

EXECUTIVE SUMMARY

Introduction

A Water Use Plan (WUP) is a technical document that, once reviewed by provincial and federal agencies and accepted by the provincial Comptroller of Water Rights, defines how water control facilities will be operated. The purpose of a water use planning process is to develop recommendations defining a preferred operating strategy using a multi-stakeholder consultative process.

This report summarizes the consultative process and records the areas of agreement and disagreement arrived at by the Columbia River Water Use Plan Consultative Committee. It is the basis for the Columbia River Draft Water Use Plan for BC Hydro's Mica, Revelstoke and Hugh Keenleyside projects. Both the Columbia River Consultative Committee Report and the Draft Water Use Plan will be submitted to the Comptroller of Water Rights.

Columbia River Treaty

The Columbia River Treaty was signed between Canada and the United States of America in 1961 and ratified in 1964. BC Hydro was appointed as the Canadian Entity under the Treaty. Under the terms of the Treaty, BC Hydro built and now operates 15.5 million acre-feet (MAF) of storage at the Mica (7.0 MAF), Hugh Keenleyside (7.1 MAF) and Duncan (1.4 MAF) projects in co-ordination with the United States to maximize power generation and flood control benefits in both countries. In return, Canada received an up-front payment for the flood control benefits as well as one-half of the annual additional power generation benefits produced at the downstream U.S. projects on an on-going basis. There is no specified termination date for the Treaty; however, the earliest the Treaty may be terminated by either party is 2024, provided notice is given 10 years prior.

Mica Project

The Mica Project is located on the Columbia River about 137 km north of Revelstoke. The project was completed in 1973, and consists of an earthfill dam, low-level outlets (now permanently closed), outlet works and a chute spillway. The generating station was completed in 1977, and contains an underground powerhouse with four operating units and space for two additional units, and a switchgear building. Kinbasket Reservoir was formed by construction of the dam, and has a total live storage capacity of 12 MAF.

Revelstoke Project

Revelstoke Dam is located on the Columbia River about 5 km upstream from the City of Revelstoke. The project was completed in 1984, and consists of an earthfill wing dam and a concrete gravity main dam. The main dam includes the power intakes with steel penstocks in the middle and spillway facilities to the right. The powerhouse is located directly downstream of the power intakes, and the switchgear building is located on the right side adjacent to the spillway chute. The powerhouse currently contains four operating units, with space to install two additional units in the future.

The reservoir formed by construction of Revelstoke Dam is known as Revelstoke Reservoir. It is fed largely by the flow discharged from the Mica Project, with additional water from local inflow. The reservoir is licensed to store 1.5 MAF.

Although the Revelstoke Project is not covered directly under the Columbia River Treaty, the project may be called upon by the Treaty to provide flood control [Article IV(2)(b)]. It is also specifically precluded from operating in a fashion that reduces the benefits contemplated by the Treaty [Article IV(5)]. Except for the obligations included in the water licences, the Columbia River Treaty and the Non-Treaty Storage Agreement (NTSA), there are no other formal agreements or obligations for the operation of the Revelstoke Project.

Hugh Keenleyside Project

Hugh Keenleyside Dam is located on the Columbia River about 8 km west of Castlegar. The project was completed in 1968, and consists of an earthfill dam, a concrete dam, four spillways, eight low-level outlets (ports) and a navigation lock. Arrow Lakes Reservoir has a live storage capacity of 7.1 MAF below its normal upper limit of 440.14 m (1444.0 ft). Prior to project development, the reservoir was two natural lakes (Upper and Lower Arrow lakes).

The Hugh Keenleyside Project is operated under the terms of the Columbia River Treaty and the Non-Treaty Storage Agreement. The original facility was not constructed to have power generating capacity. However, under a joint venture between the Columbia Power Corporation (CPC) and Columbia Basin Trust (CBT) pursuant to the provincial government's Columbia Basin Initiative¹, the Arrow Lakes Generating Station (ALH) was constructed adjacent to Hugh Keenleyside Dam. The Arrow Lakes Reservoir, Hugh Keenleyside Dam and ALH operations are co-ordinated pursuant to a Release Co-ordination Agreement, approved by the Comptroller of Water Rights.

¹ In 1995, the provincial government created the Columbia Basin Initiative in recognition of the costs borne by the region due to construction of the Columbia River Treaty dams. Legislation was enacted establishing the Columbia Basin Trust and a financial agreement was entered into providing the Columbia Basin Trust and Columbia Power Corporation funding for power project developments in the region, including the Arrow Lakes Generating Station. The Trust's share of power project returns is used to provide benefits to the people of the region.

Consultative Committee

The Columbia River Water Use Plan Consultative Committee process was initiated in February 2001 and completed in June 2004. The consultative process followed the steps outlined in the 1998 provincial government’s *Water Use Plan Guidelines*.

The Consultative Committee members included representatives of BC Hydro, provincial and federal government agencies, municipal government, industry, First Nations, and local stakeholders. The Committee held a total of seven meetings and was supported by numerous technical subcommittee meetings.

The Consultative Committee was initially comprised of 35 members. Over the course of the Columbia River water use planning process, some members opted to change their status to observer status, others were reassigned other duties, and some new members joined the Committee. Those who moved to observer status were comfortable that other Committee members represented their interests. There were 39 Committee members who actively completed the water use planning process.

Structured Decision-Making Process

The Consultative Committee explored issues and interests affected by operation of BC Hydro’s Mica, Revelstoke and Hugh Keenleyside projects, and agreed to fundamental objectives for the Columbia River Water Use Plan, as outlined below in Table 1.

Table 1: Fundamental Objectives for the Columbia River Water Use Plan

Interest	Fundamental Objectives
Culture and Heritage	<ul style="list-style-type: none"> • Minimize erosion impacts of water on potential archaeological zones. • Minimize erosion impacts of wind on potential archaeological zones. • Minimize the impact of destructive human behaviour (traffic, pot hunting, etc.) on potential archaeological zones. • Allow access to archaeological sites by appropriate people. • Maintain the cultural, aesthetic and ecological context of important cultural resources and spiritual sites. • Provide access to tradition plants. • Maximize abundance and diversity of fish and wildlife populations to support First Nations harvesting and associated activities.
Fish and Aquatic Resources	<ul style="list-style-type: none"> • Maximize the abundance, diversity and condition of wild, indigenous fish stocks in the Columbia River system.
Flood Erosion Control	<ul style="list-style-type: none"> • Minimize damage to property and injury to people.
Learning	<ul style="list-style-type: none"> • Maximize learning about the impacts of operations on non-power objectives.
Navigation	<ul style="list-style-type: none"> • Minimize disruptions to commercial navigation/transport.
Power Generation	<ul style="list-style-type: none"> • Maximize the power benefits produced by the combined operation of Mica, Revelstoke and Hugh Keenleyside facilities.
Recreation	<ul style="list-style-type: none"> • Maximize the community benefits from quality and diversity of recreation and tourism.
Wildlife and Vegetation	<ul style="list-style-type: none"> • Maximize wildlife abundance and diversity in the Columbia River system.

The Consultative Committee developed performance measures for the water use planning objectives listed above. Where possible, performance measures were modelled quantitatively. In other cases, they were described qualitatively. The Committee then developed operating alternatives to address the various objectives. The output of the modelling process provided the Committee with a description of the consequences for each alternative based on the performance measures.

Scope of the Columbia River Water Use Planning Process

In addition to the general guidance provided for all of BC Hydro's water use planning programs in the provincial government's *Water Use Plan Guidelines* and related documents, the provincial government also directed the Columbia River Water Use Plan Consultative Committee to consider the following in their trade-off discussions.

In a letter dated 19 February 2001, the Chair of the Water Use Plan Steering Committee provided the following direction to the Columbia River Water Use Plan Consultative Committee: "*The Province has made a policy decision that the magnitude of change it is willing to accept on the Peace and Columbia is smaller compared to other systems undergoing water use planning. In addition government by policy has set a cap on the funding to support the implementation of water use plans, so it is important to ensure funds are available for a wide range of projects. Government recognition of the high values of these river for power generation was articulated in its 1998 response to the BC Heritage River Board, in which it endorses the Columbia and Peace remaining as working rivers compatible with natural heritage and recreational values.*"¹

There was significant debate by the Consultative Committee over whether the Columbia River water use planning process should be limited by the provincial government's funding cap (i.e., \$50 million/year in lost revenue across of all BC Hydro's facilities). A number of proposals for reasonable limits for this Water Use Plan were put forward, ranging from 1/25th (corresponding to the 25 Water Use Plans) to 45 per cent of the System Operating Fund (SOF) (corresponding to the percentage of BC Hydro's energy that is produced at the Columbia River facilities). Some members did not agree with limiting the process by the SOF because they felt that the federal government has a fiduciary responsibility to protect First Nations interests, as well as legal obligations with respect to heritage, fisheries and international agreements. Other Committee members agreed with a funding cap and the notion of the Columbia River as a "working river", recognizing the incremental nature of the process and the need to ensure that the work of the Consultative Committee is not ignored at the end of the process. In the end, the Consultative Committee agreed to the following:

- The Committee recognizes that there are legal obligations that will need to be considered and, therefore, it is impossible at this time to set a firm upper bound on cost.

¹ O'Riordon (19 February 2001). *Letter to the Peace and Columbia River Water Use Plan Consultative Committees.*

- The Committee may define alternatives that reflect participant's longer-term vision for the future of the Basin, unconstrained by budget considerations.
- The Committee recognizes that the provincial government designed the water use planning process with an upper limit on cost, and the Committee should consider the value of the SOF in developing its recommendations to maximize the probability that their work and recommendations will be implemented.
- There should be two categories of alternatives, which are treated differently in the process: alternatives that likely fall outside the scope of water use planning that will receive qualitative assessment; and alternatives that are likely within scope that will receive more rigorous analysis.

Columbia River Treaty

The *Water Use Plan Guidelines* specifically identifies the Columbia River Treaty as one of the international agreements to be taken into account when preparing Water Use Plans. The Treaty dictates required weekly flows across the United States border and thus limits the feasible scope of operational changes. However, the Treaty does allow for changes to its default operation so long as both parties (U.S. and Canadian Entities) agree to such changes and the changes would provide additional benefits for both countries.

The following guidelines were provided to assist the Consultative Committee in determining which operating alternatives could be considered within the scope of the Columbia River water use planning process.

- The Water Use Plan may consider operating alternatives that include incremental changes to existing operations that BC Hydro can unilaterally implement. A partial list includes some flex operations (swapping water between Kinbasket and Arrow Lakes reservoirs), constraints on reservoir maximum/minimum levels that can be accommodated within Treaty operations, ramping rates and incremental use of the BC Hydro portion of the Non-Treaty storage.
- The Water Use Plan may consider operating alternatives that affect Detailed Operating Plans and Supplemental Operating Agreements developed under the Treaty, or operations under the Non-Treaty Storage Agreement. However, BC Hydro's ability to secure such an operating alternative is dependent upon successful negotiations with the U.S. Entity and, possibly, other affected parties following the Water Use Plan. The likelihood of achieving such an agreement must be assessed by the Consultative Committee when considering operating alternatives to be modelled.
- The Water Use Plan operating alternatives will recognize local and downstream flood control operations, as required by the Columbia River Treaty.

- Violating the Columbia River Treaty is outside the scope of water use planning as it may expose the Province of British Columbia to possible contractual liabilities and potentially very large financial risks associated with downstream benefits.

Non-BC Hydro Owned Facilities

BC Hydro's water use planning process was designed to specifically address BC Hydro facility operations. It was not intended to review the operations of hydroelectric facilities that are owned by entities other than BC Hydro. As such, it was established at the outset of the Columbia River water use planning process that the Water Use Plan would be restricted to review of Mica, Revelstoke and Hugh Keenleyside project operations. Although some interests in the lower Columbia River are affected by both flows out of Arrow Lakes Reservoir and the Kootenay River system, operational changes on the Kootenay River system were considered outside the scope of the process. While BC Hydro, through commercial agreements, manages water on the lower Kootenay River, these facilities are not owned by BC Hydro and therefore were excluded from the Water Use Plan.

The Operations Model developed to simulate operating alternatives for the Columbia River Water Use Plan captured operation of the Columbia River system as a whole, and was designed to determine the most economic dispatch of the generating system, subject to the operating constraints and objectives under a range of streamflow sequences. The model therefore calculated the sum of power costs at BC Hydro's Mica and Revelstoke projects, as well as ALH.

The Consultative Committee's understanding of the links between BC Hydro operations and ALH and how this was incorporated into the modelling evolved over the course of the Columbia River water use planning process. There was considerable debate by the Committee as to whether ALH should be included in the modelling of power costs associated with the proposed operating alternatives. While some Consultative Committee members felt that the focus of discussions should be on whether the benefits to interests are worth the cost as a whole (irrespective of who is bearing the costs), other Committee members felt that consideration of this lost power generation opportunity at ALH in the trade-off analysis might be beyond the scope of the water use planning policy framework and the November 1998 government policy directive to BC Hydro. Additionally, both Fisheries and Oceans Canada (DFO) and the Ministry of Water, Land and Air Protection (MWLAP) representatives maintained that the ALH Project Approval Certificate (PAC) recognized the value of flexibility in flows at Hugh Keenleyside Dam for fish and fish habitat management, and specifically included provisions to ensure that operation of ALH would not preclude beneficial opportunities for fish and wildlife. There was concern that inclusion of foregone power values at ALH might be inconsistent with the ALH PAC. The Consultative Committee agreed that this issue would be most appropriately resolved at the policy level.

Although the issue of whether the ALH PAC restrictions had any implication for the Columbia River Water Use Plan was not resolved at the Consultative Committee table, a June 2004 government policy directive to BC Hydro directing it to save CPC/CBT power projects harmless from any adverse effects resulting from implementation of the Water Use Plan meant that the financial impacts at ALH were included in the power cost calculations of the proposed operating alternatives.

Water Use Plan Recommendations

To ensure meaningful decision making for the Columbia River water use planning process, relevant information was gathered as part of Step 5 of the process to help refine estimates of flow-related impacts. In several cases, however, the process did not have resources to fully scope specific water use issues. Some of these data gaps were significant given the large geographic scope of the project and complexity of issues, and the time period and funds allocated for the Columbia River Water Use Plan. This resulting uncertainty precluded some issues from being effectively addressed through the process. Two strategies were developed to address these critical uncertainties and ensure that better information would be available for future decision making. Information Plans were proposed either when there were no quantitative data available to make informed decisions, or when existing data demonstrated a need for further study. The goal of these plans is to provide sufficient information for decision making around possible operational and non-operational physical works during the next Columbia River Water Use Plan review. Management Plans were proposed to ensure that operational changes and physical works are implemented responsibly and subsequently monitored to inform on their effectiveness before the next Columbia River Water Use Plan review. These plans were reviewed by the Consultative Committee at their final June 2004 meeting.

The following summarizes the Information and Management Plans that were recommended by the Consultative Committee for the Columbia River Water Use Plan. The Committee unanimously supported the total package of recommendations for operational changes, monitoring, physical works and the review periods. However, some members noted concern around details of implementing the Water Use Plan and issues in the watershed. Their support was conditional on one or more of the following actions being implemented:

- Resolving the conflict in the Arrow Lakes Reservoir drawdown zone between environmental interests and recreational interests.
- Protection of sensitive archaeological sites in the drawdown zone.
- Need for control over implementation of the activities and spending given the large cost of the program.
- Participation of local communities and First Nations in implementation of monitoring studies and physical works projects.

- Indemnification of CPC/CBT joint venture projects from any adverse impacts arising from implementation of this Water Use Plan¹.

Kinbasket Reservoir Fish and Wildlife Information Plan

An obstacle to making recommendations around operational changes or physical works in lieu of operational changes for Kinbasket Reservoir was the lack of quantitative data for fish and wildlife populations and supporting ecosystem processes. The Consultative Committee acknowledged the importance of better understanding reservoir ecology and the influence of current operations as an outcome of the water use planning process, and supported a plan to collect the information necessary to better inform future decision-making.

Revelstoke Flow Management Plan

The Consultative Committee supported a 5 kcfs year-round minimum flow constraint at Revelstoke Dam to meet the fish objectives for the mid Columbia River. It was recommended that the minimum flow be implemented two years after implementation of the Columbia River Water Use Plan to allow for collection of baseline data. The Committee also supported a number of studies to address uncertainties related to the benefits of a 5 kcfs minimum flow to invertebrate and fish populations, and to assess its effectiveness for future decision making.

Mid Columbia River White Sturgeon Management Plan

The Consultative Committee supported a 4-phase workplan aimed at better understanding juvenile white sturgeon habitat capabilities in the mid Columbia River, and building a self-sustaining population in Arrow Lakes Reservoir through flow treatments and conservation aquaculture. The experimental workplan is designed specifically to allow the necessary flexibility in annual fund allocations for research, experimental flow treatments for white sturgeon (in addition to the 5 kcfs year-round minimum flow) and monitoring to ensure that the program is responsive to future

¹ Throughout the Columbia River water use planning process, Columbia Power Corporation, manager of the CPC/CBT joint ventures, worked with BC Hydro and government to clarify the policy framework underpinning BC Hydro's Columbia River (and Duncan Dam) Water Use Plan as it related to potential third party impacts on CPC/CBT and the Columbia Basin Initiative. Potential third party impacts on holders of downstream water rights were not addressed in the *Water Use Plan Guidelines* and the November 1998 government policy directive to BC Hydro. In the absence of greater clarity around this policy issue, CPC and CBT were unable to support any operating alternative before the Committee until they had an assurance from BC Hydro that CPC/CBT joint venture projects would be saved harmless from any adverse impacts resulting from implementation of the Water Use Plan. This work led to a further June 2004 government policy directive to BC Hydro directing it to save CPC/CBT power projects harmless from any adverse effects resulting from implementation of BC Hydro Water Use Plans. After BC Hydro confirmed its commitment to implementing and abiding by this government policy directive, CPC and CBT each issued letters to BC Hydro stating that they were now willing to remove their objections to recommendations of the Consultative Committee for the Columbia River Water Use Plan (refer to Section 7.7.16 and Appendix G: Correspondence Related to the Columbia Power Corporation and the Columbia Basin Trust).

learnings and related changes in priorities. This will be facilitated through comprehensive reviews at the end of each phase of the program, and an option to discontinue flow tests in the mid Columbia River (if monitoring supports this decision) and direct all or part of the conservation aquaculture effort to Kinbasket Reservoir.

The Committee supported a number of research and monitoring studies integral to supporting decision making around flow treatments and hatchery supplementation in the mid Columbia River.

Arrow Lakes Reservoir Operations Management Plan

Just prior to the final June 2004 meeting, the Consultative Committee was informed that the Non-Treaty Storage Agreement (NTSA) between BC Hydro and Bonneville Power Authority (BPA) would expire by end of June 2004, and no new agreement had been renegotiated to date. Without a new NTSA in place, it would not be possible for BC Hydro to unilaterally implement all of the monthly constraints on Arrow Lakes Reservoir under the proposed operating alternatives across all water years. The Consultative Committee recommended soft constraints on Arrow Lakes Reservoir operations to help inform the BC Hydro operators on impacts. These soft constraints would be reflected in the System Operating Orders for Arrow Lakes Reservoir. No new maximum or minimum constraints would be placed on BC Hydro’s water licenses for Arrow Lakes Reservoir, and no compliance monitoring would be required by the Water Comptroller’s office. However, it was recommended that there be annual reporting of progress on monitoring and physical works, and performance in meeting the soft constraints.

Table 2 summarizes the recommendations made by the Consultative Committee for soft constraints on Arrow Lakes Reservoir operations.

Table 2: Recommendations for Soft Constraints on Arrow Lakes Reservoir Operations

Interest	Constraint
Vegetation	<ul style="list-style-type: none"> • Maintain current level of vegetation in the drawdown zone through maintaining lower reservoir water levels during the growing season. No specific operating targets were identified to meet this general objective. • If vegetation is showing signs of stress as a result of inundation during the early part of the growing season (May-July), target lower reservoir levels in the fall to allow exposure of plants during the latter part of the growing season. • Preservation of current levels of vegetation at and above elevation 434 m (1424 ft) is considered a priority.
Wildlife	<ul style="list-style-type: none"> • Ensure that inundation of nesting bird habitat by rising reservoir water levels in early summer is no worse than that which occurred on average over recent history (1984-1999). Match operating levels to inundation statistics for elevations 434 m (1424 ft) and above over the 1984-1999 period, which were used to produce the average historic performance measure score for spring/summer nesting short-eared owl habitat. • Ensure that availability of migratory bird habitat in the fall is as good or better than that which has been provided on average over recent history (1984-1999). Draft the reservoir quickly after full pool is reached, targeting a reservoir level of 438 m (1437 ft) or lower by 7 August.

Table 2: Recommendations for Soft Constraints on Arrow Lakes Reservoir Operations (cont'd)

Interest	Constraint
Fish	<ul style="list-style-type: none"> • Ensure appropriate reservoir elevations for tributary access during the kokanee spawning period (late August to early November). Reservoir levels of 434 m (1424 ft) could cause tributary access to be restricted in some streams under certain conditions. Proposed monitoring study aimed at determining reservoir level thresholds under a range of tributary streamflow conditions below which spawner access becomes a problem.
Recreation	<ul style="list-style-type: none"> • Target reservoir water levels between 437.4 m and 438.9 m (1435.0 ft and 1440.0 ft) from 24 May to 30 September. • Flexibility to achieve lower reservoir levels of 434 m (1424 ft) during the recreation season would be acceptable with proposed construction/upgrade of boat ramps for recreation interests served by these formal access points.
Culture and Heritage	<ul style="list-style-type: none"> • Maintain reservoir water levels at or below 436 m (1430 ft) for as long as possible. • First Nations willing to accept water levels above this 20 per cent of the time (or for 2.5 months) provided that it is timed in accordance with the vegetation efforts. First Nations would be willing to relax this constraint if the archaeological site protection plan is underway.
Erosion	<ul style="list-style-type: none"> • Minimize duration of full pool events. Reservoir water levels of 439 m (1440 ft) are ideal. • Avoid sudden drawdown once full pool has been reached (particularly if high runoff has saturated the reservoir banks) to avoid slumping of the shores.
Power Generation	<ul style="list-style-type: none"> • Optimize power values.

During the discussion of soft constraints for Arrow Lakes Reservoir, members of the Consultative Committee identified other constraints that should be considered by BC Hydro in its operations.

- On behalf of the representative of the City of Trail, it was noted that there is a desire to keep flows below 165 kcfs at Genelle. If BC Hydro is taking actions that cause damage at Trail, then the City will seek compensation.
- A number of Committee members also highlighted the need to avoid surcharging of Kinbasket Reservoir whenever possible.

In supporting soft constraints for Arrow Lakes Reservoir, the Consultative Committee recommended a long-term data collection plan to evaluate its performance in meeting the stated objectives for the reservoir.

Kinbasket and Arrow Lakes Reservoir Revegetation Management Plan

The Consultative Committee supported reservoir-wide planting programs compatible with both the current operating regime and proposed operating alternatives to maximize vegetation growth in the drawdown zones of Kinbasket and Arrow Lakes reservoirs. The revegetation program is a multi-year program requiring intervention over five years to facilitate long-term vegetative cover.

The Consultative Committee agreed to a maximum funding cap over five years, and set out principles by which the planting programs should be implemented. It was agreed that development of a final revegetation program will require public consultation to ensure that the plan is not in conflict with other land uses (e.g., motorized and non-motorized recreation, beach areas), and will require that planting prescriptions are compatible with First Nation archaeological site protection requirements. It was also acknowledged that there are opportunities to incorporate vegetation types valued in traditional use by First Nations in to the planting program. The Committee recommended a number of studies to inventory vegetation resources, and monitor the effectiveness of planting efforts on vegetation communities and wildlife habitat use.

Kinbasket and Arrow Lakes Reservoir Recreation Management Plan

The Consultative Committee recognized that addressing recreational issues on Kinbasket and Arrow Lakes reservoirs through operational changes was not cost effective. During their final June 2004 meeting, the Committee supported non-operational means to address recreation interests around Kinbasket Reservoir and mitigate the effects of low water impacts on Arrow Lakes Reservoir. The Committee recommended the following implementation projects as part of the Recreation Management Plan.

- Kinbasket/Arrow Lakes Reservoirs and Lower Columbia Boat Access Improvement.

The Committee supported 11 proposals for improving boat access on the Columbia River system, conditional on the Comptroller of Water Rights confirming that each project meets the criteria for Water Use Plans (i.e., there is a demonstrated operational link to the project)¹. Acceptance of these works was also conditional on a feasibility study being undertaken to ensure that these works are undertaken in the most cost-effective manner, and that impacts on other interests (e.g., fish habitat, archaeological sites) are taken into consideration.

- Kinbasket and Arrow Lakes Reservoir Debris Management.

The Committee supported an ongoing debris management program on Kinbasket and Arrow Lakes reservoirs to address debris issues related to reservoir operations, provided that an environmental review be undertaken to ensure that impacts on other interests (e.g., fish and wildlife habitat, revegetation efforts, archaeological site protection) are addressed, and potential uses of debris for fish habitat and wetland

¹ Subsequent to the June 2004 Consultative Committee meeting, the Water Comptroller reviewed the recommended boat access improvement projects and concluded that a new boat ramp at Nakusp does not fit within the scope of water use planning. In view of this decision, BC Hydro committed, in a letter dated 2 November 2004, to discuss possible partnerships with local government, Columbia Basin Trust and others towards construction and maintenance of a new ramp at Nakusp. The Comptroller also concluded that there is currently insufficient information to determine whether dredging at Indian Eddy to improve access to the Columbia River fits within the scope of water use planning. Prior to making a recommendation with respect to its inclusion in the Columbia River Water Use Plan, further information would be required regarding the mechanism causing transport of sediment from the Gyro Park Beach to Indian Eddy.

habitat restoration are identified. The Committee's support was also conditional on the Comptroller of Water Rights accepting that the debris management plan is within the scope of the water use planning process.

- Lower Columbia River Debris Management.

The Committee supported an annual expenditure of \$2,000 for debris removal at Indian Eddy, subject to an environmental review being undertaken. Currently, the City of Trail removes debris that accumulates in Indian Eddy to maintain access to the river for emergency boats.

Kinbasket and Arrow Lakes Reservoir Heritage Management Plan

The Consultative Committee supported a management plan specifically aimed at reducing operational impacts to archaeological sites in Kinbasket, Arrow Lakes and Revelstoke reservoirs. The management program puts forward a strategy to address the known archaeological sites in Arrow Lakes Reservoir from Years 1 to 5, and build on the knowledge from the first interventions and data collected from Kinbasket, Revelstoke and Arrow Lakes reservoirs to address the remaining not yet discovered sites that are eroding or at risk of due to reservoir operations. Inventory and excavation work will be required to determine the number of actively eroding archaeological sites in Kinbasket and Arrow Lakes reservoirs, and their importance in terms of quantity of intact archaeological materials. A management strategy will be developed with First Nation's participation to identify First Nation preferences around intervention at these sites, mitigation and effectiveness monitoring. The depth of the archaeological information and dynamics of the erosion process will determine the best approach to protecting these archaeological sites.

Arrow Lakes Reservoir Wildlife Management Plan

The Consultative Committee supported implementation of wildlife physical works in the mid Columbia River to help mitigate the impact of Arrow Lakes Reservoir operations on wildlife habitat and its use, particularly nesting and migrating birds. The Committee agreed to a maximum annual budget of \$100,000 in Year 1 and \$250,000/year for Years 2–10, which was based on a third party assuming responsibility for construction, maintenance and liability of these works. If a Memorandum of Understanding (MOU) cannot be developed with a third party, it was acknowledged that substantially less could be undertaken by BC Hydro within the agreed upon budget.

The Consultative Committee supported a number of monitoring studies to assess the effectiveness of the physical works in providing benefits to wildlife. They also supported feasibility studies to identify potential impacts on private lands, archaeological sites, vegetation, fish habitat and mosquito production, as well as any incompatibility risks with recreational use of the drawdown zone to support the development of the physical work options.

Lower Columbia Fish Management Plan

The Consultative Committee agreed that the greatest potential to provide gains to wild, indigenous fish populations in the lower Columbia River was through the following actions.

- Strategy for Managing Fish Impacts associated with Flow Reductions

The Consultative Committee agreed that implementation of the stranding protocol and interim ramping rate criteria, in conjunction with planned ramping rate tests, monitoring and appropriate mitigation, were an acceptable approach to addressing fish stranding in the lower Columbia River until further information is gained through ongoing fish salvage, survey activities and the ramp rate study to develop a defined ramping rate matrix to the satisfaction of BC Hydro and the fisheries regulatory agencies.

- Seasonal Flow Strategy for Mountain Whitefish

The Consultative Committee recommended that BC Hydro continue to pursue the mountain whitefish flow agreements every year through annual negotiations with the United States. The Committee supported a two-phase program implemented over a 15-year period to assess the biological effectiveness of the whitefish flow regime, with the intent of maintaining or improving current populations of whitefish below Hugh Keenleyside Dam. This involves continuation of the recent historical winter flow reductions over the first five years of the Water Use Plan, followed with optional testing of historic flows (i.e., pre-whitefish flow regime). The whitefish flow experiment and associated monitoring program is designed to test specific hypotheses and inform on critical data gaps regarding the relationship between flows and whitefish population levels.

In a June 2004 Letter of Commitment to DFO, BC Hydro has committed to pursue the mountain whitefish flows as specified in the experimental plan as a high priority.

- Seasonal Flow Strategy for Rainbow Trout

The Consultative Committee recommended that BC Hydro continue to pursue the rainbow trout flow agreements every year through annual negotiations with the United States. The Committee highlighted a number of high priority items for consideration in future operations, and recommended a monitoring program to address uncertainties related to the impact of the flow regime on rainbow trout populations.

In a June 2004 Letter of Commitment to DFO, BC Hydro has committed to pursue the rainbow trout flows as a high priority.

- **White Sturgeon Experimental Plan**

Given the practical and financial impediments to substantially increasing flows at the Canada/United State border for improving white sturgeon recruitment in the lower Columbia River, the Consultative Committee recommended the high flow option only on an opportunistic basis as opposed to through an operational change. The Committee recommended that an assessment be undertaken in those years when high flows occur naturally to gain a better understanding around the relationships between high flows and egg, larval and juvenile survival.

In lieu of this operational change, the Consultative Committee recommended that physical works be undertaken to improve conditions for white sturgeon in the lower Columbia River. This plan involves turbidity augmentation through the delivery of bentonite or other turbidity agents to the river during low flow periods (i.e., when discharge at the United States boundary is below 90 kcfs) when sturgeon eggs are known to be hatching and larvae are undergoing their downstream drift phase and are most vulnerable to predation. The Committee accepted this experiment plan, recognizing that it would first require a feasibility study to address regulatory concerns around introducing a turbidity agent to the river and associated fisheries and related ecosystem issues. The Committee also supported monitoring to inform on the effectiveness of this action, as well as a provisional annual contribution to the existing Lower Columbia River sturgeon conservation aquaculture program.

Subsequent to the June 2004 meeting, it became apparent that there was a lack of clarity around the nature of the consensus decision for the lower Columbia River white sturgeon plan. The two principle issues of concern expressed by some members of the Consultative Committee related to flexibility in the approach to physical works in lieu, and annual contributions to the conservation aquaculture program as a fallback option.

In supporting the lower Columbia River white sturgeon plan, some Committee members believe that they accepted the annual contribution to the aquaculture program as a fallback option in the event that turbidity augmentation was found to be unfeasible. Other members believe that they supported a program that included both options and the necessary flexibility within the program to explore other physical works if the turbidity experiment does not proceed.

Non-Licence Water Use Plan Recommendations

The Consultative Committee recognized that several of their recommendations could not be considered by the Comptroller of Water Rights for inclusion within BC Hydro's Water Licences for the Columbia River hydroelectric facilities. In addition to the soft constraints for Arrow Lakes Reservoir operations and the lower Columbia River mountain whitefish and rainbow trout flows, the Committee recommended that the following go forward as non-licence Water Use Planning recommendations:

- The Committee acknowledged that, on rare occasions, BC Hydro might need to surcharge Kinbasket, Revelstoke and Arrow Lakes reservoirs for flood control under emergency conditions. On rare occasions, BC Hydro might also surcharge the reservoir to address other environmental or economic considerations. The Committee recommended that BC Hydro avoid reservoir surcharge if at all possible, and that compensation be provided to address infrastructure damage in the event of surcharge.
- BC Hydro and other parties consider funding the boat access proposals deemed outside of water use planning (Galena Bay, Anderson Point, Burton (existing ramp), Halfway Creek, Shelter Bay, Nakusp).
- BC Hydro seek clarification from the Comptroller of Water Rights as to what constitutes access to the reservoirs. Once clarification has been sought, the Committee wants the Comptroller to identify how provisions will be made and then to direct appropriate parties responsible to improve access.
- Prior to the 5-year review of Arrow Lakes Reservoir operations, BC Hydro undertake an impact assessment to determine how the Non-Treaty Storage Agreement will affect BC Hydro's ability to achieve the soft constraints and meet the objectives of the system.

Summary of Costs

Subsequent to the final June 2004 meeting, further refinements were made to the estimated costs of the flow changes, physical works and monitoring recommended by the Consultative Committee. A summary of all recommendations with the revised costs is provided in Section 8.

Table 3: Estimated Costs of Recommended Operational Changes, Physical Works and Monitoring under the Columbia River Water Use Plan

Change in Operations	Annual Cost (Million \$/Year)
Soft Arrow Lakes Reservoir Constraints	0
Revelstoke 5 kcfs Minimum Flow	3
Mid Columbia River White Sturgeon Minimum Flows	0.5 ¹
Rainbow Trout Flows for Lower Columbia River	-3 ²
Mountain Whitefish Flows	2.2 ²
Physical Works	Total Cost (Million \$)
Arrow Lakes Reservoir Wildlife Habitat	2.35 ¹
Mid Columbia River White Sturgeon Aquaculture (incl. hatchery upgrade)	3.46
Mid Columbia River White Sturgeon Program Co-ordination	1.15
Lower Columbia River White Sturgeon Aquaculture	1.88 ¹
Lower Columbia River Turbidity Experiment	9.00
Arrow Lakes Reservoir Revegetation	2.10 ¹
Kinbasket Reservoir Revegetation	2.00 ¹
Kinbasket Reservoir Boat Ramps (4 ramps + annual maintenance)	1.00
Revelstoke Boat Ramps (1 ramp + annual maintenance)	0.43
Arrow Lakes Reservoir Boat Ramps (4 ramps + annual maintenance)	3.12
Dredging of Indian Eddy	0.20
Kinbasket, Arrow and Lower Columbia Debris Management	2.18
Archaeological Site Management and Protection	11.88
<i>Total Physical Works</i>	<i>40.75</i>
Monitoring*	
Kinbasket Reservoir Fish and Wildlife	5.28
Kinbasket and Arrow Lakes Reservoir Revegetation	2.96
Kinbasket, Arrow Lakes, Lower Columbia River Recreation	0.43
Kinbasket, Revelstoke, Arrow Lakes Reservoir Archaeological Site Management	1.01
Revelstoke Flow Management	5.09
Mid Columbia River White Sturgeon Management	2.79
Arrow Lakes Reservoir Operations Management	8.45
Arrow Lakes Reservoir Wildlife Management	0.40
Lower Columbia River Fish Management	9.02
Lower Columbia River White Sturgeon Management	3.75
<i>Total Monitoring</i>	<i>39.18</i>

* Estimated total costs of the physical works and monitoring studies are presented as current dollars over a maximum period of 15 years.

¹ Costs represent a maximum financial cap agreed to by the Consultative Committee.

² BC Hydro currently pursues the rainbow trout and mountain whitefish flow agreements through annual negotiations with the United States. As BC Hydro cannot implement these flows unilaterally, they cannot be written into BC Hydro's Water Licences and therefore do not represent a generation benefit/cost to the Columbia River Water Use Plan.