for two with a bottle of Nk'mip wine at Passa Tempo bistro at Spirit Ridge.

Acknowledgements

Funding bodies

Destination Osoyoos
BC Ministry of Community Services
BC Ministry of Environment
City of Oroville
Fisheries and Oceans Canada
Indigo – Kingsway Group of Companies
International Joint Commission
Okanagan Basin Water Board
Osoyoos Credit Union
Osoyoos Indian Band Development Corporation
Osoyoos Lake Water Quality Society
Regional District of Okanagan Similkameen
Town of Osoyoos
US Geological Survey
Washington State Department of Ecology
Watermark Beach Resort

Forum organizing committee

Bob Clark, Okanogan Conservation District
Mark Colosimo, International Joint Commission
Lionel Dallas, Osoyoos Lake Water Quality Society
Denise Eastlick, Destination Osoyoos
Denise E. Mills, Washington State Department of Ecology
Kim Hyatt, Fisheries and Oceans Canada
Robert Kimbrough, U.S. Geological Survey
Tom McAuley, International Joint Commission
Daniel Millar, International Osoyoos Lake Board of Control
Craig Nelson, Okanogan Conservation District
Mark Peterschmidt, Washington State Department of Ecology
Brian Symonds, BC Ministry of Environment
Anna Warwick Sears, Okanagan Basin Water Board
Stu Wells, Osoyoos Town Councillor

Special thanks to

Clint Alexander and Kelly Robson, ESSA Technologies Ltd.
Joanne Caldecott, Town of Osoyoos
Denise Eastlick, Destination Osoyoos
Miller Springs Water

Agenda

Sunday, September 16

Welcome reception at Nk'mip Desert Cultural Centre

5:00–7:30 pm **Welcome reception**

- **Welcome to Osoyoos Band Traditional Territory**
- **Opening prayer**
  Modesta Betterton, Osoyoos Indian Band
- **Overview of First Nations perspectives on fish, water and land management**
  Howie Wright, Sr. Fisheries Biologist, Okanagan Nation Alliance Fisheries Department
- **Overview of Confederated Tribes of the Colville Reservation perspectives on fish, water and land management**
  Joe Peone, Confederated Tribes of the Colville Reservation

Monday, September 17

Science associated with Osoyoos Lake - past, present and future research needs (at Sonora Community Centre)

7:00–8:00 am **Continental breakfast at the Science Forum**

8:00–9:30 am **Opening plenary session**

- **Welcome to Osoyoos Band Traditional Territory**
  Tony Baptiste, Osoyoos Indian Band
- **Opening prayer**
  Modesta Betterton, Osoyoos Indian Band
- **Welcomes and opening remarks**
  - Senator Ross Fitzpatrick
  - John Slater, Mayor of Osoyoos and Chair of the Okanagan Basin Water Board
  - Walt Hart, Pro-tem Mayor of Oroville, Washington
  - Irene Brooks and Jack Blaney, IJC Commissioners
  - Mark Pendergraft, Director, Regional District Okanagan-Similkameen
- **A historical perspective of Osoyoos Lake**
  Web Hallauer, former State of Washington Senator and Brian Symonds, Director, Regional Operations Branch Penticton, Water Stewardship Division, BC Ministry of Environment

9:30–10:10 am Scientific findings in water quality

- **Water quality trends in Okanagan, Skaha and Osoyoos Lakes in response to nutrient reductions and changing hydrology**
  Vic Jensen, Environmental Impact Biologist, Environmental Quality Section Penticton, BC Ministry of Environment
- **Scientific findings in water quality – Osoyoos Lake**
  Lionel Dallas, Director, Osoyoos Lake Water Quality Society

10:10–10:30 am Break

10:30–11:10 am Scientific findings in water quality (continued)

- **The influence of seasonal water supplies and water regulation on interactions among nutrient levels, production processes and water quality in Osoyoos Lake**
  Kim Hyatt, Research Scientist, Salmon Section, Fisheries and Oceans Canada
- **Water quality monitoring in Osoyoos Lake and downstream in the Okanogan River**
  Denise Mills, Section Manager, Water Quality Program, Central Region, Washington State Department of Ecology

11:10–12:10 pm Impacts on water quality and quantity: what do we and don't we know?

- **Groundwater issues in the Osoyoos Basin**
  Gwyn Graham, Senior Hydrogeologist, Water Management and Indicators Section, Environment Canada
- **Impacts of land use and climate on agricultural water demand implications for water supply and management**
  Denise Neilsen, Research Scientist, Environmental Health, Summerland, Agriculture and Agri-Food Canada
- **Sewer systems, septic tanks and urban runoff: non-point source pollution to Osoyoos Lake**
  Ken Hall, Professor Emeritus, Institute for Resources, Environment and Sustainability, University of British Columbia

12:10–1:10 pm Group lunch (catered)

1:10–2:30 pm Scientific findings: the influence of water quality and quantity on fisheries and species-at-risk

- **Okanagan River Restoration Initiative: an ecosystem based approach to river restoration**
  Steve Matthews, Section Head, Fish and Wildlife Science and Allocation Section Penticton, BC Ministry of Environment
- **"Squeeze play": the role of temperature, oxygen, and annual climate variations in controlling habitat utilization by juvenile sockeye salmon in Osoyoos Lake**
  D. Paul Rankin, Biologist, Fisheries and Oceans Canada
- **The influence of water temperature and discharge variations on Okanagan sockeye salmon migration, spawning and egg incubation**
  Margot Stockwell, Biologist, Fisheries and Oceans Canada
- **Plant and animal species at risk**
  Orville Dyer, Wildlife biologist, BC Ministry of Environment, co-chair of the Southern Interior Rare Plants Recovery Team

2:30–3:30 pm **Lake water quality case studies – how others approach filling water quality data gaps and assessment**

- **Osoyoos Lake DDT Study, State of Washington Department of Ecology**
  Brandee Era-Miller, Environmental Specialist, Environmental Assessment Program, Washington State Department of Ecology
- **Moses Lake nutrient management decision support modeling**
  Marcie Mangold, Water Quality Program, Eastern Region, Washington State Department of Ecology
- **Panel on data and knowledge gaps and possibly how to fill them**
  Kim Hyatt, Steve Matthews, Brandee Era-Miller, Marcie Mangold, Clint Alexander (facilitator)

3:30–3:50 pm **Break**

3:50–4:30 pm **Water and climate change in Osoyoos Basin**

- **Potential impacts of climate change on life history events of Okanagan salmonids**
  Kim Hyatt, Research Scientist, Salmon Section, Fisheries and Oceans Canada
- **Implications of climate change for Okanagan Basin water availability and salmonid restoration planning**
  Clint Alexander, Team Leader / Technical Architect, ESSA Technologies Ltd.

4:30–5:30 pm **Perspectives on flow augmentation**

- **Past and present exploration of water diversions from the Similkameen River**
  Kris Kauffman, President, Water Rights Inc., Lakewood, WA
- **Perspectives on flow augmentation: A BC provincial perspective**
  Brian Symonds, Director, Regional Operations Branch Penticton, Water Stewardship Division, BC Ministry of Environment
- **The state of Washington's Columbia River Water Management Program**
  Doug Johnson, P.E., Dam Safety Supervisor, Water Resources Program, Washington State Department of Ecology

5:30 pm **Adjourn**

Tuesday, September 18

Transboundary community stewardship and Osoyoos Lake sustainability (at Sonora Community Centre)

7:00–8:00 am **Continental breakfast at the Science Forum**

8:00–9:00 am **Bi-lateral watershed stewardship perspectives**

- **British Columbia Washington Environmental Cooperation Council**
  Tom Laurie, Governmental Liaison, Washington State Department of Ecology & David Grace, Senior Policy Advisor, BC Ministry of Environment
- **Okanagan Basin Water Board – a watershed approach**
  Anna Warwick Sears, Okanagan Basin Water Board
- **IJC's International Osoyoos Lake Board of Control activities**
  Glen Davidson, Director, Management and Standards Branch, BC Ministry of Environment

9:00–10:20 am **Communication and technical information sharing; existing mechanisms and options for improvements**

- **Washington State Department of Ecology Internet accessible information**
  Mark Peterschmidt, TMDL Lead, Water Quality Program, Central Region, Washington State Department of Ecology
- **BC Ministry of Environment Water resource information on the Internet**
  Vic Jensen, Environmental Impact Biologist, Environmental Quality Section Penticton, BC Ministry of Environment
- **Okanagan Land and Water Information System**
  Beverly McNaughton, Senior Scientist, Pacific and Yukon Water Quality Monitoring, Environment Canada
- **Okanagan Fish-and-Water Management Tools (OK-FWMT): a decision support system to balance water objectives in real-time**
  Kim Hyatt, Research Scientist, Salmon Section, Fisheries and Oceans Canada

10:20–10:50 am **Break**

10:50–12:10 pm **Stewardship activities and programs – near and far; the role of governments in community stewardship**

- **Role and limitations of government programs in community stewardship**
  Craig Nelson, District Manager, Okanogan Conservation District
- **The BC Lake Stewardship Society & the BC Lake Stewardship & Monitoring Program**
  Carolyn Johns & Kristi Carter, Project Coordinators, BC Lake Stewardship Society
- **Oroville-Tonasket Irrigation District**
  Tom Scott, Secretary/Manager, Oroville-Tonasket Irrigation District
- **Investigation of the feasibility of re-connecting abandoned oxbows in the Okanagan River upstream of Osoyoos Lake**
  Eike Scheffler, Osoyoos Oxbow Society Restoration Society and Brian Guy, Summit Environmental Consultants Ltd.

12:10–1:10 pm **Group lunch (catered)**

1:10–2:10 pm **Municipal and regional urban planning update**

- **Keeping up with the Canadians – planning in the wake of growth**
  Chris Branch, Planning and Community Development Director, City of Oroville
- **Innovative storm water management**
  Steve Shannon, Assistant Planner, Town of Osoyoos Planning Department
- **Regional District of Central Okanagan water management planning**
  Leah Hartley, Regional Planner, Regional District of Central Okanagan

2:10–2:30 pm **Break**

2:30–4:00 pm ***Facilitated full audience round table discussion***
Working collaboratively towards a sustainable Osoyoos Lake (and Okanagan Basin)
Denise Mills, Brian Symonds, Joe Peone, Chris Branch, John Slater, Dennis Beich, Barry Rosenberger, Bernard O. Bauer, Anna Warwick Sears, Clint Alexander (facilitator)

4:00-4:15 pm **Closing remarks and door prize draw**
Irene Brooks and Jack Blaney, IJC Commissioners

4:15 pm **Adjourn**

Presentation abstracts

Sunday, September 16

Overview of First Nations perspectives on fish, water and land management

Howie Wright, Sr. Fisheries Biologist, Okanagan Nation Alliance Fisheries Department, hwright@syilx.org

The Okanagan Nation Alliance Fisheries Department (formerly the Okanagan Nation Fisheries Commission, or ONFC) was established in 1995 under the direction of the Okanagan Nation Alliance and member communities to take a role in the management of fisheries and aquatic resources. The goal and mandate of the ONAFD is the conservation, protection, restoration, and enhancement of indigenous fisheries (anadromous and resident) and aquatic resources within Okanagan Nation Territory. On a watershed level, the Okanagan Nation Territory includes the Okanagan Basin, the Similkameen Basin, and the Kettle Basin, as well as parts of the Columbia Basin (Columbia River and Arrow Lakes) and Thompson Basin (Shuswap River and Salmon River). The ONAFD works to provide technical fisheries assistance for the Nation and its seven member Bands and acts as a liaison with federal and provincial fisheries agencies.

Overview of Confederated Tribes of the Colville Reservation perspectives on fish, water and land management

Joe Peone, Confederated Tribes of the Colville Reservation, joe.peone@colvilletribes.com

The Okanogan basin is of significant cultural and historic importance to the Colville Confederated Tribes. The rivers provide subsistence and opportunities to practice a traditional way of life. It maintains the Tribal culture and shared values across International boundaries.

The Tribes have focused considerable efforts in enhancement and restoration of the ecosystem with various restoration and passage improvements to recover and enhance anadromous fish runs in the Okanogan basin. Water quality and quantity issues in the Okanogan and Similkameen have the potential to impact anadromous recovery efforts.

Sediments, elevated temperatures, and contaminates from point and non-point sources can have had episodic and catastrophic releases, resulting in acute and short term elevations that can impact fish reproduction and productivity. A sediment study conducted by the Tribes in 2001–2002 indicated that the mean arsenic levels in the Similkameen are approaching Probable and Severe Effects Levels and the maximum detected level is at a magnitude of 10 higher than the Severe Effects Level.

The Colville Confederated Tribes would like to see the BC/WA Environment Cooperative Council facilitate meaningful communication between policy makers from both sides of the border. A survey of potential sources and a risk analysis associated with those sites is needed as is the development of a focused effectiveness monitoring plan. Efforts to stabilize potential sources should focus on known point sources where significant progress would benefit the ecosystem. An assessment of unrestricted development along shorelines and the present non-regulatory approach effects on current and future water quantity and sustainable flows should also be conducted.

Monday, September 17
Science associated with Osoyoos Lake - past, present and future research needs

8:30 am **A historical perspective of Osoyoos Lake**

Web Hallauer, former State of Washington Senator
Brian Symonds, Director, Regional Operations Penticton, BC Ministry of Environment, brian.symonds@gov.bc.ca

Our current understanding and management of Osoyoos Lake has been strongly influenced by both natural and human events of the past. A historical perspective of the lake and the events surrounding it provides us with a context through which we can look forward into the future.

One of the more significant historical events was the creation of the international boundary running through the lake. The border not only divides responsibility for the water and surrounding lands but it also influences our perspectives of Osoyoos Lake. For example, many Canadians view Osoyoos Lake as the downstream extent of the Okanagan Basin. From an American perspective Osoyoos Lake is in the middle of a larger Okanogan Watershed, one which includes Similkameen River.

Although divided, extreme natural hydrologic events, such as the drought in the 1920s and 1930s, and the floods of 1894, 1942, 1948 and 1972, have impacted, and will continue to impact, communities on both sides of the border. Similarly, human factors such as the effects of continued growth in Canada or the regulation of lake levels by Zosel Dam in Oroville impact water in both countries. As in past, our common interest in the water in Osoyoos Lake provides us with an opportunity for future transboundary discussions and cooperation.

Scientific findings in water quality

9:30 **Water quality trends in Okanagan, Skaha and Osoyoos Lakes in response to nutrient reductions and changing hydrology**

Vic Jensen, Environmental Impact Biologist, Environmental Quality Section Penticton, BC Ministry of Environment, vic.jensen@gov.bc.ca

The population of the Canadian Okanagan basin is approximately 300,000, tripling every 30-40 years since 1940, and presently exhibits one of the fastest growth rates in the province of British Columbia. o guard Okanagan, Skaha, and Osoyoos lakes from excessive eutrophication, phosphorus (P) reduction from municipal sewage treatment plants was implemented in various stages since 1971. Improved water quality is most evident in Skaha Lake, and to a lesser extent Osoyoos Lake. Phosphorus, and autumnal phytoplankton chlorophyll a values are decreasing and hypolimnetic dissolved oxygen readings have increased in Skaha. Similar trends but to a lesser extent have occurred in Osoyoos Lake but with considerable year to year variability. Hydrologic variation and non point source nutrient pollution, internal recycling account for the majority of the nutrient variation observed in these lakes.

9:50 **Scientific findings in water quality – Osoyoos Lake**

Lionel Dallas, Director, Osoyoos Lake Water Quality Society, dallas@vip.net

The Osoyoos Lake Water Quality Society was formed as the result of a devastating report filed by Okanagan College (as it was known then) in 1989 and made public.

We are the second such society to have been formed in this Province for similar purposes, to monitor and report on the Lake and work with various Ministries in this regard and make such findings public and assist in anyway to improve the condition of the Lake. We have acquired our own boat and between April and October we obtain and record data and

forward it to the Ministry of Environment and also work with the Fisheries and Oceans Canada.

The Osoyoos Lake Water Quality Society has 100 supporting members and a newsletter is made public in local media about monthly.

10:30 The influence of seasonal water supplies and water regulation on interactions among nutrient levels, production processes and water quality in Osoyoos Lake

Kim Hyatt, Research Scientist, Salmon Section, Fisheries and Oceans Canada hyattk@pac.dfo-mpo.gc

Contributors: Don McQueen, York University; Kim Hyatt, and D. Paul Rankin, Pacific Biological Station, Science Branch, Fisheries and Oceans Canada

Several decades of research by limnologists have firmly established that water quality in most north-temperate zone lakes is controlled through a series of well understood processes that follow a predictable seasonal cycle.

During the winter months cold temperatures and low light levels limit biological production such that water quality normally remains high. As light levels increase and lakes warm in spring through summer, all types of biological activity increase rapidly including uptake of nutrients and production by microscopic phytoplankton. Progressive warming generally results in stratification of lakes into a warm, productive surface layer where phytoplankton production is controlled by nutrient availability (rather than light) and a cooler, deeper layer where phytoplankton production is light rather than nutrient limited. Consequently, water quality (transparency, organic content, taste, odour) during the summer and fall is generally related in a consistent way to surface water nutrient levels that control phytoplankton, zooplankton and even fish production from the "bottom up."

Observations of seasonal changes to nutrient loading, phytoplankton biomass and water transparency in Osoyoos Lake are not generally consistent with the standard "bottom-up" control model linking nutrient inputs, lake productivity and water quality parameters. Further analyses suggest that seasonal variations in biological processes and water quality are influenced greatly by the small volume of Osoyoos Lake and an exceptionally high, average flushing rate associated with its geographic location and water management operations of the Okanagan Lake and Reservoir System.

Although patterns of Osoyoos Lake level maintenance and water releases at Zosel Dam undoubtedly have some subtle influences on the lake's limnology, annual variations in production and water quality of Osoyoos Lake are predominantly controlled by natural and anthropogenic processes operating in upstream portions of the Okanagan basin.

10:50 Water quality monitoring in Osoyoos Lake and downstream in the Okanogan River

Denise E. Mills, Washington Department of Ecology, Central Region Section Manager, Water Quality Program, dmil461@ecy.wa.gov

The Department of Ecology has completed seven studies in Osoyoos Lake and the lower Okanogan River since 1983 to assess the distribution and occurrence and concentrations of the pesticide DDT and its breakdown products (herein "DDT") and polychlorinated bipenyls (PCBs) in sediment and edible fish tissue. Concentrations in some fish were above levels established by Washington state to protect humans from exposure to these chemicals in drinking water or in aquatic organisms.

Based on data from these studies and other sources, some portions of the Okanogan River, Osoyoos Lake, and tributaries in the basin have been included on the state's list of impaired waters [the "303(d) list"]. Data collected in 2001 and 2002, and recently in 2006, showed lower DDT concentrations in fish tissue than were found in the 1980s and 1990s. In 2004 Ecology published a water quality cleanup plan (a total maximum daily load, or TMDL) for DDT and PCBs in the lower Okanogan River, which set targets for lowering concentrations of these contaminants to align with human health criteria. This plan encourages the use of best management practices on land to prevent erosion and transport of contaminated soils and sediments into surface waters in order to reduce DDT

and PCB loadings, although natural attenuation of DDT already in stream and lake sediments may be also important.

More study is needed to develop a better understanding of the distribution of DDT and PCBs in fish, sediments, and water in the lower Okanogan River system, and to assess the occurrence of episodic DDT loadings into surface waters. Ecology has also monitored water quality for conventional parameters at ambient stations on the Okanogan River and Similkameen River near Oroville for nearly 30 years, and portions of the Okanogan River and its tributaries are included on the state's 303(d) list for nonattainment of temperature and coliform bacteria standards. TMDLs have not been developed for these listings, but some of the measures identified to reduce DDT and PCBs loads, and measures to protect and manage riparian areas can also be effective for achieving water quality improvement goals.

Impacts on water quality and quantity: what do we and don't we know?

11:10 Groundwater issues in the Osoyoos Basin

Gwyn Graham, Senior Hydrogeologist, Water Management and Indicators Section, Environment Canada, gwyn.graham@ec.gc.ca

Contributors: Gwyn Graham and Basil Hii, Environment Canada

Groundwater is an important part of the water balance in the Osoyoos Lake Basin. In this dry environment, natural groundwater supply is derived from seasonal precipitation (rainfall and snowmelt) over permeable sand and gravel deposits of glacial origin that form aquifers, flanking the east and west sides of Osoyoos Lake. These aquifers provide natural storage as well as discharge of groundwater to Osoyoos Lake and the upstream Okanagan River, helping to maintain lake and river levels in the dry season and also moderating water temperature.

Water supply wells installed in these aquifers also provide sources of drinking water for the municipality of Osoyoos. The depth to the water table in this area typically varies from 3 to 4 m below ground depending on proximity to Osoyoos Lake, with seasonal fluctuations in the range of 1.5 to 5 m. Water table fluctuations are unusual compared to other aquifers in BC, since they peak during the driest time of the year. This is entirely due to the infiltration of irrigation water (return flow) used to maintain agricultural production during the dry season. Irrigation water is primarily obtained from Osoyoos Lake and is effectively adding artificial recharge to the aquifers during the summer dry season (June-August), with slow discharge of this water back into Osoyoos Lake through natural groundwater flow. This artificial recharge of groundwater in agricultural areas of the Osoyoos basin can also result in impacts to groundwater quality, with some areas showing high levels of dissolved nitrate from fertilizer sources and trace levels of certain pesticide products. In some areas, nitrate concentrations have decreased over time while other areas remain elevated.

Continued monitoring of groundwater quality and management of potential contaminant sources is recommended, as well as further evaluation of the overall groundwater balance for this area in the face of increasing municipal groundwater demand. Currently, there is uncertainty regarding the contribution of groundwater from bedrock aquifers in contact with lower-valley aquifers and the level of groundwater use by private wells.

11:30 Impacts of land use and climate on agricultural water demand – implications for water supply and management

Denise Neilsen, Research Scientist, Environmental Health, Summerland, Agriculture and Agri-Food Canada, neilsend@agr.gc.ca

Contributors: Denise Neilsen, AAFC - Pacific Agri-Food Research Centre; Stewart Cohen, Environment Canada Adaptation & Impacts Research Group, Institute for Resources Environment & Sustainability (IRES) University of British Columbia; Stacy Langsdale, IWR

Two of the more pressing issues facing agriculture in its interaction with water resources are the requirement for irrigation (water quantity) and the effects of supplying nutrients beyond crop requirements (water quality). Agriculture accounts for 75% of consumptive water use in the Okanagan Basin and crop production is almost entirely dependent on

irrigation. Currently, the climate of the region supports a mix of high-value horticultural crops, which require timely availability and management of water to achieve premium quality and good economic returns and lower value pasture forage. A GIS based model has been developed that estimates water demand based on crop type, seasonal crop development and spatial distribution. Annual water requirements depend on crop type with grapes requiring less than tree fruits which require less than pasture/forage. Average annual crop water demand was determined for 1961–90 climate data and for three future time periods (2020s, 2050s and 2080s) using six climate model scenarios. A 20–40% increase in demand was projected by the 2080s. Licensed allocations would be able to meet this increased demand, but supply may be limiting as comparisons of basin wide demand and unregulated inflow into Okanagan Lake (UBC watershed model) indicated that scenarios projecting increased demand also projected decreased supply. Potential impacts of changing land use will be examined.

As competition for water increases, the need for efficient irrigation will become paramount. Because nitrogen is highly mobile (easily leached) good management practices for N can be linked to use of water. Efficient water management results from the use of conservative micro-irrigation systems; from scheduling water applications to meet estimated crop demand and from reduction in evaporative loss from the soil through the use of mulches. Application of N through irrigation systems (fertigation) can be used to improve N management by targeting the nutrient to the root zone and to the time of nutrient demand. Examples will be given to demonstrate the effect of water management techniques on water and N losses beneath the root zone with the potential for leaching to groundwater and on matching supply to the amount and timing of plant N demand.

11:50 Sewer systems, septic tanks and urban runoff: non-point source pollution to Osoyoos Lake

Ken Hall, Professor Emeritus, Institute for Resources, Environment and Sustainability, University of British Columbia, kjhall@civil.ubc.ca

Osoyoos Lake continues to show signs of nutrient enrichment, called eutrophication, as contaminants from the surrounding watershed are transported to the lake. The sewer system of Osoyoos transports wastewaters to stabilization ponds for treatment. Water from these ponds is used for golf course irrigation, but contaminants – such as nitrogen and phosphorus, can leach into the groundwater and ultimately enter the lake. Households not connected to sewers use septic systems, an anaerobic holding tank and tile field, to treat their wastewaters. Poor maintenance and permeable unconfined aquifers provide the opportunity for contaminant transport to the lake. Urban stormwater runoff contains contaminants generated by vehicles through corrosion (trace metals), leakage (oil and grease), and exhaust emissions (polycyclic aromatic hydrocarbons) as well as gardening activities (fertilizers and pesticides). In the arid climate of Osoyoos, the long antecedent dry periods allow contaminants to build up on impervious surfaces and then get flushed into the lake when a rainfall event occurs. These disperse sources of contaminants to the lake, coupled with an expanding population and predicted climate change, will require innovative and integrated approaches to watershed management if the residents of Osoyoos want to prevent further deterioration of their Lake.

Scientific findings: the influence of water quality and quantity on fisheries and species-at-risk

1:10 Okanagan River Restoration Initiative: an ecosystem based approach to river restoration

Steve Matthews, R.P.Bio, Section Head, Fish and Wildlife Science and Allocation Section Penticton, BC Ministry of Environment, steve.matthews@gov.bc.ca

Okanagan River supplies the majority of inflow to Osoyoos Lake and as a result, the state of the river is a key component to sustaining a healthy lake. Over the last 50–100 years the river has been shortened, straightened, dyked and dammed for flood control and is now labeled the third most endangered river in Canada.

The provincial and federal governments are working with First Nations and a large number of local and international partners to restore key sections of Okanagan River by setting

back river dykes, and rebuilding a more natural river and floodplain. This ecosystem based approach will result in major benefits for a wide range of fish and riparian wildlife species, many of which are listed as threatened or endangered. In addition, a proper functioning flood plain will contribute to improvements in water quality in Okanagan River and Osoyoos Lake.

This project, while successful, has proven to be challenging, time consuming and expensive. These factors accentuate the need for careful planning and best management practices today in order to minimize problems in the future.

1:30 **"Squeeze play": the role of temperature, oxygen, and annual climate variations in controlling habitat utilization by juvenile sockeye salmon (*Oncorhynchus nerka*) in Osoyoos Lake, British Columbia**

D. Paul Rankin, Biologist, Salmon Section, Fisheries and Oceans Canada, rankinp@pac.dfo-mpo.gc.ca

Contributors: D. Paul Rankin, Kim D. Hyatt and Margot Stockwell, Fisheries and Oceans Canada

Okanagan sockeye salmon spawn and then rear in Canadian portions of a small section of the Okanagan River and Osoyoos Lake respectively. Lakes and rivers of the British Columbia southern interior exhibit annual and seasonal changes in physical variables (temperature and oxygen) that are extreme enough to pose serious threats to the persistence of a cold water species such as sockeye salmon which are near the southern end of their geographic range. Multiyear results from acoustic and trawl surveys are used here to determine annual and seasonal variations in the distribution and abundance of juvenile sockeye salmon relative to "extreme" changes in temperature and oxygen conditions in Osoyoos Lake. Comparative observations of juvenile sockeye subjected to a narrower range of physical conditions in Great Central Lake B. C. serve as an "experimental control". Intensive monitoring of Osoyoos Lake water quality during the critical late-summer/fall period in recent years has allowed us to reassess the "Squeeze Play" hypothesis.

1:50 **The influence of water temperature and discharge variations on Okanagan sockeye salmon migration, spawning and egg incubation**

Margot Stockwell, Biologist, Salmon Section, Fisheries and Oceans Canada, stockwellm@pac.dfo-mpo.gc.ca

Contributors: Margot Stockwell and Kim Hyatt, Fisheries and Oceans Canada

Seasonal changes in water temperature and discharge are two of the most important variables that influence the behaviour and physiology of Pacific salmon. Each freshwater life history stage has specific thermal and flow requirements for optimal production. In addition, water temperature controls developmental rates of incubating eggs and alevins as well as migratory timing of both juveniles and returning adults. Okanagan sockeye salmon production is challenged by natural as well as human induced changes to water quality (high temperatures) and water quantity. Water in the Okanagan basin is a severely limited resource that is managed to meet competing demands among domestic, agricultural, recreational and fisheries sectors throughout the valley. Guidelines for seasonal storage and release of water, regulated primarily at Penticton Dam, are specified under the Canada-BC Okanagan Basin Agreement (OBA) to meet competing user needs and for flood control during spring freshet. Fisheries flows are specified in the OBA because management decisions regarding rates and timing of seasonal water release can greatly influence fish production. For example losses of Okanagan sockeye salmon production can occur through: (a) increased risk of disease and loss of egg viability when spawning is delayed by high temperatures or low flows, (b) desiccation of eggs and alevins when incubation flows are too low, and (c) scour or premature flushing of eggs or fry when flows are too high. Additionally, the onset and duration of periods when sockeye are vulnerable to flow variation is determined by water temperature. Thus, migration and spawning will stop and restart at well-defined temperature limits while the completion of each developmental stage (e.g. egg to alevin or alevin to fry) is dependant upon that stage's thermal experience. Research on responses of salmon to physical variables discussed here is now being applied to create advanced fish-and-water management tools

to identify fish friendly water release strategies that don't unduly compromise the needs of other water users in the Okanagan basin.

2:10 Plant and animal species at risk

Orville Dyer, Wildlife biologist, BC Ministry of Environment, co-chair of the Southern Interior Rare Plants Recovery Team, orville.dyer@gov.bc.ca

Water levels in Osoyoos Lake affect several species of plants, including four that are listed as "At Risk" in Canada by the Committee for the Status of Endangered Wildlife in Canada (COSEWIC). These species occur in only a few locations in Canada. They occupy a narrow ecological niche, generally along sandy beaches or shorelines. Their seeds require prolonged soaking by higher water levels throughout winter, then reduced water levels in late spring and summer to allow germination. Recovery strategies are being prepared for these species, as required by the Canadian Species at Risk Act. Conservation and management of shoreline habitat and water levels at Osoyoos Lake are important for maintaining these species in Canada.

Lake water quality case studies – how others approach filling water quality data gaps and assessment

2:30 Osoyoos Lake DDT Study, State of Washington Department of Ecology

Brandee Era-Miller, Environmental Specialist, Environmental Assessment Program, Washington State Department of Ecology, bera461@ecy.wa.gov

A sediment core 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). The purpose of taking the sediment core was to get a historical picture of DDT occurrence in the Okanogan River.

The sediment core was taken from lower Osoyoos Lake. Sediments in the bottom of the core dated back to 1917. The reconstructed history of DDT contamination in Osoyoos Lake shows initial DDT concentrations barely detectable from 1917 until 1945. DDT rose sharply after 1945, peaked around 1976, then declined sharply between 1976 and 1981. DDT concentrations showed little change during the subsequent two decades (this is a common pattern with DDT in aquatic sediments). Interestingly, a large spike of DDT was seen around late 1998 or early 1999. This suggests that a large disturbance or input of agricultural soils may have occurred during the late 1990s.

PCB concentrations in the core were low and mirrored the DDT concentrations including the late 1990s spike. The peak PCB concentration was found in the 1976 horizon followed by a sharp decline 5 years later. No PCBs were detected in sediments deposited in 1957 or earlier.

2:50 Moses Lake nutrient management decision support modeling

D. Marcie Mangold, Water Quality Program, Eastern Region, Washington State Department of Ecology, dman461@ecy.wa.gov

The primary water quality problem in Moses Lake is recurring algae blooms, including blue-green algae, which impair recreational uses for the lake several times each summer. Excess phosphorus is the major cause of this algae growth.

Moses Lake was placed on the 1996 303(d) list of the federal Clean Water Act (CWA) for phosphorous. It was removed from the 1998 303(d) list with the Moses Lake Clean Lake Project in place in effort to clean up the phosphorus problems. Studies over the last 20 years indicate the lake still does not meet water quality standards. In 2004, Moses Lake was placed back on the 303 (d) list.

Through the Total Maximum Daily Load process the Department of Ecology collected historical data, conducted intensive sampling in 2001 and developed a hydrodynamic, unsteady-state water quality model. Using this model we estimated the capacity of the lake to assimilate total phosphorus (TP) loads from point and nonpoint sources.

Using critical loading conditions, the lake model showed that a 35% load reduction in TP from Rocky Ford Creek, Crab Creek, Rocky Coulee Wasteway baseflow, and groundwater was necessary to meet the proposed TP criterion with only a 10% exceedance probability. Further reductions in external phosphorus loads only marginally reduced TP concentrations in the lake because under these conditions internal sources begin to dominate in-lake concentrations.

Water and climate change in Osoyoos Basin

3:50 Potential impacts of climate change on life history events of Okanagan salmonids

Kim Hyatt, Research Scientist, Salmon Section, Fisheries and Oceans Canada, hyattk@pac.dfo-mpo.gc.ca

Contributors: Kim Hyatt and Margot Stockwell, Fisheries and Oceans Canada

The Intergovernmental Panel on Climate Change (IPCC) has made a compelling case that atmospheric warming is well underway and virtually certain to affect all regions of the globe within less than a single human generation. Warming is expected to be especially pronounced in the north-temperate zone in which the Okanagan basin is situated.

Global Climate Models (GCMs) are commonly used in association with regional data sets to provide plausible projections of future conditions with respect to annual or seasonal temperature and precipitation in a given location. GCM projections of future conditions have been used in recent studies to explore the impacts of climate change on agricultural production and water consumption in the Okanagan. We are currently using projections from the same suite of GCMs (HadCM3-A22, CGCM2-A21 and CSIRO MK2 A21) centered on the year 2050 to assess potential, climate change impacts on key life history stages of important coldwater fishes (sockeye and kokanee salmon) resident in river and lake habitats of the Okanagan valley.

Climate change impacts have been assessed by comparing observations of the frequency of occurrence, timing or magnitude of a given life history event during a base period (1961–1990) versus projected outcomes for the same events during the future 2050's period (i.e. 2035–2065). Results from our analysis are highly consistent across all GCM projections and suggest: (a) adult migration delays for Okanagan sockeye salmon will increase from an average of 40 days (base-case) to an average of between 71–81 days (2050 case). (b) 2050 spawn timing will occur 2–3 weeks later relative to current timing. (c) 2050 egg hatch will occur 1–2 weeks later. (d) 2050 fry emergence will occur 1–2 weeks earlier. (e) The frequency and severity of climate induced losses of seasonal rearing habitat for juvenile sockeye in Osoyoos Lake. will increase greatly.

We conclude that interactions among climate change and life history events identified here will exert a profound influence on future production trends, manageability and the probability of long-term persistence of sockeye salmon and perhaps the entire complex of coldwater fishes in British Columbia's southern interior.

4:10 Implications of climate change for Okanagan Basin water availability and salmonid restoration planning

Clint Alexander, Team Leader, Fisheries and Aquatic Resource Management, ESSA Technologies Ltd., calexander@essa.com

Contributors: Kim Hyatt, Fisheries and Oceans Canada; Clint Alexander, ESSA Technologies Ltd.; Stacy Langsdale, US Army Corp of Engineers; and Margot Stockwell, Fisheries and Oceans Canada

People frequently hold opposing values, but in the case of water futures in the Okanagan there are few opposing facts. A compelling portfolio of evidence already exists whose take home messages are clear. Casting ourselves to the year 2050, the key foreseeable conditions include: (1) greenhouse gasses will continue to accumulate raising average winter temperatures in the Okanagan by 3–4ºC; (2) winter snow packs will decline and average annual inflows decrease by at least 25%; (3) the length of the growing season will increase 20% to 35% increasing evapotranspiration and crop water demand; (4) human population will easily grow to over 600,000; and (5) combining 2–4, average net

cumulative inflows to Okanagan Lake will be 40% lower than present. Impacts of these conditions on water quantity and quality at the bottom of the valley will threaten aquatic ecosystem integrity, especially conservation and restoration of coldwater salmonids.

We assembled a basin-wide water budget for the 2050s period and ran these net Okanagan Lake inflows through the established operating rules embedded within the Okanagan Fish/Water Management Tool. Our study found that average egg-to-yearling survival for endangered Okanagan River sockeye will fall by 44%. Alarmingly, our 2050s water availability conditions led to the complete loss of high juvenile survival cohorts, reducing the sockeye population's resilience. In addition, our 2050 period fish/water managers were unable to achieve the current September 30 operating benchmark for Okanagan Lake even once in 28 simulated years. Consequences of extensive lake draw-downs would be catastrophic, highlighting the need for more serious preparations. The solution includes much more strenuous surface and groundwater license restrictions and sensible, enforceable demand management regulations on all new and existing water extraction activities. Creation of water banks, water markets and water license buy-backs are also foreseeable. Politicians, planners and regulators should meaningfully move forward with these anticipatory water conservation and management steps now to avoid the creation of increasingly complex and insoluble problems later. Failure to do so will have dire consequences for aquatic ecosystems and the quality of life in the Okanagan.

Perspectives on flow augmentation

4:30 **Past and present exploration of water diversions from the Similkameen River**

Kris Kauffman, President, Water Rights Inc., Lakewood, WA, waterrightsinc@msn.com

Mr. Kauffman first describes the Okanogan River Basin in the United States and Canada with average annual flows of some 1.7 MAF (~74%) from the Similkameen; 0.5 MAF (~22%) from the Okanagan; and, some 2.3 MAF (100%) from the Okanogan to the Columbia River. He then discusses projects proposed over the last century that have modified, or would modify, the natural flow characteristics of the Okanogan River System, inclusive of the Okanogan/ Okanagan, Similkameen, Ashnola, Pasayten and Toulameen Rivers. He focuses on current proposals that may have some merit within a fifty year planning horizon. Since this is a multiple trans-boundary River system (the Okanogan, Similkameen, Ashnola and Pasayten Rivers cross the U.S. – Canadian Boundary) the international implications of existing and proposed projects that exist, or may have to be considered, are characterized.

4:50 **Perspectives on flow augmentation: A BC provincial perspective**

Brian Symonds, Director, Regional Operations Branch Penticton, Water Stewardship Division, BC Ministry of Environment, Brian.Symonds@gov.bc.ca

Flow augmentation can be achieved by modifying the natural hydrographs within a basin or by diverting water into a basin from another basin.

Within the Canadian portion of the Okanagan there are numerous sites where water is diverted into storage during periods of surplus for use later when additional water is required to meet instream and offstream demands. The largest of these reservoirs is Okanagan Lake. There are also a lesser number of locations within the basin where water is diverted between adjacent streams to augment flows in the receiving stream to more effectively manage local supplies. While both these approaches are useful in modifying natural hydrographs within the basin to better balance supply and demand between seasons or within a limited geographic area, they do not change the overall amount of water available within the Okanagan.

Another approach to augmenting flows is to use an interbasin diversion to augment the total amount of water available in the receiving basin. There are a few sites at higher elevations where there are minor diversions into the Okanagan. In each case the quantity being diverted is relatively minor and from a small area of the headwaters of an adjacent drainage. From a hydrologic perspective the impacts of these diversions on the total runoff from the Okanagan Basin is not significant. In the mid1960s a preliminary investigation

was done to look at the engineering feasibility of diverting a relatively large quantity of water from mainstem of Shuswap River into the north end of Okanagan Lake. Due to economic, social and environmental concerns the project has never proceeded beyond this stage.

In 1996 BC passed the Water Protection Act which prohibited any new large scale transfers of water between major watersheds in BC. Large scale transfers are defined as "a project to divert or extract a peak instantaneous flow of 10 m^3 or more a second of water." The legislation also prevents the issuance of licenses for the bulk removal or export of water from BC.

5:10 The state of Washington's Columbia River Water Management Program

Doug Johnson, P.E., Dam Safety Supervisor, Water Resources Program, Washington State Department of Ecology, djsd461@ecy.wa.gov

Mr. Johnson will discuss the state of Washington's Columbia River Water Management Program and how funding may be available for storage, conservation, and water management in the Okanogan/Similkameen watershed. An overview of the proposed Shankers Bend Project and how it may enhance flows and lower temperatures in the lower Okanogan River will be provided.

Tuesday, September 18

Transboundary community stewardship and Osoyoos Lake sustainability

Bi-lateral watershed stewardship perspectives

8:00 **British Columbia Washington Environmental Cooperation Council**

Tom Laurie, Governmental Liaison, Washington State Department of Ecology, tlau461@ecy.wa.gov & David Grace, Senior Policy Advisor, BC Ministry of Environment, david.grace@gov.bc.ca

2002 marked a decade of transboundary cooperation as the tenth anniversary of the British Columbia Washington Environmental Cooperation Council (ECC) passed. Environmental issues in the Pacific Northwest have a high public profile. Watersheds and Airsheds in the region do not conform to international borders. Following a 1991 “Throne Speech” which expressed a desire for an international commission to attack air and water pollution in the region, the WA Dept of Ecology and the BC Ministry of Environment, Lands and Parks had an initial meeting in May 1991 which paved the way for the 1992 Agreement. The ECC’s cooperative model has attracted enquiries from as far as Europe. The purpose of the ECC is to ensure coordinated action and information sharing between British Columbia and Washington State on environmental matters of mutual concern. Increasing population on both sides of the border; the shared environmental resources of air, land, and water; and the challenges of adapting to climate change are compelling drivers behind the ECC. The ECC provides an on-going forum for the state, province and federal agencies to address important and sometimes controversial cross-border environmental issues as partners. The emphasis is on cooperation and information sharing. This presentation will describe the ECC’s structure, current activities and priorities.

8:20 **Okanagan Basin Water Board – a watershed approach**

Anna Warwick Sears, Okanagan Basin Water Board, anna.warwick.sears@obwb.ca

The Okanagan Basin Water Board was established in 1970 as a made-in-the-Okanagan solution to address water issues at the scale of the entire watershed. The Okanagan Basin spans three regional districts and 13 municipalities, and the Board is comprised of elected representatives from jurisdictions up and down the valley. In the early years, the Board focused on two central problems identified by the Okanagan Basin Study – reducing nutrient pollution from effluent discharges, and managing the invasive aquatic weed Eurasian watermilfoil – cleaning up local beaches and water sources. Recently, in response to concerns about population growth and climate change, the Board has taken a more expansive role – providing leadership and a central organizing function for water management in the Basin. The Board is the local government sponsor for the Okanagan Basin Water Supply & Demand Study, a science-based evaluation of current and future water availability. The Board is also working with the Okanagan Water Stewardship Council to develop sustainable water strategies for the Basin.

8:40 **IJC’s International Osoyoos Lake Board of Control activities**

Glen Davidson, Director, Management and Standards Branch, BC Ministry of Environment, glen.davidson@gov.bc.ca

Glen Davidson is a provincial Deputy Comptroller of Water, Director, Management & Standards Branch, Water Stewardship Div. of BC Ministry of the Environment, and a member of the International Joint Commission's International Osoyoos Lake Board of Control. In his Board of Control capacity, Mr. Davidson will present a brief overview of the operation of Osoyoos Lake levels in 2007. He will follow this with a description of the Board's Osoyoos Lake Plan of Study that will be used to inform a new "Order" from the

Commission for the operation of Osoyoos Lake beginning in 2013. The Plan of Study may be previewed here: www.ijc.org/rel/boards/osoyoos/final_pos_060811.pdf.

Communication and technical information sharing; existing mechanisms and options for improvements

9:00 Washington State Department of Ecology Internet accessible information

Mark Peterschmidt, TMDL Lead, Water Quality Program, Central Region, Washington State Department of Ecology, mape461@ecy.wa.gov

The Washington State Department of Ecology has extensive amounts of environmental information available to the public through the internet. The presentation on the Washington State Department of Ecology Internet Accessible Information is an introduction to the types of water quality information available across the internet and an introduction to how the information is organized and presented. Please come and visit the web site at: www.ecy.wa.gov.

9:20 BC Ministry of Environment Water resource information on the Internet

Vic Jensen, Environmental Impact Biologist, Environmental Quality Section Penticton, BC Ministry of Environment, vic.jensen@gov.bc.ca

An overview will be provided of some of the web sites which provide public access to BC Ministry of Environment water resource information.

These may include:

General water resource web sites

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
http://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

9:40 **Okanagan Land and Water Information System**

Beverly McNaughton, Senior Scientist, Pacific and Yukon Water Quality Monitoring, Environment Canada

spOKe (**s**ustainable **p**lanning for the **Ok**anagan **e**nvironment) is an information portal that facilitates sharing and access to watershed-scale land and water information and knowledge. It acts as a catalogue for data, interpreted information, tools and services in order to facilitate the interconnection of land/water data from distributed sources for the Okanagan. The key goal is to improve access to information from the many stakeholders in the expectation that it will lead to a greater understanding of the complex land/water issues we are facing, and support effective decision making.

10:00 **Okanagan Fish-and-Water Management Tools (OK-FWMT): a decision support system to balance water objectives in real-time**

Kim Hyatt, Research Scientist, Salmon Section, Fisheries and Oceans Canada. hyattk@pac.dfo-mpo.gc.ca

Contributors: Kim Hyatt, Fisheries and Oceans Canada; Clint Alexander, ESSA Technologies Ltd.; Brian Symonds, Ministry of Environment; Margot Stockwell, Fisheries and Oceans Canada; Andrew Wilson, Ministry of Environment; Brian Guy, Summit Environmental; Howie Wright, Okanagan Nation Fisheries Commission; Harvey Andrusak, Redfish Consulting Ltd.; Deana Machin, Okanagan Nation Fisheries Commission; Chris Bull, Glenfir Resources.

Natural variation, scientific complexity, competing objectives and multi-agency communication barriers are challenges faced by resource managers who must decide how to allocate limited and variable water supplies. In the case of Okanagan Lake (British Columbia), water levels are managed to provide a balance among fisheries, flooding and other interests.

In 2001, the Okanagan Basin Technical Working Group (OBTWG) identified development of an Internet-accessible software application (OK-FWMT) as the central tool for implementing improved in-stream flows. The FWMT system is a multi-user decision support system based on five coupled “state-of-the-science” biophysical models (hydrology, socioeconomic water management rules, water temperature, kokanee and sockeye) that address lake and down-river considerations at a variety of sites. FWMT system sub-models are routinely updated with daily real-time data on lake elevation, water temperature and discharge and annual information derived from ongoing field monitoring programs.

OK-FWMT software operates in three modes: (a) retrospective mode using historical data sets, (b) operational mode using real-time data for in-season decisions and (c) prospective mode using projected data sets that permit predictions of the impacts of future conditions on fish-and-water management. A comprehensive, 25-year, retrospective analysis showed significant fisheries gains were possible from routine use of this tool without undue increases of flood risk or economic loss. More recently, results from a 30-year prospective analysis suggest the need for timely management interventions to head off future fish-and-water management problems induced by climate change. These insights into fish-and-water management issues and options originate from the unparalleled collaboration sustained by the OBTWG and their partners over a 7-year period.

Given FWMT’s ease of use and demonstrated potential, water and fisheries managers representing private industry, First Nations, federal and provincial interests have subscribed to real-time deployment of FWMT since 2004–05 by an interagency operations group to facilitate dialogue and routine consensus on fish-and-water management decisions.

Stewardship activities and programs – near and far; the role of governments in community stewardship

10:50 Role and limitations of government programs in community stewardship

Craig T. Nelson, District Manager, Okanogan Conservation District, craign@okanogancd.org

Community stewardship programs delivered mostly by grass roots private organizations or local agencies have wide ranging impacts on the types and quantities of conservation practices that are applied. However, the role of these organizations extends far beyond the application of conservation programs or the education of the public about resource concerns. They are the conduit of information back to parent organizations, and government officials regarding local needs, priority concerns, and most importantly how improvements can best be achieved in their community.

The Okanogan Conservation District is a sub-division of Washington State government and provides voluntary, non-regulatory, assistance to landowners, land managers, and occupiers of land within the District. The District provides this assistance through technical assistance such as conservation plans, and various analyses provided to individuals based upon requests. Because of the voluntary and in particular the non-regulatory role the District has, landowners are more comfortable with expressing concerns and identifying issues on their own property. This can lead to a greater discovery of resource concerns and an overall improved plan to implement conservation practices. The drawback to the District's program has been the funding. For the first 67 years of the existence of the District it was funded by grants. With only sporadic funding from local and State government a consistent program and staff were nearly impossible to develop and maintain. This situation has greatly improved with the approval of a special property assessment that will provide approximately $120,000 each year to maintain a core program and fund items that grants were struggling to cover.

District staff and supervisors are focusing more efforts at bringing small communities or clusters of landowners together to achieve geographically focused conservation programs that address community concerns by implementing site specific conservation practices. Community members are an integral part of identifying their resource concerns and the practices that are necessary for achieving resource protection. Community members input at this level is critical to short and more importantly long term success. District success is pinned on the input and participation of community members in the planning, implementation, monitoring, and evaluation of conservation programs.

11:10 The BC Lake Stewardship Society & the BC Lake Stewardship & Monitoring Program

Carolyn Johns, carolynj-bclss@shaw.ca & Kristi Carter, kristic-bclss@shaw.ca, Project Coordinators, BC Lake Stewardship Society

The BC Lake Stewardship Society (BCLSS) is a registered (1997) non-profit organization whose membership includes lakeshore residents, students, stewardship groups, and environmental professionals. Our vision is clean, healthy lakes that provide quality habitat for aquatic life, wildlife and people throughout BC. Our fundamental values are the preservation, protection, and restoration of lakes throughout BC. The BCLSS assists in training, education and technical support to lake stewardship groups interested in protecting lakes in their community. The Society provides lake monitoring programs, educational materials, training courses, and workshops to stewardship groups in the province.

The BCLSS is currently focusing its efforts on the BC Lake Stewardship & Monitoring Program (BCLSMP). With increased reliance on the public to play a greater role in stewardship activities, environmental monitoring, and water quality management, the BCLSMP was initiated in 2002 and launched in the spring of 2003 in partnership with the Ministry of Environment and Vancouver Foundation. The BCLSMP enables a strong, quality-assured baseline of data to be established, which helps the health of a lake to be determined, monitored and managed over time. The program trains volunteer lake stewards, in a half-day course, at various levels of water quality data collection to allow

them to monitor their lake. As well, this program educates lake-users and the general public on lake-related issues and fosters their awareness, concern, and support for the conservation and preservation of lake ecosystems. Through this initiative, the BCLSS has moved BC closer to a shared stewardship model for addressing lake water quality issues throughout the province.

The first three years of the program (2003–2006) were a huge success with many of the goals established in the original program achieved. The BCLSS is extending and expanding the program to include more in-depth LakeKeepers training courses (1 to 3 days in length) and an aquatic plant mapping component with a corresponding chapter for inclusion in the LakeKeepers manual. For more information visit our website (www.bclss.org).

11:30 Oroville-Tonasket Irrigation District

Tom Scott, Secretary/Manager, Oroville-Tonasket Irrigation District, otid@nvinet.com

The Oroville-Tonasket Irrigation District is the largest irrigation district in North Okanogan County. As a purveyor of irrigation water to approximately 10,000 acres of land, we wish to make people aware of this great resource and educate users about water usage and actual crop needs and how to conserve and utilize the resource.

11:50 Investigation of the feasibility of re-connecting abandoned oxbows in the Okanagan River upstream of Osoyoos Lake

Eike Scheffler, Osoyoos Oxbow Society Restoration Society, Brian Guy, Summit Environmental Consultants Ltd., bg@summit-environmental.com and Brandon Beierle, bb@summit-environmental.com

The Okanagan Lake Regulation System was constructed in the 1950s with the primary purpose of minimizing flood risk around Okanagan Lake. The Okanagan River immediately upstream of Osoyoos Lake is now a straight, engineered channel, and the natural meanders of the river have been removed. These abandoned meanders are referred to as “oxbows.” The Osoyoos Oxbow Restoration Society is investigating the feasibility of re-connecting some of the abandoned oxbows in order to restore riverine, riparian, and terrestrial processes upstream of Osoyoos Lake, and thereby potentially improve the water quality of the lake.

Phase 1 of the project involved development of a business plan, some fundraising, and a coarse assessment of the hydraulic feasibility of the proposed project. Input was received from many agencies concerned with water management in the Okanagan. Phase 2 involves a longer term and more detailed assessment of the feasibility of and constraints affecting the proposed project. Phase 2 was initiated in fall 2006, and involves collection and analysis of physical, chemical, and biological information in the river and several oxbows. The first year of the program, which included monitoring of water levels and temperatures in the river, three oxbows, and three domestic wells; as well as analysis of water and sediment chemistry, has been completed. This presentation will provide an overview of the project and its current status, and will present the monitoring information obtained in the first year of the Phase 2 program, along with recommendations for ongoing monitoring and additional studies needed to fully assess project feasibility.

Municipal and regional urban planning update

1:10 Keeping up with the Canadians – planning in the wake of growth

Chris Branch, Planning and Community Development Director, City of Oroville, chrisb.oroville@nvinet.com

The City of Oroville’s first Comprehensive Land Use Plan was prepared in 1964 during the same planning effort for the regional government, Okanogan County. Oroville’s plan was updated in 1972, 1993 and 1995, and is currently undergoing revisions to address land use in the unincorporated area as annexation pressure increases by those landowners and developers seeking municipal water connections. The issue of water management continues to emerge as the over-riding theme in terms of development potential and land

use management. The Okanogan County (regional) plan is still of the 1964 vintage. The City and County continue to pursue a joint update to both their plans.

The recent construction of a major sewer main on East Lake Osoyoos addresses water quality concerns from a wastewater aspect; however, it has also increases development pressure, especially from Canadian firms that appear to have run out of affordable property in the Canadian Okanagan. Water is in great demand while limited water rights and an uncertain resource dominate the decision-making discussion.

1:30 Innovative storm water management

Steve Shannon, Assistant Planner, Town of Osoyoos Planning Department, sshannon@osoyoos.ca

Topics of discussion will include a brief description of development servicing standards for storm water management in the Town of Osoyoos and an overview of stormwater management plans associated with some of the major developments in Osoyoos such as Watermark Beach Resort and the proposed Indigo Resort.

1:50 Regional District of Central Okanagan water management planning

Leah Hartley, Regional Planner, Regional District of Central Okanagan, leah.hartley@cord.bc.ca

The Regional District of the Central Okanagan has viewed water management planning as a priority for over seventeen years. Ever since completion of the Okanagan Basin Studies of the 1980s and the adoption of the Okanagan Lake Foreshore Plan in 1990, the Regional Board has been active in identifying and addressing critical water management issues. The Central Okanagan Water Resources Discussion Paper (2001), Westside (TLU) Water Management Plan (2004), Mission Water Use Plan (2007/08), Sensitive Habitat Inventory Mapping (SHIM, 2001 to present) and Okanagan Lake Foreshore Plan Update (2007) all represent significant efforts by the RDCO in the direction of water sustainability.

Emphasizing a balance of economic, social and environmental concerns, water management planning is a key component of regional growth management, regional economic and land use planning. In the face of the potential impacts of climate change on water supply in the Okanagan, efforts such as these are becoming all the more important.

Biographies

Biographies are listed in alphabetical order.

Clint Alexander, B.Sc, MRM

Team Leader / Technical Architect, ESSA Technologies Ltd., Kelowna, BC
calexander@essa.com

Clint Alexander is an integration specialist focused on methods for bringing together biological, physical, and economic components of environmental problems into decision oriented advice. Focal areas include large-scale watershed restoration programs and water management related trade-off evaluations for dams and reservoirs in Western North America.

Mr. Alexander has over 10 years of experience in simulation modeling, information system design and trade-off analysis. For example, he has been the technical lead for the highly successful Okanagan Fish/Water Management system (OKFWM) since 2003, including project management, software design and deployment for the Canadian Okanagan Basin Working Group (COBTWG).

In addition, Mr. Alexander is an experienced facilitator of stakeholder groups, where he emphasizes the importance of clarity in design and integrating the expert knowledge of client's working in specialized areas (e.g., hydrology, fisheries biology, fluvial geomorphology). Since joining ESSA, Mr. Alexander has been rapidly promoted through positions of increasing project management responsibility, and served as project manager or technical lead for numerous large scale decision support projects. Given his ability to serve as facilitator, data analyst, model developer and programmer he is uniquely positioned to perform, manage or advise staff working in a variety of roles.

Mr. Alexander holds a B.Sc. in Ecology and Environmental Biology from the University of British Columbia and a Masters in Resource and Environmental Management (MRM) from Simon Fraser University.

Dr. Bernard O. Bauer

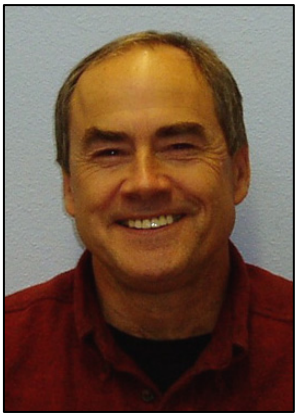
Dean of the Irving K. Barber School of Arts & Sciences at the University of British Columbia Okanagan, bernard.bauer@ubc.ca

Dr. Bernard O. Bauer is Dean of the Irving K. Barber School of Arts & Sciences at the University of British Columbia Okanagan, where he is also a Professor with a cross-appointment to the Earth & Environmental Sciences and the Geography programs. He holds a B.Sc (Honours) and an M.Sc from the University of Toronto and a PhD from the Johns Hopkins University.

Prior to his appointment at UBC Okanagan in July, 2005, Dr. Bauer was the Dean of Science at Okanagan University College and the Chair of the Department of Geography at the University of Southern California where he spent the first 17 years of his professional career conducting research and teaching undergraduate and graduate courses on earth surface processes, weather & climate, hydrology & water resources, boundary layer processes, sediment transport mechanics, and environmental monitoring. From 1997-99 he took a leave of absence from USC to serve as the Director of the Geography and Regional Sciences Program at the US National Science Foundation (NSF) in Washington, DC, where he also co-managed the Water and Watersheds Program in collaboration with the Environmental Protection Agency and the US Department of Agriculture.

Dr. Bauer currently serves as a member of the Okanagan Water Stewardship Council and on the Board of Directors of the Okanagan Partnership.

Dennis Beich



Regional Director, North Central Region, Washington Department of Fish and Wildlife, beichdvb@dfw.wa.gov

Dennis Beich has been the Washington Department of Fish and Wildlife North Central Region Regional Director since 1999. He was previously the Okanogan County Water Resource Director, and a Wetland Biologist in Eastern Washington. He has a B.Sc in Forest Resources from the University of Washington.

Brandon Beierle, Ph.D.

Summit Environmental, bb@summit-environmental.com

Brandon Beierle is a Senior Environmental Scientist with Summit Environmental Consultants Ltd. He holds a Ph.D. in Physical Geography from Queen's University and an M.Sc. in Geomorphology from the University of Calgary. Brandon has worked on projects ranging from stormwater management to the timing and extent of past glaciations, in places from the Canadian Arctic to Patagonia. As a fluvial geomorphologist, he has completed projects on numerous rivers including sedimentological, hydrological and geophysical studies on the Milk, Bow, Blackstone, White, Llewellyn and other Canadian rivers.

Jack P. Blaney

Commissioner, International Joint Commission, alltopj@ottawa.ijc.org

Jack P. Blaney has served as Commissioner to the International Joint Commission's Canadian Section since 2001. Prior to this appointment Dr. Blaney was President of Simon Fraser University. In 2003, Dr. Blaney served as Chair of the British Columbia Citizens' Assembly on Electoral Reform. He also served as Chair of the Fraser Basin Council, which brings together all levels of government, including First Nations, and the private and civil sectors of society, so that together they may resolve sustainability questions in British Columbia's Fraser River Basin.

Chris Branch

Planning and Community Development Director, City of Oroville, chrisb.oroville@nvinet.com

Chris Branch has been in his current position with City of Oroville since 1999 and is contracted part time to the City of Tonasket. He was Circuit Rider Planner for several small communities (including Oroville and Tonasket) from 1989 to 1999, Okanogan County with Highlands Associates, Okanogan Washington. He holds a B.A. in Environmental and Economic Studies, from Evergreen State College, Olympia, WA.

Irene B. Brooks

Commissioner, International Joint Commission, brooksi@washington.ijc.org

Irene B. Brooks has served as Commissioner to the International Joint Commission since December 2002 and currently serves as Acting Chair of its United States Section. She has represented Pennsylvania on all interstate river basin commissions of which the Commonwealth is a member and has served as Chair of the Great Lakes Commission. She began her career in water resources and conservation as Chester County (Pennsylvania) Commissioner where she developed and implemented a comprehensive countywide plan to help protect and preserve the environment, farmland and open spaces. The Chester County Open Space Program has been adopted by other counties across the country and has won several Presidential Awards.

Kristi Carter

BC Lake Stewardship Society Project Coordinator, kristic-bclss@shaw.ca

Kristi Carter is working part time for the BC Lake Stewardship Society. Since graduating from the University of British Columbia in 2000, she has worked mainly for non-profit organizations. She enjoys the challenge and diversity of work that comes with working in a non-profit setting. Her passions include a full scope of environmental issues, with a focus on freshwater quality and availability.

Lionel Dallas

Director, Osoyoos Lake Water Quality Society, dallas@vip.net

Lionel Dallas is a director with the Osoyoos Oxbows Restoration Society and co-founder of the BC Lake Stewardship Society.

He is active in many community organizations. He served as director of the Osoyoos Desert Society, which is instrumental in getting property out of crown lands. He served as director of the parent body of the Okanagan History Society, and was President of the Oliver/Osoyoos branch until 2007.

Mr. Dallas helped establish the Osoyoos Lake Water Quality Society – serving as director from 1990 to present. He was the liaison between Canada and Washington State and member of several committees in Washington State in this regard over many years. He was an initial member of the Okanagan Watershed Management Plan. Mr. Dallas also served with the South Okanagan Conservation Project; Regional Growth Strategy Committee.

Mr. Dallas also served on several Town of Osoyoos committees, including Official Community Plan; Old Community Centre. He was Director with the Osoyoos Senior Centre for several years; also served as director with the Osoyoos Chamber of Commerce. Helped establish The Osoyoos Ratepayers Association and was Chair of the Community Consultative Committee to the RCMP, Osoyoos Detachment.

Mr. Dallas was jointly responsible for establishing and operating Med-Trans, now known as South Okanagan Transit Community Bus. He is a member of the North American Lake Management Society, the Washington Lake Protection Association.

Orville Dyer

Wildlife biologist, BC Ministry of Environment, co-chair of the Southern Interior Rare Plants Recovery Team, orville.dyer@gov.bc.ca

Orville Dyer is a wildlife biologist working with the BC Ministry of Environment and co-chair of the Southern Interior Rare Plants Recovery Team.

Glen Davidson, P.E.

Director, Management & Standards, Water Stewardship Division, Ministry of Environment, glen.davidson@gov.bc.ca

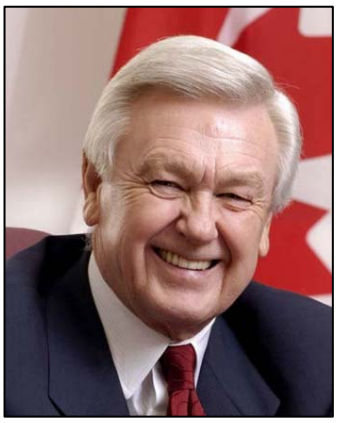
Glen Davidson graduated from the University of British Columbia in faculty of Applied Science and is currently registered as a Professional Engineer (Civil) in British Columbia. His background includes over 20 years experience in water resource engineering in such fields as water allocation, river engineering, hydrology and floodplain management. He is currently employed in Victoria by the Ministry of Environment as the Director of Management and Standards for the Water Stewardship Division, where he also serves as Deputy Comptroller of Water Rights. He is appointed as a Canadian member of the Osoyoos and Kootenay Boards of Control by the International Joint Commission.

Brandee Era-Miller

Environmental Specialist, Environmental Assessment Program, Washington State Department of Ecology, bera461@ecy.wa.gov

Brandee Era-Miller obtained her B.A. & B.S. in Environmental Science and Natural Resource Policy from the Evergreen State College in 1999. She has worked as an environmental specialist for the Washington State Department of Ecology's Environmental Assessment Program since 2000. She investigates the contamination of water, sediment, and fish tissue from areas throughout the State of Washington.

The Honourable D. Ross Fitzpatrick



Senator Okanagan/Similkameen, fitzpr@sen.parl.gc.ca

Ross Fitzpatrick was appointed to the Senate of Canada for British Columbia in March of 1998. Born and raised in the Okanagan, Senator Fitzpatrick has a strong commitment to the community, environment, business and above all Canada. This commitment is reflected in his tireless work with many non-profit organizations and community groups, including the Vancouver Institute, BC Government House Foundation, Okanagan Thompson International Sculpture Society, and the Okanagan Symphony. He is a member of the Okanagan Vintners Estate Winery Association, Kelowna Art Gallery, Canadian Club and is a supporter of Kelowna General Hospital Foundation, the Rotary Performing Arts Centre, Central Okanagan Foundation , the BC Children's Hospital and the Okanagan Partnership.

Senator Fitzpatrick received a Bachelor of Commerce and Business Administration from the University of British Columbia in 1958, and pursued postgraduate studies at the University of Maryland in Economics and attended Columbia University's Graduate School of Business. He has been recognized by UBC as a Distinguished Alumnus, for his

outstanding contribution to business, the university and the community and received an Honourary Doctorate of Laws from Okanagan University College.

Senator Fitzpatrick has had a distinguished business career. He is the proprietor of Cedar Creek Estate Winery, Chairman of the Fitzpatrick Group of companies, Chairman of Greata Development Corporation and Chairman of Channel Resources. Senator Fitzpatrick was the founder and CEO of Viceroy Resource Corporation, which was named BC's fastest growing company for three consecutive years by Profit magazine, and was recognized as one of the most successful startup mining operations in North America. It also received six environmental awards for its development of Castle Mountain Gold Mine in California. Senator Fitzpatrick also founded and developed companies in the oil and gas industry and aerospace industries in Canada and the United States. Fitzpatrick began his career in politics in 1963 as the Executive Assistant to a Federal Cabinet Minister.

Senator Fitzpatrick is married to Linda. He has two children Gordon and Lesley.

Brian Guy, Ph.D., P.Geo., P.H.

Summit Environmental, bg@summit-environmental.com

Brian Guy is President and Senior Geoscientist with Summit Environmental Consultants Ltd. He holds a Ph.D. in Water Resources Engineering from the University of Guelph, and is an Adjunct Professor at the University of Northern B.C. He represents the Canadian Water Resources Association on the Okanagan Water Stewardship Council, and is presently managing Phase 2 of the Okanagan Water Supply and Demand study. He has also managed many large-scale environmental impact assessments and other studies in the forestry, mining, energy, manufacturing, and other sectors.

David Grace

Senior Policy Advisor, Intergovernmental and External Relations Branch, Strategic Policy Division, BC Ministry of Environment, david.grace@gov.bc.ca

David Grace works as a Senior Policy Advisor within the Intergovernmental and External Relations Branch of the Strategic Policy Division of the BC Ministry of Environment. His work includes supporting the implementation of Provincial bilateral Environmental Cooperation Arrangements with bordering States. Related duties include liaising with Federal governments with respect to transboundary environmental issues, serving as the coordinator of the BC WA Environmental Cooperation Council and Provincial coordinator of the Georgia Basin Action Plan. He also works closely with Ministry Executive to provide support in relation to a number of internal and external committees.

Gwyn Graham, M.Sc., P.Geo.

Senior Hydrogeologist, Water Management and Indicators Section, Environment Canada Pacific & Yukon Regional Office, Vancouver, BC, gwyn.graham@ec.gc.ca

Gwyn works as a senior hydrogeologist with Environment Canada's Pacific & Yukon regional office in Vancouver, BC. He holds a Masters degree in hydrogeology from the University of Waterloo and has over 10 years experience as a hydrogeologist on a wide range of groundwater projects both in public service and previous consulting practice.

Dr. Ken J. Hall

Professor Emeritus, Dept. of Civil Engineering & Institute for Resources and Environment, University of British Columbia

Ken Hall is an environmental chemist with 35 years experience in conducting research on water quality, environmental contaminants, wastewater treatment, and environmental impact investigations. As the assistant director of the Westwater Research Centre (1972-1990) at UBC he coordinated field monitoring studies for an interdisciplinary program that involved land use, wastewater discharges, water quality, and biological studies on the Lower Fraser River, BC. He coordinated a three year program to investigate the impacts of log handling and storage activities on a lake ecosystem in central BC. He has conducted limnological studies on eutrophic, meromictic, and coastal oligotrophic lakes and am presently involved in lake restoration studies using aeration and fertilization techniques. His recent research has been investigating the contaminants associated with non-point pollution from urban stormwater runoff and it's impacts on the aquatic ecosystem.

Dr. Hall's studies with graduate students have involved research on a diversity of topics including the use of in situ bioassays using freshwater leeches to monitor the availability of contaminants from pulpmills, the elucidation of the biochemical pathways of the biological phosphorus removal process for wastewater treatment, and the use of constructed marshes to treat toxic leachate from wood waste piles in the Lower Fraser.

He has supervised the theses of 32 M.Sc. and 7 Ph.D. students in the Departments of Civil Engineering, Chemistry, Zoology and Resource Management during his 33 years at UBC.

Dr. Hall has taught courses in water pollution engineering and its ecological impacts, environmental impact studies, watershed management, and a laboratory course on environmental analysis. His recent teaching has explored the use of multimedia (CD/ROM) and the internet with the staff in the Institute for Resources and Environment to deliver courses on watershed management to a wider and international community.

Dr. Hall has served on two committees as part of the Greater Vancouver Regional Districts (GVRD) liquid waste management program. The Brunette Watershed task group was responsible for developing a management plan for an urban watershed that can be used as a template to manage urban watersheds in the region. He is also on the environmental assessments task group which coordinates and evaluates the monitoring program for all of the GVRD waste discharges and their impacts on the receiving environment. Dr. Hall was a member of the Environmental Programs Advisory Committee at UBC and served as a consultant on the stormwater management program for the university.

Wilbur G. (Web) Hallauer

Lake Osoyoos Association

From 1949 to 1969 Web Hallauer represented the U.S. Okanogan as a Washington State Senator and legislator. He chaired the Legislative Interim Committee on Water Resources from 1965-67, during which time the committee created ten legislative proposals that all passed, including a drastic tightening of water pollution laws. He was the Director of the Washington State Department of Ecology from 1977-1980.

Web was a long-time member of the Similkameen Okanogan Flood Control and Reclamation League during the group's life from 1948-2001. He served as its secretary/treasurer and its president. Currently Web is involved in reviving the Lake Osoyoos Association. He lives on the east side of Osoyoos Lake, just south of the border.

Walter A. Hart III

City councilor for the City of Oroville and Mayor Pro Tem, wahart3@msn.com

Walt was raised on the Okanogan River in Oroville from 1949 until 1965 when he left for college. Following college at Eastern Washington University and a stint as a body shop manager in Cheney, he returned to Oroville in 1974, once again residing near the Okanogan River. In 1983 he married Vicki Brewster and they made their home in Corvallis Oregon. Walt worked as a body shop manager for a GM dealer, as a MAC Tool dealer, and as a unibody specialist at a Ford/Chrysler dealership. In 1998 the Hart's bought a house on the Okanogan River in Oroville and moved in the summer or 1999. They currently run Hart's Automotive Body Shop and manage their rental properties in Oroville.

Walt is currently a city councilor for the City of Oroville and Mayor Pro Tem. He has just been re-elected Commander of Hodges Post 84 American Legion. Walt is the Chairperson for the 2008 Centennial Committee for Oroville. He is also an active member of the Oroville Chamber of Commerce. He is the Committee Chairman for Cub Scout Pact 23. An Eagle Scout, he is a past Scoutmaster and Explorer Post Advisor. He is the Past President of two Kiwanis Clubs, Oroville and the Corvallis Sunrisers.

Walt retired with 39 years in the US Army Reserve on July 31st this year, after serving a year in Iraq during 2004-2005.

Leah Hartley, M.C.I.P.

Regional Planner, Regional District of Central Okanagan, leah.hartley@cord.bc.ca

As Regional Planner, Leah Hartley has fostered partnerships between municipalities, first nations, provincial agencies and community associations addressing sustainable development in the Central Okanagan region. Leah is a graduate in Environmental Studies from University of Waterloo, and pursues ongoing studies at UBC's Sauder School of Business. She has worked in private and public sectors in British Columbia and is well versed in resource and private land development practices.

Over the past five years, Leah has advanced the Central Okanagan Regional District's role in water resource management. Linking land use decisions to water management is seen as a key foundation in planning for long term integrity of communities and the environment within the Okanagan Basin.

Dr. Kim D. Hyatt

Research Scientist, Fisheries and Oceans Canada, Pacific Biological Station in Nanaimo, BC, hyattk@pac.dfo-mpo.gc.ca

Dr. Hyatt is a research scientist at Fisheries and Oceans Canada's (DFO) Pacific Biological Station (PBS) in Nanaimo, B.C. He has worked as a teacher (Okanagan University College 1976-1978), environmental consultant (1978-1980) and fisheries scientist (DFO 1981-present). He heads the Salmon in Regional Ecosystems Program and his current research interests are focused on: (1) the status of salmon populations in Canada's Pacific Region, (2) salmon and associated food webs, (3) climate effects on salmon in freshwater and marine ecosystems, and (3) creation of decision support systems to improve fisheries management.

Kim has held adjunct faculty appointments at Simon Fraser University, the University of British Columbia and the University of New Brunswick. He also serves as: a Science Advisor and manager for the National Fisheries Sector Office of the Canadian Climate Impacts and Adaptation Research Network (C-CIARN Fisheries); President of the Canadian Aquatic Resources Section of the American Fisheries Society (AFS); Chair of AFS's Resource Policy Committee; Research Director for the non-profit Northwest Ecosystems Institute, and as a Representative on the International Union for the Conservation of Nature's (IUCN) salmonid species group.

Vic Jensen, R.P.Bio

Environmental Impact Biologist, Environmental Quality Section Penticton, BC Ministry of Environment, vic.jensen@gov.bc.ca

Vic Jensen has a B.Sc in Biology from the University of Victoria and is a registered professional biologist. He presently is the Environmental Impact Assessment Biologist for the Ministry of Environment in Penticton, as position he held since 1986. He monitors, assesses and reports on the ambient environmental health of priority aquatic environments within the Okanagan Region.

Carolyn Johns

BC Lake Stewardship Society Project Coordinator, carolynj-bclss@shaw.ca

Carolyn graduated from Okanagan University College with a B.Sc majoring in Freshwater Science. Carolyn has worked for the City of Kelowna's Watershed Restoration Crew and as an Environmental Technician for Kemess Mine in northwestern BC. She has experience in water quality monitoring, assessment and restoration. She believes strongly in community action and stewardship initiatives.

Doug Johnson, P.E.

Engineering & Technical Support Section Manager, Washington State Department of Ecology, Olympia, WA, djsd461@ecy.wa.gov

Doug is a civil engineer with over 22 years of experience in dam safety and water resources engineering. He is currently supervisor of Engineering and Dam Safety for the Washington State Department of Ecology, and has been in charge of dam safety in the Washington for the past 10 years. He received his bachelor's degree in civil engineering from the University of Washington in 1983. He served as President of the Association of State Dam Safety Officials from 2002 to 2003. He is a registered professional engineer in Washington State, and a member of ASCE.

Kris G. Kauffman, P.E.

President, Water Rights, Inc., waterrightsinc@msn.com

Mr. Kauffman has been a registered Civil Engineer in Washington since 1970 and remains in good standing under Professional Engineer License No. 11975. He graduated in Civil Engineering from the University of Washington in 1965, emphasizing Water Resources course work. He was born in Port Angeles in 1942, and grew up in North Seattle.

Professional work includes field engineering in North America; (West) Pakistan (1965-1968); regional Engineer for the Washington Department of Water Resources (later Ecology) for Northeastern Washington, including transboundary waters such as the Columbia, Okanogan, Similkameen, Myers Creek, the Kettle River Basin as well as the Pend Orielle River, then all of Eastern Washington, for water rights and flood control permits (1968-1972) inclusive of representing the State in contested water right cases related to both surface and groundwater before administrative appeal board and Superior Court settings.

Kris participated in and supervised the project engineering and planning activities in water resources for all 62 basins in Washington State (1973-1980) and has been involved with

the transboundary Skagit River Basin also. In 1979 Kris was appointed to the International Osoyoos Lake Board of Control (IOLBOC) by the International Joint commission. He was appointed again with regard to the 1982 and 1985 IJC orders related to the new Zosel Dam. He continues as the longest standing member on this Board with three colleagues from Canada and two from the U.S.

Kris has been President of Water Rights, Inc., for over twenty five years, performing professional consulting in various aspects of Water Resource Planning, Management and Water Right matters. In this capacity, he has appeared as an expert or client representative before various agencies, the State Pollution Control Hearings Board, various State Superior Courts and Federal District Courts for both Eastern and Western Washington.

Kris chaired the regional staff (four State and Federal Representatives) review for the Coordinated Comprehensive Joint Plan (CCJP) for Water and Related Land Resources for the Columbia-North Pacific Region which had up to a 2020 time horizon under the Pacific Northwest Rivers Basins' Commission, circa 1978. He was also in responsible charge of the State's drought response in 1977.

Kris was Chief Engineer for Washington State Parks from 1980 to 1992.

He has been active at the local, regional and national level of the American Society of Civil Engineers (ASCE), being the past Chair of the Water Laws Committee of the Water Resource Planning and Management Division of the National ASCE that has published documents including The Shared Used of Transboundary Water Resources. He is a founding member and past president of the Washington AWRA section; a member of the AWWA; the past President of the Washington Resources Council; and, a past member of the Cascade Land Conservancy Board.

Tom Laurie

Government Liaison, Washington State Department of Ecology, tlau461@ecy.wa.gov

Tom Laurie is currently Government Liaison for the Washington State Department of Ecology. He has 30 years experience working in Washington State with tribal and state governments including positions in planning, policy development, and environmental and executive management. He worked for the Port Gamble S'Klallam Tribe in Washington State for twelve years in several positions, including director, and joined Ecology's executive office in 1989. His current duties include providing executive support and policy development and coordination on a wide range of environmental and jurisdictional issues including water rights, water quality, climate change and adaptation, watershed planning, spill preparation and response, environmental justice, air quality, toxic clean-up, shoreline and coastal zone management, environmental monitoring, and nuclear waste clean-up at Hanford. Current projects include the Columbia River Water Management Program, the Nooksack instream flow settlement initiative, and the tribal water right pathways project.

Tom also represents the Dept. of Ecology on the Washington State Forest Practices Board, an independent state agency governing forest practices on state and private lands, and serves as a government liaison to British Columbia and Environment Canada on cross-border issues and coordinates the British Columbia – Washington Environmental Cooperation Council. Tom holds both a bachelor's degree and master's degree in public administration from The Evergreen State College in Olympia, Washington.

D. Marcie Mangold

401 Certification Hydro Dam Relicensing Specialist, Water Quality Program, Washington State Department of Ecology, dman461@ecy.wa.gov

D. Marcie Mangold obtained her Masters in Geography and Environmental Studies from the University of Colorado in 2001, obtained her Bachelors in Environmental Science from Eastern Washington University in 1994 and has worked with the Department of Ecology's Water Quality Program since 2001. Marcie's current position with Ecology is the 401 Certification Hydro Dam Relicensing Specialist. Previous to being a Dam Relicensing Specialist, she was a Total Maximum Daily Load Specialist and wrote and managed National Pollution Discharge Elimination System permits and State Waste Discharge permits.

Steve Matthews

Head, Fish and Wildlife Section, BC Ministry of Environment, Okanagan Region, steve.matthews@gov.bc.ca

Steve Matthews has been Head of the Fish and Wildlife Section, BC Ministry of Environment , Okanagan Region for the past 3 years. He is responsible for directing all fish and wildlife management within the region. He has 28 years experience working as a Fisheries Biologist with MOE – 27 years in the Okanagan region.

Mr. Matthews has extensive experience in managing small lake, large lake, and river fisheries, including protection and restoration of aquatic habitats. He has been leader of the Okanagan River Restoration Initiative since inception in 1999 and he has initiated a similar initiative on Mission Creek in Kelowna.

Beverly McNaughton

Aquatic Ecosystem Assessment Scientist, Environment Canada, beverly.mcnaughton@ec.gc.ca

Beverly McNaughton is an Aquatic Ecosystem Assessment Scientist for Environment Canada, working close to 20 years in the field of water quality. One of the projects she is currently working on, funded through GeoConnections, is compiling land and water data for the Okanagan. Other projects include the Pacific and Yukon Water Quality Website (waterquality.ec.gc.ca) which reports out on long term water quality monitoring data and the Freshwater Quality Indicator which ranks waterbodies as Excellent, Good, Fair, Marginal or Poor. A 2007 report on this is now available on the Water Quality website . On a lighter note, she enjoys fine wines and being taken for a walk by her two border collies.

Denise Mills

Water Quality Manager, Washington State Department of Ecology, Central Region, dmil461@ecy.wa.gov

Denise Mills is the Water Quality Manager for the Washington State Department of Ecology's Central Region, where she oversees a range of water quality protection, permitting, and water cleanup activities in the central part of the state. Prior to this, Denise was the assistant director for trust land management in Idaho and earlier managed Montana's environmental cleanup programs.

Additionally, she worked for over 18 years as a consultant managing hydrogeological and remedial investigations at waste disposal, manufacturing, and industrial facilities, and performing water supply and aquifer protection studies. During recent graduate studies in

Hawai'i, Denise was a watershed planning facilitator in Kona and taught physical geography at the University of Hawai'i.

Denise has a B.Sc. in Geology from the University of Washington, an M.Sc. in Geography from the University of British Columbia in Vancouver, and is currently working toward a PhD in Urban and Regional Planning at UH. She is a licensed geologist and hydrogeologist in Washington, and a registered professional geologist in Idaho and Oregon.

Denise Neilsen, Ph.D.

Research Scientist, Pacific Agri-Food Research Centre (Summerland, BC), Agriculture and Agri-Food Canada, neilsend@agr.gc.ca

Dr. Denise Neilsen is a research scientist with Agriculture and Agri-Food Canada at the Pacific Agri-Food Research Centre (PARC) at Summerland, British Columbia. Her work focuses on soil, water and nutrient management in tree fruit production systems and in the recent past has been involved with reducing the potential environmental impact of nitrogen and water use in agriculture. She has coordinated and conducted research projects on efficient methods of supplying nitrogen and water to fruit trees, which have included techniques to assess the timing and quantity of plant demand. She was co-PI on a large integrated Study Enhancing the Dialogue on Climate Change and Water Resources in the Okanagan published in 2004 and is currently co-PI of a project to model agricultural water demand as part of the Okanagan Basin Water Supply/Demand Study. Dr. Neilsen is also working on the development of models to describe crop suitability for current and future climates.

Craig T. Nelson

District Manager, Okanogan Conservation District, craign@okanogancd.org

Craig Nelson, Okanogan Conservation District Manager, has a BA in Geography with a minor in Environmental Studies and is a graduate of the Washington Ag Forestry Leadership Program. Craig's professional experience includes promoting irrigation water management, stream restoration, regional and watershed planning. He has also served on several statewide issue committees for conservation districts, served as President of the Washington Association of District Employees, and co-chaired the Washington Association of Conservation Districts (WACD) Livestock Committee for two years, and has served as Chair of the WACD Awards Committee for four years. He also served as a City Councilmember for the City of Okanogan from July 2000 to December 2004 and was appointed to the City Council again in May 2007 to fill a vacant position.

Mark Pendergraft

Regional Director for Rural Osoyoos (Area A), Regional District of Okanagan-Similkameen, mpendergraft@rdos.bc.ca

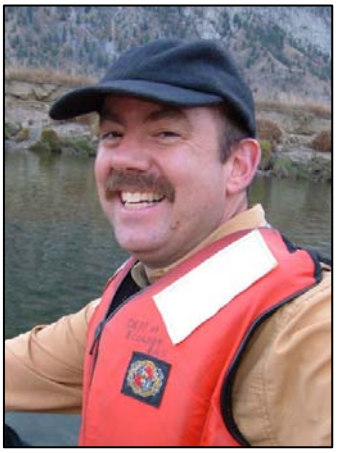
Mark Pendergraft is a born and raised second generation Osoyoos Resident. He grew up on his family's ranch, and has worked and lived here his whole life. He has a genuine concern for our lake, having seen the changes to it over the years. He is presently the Regional Director for Rural Osoyoos (Area A) of the Regional District of Okanagan-Similkameen.

Joe Peone

Director, Fish and Wildlife, Confederated Tribes of the Colville Indian Reservation, joe.peone@colvilletribes.com

Joe Peone worked for several years as a field biologist and project managers until taking over the Directorship of the Colville Confederated Tribes' Fish and Wildlife Department in 1995. Under Joe's direction the department has grown from about 20 employees to over 80. He has diligently worked to return anadromous fish to the Tribal boundary waters and protect and enhance the Tribes' fish and wildlife resources.

Mark Peterschmidt



Environmental Specialist, Waste Quality Program, Washington State Department of Ecology, mape461@ecy.wa.gov

Mark Peterschmidt is an Environmental Specialist IV working for the Washington State Department of Ecology's Waste Quality Program. Mark is working on Water Quality Improvement projects to address arsenic, DDT, PCBs and high temperatures in watersheds in central Washington. Mark has been working with the communities of Central Washington to characterize water quality impairments and find community based corrective actions. Mark also works with the Department of Ecology's Hazardous Materials Spill Response Team. Before beginning work for the water Quality program in 2000, Mark worked ten years for the Department of Ecology's Toxics Cleanup Program investigating and evaluating hazardous material releases and cleanups.

D. Paul Rankin

Biologist, Pacific Biological Station, Fisheries and Oceans Canada, rankinp@pac.dfo-mpo.gc.ca

Paul Rankin obtained his B.Sc. at the University of Victoria and a M.Sc at the University of British Columbia with Dr. Tom Northcote. He started working with Fisheries and Oceans Canada, at the Pacific Biological Station, with the Lake Enrichment Program on sockeye salmon in lakes. He has been working on the Osoyoos Lake sockeye since 1997. He is particularly interested in juvenile sockeye production, rearing conditions and water quality in Osoyoos and Skaha Lakes and how these lakes compare to sockeye rearing lakes on the west coast of Vancouver Island and the central coast of BC.

In his spare time he enjoys playing his bagpipes, photography and watercolours.

Barry Rosenberger

Area Director, BC Interior Area, Fisheries & Oceans Canada, rosenbergerb@pac.dfo-mpo.gc.ca

Barry Rosenberger is Area Director of the BC Interior Area of the Department of Fisheries & Oceans. Barry has been with the DFO for 29 years, working in various locations including Hope, New Westminster, Alert Bay, Prince Rupert, Bella Bella and Kamloops. He has worked in enforcement, habitat management, stock assessment, and Treaty land claim negotiations and fisheries management.

In March 2002 Barry assumed the role of Area Director for the BC Interior and is responsible for operational delivery of habitat management, Salmonid Enhancement, Program,

stock assessment, aboriginal programs and fisheries management for DFO. The BC Interior Area covers the Fraser watershed upstream of Yale along with the Peace, Columbia and Okanagan watersheds.

Eike G. Scheffler, M.Sc.

Osoyoos Oxbow Society Restoration Society, eike@vip.net

Mr. Scheffler spent forty years in and out of the ecological field as a professional, UBC Master of Science biologist and agrologist, trained under Dr. Cowan and Dr. Brink. He originally conducted his thesis work in this region in the mid 1960s and graduated with honours.

He has worked in the environmental field in all four Western Provinces (at one time as Chief Wildlife Biologist for Alberta). He has three years of academic legal training.

He has owned and operated several ranches and businesses. He was co-owner of one of the best sports fishing lodges (by published business surveys) in the Yukon. He is now semi-retired, but is still consulting privately as an ecologist working in the fields of local land use, riparian, and developmental matters.

Tom Scott

Oroville-Tonasket Irrigation District manager, otid@nvinet.com

Tom Scott is the Oroville-Tonasket Irrigation District manager. He is a product of local schools with 38 years of experience in the irrigation business and public service. He is a member of the WIRA 49 Water Shed Committee and the Similkameen Watershed Interim Steering Committee.

Anna Warwick Sears, Ph.D.

Executive Director, Okanagan Basin Water Board, anna.warwick.sears@obwb.ca

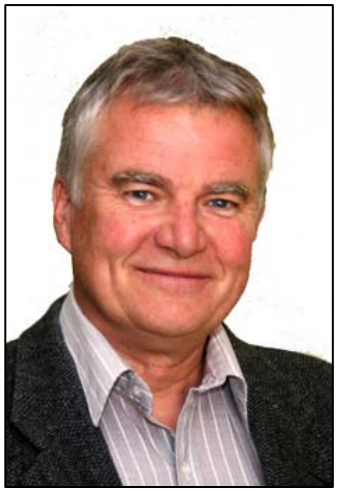
Anna Warwick Sears is the Executive Director of the Okanagan Basin Water Board (www.obwb.ca), a local government body with responsibility to provide leadership on water issues that span the entire valley. Anna trained as a population biologist, studying competition for limiting resources in arid environments. Prior to moving to the Okanagan she worked as the Research Director of an environmental NGO in Sonoma County, California, where she led a large-scale watershed planning project. At the Water Board, Anna is particularly focused on joining science with public policy development to provide the best possible information for decision makers planning the future of Okanagan communities. The Water Board has recently undertaken a large-scale study, in partnership with the BC Ministry of Environment, to evaluate present and future water supply and demand for the Okanagan Basin. The Water Board is also working with the Okanagan Water Stewardship Council, a multi-stakeholder technical advisory body, to develop a Sustainable Water Strategy for the Basin.

Steve Shannon

Assistant Planner, Development Services Department, Town of Osoyoos, sshannon@osoyoos.ca

Steve Shannon has a Bachelor of Environmental Science degree from Royal Roads University and a Diploma in Environmental Planning and Technology from Selkirk College. Following University he worked as a GIS Technician for the Regional District of Central Kootenay. He has also worked for the City of Port Moody and the City of Surrey. In 2005 he joined the Town of Osoyoos as Assistant Planner and has recently taken on the responsibility of Subdivision Approving Officer for the town.

John Slater



Mayor of Osoyoos, jslater@osoyoos.ca

John owns and operates a nursery and greenhouse, and during his free time, enjoys downhill skiing and golfing. He is married to Jane and has raised three children in Osoyoos, where he has lived since 1980.

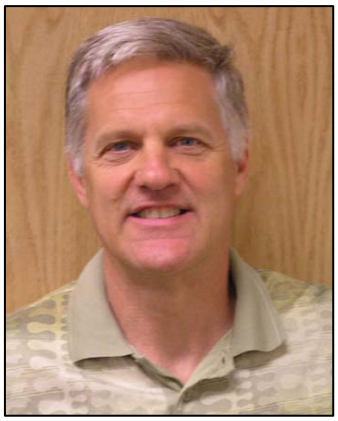
John has spent the past 17 years immersed in local and regional government politics, as a councillor, director, board member, and currently Mayor of the Town of Osoyoos. He has served as director on the Okanagan Regional Library Board, Okanagan Basin Water Board (currently Chair), Highway 97 Transportation Commission, Hwy 97 Border Coalition Society (currently Chair), Destination Osoyoos Board, Regional District of Okanagan Similkameen, BC Vegetable Marketing Commission, and various other boards and committees locally.

Margot Stockwell

Research Biologist, Pacific Biological Station, Science Branch, Fisheries and Oceans Canada, StockwellM@pac.dfo mpo.gc.ca

Margot Stockwell is a Research Biologist for Fisheries and Oceans Canada in Nanaimo. For the past 7 years, much of Margot's work has been focused on the impacts of variable water temperatures and discharge on fresh water life history stages of Okanagan sockeye salmon. The results of this work have provided core information for (i) evaluating the feasibility of potential stock restoration options, (ii) developing decision support tools for fisheries and water managers, and currently (iii) assessing the role of climate variation and change on sockeye production in fresh water.

Brian Symonds, P. Eng.



Director of Regional Operations, Water Stewardship Division, BC Ministry of Environment, brian.symonds@gov.bc.ca

Brian Symonds is the Director of Regional Operations with the Water Stewardship Division of the BC Ministry of Environment. Mr. Symonds graduated with a B.A.Sc. in Civil Engineering from UBC in 1979.

Following graduation he worked for several years as a consulting engineer on a variety of water resource projects. During this period he completed a Master in Water Resources Engineering at UBC (1983).

In 1985 he joined the Ministry of Environment regional office in Williams Lake where he was responsible for leading the water allocation program in that region.

In 1989 he transferred to the ministry's Penticton office. While in the Okanagan he has held a variety of positions with the provincial Water Management program. His scope of responsibilities has included water licensing, flood hazard management, dam and dike safety, management of the Okanagan Lake Regulation System, watershed planning, snow surveys and source water protection.

In October 2005 Mr. Symonds assumed the position of Director of Regional Operations within the newly created Water Stewardship Division. In this capacity he is responsible for the regional delivery of the Division's programs and services throughout BC.

In addition Mr. Symonds has been a member of the International Osoyoos Lake Board of Control since 2002.

Howie Wright, M.Sc., R.P.Bio.

Senior Fisheries Biologist, Okanagan Nation Alliance Fisheries Department, hwright@syilx.org

Howie Wright is the Senior Fisheries Biologist for the Okanagan Nation Alliance Fisheries Department and a member of the Gitksan Nation. Howie completed both his Bachelor of Science and Master of Science at the University of British Columbia. He is a member of the Marine Fishes Species Specialist Committee for the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) and also Fisheries and Oceans Canada National Science Advisory Board. He has been working with the Okanagan Nation Alliance Fisheries Department since 1998.

Next steps and further information

A forum summary report will be available on the Okanagan Basin Water Board web site (www.obwb.ca) by the first week of October. This report will highlight the key points of action and next steps emerging from the forum, emphasizing synthesis, information gaps, and suggest what actions and balance of responsibilities will be needed to effectively address them.

Interested individuals will also be able to access the majority of forum presentations on the OBWB web site. In addition, contact information for all presenters, panel members and a list of groups and associations people may wish to become involved with will be provided on www.obwb.ca web site (and listed in the summary report).