



Province of British Columbia
Water Act

Order

Water Act

Section 88

File No. 76975-35/Columbia

WHEREAS British Columbia Hydro and Power Authority (BC Hydro) is the operator of the Mica and Revelstoke generating stations and Kinbasket, Revelstoke and Hugh Keenleyside dams, in respect of which it holds Conditional Water Licences for Kinbasket storage (27068 and 39432), Mica diversion (39431), Revelstoke diversion and storage (47215), and Arrow storage (27066);

WHEREAS BC Hydro has engaged in public consultation to determine values for system parameters and to develop operating procedures which may provide benefits as described below;

WHEREAS the licensee has submitted the Columbia River Water Use Plan, which recommends changes to the operations of Revelstoke hydro-electric facility and recommends works in areas influenced by the Mica, Revelstoke and Hugh Keenleyside facilities, all of which are intended to benefit wildlife, recreation, fisheries, and shoreline conditions;

WHEREAS the public consultation process recommended that the licensee consider soft constraint targets on Arrow Lakes Reservoir operations and implement works in order to balance the wildlife, recreation, fisheries, culture and heritage, shoreline conditions, and power generation interests on this reservoir;

WHEREAS the public consultation process recommended that the licensee pursue mountain whitefish flows and rainbow trout flows in lower Columbia River through annual negotiations with the United States entities of the Columbia River Treaty;

WHEREAS I have accepted the Columbia River Water Use Plan dated January 11, 2007; and

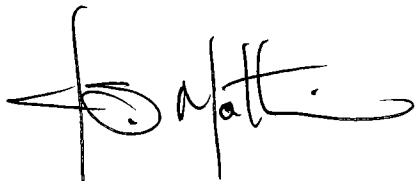
WHEREAS the Columbia River Water Use Plan proposes a monitoring program to determine the effects of existing operations on the values specified above and to determine whether operating the projects in accordance with the operating parameters, works and procedures in the Plan will provide the expected benefits;

I HEREBY ORDER THAT:

1. The licensee shall release from Revelstoke Dam:
 - a. a minimum flow of 141.58 cubic metres per second (5000 cubic feet per second) after completion of two years of baseline studies for the following monitoring programs and after leave is received from the Comptroller of Water Rights:
 - i. Schedule C: 4.a *monitor physical habitat parameters, periphyton and benthic invertebrates;*
 - ii. Schedule C: 4.b *monitor the abundance and biological characteristics of mountain whitefish, rainbow trout and bull trout;*
 - iii. Schedule C: 4.c *monitor changes in habitat use by juvenile and sub adult fish; and*
 - iv. Schedule C, 4.d *monitor behavioural (diel and seasonal) responses of key adult fish species.*
 - b. the licensee is not required to deliver the above minimum flow during a forced plant outage.
2. The licensee shall submit, for approval by the Comptroller, terms of reference for works and feasibility studies for:
 - a. Kinbasket Reservoir as described in Schedule A;
 - b. Revelstoke Reservoir as described in Schedule B;
 - c. mid Columbia River as described in Schedule C;
 - d. Arrow Lakes Reservoir as described in Schedule D;
 - e. Lower Columbia River as described in Schedule E; and
 - f. the conservation of White Sturgeon as described in Schedule F.
3. The licensee shall submit within 9 months of the date of this order, for approval by the Comptroller, terms of reference for:
 - a. an archaeological overview assessment of the drawdown zones of Kinbasket, Revelstoke, and Arrow Lakes reservoirs and the mid Columbia River; and
 - b. non-intrusive erosion monitoring of archaeological resources located in Arrow Lakes Reservoir and mid Columbia River drawdown zones.

4. With respect to the maintenance and provision of records the licensee must:
 - a. keep records of:
 - i. discharge from Mica and Revelstoke dams;
 - ii. generation discharge from Mica and Revelstoke generating stations;
 - iii. total discharge below Hugh Keenleyside dam including discharge from Arrow Lakes Generating Station; and
 - iv. elevations of Kinbasket, Revelstoke and Arrow Lakes Reservoirs.
 - b. provide a written report to the Comptroller of Water Rights on or before February 1 of each year summarizing the records from the previous calendar year; and
 - c. provide on request of the Comptroller of Water Rights records collected under 4.a.
5. For 5 years following the date of this order, the licensee shall provide an annual report to the Comptroller of Water Rights summarising the operations of Arrow Lakes Reservoir for the previous calendar year with respect to balancing different soft constraint objectives.
6. The licensee may operate the works in an alternate manner in the event of an emergency, dam safety requirement, an extreme hydrological event, or routing obligations under the Columbia River Treaty.
7. All emergency operations or other deviations from operations ordered above shall be reported to the Comptroller of Water Rights in a timely manner.

Dated at Victoria, B.C., this 26th day of January 2007.

A handwritten signature in black ink, appearing to read "J. Mattison". The signature is written in a cursive style with a large initial "J" and "M".

James S. Mattison, P. Eng.
Comptroller of Water Rights

Schedule A
Kinbasket Reservoir

Reservoir Vegetation Management

1. In lieu of operational constraints on Kinbasket Reservoir, the licensee shall submit within 12 months of the date of this Order, for approval by the Comptroller, terms of reference for the following works:
 - a. *a reservoir-wide planting program to enhance sustainable vegetation growth within the drawdown zone of Kinbasket Reservoir to benefit fish, wildlife, aesthetics, dust control and recreation.*
2. The licensee shall submit within 12 months of the date of this Order, for approval by the Comptroller, terms of reference for the following effectiveness monitoring programs:
 - a. *evaluate plant survival and monitor representative planting sites under the various revegetation treatments in Kinbasket Reservoir;*
 - b. *assess and map vegetation distribution by elevation and identify riparian wildlife habitat within Kinbasket Reservoir; and*
 - c. *monitor wildlife utilization patterns in response to revegetation efforts in Kinbasket Reservoir.*

Debris Management

3. The licensee shall submit within 12 months of the date of this Order, for approval by the Comptroller, terms of reference for the following feasibility studies:
 - a. *an environmental review to assess potential impacts of debris removal on other interests such as fish and wildlife and identify potential uses of debris for fish habitat and wetland habitat restoration in Kinbasket Reservoir.*

Recreation Access

4. The licensee shall submit within 3 months of the date of this Order, for approval by the Comptroller, terms of reference for the following feasibility studies:
 - a. *evaluate the construction of a new ramp or extension of an existing ramp, including annual maintenance requirements, and recommend options at each of the following sites:*
 - i. Bulldog Creek;
 - ii. Valemount Marina;
 - iii. Nixon Creek; and
 - iv. Bush Harbour.

Fish & Wildlife Monitoring

5. The licensee shall submit within 9 months of the date of this Order, for approval by the Comptroller, terms of reference for the following effectiveness monitoring programs:
 - a. *monitor total gas pressure (TGP) production from Mica Dam, the extent of downstream TGP impacts, and whether current management practices are effective in managing TGP levels below acceptable thresholds;*
 - b. *monitor biological characteristics, distribution, and abundance of kokanee population trends in Kinbasket Reservoir and evaluate potential links between reservoir operations and population levels;*
 - c. *monitor the physical, chemical and biological conditions in the pelagic and littoral zones of Kinbasket Reservoir to assess operational impacts on the productivity of key pelagic fish populations;*
 - d. *monitor extent, spatial location and seasonal timing of fish stranding due to drawdown of Kinbasket Reservoir and develop recommendations for future consideration of mitigative options;*
 - e. *monitor the life history and habitat use of burbot in Kinbasket Reservoir to address the effects of reservoir operations on the population;*
 - f. *monitor the life history and habitat use of bull trout in Kinbasket Reservoir to address the effects of reservoir operations on the population;*
 - g. *monitor the life history and habitat use of rainbow trout in Kinbasket Reservoir to address the effects of reservoir operations on the population, including tributary access and redd backwatering; and*
 - h. *monitor the peatland in the Valemount end of Kinbasket Reservoir and whether reservoir operations affect the plant and wildlife communities that it supports.*

6. The licensee shall submit within 12 months of the date of this Order, for approval by the Comptroller, terms of reference for the following effectiveness monitoring programs:
 - a. *monitor the effects of reservoir operations on the nesting success of breeding birds (in particular species listed under the federal Species at Risk Act and the BC Wildlife Act) in the drawdown zone to determine the significance of nest mortality and provide recommendations on physical works required to mitigate adverse impacts in Kinbasket Reservoir; and*
 - b. *monitor the life history and habitat use of reptiles and amphibians in the drawdown zone to determine the relative abundance, distribution and seasonal patterns of habitat use in relation to Kinbasket Reservoir operations.*

Implementation:

7. Upon receiving, from the Comptroller, approval of the above terms of reference and leave to commence, the licensee shall implement the aforementioned

works, feasibility studies, and effectiveness monitoring programs in accordance with the approved terms of reference and shall report progress on these projects to the Comptroller annually until their conclusion.

Schedule B
Revelstoke Reservoir

Fish Monitoring

1. The licensee shall submit within 6 months of the date of this Order, for approval by the Comptroller, terms of reference for the following effectiveness monitoring programs:
 - a. *monitor biological characteristics, distribution, and abundance of kokanee in Revelstoke Reservoir and evaluate links between reservoir operations and population levels; and*
 - b. *monitor the physical, chemical and biological conditions in the pelagic and littoral zones of Revelstoke Reservoir to assess operational impacts on the productivity of key pelagic fish populations.*

Implementation:

2. Upon receiving, from the Comptroller, approval of the above terms of reference and leave to commence, the licensee shall implement the effectiveness monitoring programs in accordance with the approved terms of reference and shall report progress on these projects to the Comptroller annually until their conclusion.

Schedule C
Mid Columbia River

Vegetation

1. In lieu of operational constraints on Arrow Lakes Reservoir, the licensee shall submit within 12 months of the date of this Order, for approval by the Comptroller, terms of reference for the following works:
 - a. *a planting program to enhance sustainable vegetation growth within the drawdown zone of the mid Columbia River to benefit fish, wildlife, aesthetics, dust control and recreation.*
2. The licensee shall submit within 12 months of the date of this Order, for approval by the Comptroller, terms of reference for the following effectiveness monitoring programs:
 - a. *monitor plant survival and monitor representative planting sites under the various revegetation efforts in the mid Columbia River;*
 - b. *monitor and map vegetation distribution and composition by elevation and identify riparian wildlife habitat in relation to inundation cycles to establish plant status and revegetation efforts in the mid Columbia River; and*
 - c. *monitor responses of plants ranging from seedlings to mature plants, and species to inundation cycles in the mid Columbia River.*

Recreation Access

3. The licensee shall submit within 3 months of the date of this Order, for approval by the Comptroller, terms of reference for the following feasibility study:
 - a. *evaluate the construction of a new ramp in the Revelstoke area or upgrading the existing ramp at Centennial Park, including annual maintenance requirements, and recommend options.*

Fish and Wildlife Monitoring

4. The licensee shall submit within 6 months, for approval by the Comptroller, terms of reference for the following effectiveness monitoring programs:
 - a. *monitor physical habitat parameters, periphyton and benthic invertebrates in the mid Columbia River to determine the linkages between operational change, physical habitat change, and ecological productivity associated with baseflow releases from Revelstoke Dam;*
 - b. *monitor the abundance and biological characteristics of mountain whitefish, rainbow trout and bull trout in the mid Columbia River to assess the response of these populations to changes in baseflow releases from Revelstoke Dam;*

- c. *monitor changes in habitat use by juvenile and sub adult fish (with an emphasis on bull trout and rainbow trout) in the mid Columbia River in response to baseflow releases from Revelstoke Dam;*
 - d. *monitor behavioural (diel and seasonal) responses of key adult fish species (bull trout and mountain whitefish) to baseflow releases from Revelstoke Dam.*
5. The licensee shall submit within 12 months, for approval by the Comptroller, terms of reference for the following effectiveness monitoring programs:
- a. *monitor wildlife utilization patterns in response to revegetation efforts in the mid Columbia River;*
 - b. *monitor the distribution and abundance of larval and adult mosquitoes in relation to physical environmental variables (elevation, temperature) and biotic variables (habitat) in the Revelstoke area;*
 - c. *monitor the effects of reservoir operations on nesting success of breeding birds (in particular species listed under the federal Species at Risk Act and the BC Wildlife Act) in the drawdown zone to determine the significance of nest mortality and provide recommendations on the type and amount of works required to mitigate adverse impacts in the mid Columbia River drawdown zone;*
 - d. *monitor the life history and habitat use of reptiles and amphibians in the drawdown zone to determine the relative abundance, distribution and seasonal patterns of habitat use in relation to Arrow Reservoir operations on the mid Columbia River;*
 - e. *monitor the life history and habitat use of migrating shorebirds in Revelstoke Reach to determine relative abundance, distribution and seasonal patterns of habitat use in relation to reservoir operations and, if required, determine possible mitigation strategies;*
 - f. *monitor neotropical bird migrants at the Revelstoke Banding Station (Machete Island) to determine the relative abundance, distribution and seasonal patterns of habitat use in relation to reservoir operations and, if required, determine possible mitigation strategies;*
 - g. *monitor the relative abundance, distribution and seasonal patterns of habitat use of waterbirds in the Revelstoke Reach of the mid Columbia River, in relation to reservoir operations and, if required, determine possible mitigation strategies; and*
 - h. *monitor specific areas identified as providing high value wildlife habitat to determine the opportunities for protection and enhancement within the Revelstoke Reach.*
6. The licensee shall submit within 12 months of the date of this Order, for approval by the Comptroller, terms of reference for the following feasibility study:

- a. *determine physical work alternatives and recommend options to improve conditions for nesting and migratory birds and wildlife in general within the drawdown zone of Revelstoke Reach.*

Implementation

7. Upon receiving, from the Comptroller, approval of the above terms of reference and leave to commence, the licensee shall implement the aforementioned works, feasibility studies, and effectiveness monitoring programs in accordance with the approved terms of reference and shall report progress on these projects to the Comptroller annually until their conclusion.

Schedule D
Arrow Lakes Reservoir

Revegetation

1. In lieu of operational constraints on Arrow Lakes Reservoir, the licensee shall submit within 12 months of the date of this Order, for approval by the Comptroller, terms of reference for the following works:
 - a. *a reservoir-wide planting program to enhance sustainable vegetation growth within the drawdown zone of Arrow Lakes Reservoir to benefit fish, wildlife, aesthetics, dust control and recreation.*
2. The licensee shall submit within 12 months of the date of this Order, for approval by the Comptroller, terms of reference for the following effectiveness monitoring programs:
 - a. *monitor wildlife utilization patterns in response to revegetation efforts in Arrow Lakes Reservoir;*
 - b. *monitor plant survival and develop representative planting sites under the various revegetation efforts in Arrow Lakes Reservoir;*
 - c. *monitor and map vegetation distribution by elevation and identify riparian wildlife habitat in relation to inundation cycles to establish plant status and revegetation efforts in the Arrow Reservoir; and*
 - d. *evaluate responses of plants of different ages, seedlings to mature plants, and species to inundation cycles in the Arrow Reservoir.*

Debris Management

3. In lieu of operational constraints on Arrow Lakes Reservoir, the licensee shall submit within 12 months of the date of this Order, for approval by the Comptroller, terms of reference for the following feasibility studies:
 - a. *an environmental review to assess potential impacts of debris removal on other interests such as fish and wildlife and identify potential uses of debris for fish habitat and wetland habitat restoration in the Arrow Reservoir.*

Recreation Access

4. Within 3 months of the date of this Order, the licensee shall submit, for approval by the Comptroller, terms of reference for the following feasibility studies:
 - a. *evaluate the construction of a new ramp or extension of an existing ramp, including annual maintenance requirements, and recommend options at each of the following sites:*
 - i. Burton;
 - ii. Edgewood;
 - iii. Fauquier;

- iv. Macdonald Creek Park; and
- v. up to 2 sites between Renata and Syringa Creek Park.

Fish and Wildlife Monitoring

- 5. The licensee shall submit within 9 months of the date of this Order, for approval by the Comptroller, terms of reference for the following effectiveness monitoring programs:
 - a. *monitor the life history and habitat use of burbot to assess potential reservoir operating impacts on the population in Arrow Lakes Reservoir;*
 - b. *monitor passage conditions at tributaries to Arrow Lakes Reservoir under a range of operating levels and stream flow conditions for rainbow trout, bull trout and kokanee; and*
 - c. *monitor specific areas identified as providing high value wildlife habitat to determine opportunities for protection and enhancement within the Arrow Lakes Reservoir.*
- 6. Within 12 months of the date of this Order, the licensee shall submit, for approval by the Comptroller, terms of reference for the following feasibility studies:
 - a. *review physical works options to improve conditions for nesting and migratory birds and wildlife in general within the Arrow Reservoir drawdown zone.*

Implementation

- 7. Upon receiving, from the Comptroller, approval of the above terms of reference and leave to commence, the licensee shall implement the works, feasibility studies, and effectiveness monitoring programs in accordance with the approved terms of reference and shall report progress on these projects to the Comptroller annually until their conclusion.

Schedule E
Lower Columbia River

Debris & Deposition Management

1. In lieu of operational constraints on Arrow Lakes Reservoir, the licensee shall submit within 12 months of the date of this Order, for approval by the Comptroller, terms of reference for the following feasibility studies:
 - a. *an environmental review to assess potential impacts of debris removal from Indian Eddy on other interests such as fish and wildlife and identify potential uses of debris for fish habitat and wetland habitat; and*
 - b. *an engineering assessment to determine the relation among flow fluctuations at Hugh Keenleyside Dam, sand erosion from Gyro Park Beach and subsequent deposition downstream at Indian Eddy, and an environmental review of dredging sand from Indian Eddy.*

Fish and Wildlife Monitoring

2. The licensee shall submit within 9 months of the date of this Order, for approval by the Comptroller, terms of reference for the following effectiveness monitoring programs:
 - a. *monitor planned and opportunistic flow reductions to establish impacts of flow reductions on fish populations in the lower Columbia River and the required operational procedures to mitigate ramping impacts;*
 - b. *monitor the life history and habitat use of sculpin and dace, in particular species listed under the federal Species at Risk Act and the BC Wildlife Act, in the lower Columbia River in relation to seasonal operations at Keenleyside Dam;*
 - c. *monitor physical habitat parameters, periphyton and benthic invertebrates below Keenleyside Dam to evaluate net change in trophic productivity and overall ecological health in relation to rainbow trout and mountain whitefish flow regimes;*
 - d. *monitor trends in the biological characteristics, distribution and abundance of mountain whitefish, rainbow trout and walleye populations in the lower Columbia River in relation to rainbow trout and mountain whitefish flow regimes;*
 - e. *monitor the relative abundance, distribution, spawning site selection and timing of rainbow trout spawning in the lower Columbia River in relation to rainbow trout and mountain whitefish flow regimes;*
 - f. *monitor spawning locations of whitefish in the lower Columbia River using detailed topographic surveys to improve the effectiveness of the whitefish flow regime in the lower Columbia River;*
 - g. *monitor whitefish life history, including spawning and egg mat sampling in the lower Columbia River, to establish the effectiveness of the current*

whitefish flow regime on egg survival, juvenile recruitment, and adult populations; and

- h. *monitor the effects of whitefish flows on the availability of Great Blue Heron habitat in the vicinity of Waldie Island and determine the importance of Waldie Island as an overwintering site for juvenile and adult heron from the Revelstoke colony.*

Implementation

3. Upon receiving, from the Comptroller, approval of the above terms of reference and leave to commence, the licensee shall implement the works, feasibility studies, and effectiveness monitoring programs in accordance with the approved terms of reference and shall report progress on these projects to the Comptroller annually until their conclusion.

Schedule F**Columbia River White Sturgeon Management Plan**

1. The licensee shall submit within 12 months of the date of this Order, for approval by the Comptroller, terms of reference for the following effectiveness monitoring programs:
 - a. *sampling program to establish whether sturgeon are present in Kinbasket Reservoir and, if present, to document habitat use of adult and juvenile sturgeon in relation to operations;*
 - b. *hydrometric surveys of the mid Columbia River in locations of known white sturgeon spawning to establish spawning flows and spawning habitat requirements for possible rehabilitation;*
 - c. *monitor juvenile sturgeon habitat use in the mid Columbia River to determine the presence of juveniles in the river, whether habitats are sufficient to allow recruitment of larvae and whether seasonal flow releases from Revelstoke Dam provide suitable habitat for successful recruitment;*
 - d. *track white sturgeon previously tagged between 2002 and 2003 to determine staging and spawning habitat preferences and to identify staging and spawning areas near Revelstoke;*
 - e. *conduct a substrate mat program to assess the distribution of sturgeon eggs in the mid Columbia River and evaluate the impacts of the seasonal minimum flow on egg and larval stranding;*
 - f. *genetic assessment work to determine levels of stock differentiation in Arrow Lakes Reservoir and lower Columbia River white sturgeon populations;*
 - g. *assessment of the impacts of low water temperatures in the mid Columbia River on sturgeon egg and larval development;*
 - h. *monitor the abundance, biological characteristics and reproductive status of white sturgeon in the lower Columbia River to determine operational factors influencing population processes and to ensure that implementation of any physical works does not decrease abundance;*
 - i. *monitor the relative abundance, distribution and patterns of habitat use of juvenile white sturgeon in the lower Columbia River in relation to discharges from Keenleyside Dam; and*
 - j. *create a plan and assess on an opportunistic basis, the effects of high flow events in the lower Columbia River on egg, larval and juvenile sturgeon survival.*
2. The licensee shall submit within 12 months of the date of this Order, for approval by the Comptroller, terms of reference for a feasibility study:
 - a. *to recommend physical works options to address credible hypotheses for sturgeon recruitment failure in the lower Columbia River.*

3. In lieu of operational constraints on Arrow Lakes Reservoir and at Keenleyside Dam, the licensee shall submit within 12 months of the date of this Order, for approval by the Comptroller, terms of reference for the following works:
 - a. *experimental aquaculture program to provide juveniles for assessing flow treatments on larval and juvenile sturgeon survival and impacts of Arrow operations on juvenile habitat availability, suitability, and survival.*
 - b. *conservation aquaculture to support the sturgeon population until such a time as stock abundance/age structure and habitat conditions can support a self-sustaining population.*
 - c. *upgrade existing facilities at the Kootenay Hatchery to support 3 a. and b. above.*
4. Upon receiving, from the Comptroller, approval of the above terms of reference and leave to commence, the licensee shall implement the works, feasibility studies, and effectiveness monitoring programs in accordance with the approved terms of reference and shall report progress on these projects to the Comptroller annually until their conclusion.