EXECUTIVE SUMMARY

Water use planning was introduced in 1996 as an approach to ensuring provincial water management decisions reflect changing public values and environmental priorities. A Water Use Plan (WUP) is a technical document that, once reviewed by provincial and federal agencies and First Nations, and accepted by the provincial Comptroller of Water Rights, defines how water control facilities will be operated. The purpose of water use planning is to understand public values, and develop recommendations that define a preferred operating strategy using a public consultative process.

The Elko water use planning process was initiated in May 2002 and completed in April 2003. The consultative process followed the steps outlined in the provincial *Water Use Plan Guidelines* (Province of British Columbia, 1998). This report summarizes the consultative process and records the areas of agreement and disagreement arrived at by the Elko Consultative Committee. It forms the basis for the *Elko Draft Water Use Plan* which will be submitted to the Comptroller of Water Rights for review and approval.

Elko Hydroelectric Facility

The Elko project is located within the Regional District of East Kootenay on the Elk River, in southeastern British Columbia, approximately 70 km southeast of Cranbrook. The 185-km long river flows south from Elk Lakes in the Continental Ranges of the Rocky Mountains into the Kootenay River. The Elko project is part of BC Hydro's integrated generation system and produces on average 73.0 GWh per annum, enough energy to meet the demands of 7300 homes for one year.

The Elko project is an in-basin diversion consisting of the Elko Dam, a concrete pipeline, surge tank and steel penstocks leading to a 12 MW capacity generating station (powerhouse) located about 1.2 km downstream of the dam. Water from the generating station is discharged back into the Elk River, which eventually flows into Lake Koocanusa Reservoir in the Kootenay River system. To gain an additional 2.8 m of hydraulic head for power generation, flashboards are installed at the spillway in July at the tail end of the freshet. The flashboards are generally removed in April.

Consultative Committee Process

The Elko Water Use Plan Consultative Committee (CC) was initially comprised of 12 representatives and their designated alternates. Subsequent to the first Consultative Committee meeting, one participant changed their status from Consultative Committee member to observer. Key interests included fish, aquifer, wildlife, First Nations' cultural resources and power. The representatives included BC Hydro, provincial and federal agencies, regional districts, the Ktunaxa–Kinbasket Tribal Council (KKT), Canadian Columbia River Inter–tribal Fisheries Commission (CCRIFC), and local area residents. CCRIFC also participated in fisheries technical discussions.

The main Consultative Committee and its two subcommittees – Fisheries Technical Committee (FTC) and Sinkhole Committee (SC) – held a total of 12 meetings, ultimately reaching a consensus decision for a preferred operating alternative for the Elko hydroelectric project and a specified monitoring program.

Objectives and Performance Measures

The Consultative Committee explored issues and interests affected by operations of the Elko hydroelectric project, and agreed to the following objectives for the Elko Water Use Plan.

- **Power:** Minimize economic impacts to power generation at the Elko facility by maximizing revenue from energy sales, minimizing operating and maintenance costs, and minimizing negative effects on ancillary services.
- **Recreation:** Maximize recreational opportunities by maximizing access to the river and maximizing boater safety.
- **Fish and Fish Habitat:** Maximize (native) fish abundance and diversity by minimizing entrainment of fish, maximizing habitat suitability, minimizing fish stranding, minimizing sediment effects and minimizing impacts associated with maintenance and operational procedures.
- **Wildlife and Wildlife Habitat:** Maximize wildlife habitat (quality, quantity and diversity) by maximizing the availability and suitability of Red-listed and Blue-listed habitats, maximizing the availability of fish, insects and aquatic invertebrate prey consumed by wildlife, and minimizing the disturbance of Blue-listed Rocky Mountain Big Horn Sheep associated with maintenance operations.
- **Cultural Resources:** Maximize abundance and diversity of fish and wildlife populations to support First Nations harvesting and associated activities *(refer to fish and wildlife objectives).*
- **Aquifer:** Maximize aquifer recharging at and near the community of Baynes Lake.
- **Erosion:** Minimize erosion damage to property by minimizing the effects of erosion and maximizing the operational flexibility to deal with erosion issues.

Given the Elko project is a run-of-river facility with a limited capacity through operations to influence many of the identified objectives, the Consultative Committee focused on three objective areas: power, aquifer, and fish and fish habitat.

The Consultative Committee developed performance measures for the power-related objectives; however, agreed that it would not be necessary to develop performance measures to assess the impacts of operating alternatives on fish and aquifer objectives because of the degree of uncertainty. It was agreed that the most appropriate means of assessing the degree to which operating alternatives were meeting these objectives would be through professional judgment based on the available information. Two research studies were completed during the water use planning process to assess fish habitat.

No performance measures were developed for wildlife or heritage, as it was agreed that the degree to which the fish objectives were met would provide an indication of how well operation of the Elko project meets these other objectives. As well, no performance measures were developed for recreation or erosion objectives because operations [1] were not thought to significantly affect these interests.

Primary Fish Concerns

The Consultative Committee identified three primary fish concerns to be considered during the Elko water use planning process – *survival flows, river stage effects, and headpond drawdown rate.*

Survival Flows for Overwintering Fish in the Canyon

The Consultative Committee identified low winter flows in the canyon section as the principal fish issue to be focused on during the water use planning process. During the fall/winter period when inflows to the headpond are equal to or less than plant capacity (25 m^3/s), inflows are diverted to the powerhouse and little water is spilled from the dam. Therefore, river flows between Elko Dam and the powerhouse are restricted to leakage from the dam (through the flashboards and radial gates) and groundwater contributions. The area of concern is the extent to which these low flows may jeopardize habitat and, thus, the survival of overwintering fish (both resident and those entrained over the dam) within the canyon section.

To address uncertainty regarding fish utilization and the adequacy of the current flow regime for overwintering fish, two assessments of fish and fish habitat within the canyon were undertaken during low flow conditions. Results of these studies (Bisset and Cope, 2003; Cope, 2003) showed that this reach functions primarily as overwintering and rearing habitat for fish entrained over the dam (mountain whitefish, cutthroat trout, bull trout). An assessment of the substrate showed limited potential for successful spawning of cutthroat and bull trout; however, the substrate appeared suitable to support spawning for an isolated whitefish population. Flows measured during the field study suggested that leakage flows were sufficient for overwintering fish. However, there was uncertainty regarding the effects of sustained cold weather periods on the extent of leakage from the dam and how this would ultimately affect fish and overwintering habitat downstream within the canyon channel.

The Fisheries Technical Committee developed one minimum flow option related to survival flows for consideration by the Consultative Committee at their final meeting. The volume of water associated with this alternative closely approximated the leakage flows currently being discharged from the dam. The minimum flow alternative was associated with maintaining hydraulic connectivity between refuge pools and minimizing the likelihood of anchor ice formation.

[1] Elko is operated as a *run-of-river* facility, which means that there is no significant volume of water stored in the headpond upstream of the dam: what flows in, flows out.

River Stage Effects

During planned and unplanned outages of the power generators, there is an immediate reduction in the water being discharged from the units and this causes a reduction in water levels downstream in the lower Elk River. These changes are most significant during winter when there is no spilling from the dam (as inflows are mostly being diverted to the powerhouse). This decrease in stage (and discharge) persists until the headpond surcharges and spills water over the dam, through the canyon, and by the powerhouse tailrace. For fish, the primary concern relates to potential impacts on stranding (overwintering cutthroat trout) and spawning success (whitefish).

Headpond Drawdown Rate

There were two potential issues related to the rate at which the headpond is drafted: fish stranding and mortality, and increased suspended sediments downstream of the dam. During drafting of the headpond to install/remove the flashboards, there are shallow depressions along a mainstem bench and in a side channel at the upper end of the headpond that are prone to isolation and dewatering as water levels recede and can cause fish to become stranded. Additionally, there is concern that the rate at which the headpond is drawn down causes a sudden spike in suspended sediment levels downstream of the dam (above provincial and federal water quality guidelines), which may have an adverse impact on fish and incubating eggs.

Aquifer Recharging

Another primary area of interest identified by the Consultative Committee relates to aquifer recharging around the community of Baynes Lake. The community, located about 10 km southwest of the dam, has been experiencing chronic water shortage problems (with their wells) over the past 40 years. Local residents claim that water levels have been dropping continuously during this time.

Locals believe that part of the groundwater problem is related to operating levels of the Elko headpond. The reason for this is due to a number of plugged sinkholes (filled in by East Kootenay Power in the 1960s) located in a side channel at the top end of the headpond, which only become wetted when the headpond is at its highest operating levels when the flashboards are installed. Observations of the sinkholes during the high water level period have confirmed that there is only about 30 cm of water above the tops of the plugged sinkholes. The upstream end of the side channel, which contains the sinkholes, has become overgrown with alders and grass, and now remains dry throughout the year. Members of the Sinkhole Committee believed that maintaining water above the sinkholes would provide groundwater benefits, as this water would pass down through the sinkholes and help to recharge the aquifer. It was assumed that water passing through the plugged sinkholes leads directly to – and feeds – the aquifer (groundwater) around the community of Baynes Lake.

It was noted that high water levels required to keep the plugged sinkholes wetted are dependent on the season. During freshet (May–June), the flashboards are removed for

Dam Safety reasons to pass the design flood. At this time, headpond levels are dependent on natural high inflows, which may drop below the desired elevation in the side channel. During the non-freshet period (starting as early as mid July), the headpond is typically kept as full as possible to maximize head for power generation, and this is maintained through a new headpond controller.

The Sinkhole Committee developed one operational recommendation and two other recommendations, outside of the scope of Water Use Plans for consideration by the Consultative Committee at their final meeting.

Operating Alternatives

A total of two operating alternatives were considered by the Consultative Committee during the Elko water use planning process. Both of these alternatives focused on providing fishery benefits that specifically dealt with concerns over low winter flows through the canyon. One of the alternatives was based on a recommendation provided by a fishery consultant and the deliberations of the Fisheries Technical Committee. A summary of the main components for each alternative is provided below.

Operating Alternative #1: 0.5 m^3/s Minimum Flow

- This option involves provision of a minimum flow release from the dam to maintain connectivity of overwintering habitat and prevent freeze-up of pool refuge habitat, and thus better ensure the survival of fish overwintering within the canyon channel.

Operating Alternative #2: 0.25 m^3/s Minimum Flow and Monitoring Studies

- This option was proposed by a Consultative Committee member during the final Consultative Committee meeting held on 20 February 2003. It is associated with provision of a lower minimum flow release from the dam, in conjunction with additional monitoring studies to mitigate the increased uncertainty associated with selecting a lower flow.

Reaching Consensus on an Operating Alternative

During the final Consultative Committee meeting, the Consultative Committee assessed each of the alternatives both quantitatively and qualitatively based on the performance measure values, professional opinion, and best available information. The main trade-off was between the potential cost savings and the increased uncertainty associated with a lower minimum flow alternative. The Consultative Committee did not believe that the marginal cost savings from generating revenue for a lower minimum flow alternative (#2) were worthwhile given the increased risk to fish and the uncertainty surrounding a suitable minimum flow.

The Consultative Committee reached a consensus decision to recommend Operating Alternative #1 – 0.5 m^3/s minimum flow.

Other Water Use Plan Recommendations

The Consultative Committee also made additional recommendations related to rampdown rates and operation of the headpond at their final meeting.

Rampdown Rates

The Consultative Committee recommended the adoption of a 2-hour rampdown rate for the power generators during planned and unplanned outages affecting greater than 20 per cent of the river flows below the powerhouse. This recommendation was developed due to concerns related to potential fish and egg stranding and its impacts on spawning success (below the powerhouse) associated with river stage changes (see Section 4.3 for more details). It is also associated with reducing mortality and stranding of invertebrates and algae.

Headpond Levels

The Consultative Committee recommended that headpond elevations be maintained as currently operated, and a feasibility study be undertaken to assess whether the range of headpond operating levels could be reduced (e.g., from the upper 30 cm to 15 cm) during the non-freshet period. In addition, the Consultative Committee recommended that, if tightening of the operating levels was found to be feasible, BC Hydro should implement the changes or consider a non-operational alternative (e.g., scalping out an equivalent amount of elevation from the identified side channel), subject to regulatory approval. This recommendation was based on (i) the belief that higher water levels in the side channel would provide more water within the aquifer through infiltration into the plugged sinkholes and (ii) that it would reduce the likelihood of fish stranding events in the side channel. It was recognized that the interaction between headpond levels and groundwater was highly complex and uncertain; the BC Hydro representative expressed concern about whether there would be any benefits to aquifer recharging by maintaining higher water levels within the side channel.

Expected Outcomes of the Recommendations

The expected costs associated with recommended Operating Alternative #1 are uncertain, as they are dependent on the degree to which leakage flows are reduced during sustained cold weather periods. Likely annual costs for this alternative were estimated to be approximately $16,000 per year (compared with current operations).

The expected outcomes of the final Consultative Committee recommendations are summarized in Table 1.

Table 1: Expected Outcomes of the Final Consultative Committee Recommendations

Interest	Recommendations
Power Generation	Minimal impacts to power generation are expected
Fish and Fish Habitat	The anticipated benefits include: • Reduced fish mortality in the canyon channel during winter as a result of better hydraulic connectivity between refuge pools and a reduced risk of anchor ice formation • Reduced impacts to downstream river productivity with less mortality and stranding of invertebrates and periphyton algae • Improved spawning opportunities for whitefish in the canyon channel • Reduced incidence of fish/egg stranding in the lower Elk River • Reduced incidence of fish stranding in the upper side channel of the headpond • Increased success of spawning in the lower Elk River • Improved fish information for future water use planning decisions
Wildlife	Expected improvements to fish resources will also have ancillary benefits for wildlife interests
Aquifer	The anticipated benefits include: • Improved infiltration into the side channel leading to increased aquifer recharging • Improved information for future water use planning decisions
Cultural Resources	The expected improvements to fish and wildlife will better support First Nations harvesting and associated activities

Monitoring Program

The Consultative Committee discussed areas of uncertainty associated with their recommendations and agreed to a number of monitoring studies to address these data gaps. A total of three studies were agreed to as follows:

Monitoring of Habitat Maintenance (Survival) Flow within the Canyon Channel of the lower Elk River: The objectives of this study will be to assess whether the recommended minimum flow of 0.5 m^3/s is sufficient to prevent total freeze-up of pool refuge habitat and maintain habitat connectivity for overwintering fish, particularly during periods of sustained cold weather. It is estimated to cost no more than $20,000[1], and is expected to be carried out over the first 5-years of the Water Use Plan.

Assessment of Headpond Drawdown Rates: The objectives of this study will be to: 1) assess the degree to which a slower headpond drawdown rate reduces suspended sediment levels downstream of the dam; 2) determine how identified elevation ranges and drawdown rates affect the extent of fish stranding; and 3) select an appropriate rate to mitigate fish impacts associated with headpond drafting. This study was estimated to

[1] The monitoring costs for Items 1 and 2. (agreed to at the final Consultative Committee meeting) were subsequently revised during a Fisheries Technical Committee meeting held on 16 April 2003. The overall costs for monitoring were unchanged from what the Consultative Committee had agreed to with the revised estimates as follows: $14,500 for the Habitat Maintenance Flow Study; and $22,500 for the Headpond Drawdown Study. See Appendix C for more details.

cost $17,000. It would be conducted during one flashboard installation and one removal operation within the first year of the Water Use Plan.

Side Channel/Sinkhole Monitoring Study: The objectives of this study will be to assess the degree to which higher headpond operating levels (associated with a narrowing of the water level range) provides benefits to water infiltration through the plugged sinkholes located in the upper headpond side channel. This study was estimated to cost $10,000.

Non-Water Use Planning Recommendations

During the course of the Elko Water Use Plan, the Fisheries Technical and Sinkhole committees put forward recommendations that were outside the scope and mandate of water use planning for consideration by the Consultative Committee. During the final Consultative Committee meeting held on 20 February 2003, the Consultative Committee reviewed these recommendations and expressed their support for them. In total, three non-WUP related recommendations were considered.

Non-WUP Recommendation #1 – Baynes Lake groundwater monitoring: This recommendation was suggested after it was realized that the proposed monitoring study for the Elko Water Use Plan was not connected to an operational change and, therefore, not eligible for funding based on criteria for Water Use Plan monitoring studies. Recognizing the lack of information about the correlation between the Elk River (headpond) and the groundwater table in and around the community of Baynes Lake, the Consultative Committee supported the idea that a study should be undertaken to address this data gap.

Non-WUP Recommendation #2 – Total suspended solids (TSS) monitoring during flashboard removal this spring: The Fisheries Technical Committee recommended that monitoring be conducted this spring, given uncertainty about the effects of the current drawdown rate (15 cm/h) on suspended sediment levels during flashboard removal and the high degree of concern related to its effects on downstream fish interests. It was recognized that it might take up to six months, or more, before funds are available within the Water Use Plan monitoring program and the Fisheries Technical Committee felt that this item should be monitored as soon as possible. The cost for this study was estimated at $8,500. The BC Hydro representative agreed with this recommendation, and offered to fund the work provided it was a one-time study.

Non-WUP Recommendation #3 – Unplugging of the sinkholes: The Sinkhole Committee made this recommendation during their 4 November 2003 meeting held in Cranbrook. The recommendation was stated as follows:

The Sinkhole Committee recognizes the potential benefits to aquifer recharging with the removal of the sinkhole plugs, and recommends that appropriate decision-makers (regulatory agencies) and stakeholders meet to discuss this.

The Consultative Committee supported this recommendation, with the BC Hydro representative expressing concern about potential lost power generation if unplugging the sinkholes resulted in the diversion of water out of the headpond. If this was the case,

there was an expectation that BC Hydro would be compensated for water taken away from power generation. It was noted that while it was recognized this was outside the scope of the water use planning, local residents could contact the Water Branch to show support for this recommendation.

Review Period

The Consultative Committee recommended that a formal review of the Elko Water Use Plan be undertaken 10 years after its implementation.