## Slide 1

WASHINGTON STATE UNIVERSITY

Investigating methods for including ecosystem requirements in Orders of Approval

Cailin Huyck Orr, School of Earth and Environmental Science

Lai Tran, Kirti Rajagopalan and Wes Helander, Civil and Environmental Engineering
Michael Barber, State of Washington Water Research Center
Marc Beutel, Civil and Environmental Engineering
Barry Moore, Natural Resource Sciences

Slide 2

Setting and local habitats

Slide 3

Water quality

Slide 4
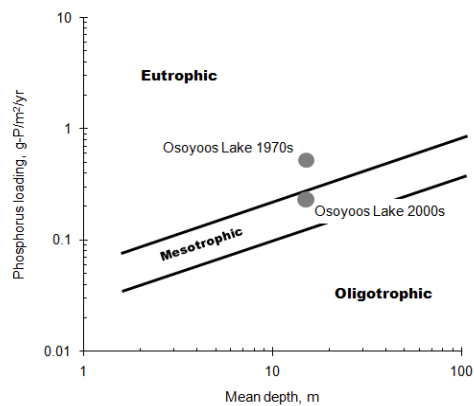
Invasive species

Milfoil

Mysis shrimp

Cattail

Osoyoos Lake wetlands

Threatened species

Painted turtle

Yellow breasted chat

Tiger salamander
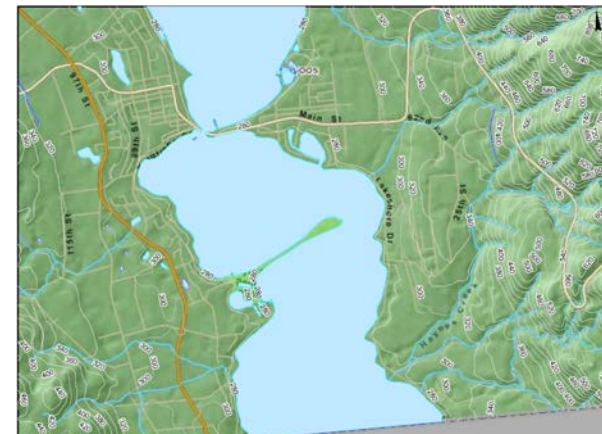
Toothcup

Photo:Osoyoos Lake Quality Society
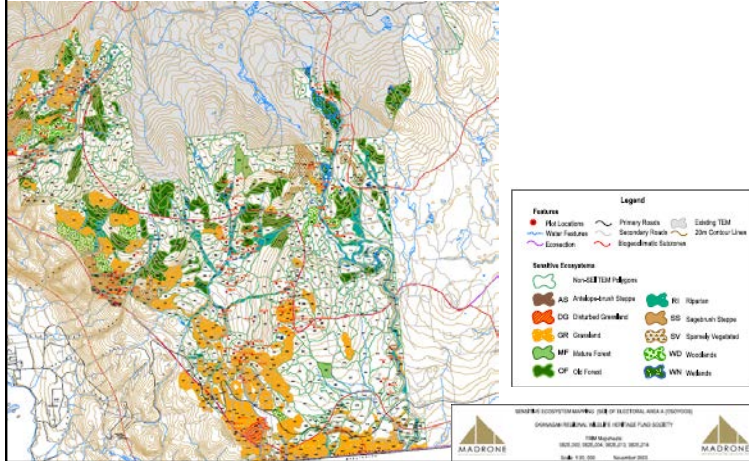
Wetlands

Riparian

Photo: Regional district Okanagan-Similkameen
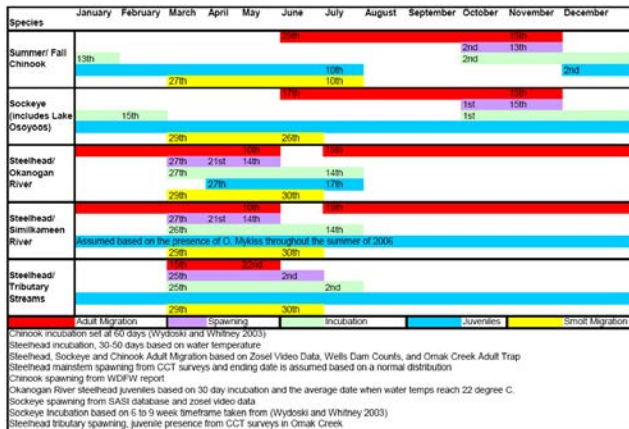
Tiger salamander habitat map

Sensitive Ecosystem Inventory

Salmon redd

Fish periodicity: Okanogan and Similkameen Rivers

Prepared by Colville Tribes and Washington State Department of Fish and Wildlife, Anadromous Fish Division 2009.

Zosel Dam Operating Procedures Plan fish flows

Discharge: Zosel Dam (cfs, m³/s)	Time period	Target species	Life stage	Location
333, 9.43	Oct 1 – Apr 15	Chinook	egg/fry survival	downstream
482, 13.6	Mar 1 – Jun 15	Steelhead	spawning egg/fry survival	downstream
200, 5.66	June 15- Aug 1	resident fishery	all	downstream
Additional release:				
Pulse release: 2,850 acre-feet , 3.5 million m³	April – timing determined each year	Sockeye	smolt	Flush from lake to downstream

Ecology 1990, (Barber et al. Study1, 2010)

Downstream flow mitigation structure
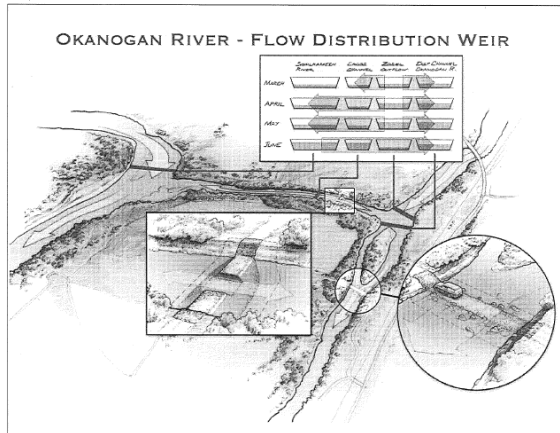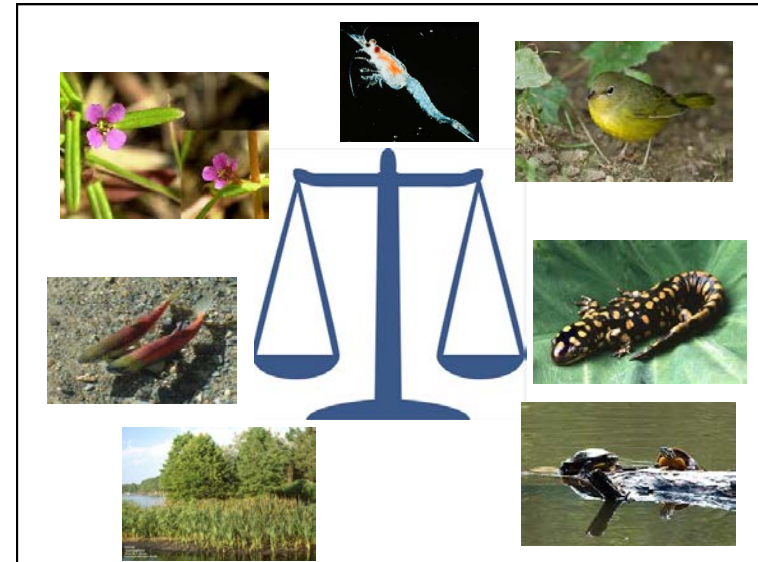

OKANOGAN RIVER - FLOW DISTRIBUTION WEIR

Figure 27. Apportionment of flows in Okanogan and Similkameen rivers with flow **Colville Confederated Tribes**

Major points

- Water quality in the lake is an important criterion for in-lake habitat.
- Lake levels could possibly be used to control invasive species. This is likely to degrade shoreline habitat of threatened species.
- Lake levels impact riparian habitats that are important for threatened animal species.
- Discharge from Zosel dam impacts downstream Salmonid habitat
- There are trade-offs between different management scenarios

Acknowledgements