Improving Ecosystem Function in the Canadian (Upper) Columbia Basin

Upper Columbia Basin Environmental Collaborative

Discussion Paper – March 21, 2018

This purpose of the discussion paper is to present potential revised goals associated with dam operations to improve environmental values in Canada's Columbia Basin. The scope of the discussion paper includes reservoirs and reaches of the Columbia, Kootenay and Pend-d'Oreille Rivers affected by hydroelectric dams. The goals focus on improving terrestrial and aquatic ecosystems within Canadian reservoir footprints and improving large riverine habitats in and along the river reaches downstream of the impoundments. Previous studies have shown that construction of dams and flooding of numerous reservoirs has had major negative impacts on ecosystems in the region (e.g., Utzig and Schmidt 2011). The major aquatic components considered here are shown in Figures 1 and 2, and summarized below:

Aquatic Component	Relevant Dam(s)	Treaty?
Columbia River System		
Kinbasket Reservoir (Treaty / Non-Treaty Storage)	Mica	Y(N)
Revelstoke Reservoir	Revelstoke	N
Columbia River between Revelstoke Dam and Arrow Reservoir (i.e. Revelstoke Reach)	Revelstoke (Mica)	Y
Arrow Lakes Reservoir	Keenleyside	Y
Columbia River between Keenleyside Dam and the USA border	Keenleyside (Revelstoke/Mica)	N
Pend-d'Oreille River System	Waneta, Seven Mile and US dams	N
Kootenay River System		
Koocanusa Reservoir	Libby	N
Kootenay River between Libby Dam and Kootenay Lake	Libby	N
Duncan Reservoir	Duncan	Y
Duncan River between Duncan Dam and Kootenay Lake	Duncan	Y
Kootenay Lake	Libby Dam and Duncan Dam	N
Kootenay River between Kootenay Lake and Columbia River	Corra Linn, Upper Bonnington, Lower Bonnington, South Slocan, Kootenay Canal, Brilliant	N

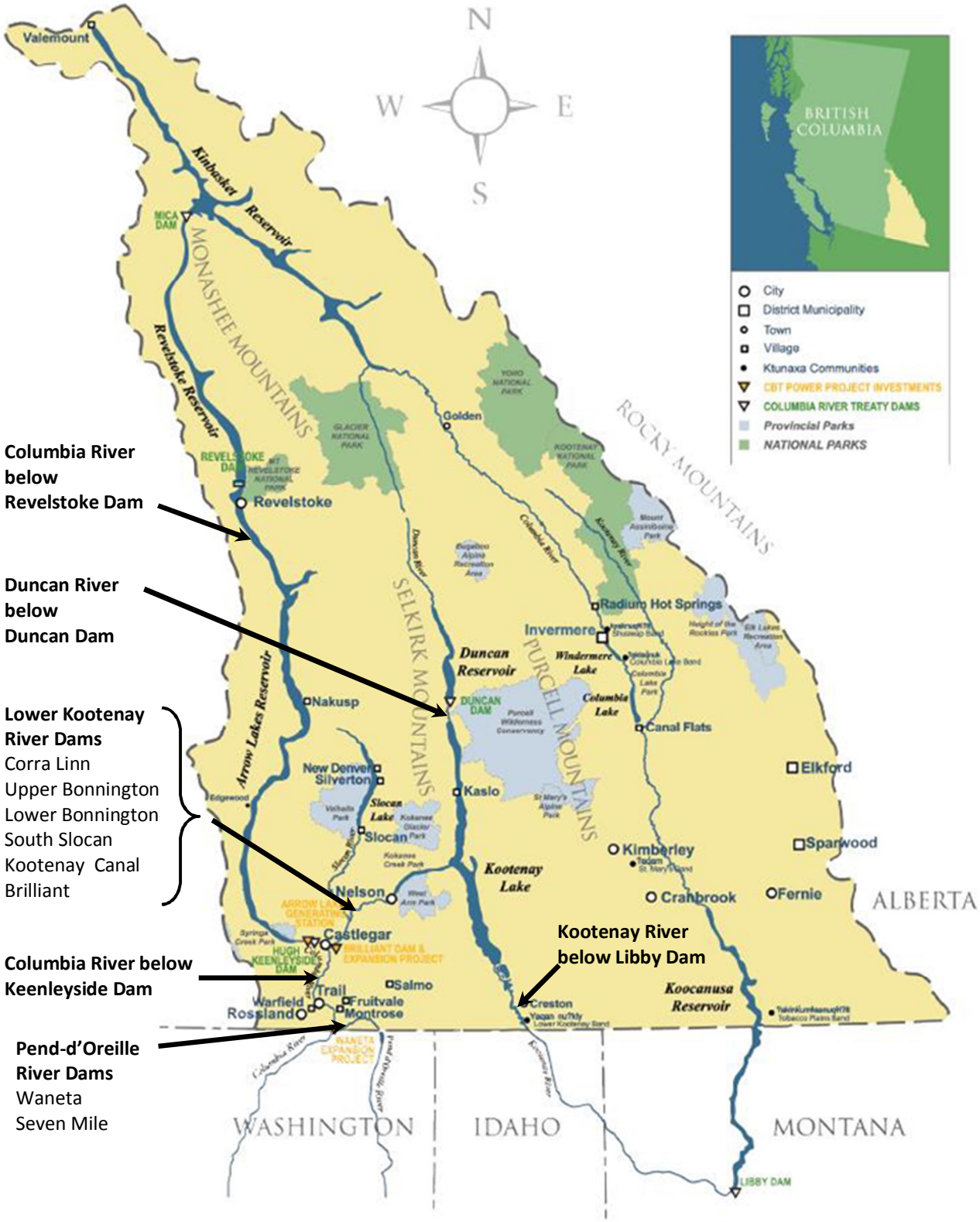

Figure 1. Dams, reservoirs and river reaches on the Canadian Columbia, Kootenay and Pend-d'Oreille Rivers (adapted from the Columbia Basin Trust).

Figure 2. Lower Kootenay River Dams (from International Kootenay Lake Board of Control – International Joint Commission – IJC).

This focus is on ecosystems and habitats, rather than a single-species approach. The dam and reservoir operations have impacted numerous species and guilds, including many listed species (Utzig and Schmidt 2011), and therefore this approach is likely to be more cost effective and provide a wider array of benefits than multiple singe-species approaches.

The ecosystem restoration goals described here are complementary to, and potentially prerequisites for, returning salmon to the Upper Columbia Basin. Whereas projected climates pose significant risks to the successful return of salmon, opportunities to achieve the ecosystem restoration goals identified here are not jeopardized by climate change. To the contrary, these measures would increase the resilience of aquatic, wetland, riparian and upland ecosystems to climate change, and therefore may strengthen separate efforts to return salmon to the Upper Columbia Basin.

Some of the suggested measures can be realized without modification of the Columbia River Treaty (CRT), while others may require modification of the Treaty itself, or at least side agreements between the two parties to the Treaty. The initiatives suggested here can contribute to CRT negotiations (and Non-Treaty Storage Agreements ï NTSAs), but they also provide input into routine reservoir operations planning carried out by BC Hydro (BCH) the US Army Corps of Engineers (ACE), Bonneville Power and other relevant dam managers. The goals and measures identified here have not been prioritized, however UCBEC intends to prioritize them following discussions with various levels of government, First Nations and other stakeholders.

1.0 COLUMBIA BASIN CONSIDERATIONS

Preliminary identified steps/measures:

- Through the CRT negotiations, include ñEcosystem Functionòas a third primary purpose of the CRT. Ecosystem Function should be defined to include all aquatic, wetland, riparian ecosystems impacted by dams throughout the Columbia Basin, on both sides of the international border.
- Through the CRT negotiations, ensure that the ñentitiesòon both sides of the border include effective representation of Ecosystem Function interests in decision-making.
- Substantially increase the funding in Canada to the Fish and Wildlife Compensation Program ï Columbia Basin such that is appropriate to the restoration and mitigation of environmental impacts created by the reservoirs and dams within the basin; broaden its scope to include all the dams and reservoirs in the basin.

2.0 COLUMBIA RIVER SYSTEM

2.1 Kinbasket Reservoir – Mica Dam

Preliminary identified steps/measures:

- Develop and implement a scoping study similar to the Mid-Arrow study (see below) to identify various options for Mica Dam operations that could benefit terrestrial, riparian, wetland and stream-reach ecosystems within the upper elevations of the reservoir footprint. These studies should build on existing Water Use Planning studies, and include assessment of various physical works, such as debris management structures and earth works. They should also consider changes to frequency and duration of flooding, such as those considered in the Mid-Arrow report.
- Through CRT and NTSA negotiations, ensure that the implementation of changes to Mica Dam operations that may be identified though ecosystem studies would be feasible under future CRT and NTSA terms.

2.2 Revelstoke Reservoir – Revelstoke Dam

Preliminary identified steps/measures:

- Initiate studies to explore operational changes to the Mica and Revelstoke dams that may allow use of a portion of the storage in Revelstoke Reservoir to provide improvements in environmental function downstream, while minimizing impacts on this and other reservoir environmental values. The focus should be on mitigating impacts of peaking and restoring large riverine habitat in the Revelstoke Reach.

2.3 Columbia River between Revelstoke Dam and Arrow Reservoir (i.e. Revelstoke Reach)

Preliminary identified steps/measures:

- In combination with changes to Arrow Reservoir management, implement changes to the operation of the Revelstoke Dam to ensure the restoration and/or maintenance of productive large riverine ecosystems between the Revelstoke Dam and the upper reaches of the Arrow Reservoir. Focus initial studies on reducing and/or mitigating peaking impacts on aquatic habitats, and the restoration of a more natural hydrograph.

- Examine various opportunities for peak-shaving and load sharing to reduce the frequency and magnitude of peaking at the Revelstoke Dam to reduce stress on riverine ecosystems from dam operations (e.g., more effective use of smart metering and differential pricing).

2.4 Arrow Reservoir

The Mid-Arrrow report (Thompson et. al. 2017) outlines potential scenarios that would limit the frequency and duration of flooding within the reservoir above 1420 ft. Scenario 3 most closely mimics the natural pre-dam Arrow Lakes flooding patterns, and offers increased flexibility for storage that can provide benefits for downstream anadromous fisheries flows and flood control. In addition to the goals associated with implementing Scenario 3, further preliminary identified steps/measures include:

- Develop and implement studies to assess the potential re-vegetation and stream rehabilitation benefits from the Mid-Arrow Scenario 3. For example this could include an incremental implementation of the 1 in 7 flooding scenario in the upper 2 meters of the reservoir over a 15-year period to test the re-vegetation projections in the study. It could also include modeling, and testing of how other dams and reservoirs could be managed to compensate for lost storage in the Arrow Reservoir, and changes in annual flow regimes.
- Implement further studies to answer the other information needs identified in the Mid-Arrow report.
- Assess the feasibility of combining various physical works (e.g., excavated ponds, dyked ponds or wetlands, floating islands) with changes in reservoir operations to maximize environmental benefits.
- Through CRT negotiations, ensure that implementation of Mid-Arrow Scenario 3 is a viable option under future Treaty terms.

2.5 Columbia River downstream from Keenleyside Dam

Preliminary identified steps/measures:

- In combination with changes to Arrow Reservoir management, implement changes to the operation of the upstream Revelstoke and Mica Dams in coordination with operation of the Kootenay System to ensure the restoration and/or maintenance of productive large riverine ecosystems downstream of the Keenleyside Dam.
- Explore opportunities for restoring salmon habitat in this reach if salmon return is found to be viable under future Treaty operations and projected climate change impacts.

2.6 Pend-d'Oreille River System

- Ensure that operations of the Waneta and Seven Mile dams in Canada, and the various other dams in the United States are coordinated in such a way that the aquatic and riparian ecosystems associated with the lower Pend-d'Oreille River and its associated reservoirs are fully functioning and productive.
- Ensure that flows from the Pend-d'Oreille system are compatible with restoring large river aquatic and riparian ecosystems on the Columbia River below their confluence.
- Explore opportunities for mitigating the environmental impacts of the reservoirs associated with Waneta and Seven Mile dams.

3.0 KOOTENAY RIVER SYSTEM

Preliminary identified steps/measures:

- Explore the establishment of a multi-stakeholder, international governance structure for the Kootenay River system that includes Ecosystem Function of the Kootenay system as a primary purpose; ensure

that the decision-making body includes effective representation of Ecosystem Function interests on both sides of the border.

3.1 Koocanusa Reservoir – Libby Dam

Preliminary identified steps/measures:

- Develop and implement a scoping study similar to the Mid-Arrow study to identify various options for Libby Dam operations that could benefit terrestrial, riparian, wetland and stream reach ecosystems within the upper elevations of the reservoir footprint. These studies could include assessment of various options, including adjusting the frequency and duration of flooding, as well as constructing physical works to enhance wetland/ riparian habitats (e.g., excavated ponds, dyked ponds or wetlands, floating islands).
- Through CRT negotiations, ensure that the implementation of changes to Libby Dam operations that may be identified though ecosystem studies would be feasible under future treaty terms.

3.2 Kootenay River between USA border and Kootenay Lake

Preliminary identified steps/measures:

- Develop and implement a scoping study to explore the restoration of natural riparian habitat adjacent to the Kootenay River. This will require a review of the existing dyking system, and identification of opportunities to enhance floodplain function. This should include opportunities for improving the operation and effectiveness of the Creston Valley Wildlife Management Area.
- Through CRT negotiations, negotiate mitigation payments to offset the loss of valley bottom large river and floodplain habitats throughout the Canadian Columbia Basin. Use the funds to restore this section of the Kootenay River, and provide long-term operation funds for the Creston Valley Wildlife Management Area.

3.3 Duncan Reservoir – Duncan Dam

Preliminary identified steps/measures:

- Develop and implement a scoping study similar to the Mid-Arrow study to identify various options for Duncan Dam operations that could benefit terrestrial, riparian, wetland and stream reach ecosystems within the upper elevations of the reservoir footprint. These studies could include assessment of various options, including adjusting the frequency and duration of flooding, as well as constructing physical works to enhance wetland/ riparian habitats (e.g., excavated ponds, dyked ponds or wetlands, floating islands).
- Through CRT negotiations, ensure that the implementation of changes to Duncan Dam operations that may be identified though ecosystem studies would be feasible under future Treaty terms.
- Explore the feasibility of creating upstream fish passage over the Duncan Dam.

3.4 Duncan River between Duncan Dam and Kootenay Lake

Preliminary identified steps/measures:

- Modify operations of the Duncan Dam to minimize negative impacts on the aquatic ecosystems in the Duncan River downstream of the dam.
- Through CRT negotiations, ensure that there is sufficient flexibility in any Duncan Reservoir storage agreements to accommodate flows that are necessary to maintain fully functioning and productive aquatic and riparian ecosystems associated with the lower Duncan River.

3.5 Kootenay Lake

Preliminary identified steps/measures:

- Ensure that operations of the Duncan, Libby and Corra Linn Dams are coordinated in such a way that the aquatic ecosystems of Kootenay Lake are fully functioning and productive. This should include not only fish, but other species such as crayfish and mussels. Operations should ensure that lake levels are compatible for both stream- and shore-spawning kokanee populations.
- Through CRT negotiations, ensure that there is sufficient flexibility in any Duncan and Libby storage agreements to accommodate the timing and magnitude of flows that are necessary to maintain fully functioning and productive aquatic and riparian ecosystems associated with Kootenay Lake.

3.6 Kootenay River between Kootenay Lake and Columbia River

Preliminary identified steps/measures:

- Ensure that operations of the Duncan, Libby, Corra Linn, Upper Bonnington, Lower Bonnington, South Slocan, Kootenay Canal, and Brilliant Dams are coordinated in such a way that the aquatic and riparian ecosystems associated with the lower Kootenay River and its associated reservoirs are fully functioning and productive.
- Explore opportunities to minimize the environmental impacts of peaking on the Brilliant Dam headpond (e.g., shoreline erosion).
- Through CRT negotiations, ensure that there is sufficient flexibility in any Duncan and Libby storage agreements to accommodate the timing and magnitude of flows that are necessary to maintain fully functioning and productive aquatic and riparian ecosystems associated with the lower Kootenay River and its associated reservoirs.

References

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