Canadian CRT Ecosystem-based Function Goals/Objectives/ Performance Measures

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Columbia River Treaty Review -- BC Decision

- "Ecosystem values are currently, and will continue to be, an important consideration in the planning and implementation of the Treaty"
- "The Province will explore *ecosystem based improvements* recognizing that there are a number of available mechanisms inside and outside the Treaty"

CRT LGC Recommendations

***6. Expand the Focus of the Treaty to Include Ecosystems and Other Interests**: The Committee urges the Province to seek refinements to the Treaty and/or the supporting documents that provide for operations which benefit a broad range of interests in this region and in the U.S.*

As an initial priority, Basin residents support incorporation of ecosystem function as a first-order value within the Treaty, along with flood control and power production. Many Basin residents view a healthy environment as the foundation for economic and social well-being in the Basin.

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U.S. Regional CRT Recommendations

Treaty provisions should enable the greatest possible shared benefits in the United States and Canada from the coordinated operation of Treaty reservoirs for ecosystem, hydropower, and flood risk management, as well as water supply, recreation, navigation, and other pertinent benefits and uses, as compared to no longer coordinating Treaty storage operations.

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What has been done?

- 2012 – 2013 CRT review process – technical studies and addendum re:
  (i) an ecosystem scenario; and
  (ii) more stable Arrow scenario
- 2015 technical workshop on possible CRT ecosystem-based function scenarios
- Arrow scenarios ("mid-Arrow") scoping and evaluation process

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EbF Goals/Objectives: Process

- Project steering committee: federal and provincial agencies, First Nations, BC Hydro, ENGO
- CRT Ecosystem-based Function Objectives workshop June 22 – 23 Nelson
- Invitees as above plus Local Governments' Committee and specialized consultants
- Product is a preliminary set of proposed CRT EbF goals, objectives and performance measures
- ONA and other specialists added additional review/revisions

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EbF Goals/Objectives: Purposes

1. To allow for the evaluation, from an ecosystem perspective, of a range of potential operational scenarios; and
2. To support the development of 'ecosystem function' scenarios which would attempt to achieve as many of the goals and objectives as possible.

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Context

- **Not intended to define or limit aboriginal rights** of Columbia River First Nations or to constrain bilateral or trilateral CRT consultation processes between First Nations and the federal and/or provincial governments
- **Some of the goals/objectives are conflicting** because impacts will be balanced during decisions about future operations, not in the development of goals, objectives or performance measures
- **Benchmark or reference point for comparing scenarios** is 'current operations' since 2008
- **Credible, defensible data** will be the basis for detailed requirements in performance measures (e.g. dates, flows, reservoir levels)

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EbF Goals and Objectives: Example

- **GOAL – Maximize terrestrial habitats and associated values identified as impacted.**

Objective: Adjust the timing, frequency and duration of inundation sufficiently to achieve a threshold that will potentially allow the development of functioning floodplain, riparian, wetland and upland ecosystems within the reservoir footprints and on the floodplains of rivers downstream of reservoirs.

Location: Reservoir footprints and the upstream ends and inflow fans of tributary streams of Arrow, Kinbasket, Duncan and Koocanusa reservoirs; Duncan/Lardeau floodplain downstream of the Duncan dam, Columbia River downstream of Revelstoke and Arrow Reservoirs and the Kootenay River upstream of Kootenay Lake.

Rationale and preliminary performance measures provided

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- Maximize terrestrial habitats and associated values identified as impacted.
- Minimize sediment movement into waterways, and the loss of land and habitats, by reducing erosion to levels that mimic natural rates.
- Maximize aquatic ecosystem productivity.
- Restore normative/pre-dam water flow regimes to enhance riverine aquatic and riparian, floodplain and wetland ecosystems.

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- Maximize habitats for indigenous river-dependent fish species.
- Maximize fish access to tributary spawning habitats.
- Minimize aquatic biota mortality directly caused by hydro generation operations.
- Maximize carbon sequestration.

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GOAL – Maximize terrestrial habitats and associated values identified as impacted

OBJECTIVES

- Adjust the timing, frequency and duration of inundation sufficiently to achieve a threshold that will potentially allow the development of functioning floodplain, riparian, wetland and upland ecosystems within the reservoir footprints and on the floodplains of rivers downstream of reservoirs.
- Increase the amount, productivity and functioning of riparian, floodplain and wetland ecosystems adjacent to and within CRT reservoir footprints and affected river reaches. *(Effectiveness objective)*

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GOAL – Maximize terrestrial habitats and associated values identified as impacted

OBJECTIVES

- Increase the amount, productivity and functioning of littoral communities (aquatic shallow water) within CRT reservoirs.
- Minimize spring and summer inundation of valuable habitats for breeding birds, mammals, amphibians and reptiles to maximize their survival.

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GOAL – Minimize sediment movement into waterways, and the loss of land and habitats, by reducing erosion to levels that mimic natural rates.

OBJECTIVES

- Decrease erosion from wave action, including debris scouring.
- Decrease erosion from slumping.
- Minimize negative impacts on archaeological sites from erosion.

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GOAL – Maximize aquatic ecosystem productivity.

OBJECTIVES

- Maximize pelagic (lake) productivity by optimizing water residence time to increase nutrient retention, primary productivity and retention of biota.
- Maximize aquatic productivity in Arrow reservoir by adjusting the timing, frequency and duration of inundation in the Mid-Columbia/Revelstoke Reach.

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GOAL – Restore normative/pre-dam water flow regimes to enhance riverine aquatic and riparian, floodplain and wetland ecosystems.

OBJECTIVES

- Minimize the difference from pre-dam water flow regimes downstream of all CRT reservoirs.
- Restore high flow rates sufficient to shift streambed materials and enhance fish habitat complexity.

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GOAL – Maximize habitats for indigenous river-dependent fish species.

OBJECTIVES

- Re-establish permanently flowing large main stem rivers and side channel aquatic habitats.

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GOAL – Maximize fish access to tributary spawning habitats.

OBJECTIVES

- Maximize vegetation rehabilitation along tributary streams. *(Effectiveness objective)*
- Maximize the number of spawners that access tributary spawning grounds. *(Effectiveness objective)*

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GOAL – Minimize aquatic biota mortality directly caused by hydro generation operations.

OBJECTIVES

- Minimize stranding by limiting water level changes in lake and riverine shorelines during critical life cycle stages
- Minimize frequency and duration of elevated total dissolved gases downstream of dams that exceed a threshold tolerable level for fish. *(Effectiveness objective)*
- Minimize entrainment through turbines where flows or elevation changes are implicated. *(Effectiveness objective)*

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GOAL – Minimize aquatic biota mortality directly caused by hydro generation operations.

OBJECTIVES

- Minimize entrainment through turbines where flows or elevation changes are implicated. *(Effectiveness objective)*
- Optimize operations to address water temperature related issues, particularly during critical life-cycle stages.

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GOAL – Maximize carbon sequestration.

OBJECTIVES

- Increase the amount, productivity and functioning of riparian, floodplain, wetland and upland ecosystems adjacent to and within CRT reservoir footprints and affected river reaches.

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ONA + specialists Draft

- Goals/objectives for individual reservoirs/dams and river segments – Example is Kinbasket reservoir/Mica dam
- References relevant technical resources
- Identifies data gaps

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Existing Vegetation

GOAL – Maintain current spatial extent of native terrestrial vegetation in the drawdown zone of Kinbasket Reservoir.

OBJECTIVE – Ensure the persistence of the spatial extent of existing native terrestrial vegetation in the drawdown zone that is consistent with current conditions.

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Existing Vegetation

GOAL – Increase the spatial extent and composition of native terrestrial vegetation communities by 5 to 15 per cent within a 10 to 20 year period.

OBJECTIVE – Modify habitat (revegetation or physical works) to increase the total spatial extent of existing native terrestrial vegetation in the drawdown zone

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Existing Vegetation

GOAL – Improve habitat suitability for wildlife species using the drawdown zone to fulfill some or all of their life requisites (e.g., reptiles, amphibians, waterfowl, songbirds, shorebirds, raptors, small mammals, ungulates, etc.).

OBJECTIVES

- Modify habitat (revegetation or physical works) to increase the total amount of functional wildlife habitat (terrestrial, shallow wetland, riparian, floodplain, or a combination of habitats) for species of wildlife that use the drawdown zone.
- Develop hard constraints for reservoir operations for wildlife groups that would benefit from seasonal habitat availability in the drawdown zone. (e.g., reptiles, amphibians, waterfowl, songbirds, shorebirds, raptors, small mammals, ungulates, etc.).

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Habitat Connectivity

GOAL – Maintain and increase total connected area of vegetated habitat (area & function) – between reservoir drawdown zone and adjacent upland habitats.

OBJECTIVE – Maintain a gradient of successional stages from pioneering at lower elevations in the drawdown zone to older seral stages in the adjacent upland to improve connectivity between the drawdown zone and adjacent upland habitats.

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Wetland Habitat

GOALS

- Maintain existing wetland habitat that was present pre-dam and that persists in the drawdown zone of Kinbasket Reservoir.
- Maintain wetland habitat that was created in the drawdown zone by the creation of Kinbasket Reservoir
- Increase the spatial extent of shallow wetland habitat by 5 to 15 per cent within a 10 to 20 year period.

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Wetland Habitat

OBJECTIVES

- Ensure the persistence of existing shallow wetland habitat in the drawdown zone of Kinbasket Reservoir. This includes pre-dam and created wetland habitat.
- Modify habitat (physical works) to increase the total amount of wetland habitat in the drawdown zone.

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Geo-fluvial Processes

GOALS

- Maintain geo-fluvial processes to mimic natural rates. (timing, critical load considerations)

Goals to add that deal with:

- Peak flow
- Bank/shoreline Stability
- Sediment load

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Geo-fluvial Processes

OBJECTIVES

- Reduce high flow, erosion and scouring impacts to fish impacts and cultural heritage sites
- Specify flow criteria to protect aquatic ecosystems, e.g., redd scour criteria and low flow desiccation criteria

ACTION – split into two to reflect positive and negative impacts.

ACTION- define between relationships reservoir shoreline erosion, and tributary erosion/sediment transport

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Productivity

GOAL – Improve primary, secondary, and tertiary aquatic ecosystem productivity based on specific reservoir conditions to sustain the aquatic and terrestrial species.

OBJECTIVES

Maximize production of limnetic fish by providing optimal conditions for plankton growth through manipulation of water chemistry, water levels, and flow conditions.

Continued…

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Productivity

- Maintain and /or restore aquatic production levels equivalent to historical for key species that are indicators of ecosystem integrity and state changes levels, to within acceptable variance levels.
- Maintain productivity of preferred species of phyto- and zooplankton, to sustain limnetic Kokanee, Rainbow and Bull trout [and potentially anadromous salmon if reintroduced or within xx-xx%.

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Water Chemistry

GOALS

- Maintain TDG levels that are safe for aquatic life
- Maintain restore and enhance aquatic water chemistry to achieve normative function.
- Meet provincial and federal ambient water quality standards at all times.

OBJECTIVE

- Sustain aquatic productivity within the historical range (i.e., period of record back to pre-impoundment) at all trophic levels.

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Thermal Regime

GOALS

- Stay within thermal regimes that support indigenous biota
- Consider using set guidelines (i.e., clean water act, aquatic life criteria) as specific measures

Or

- Use species specific life history needs (e.g., kokanee).

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Thermal Regime

OBJECTIVES

- Maintain the match between environmental thermal regimes and the evolutionary adaptions of aquatic biota.
- Determine operating conditions that will affect stratification, and downstream impacts on aquatic life (i.e., does the current thermal regime meet the needs for aquatic life? If not, what changes can we make to improve quality?)

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Mainstem and Side-channel Habitat

GOALS

- Maintain existing level of availability of free-flowing riverine mainstem habitat.
- Increase seasonal availability of critical species-specific, life history-dependent habitat by xx percent over xx years.

OBJECTIVES

- Maintain and improve the integrity and condition of riparian-channel.
- Maintain populations of riverine species in Kinbasket Reservoir, or improve by xx percent over xx years (eventually achieve populations ≥90% of pre-dam levels).
- Surplus fish abundance (access to fisheries for food) in 9 of 10 years.

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Tributary Habitat and Connectivity

GOALS

- Maintain current populations of indigenous fish species or increase by xx-xx percent over xx years.
- Optimize large tributary habitat, i.e., Mainstem Columbia, Wood River, Canoe River, and Bush River.

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Tributary Habitat and Connectivity

OBJECTIVES

- Maintain or improve access to tributary spawning areas for adult indigenous fish via control of reservoir levels during at key life history periods.
- Maintain biomass (or numbers) of spawning fish in tributary spawning grounds (viable population with long-term productivity > 1), or increase by xx-xx percent over xx years.
- Surplus fish abundance (access to fisheries for food) in 9 of 10 years.

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Tailrace and Dam Habitats

GOAL – Reduce level of mortality to aquatic biota that is directly caused by hydro generation operations.

OBJECTIVES

- Reduce levels of stranding- and scouring-related mortality by decreasing amplitude of water fluctuations (overall, or specifically during periods when biota are at greater risk of stranding) or by re-contouring river banks.
- Maintain or reduce the frequency and/or duration of 'elevated TDG events (i.e., periods during which TDG levels exceed threshold levels downstream of dam).
- Reduce the frequency and/or duration of 'elevated TDG' events (i.e., periods during which TDG levels exceed threshold levels downstream of dam).

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NEXT STEPS

UNDERWAY

- Additional workshops to further g&o development.
- Suggested revisions considered by the Steering Committee

WORKSHOP SUGGESTIONS

- Use Kinbasket template for other reservoirs
- Review and incorporate Duncan WUP ecological performance measures as appropriate
- Input from the ongoing Entrainment Working Groups and White Sturgeon Trans-Boundary Recovery Group

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