

CASCADE HERITAGE POWER PROJECT

ASSESSMENT REPORT

With Respect to
Review of the Application for an Environmental Assessment Certificate
Pursuant to the British Columbia Environmental Assessment Act, SBC 2002, c. 43

And

SCREENING REPORT

With Respect to
The Requirements of a Screening
Pursuant to the Canadian Environmental Assessment Act, SC 1992, c. 37 as amended

July 12, 2006

Prepared by

Environmental Assessment Office

And

**Fisheries and Oceans Canada
Transport Canada**



EXECUTIVE SUMMARY

Project Overview and Description

Powerhouse Developments Inc. (Proponent) has submitted an application to the Environmental Assessment Office (EAO) for an Environmental Assessment Certificate for the Cascade Heritage Power Project (Project). The Project is a 25-megawatt run-of-river hydroelectric facility that consists of a weir (an inflatable rubber dam of maximum height 3.0 metres [m]), an intake structure, 775-m-long underground tunnel, a power plant building, an 80-m-long tailrace channel, a substation, and a 300-m-long transmission line.

The Project is situated on the Kettle River approximately 18 kilometres (km) east of Grand Forks, 2.5 km south of the community of Christina Lake (3.0 km south of the lake), and 5 km upstream of the Canada/US Border. It is located in the area known as the Cascade Canyon and Falls, at the site of the former Cascade Water Power and Light Co. Ltd. facility, which operated from 1897 until 1921.

The Cascade Canyon/Falls is considered a unique and beautiful natural feature, and recreational use in the area includes hiking/walking, viewing the Canyon/Falls, trail riding, cycling, fishing, kayaking/canoeing, and swimming. Existing development in the immediate vicinity of the area includes Highways #3 and #395, a railway, electricity distribution and transmission lines, a gas pipeline, the Trans-Canada Trail (the old Kettle Valley Railway), Cascade Village, rural residential development, a recreational vehicle park and campground, and a golf course. There are remnants of the former hydroelectric facility (a tunnel, a surface canal, a bulkhead, a spillway and the powerhouse foundation). Remnants from the former dam affected the upstream channel of the Kettle River until the late 1990's, and aerial photographs from 1969 and 1988 show a backwatered area estimated to be greater than the head pond proposed for the current Project.

The Proponent submitted its application for the Project to the EAO in 1999. At that time it was determined that the application did not adequately describe the potential effects of the Project or set out practical measures for mitigating or preventing all significant adverse effects. The Proponent redesigned the Project in 2002 to address concerns that had been raised, and submitted additional information on its application in 2003.

Public Consultation

Since 1999, public notification and consultation about the Project has included: four formal public comment periods established by the EAO (lasting 73 days, 30 days, 75 days and 18 days respectively); advertising in local/regional newspapers and Washington State newspapers; open houses/public meetings in Christina Lake, Grand Forks and Midway; and meetings with local government and stakeholder organizations.

Copies of the Proponent's application were made available to the public on the EAO website and in hard copy in Christina Lake and Grand Forks. The public comment periods and open houses/public meetings were advertised. Letters from the EAO inviting comments were mailed to approximately 150 interested local citizens and

regional and provincial organizations. Two EAO newsletters were distributed to residents of Christina Lake during the course of the review. The Proponent distributed a brochure to 4,000 households in the Christina Lake and Grand Forks area.

In 1999, the EAO received more than 100 letters during the 73-day public comment period, of which the vast majority stated opposition to the Project. In 2003/2004, the EAO received 486 written submissions during the 75-day public comment period. Again, the majority (approximately 98%) stated concern about, and opposition to, the redesigned Project. Approximately 327 (67%) of these submissions were form letters/e-mails opposing the Project – these form letters/e-mails originated from an Internet website. Of the 486 submissions, 66 were from Christina Lake (61 opposed; 5 in support), 41 were from Grand Forks (38 opposed; 3 in support), 9 were from other Boundary area communities (8 opposed; 1 offering conditional support), and 22 were from Washington State (all opposed). There were 65 submissions from unidentified locations, some of which may also have been from within the Boundary area. Of the remaining 283 submissions, 247 were from other BC communities, 30 were from other provinces, and 6 were from other countries.

The principal concerns identified by the public were potential impacts on tourism and recreation, water availability and licencing of water use, water quality, fish, and issues related to both land use and energy policy. The Proponent has made commitments to continue consulting with local residents and community groups about the Project if the Project receives approval, including but not limited to consulting on local economic development opportunities, potential for tourism development, and employment opportunities.

In summary, while the Proponent's redesign of the Project since the original concept was proposed, together with other additional mitigation measures, has significantly reduced the Project's potential to cause adverse effects, this has had little or no effect on the level of public opposition to the Project.

First Nations Consultation and Interests

The Project is situated within the asserted traditional territory of the Okanagan First Nations. Okanagan Nations include the: Lower Similkameen Indian Band; Okanagan Indian Band; Osoyoos Indian Band; Penticton Indian Band; Upper Nicola Indian Band; Upper Similkameen Indian Band; and Westbank First Nation. The Okanagan Nation communities and Indian Reserves nearest to the Project are located in the Okanagan Valley, approximately 144 kilometres west by road (the Osoyoos Indian Band and Indian Reserve). There are no Okanagan Nation Indian Reserves located within the Kettle River watershed.

The Project site is located within territory that appears to have been historically used by the Sinixt or Lakes people before the onset of the 20th Century. It would appear that today, most Sinixt people reside on the Colville Reservation in Washington State, and are registered members of the Colville Confederated Tribes. In 1956, the federal government declared the Sinixt to no longer exist in Canada, and they are currently not recognized as a First Nation in Canada. Ethnographic evidence suggests that, while there was interaction between the Okanagan and Sinixt people, the Sinixt were a

politically distinct group of Okanagan speaking people, although the Sinixt and the Northern Okanagan shared the same language, culture, history and traditions.

ONA consultation opportunities were provided by EAO during the assessment of the Project, and included opportunities for discussion and resolution of technical issues as well as asserted rights and title issues associated with the Project. At least a dozen government-to-government meetings were held during the EA process to discuss ONA interests and concerns, and many of these sessions were held in working group format, and involved other provincial, as well as federal and local government, agencies and US (Washington State) agencies.

Both the EAO and the Proponent provided funding for ONA participation in the process. In 1999, the Proponent commissioned a report from the ONA to document ONA traditional use activities in the Project area (an Aboriginal Interests and Use Study - or AIUS). In June 2004, ONA representatives, including Elders from the Lower Similkameen Indian Band, Upper Similkameen Indian Band, Osoyoos Indian Band, Penticton Indian Band, and Westbank First Nation participated in a site visit with the EAO and Proponent. The ONA invited technical and Elder representatives from each member band to attend a workshop on June 16, 2005, to review the Proponent's responses to written comments provided by the ONA and government agencies on the Proponent's Additional Information submission on the redesigned Project.

ONA issues of concern included potential adverse effects on water quantity (including the volume of flows in the Cascade Canyon), water quality, fish, wildlife and vegetation, and on archaeological sites, including a sacred mythological/spiritual site. The ONA were also concerned about the potential for the Project to result in restrictions on access to the area for traditional use (including spiritual and ceremonial) purposes. Locally, there is some potential for adverse effects on fish and fish habitat, vegetation, wildlife and wildlife habitat. These may occur on a site-specific basis, during both construction and operation of the Project.

Of particular importance is the spiritual significance of Cascade Canyon to the Okanagan people, and the ONA concern that this not be impacted. Use of the Project site would involve a relatively small area, and the Proponent has committed to measures that will generally mitigate these site-specific impacts. One benefit of the redesigned Project over the original proposal is that there will be no facility development or surface disturbance in the Canyon itself, and, while the ONA remain concerned that flows will be reduced in the Canyon when the power plant is operating, minimum flows must be maintained to satisfy fisheries agencies.

The Proponent has initiated discussions with the ONA with respect to potential benefits associated with Project development, including Project-related employment, a museum and other possible opportunities, although these discussions have not reached a detailed stage, and there is currently no Proponent/ONA agreement on these matters.

If the Project is approved, the ONA will continue to be involved in the Project prior to, during and after construction. Providing that the Proponent implements the actions described in its Table of Commitments and Assurances, and that a *Water Act* reserve is placed on unrecorded waters on the Kettle River upstream of the Project, while there may be impacts on the ONA asserted aboriginal rights linked to this proposed Project, the potentially adverse effects identified by the ONA will be adequately mitigated, and

the ONA will be able to reasonably continue to exercise their asserted rights in the area of the Project, should it be developed.

Potential Project Effects

The following summarizes:

- the various elements of the redesigned Project, intended to mitigate the potential adverse effects of the original proposal;
- the location of Project components and how the Project will operate;
- the potential environmental effects and proposed mitigation measures; and
- the potential socio-economic effects and proposed mitigation measures.

Project Redesign

The redesigned Project would use an underground tunnel to convey water from the intake to the power plant, rather than the surface canal originally proposed, and this would enable the elevation of the intake structure to be lowered. As a result, the elevation of the weir would be lowered by 2.3 m, and the maximum length/extent of the head pond would be reduced by about 77%. The switch to the underground tunnel also eliminates the surface disturbance that would have occurred with the canal option, and reduces, by about 60%, the amount of construction waste rock that would have been generated, and preserves the historic powerhouse bulkhead and spillway.

Project Operation/Components

The Project will divert up to 90 cubic meters per second (m^3/s) of flow from the Kettle River upstream of the Cascade Canyon/Falls, and return the water to the river downstream of the Canyon. The estimated 1-in-20-year flood event for the river is $750 \text{ m}^3/\text{s}$, and the 1-in-200-year flood event is $855 \text{ m}^3/\text{s}$. The estimated highest average monthly flow in the river, $313 \text{ m}^3/\text{s}$, occurs in May. The estimated lowest average monthly flows occur from September to February, and range from $19 \text{ m}^3/\text{s}$ to $14 \text{ m}^3/\text{s}$. The Project will likely operate at maximum capacity during the high-flow period in April, May and June. With the Project operating, the average flow through the Canyon/Falls for these months would be $37 \text{ m}^3/\text{s}$, $223 \text{ m}^3/\text{s}$ and $152 \text{ m}^3/\text{s}$, respectively.

The weir structure will be located just upstream of the entrance to the Canyon, and the head pond that it will create to cover the intake will be entirely within the natural water levels and existing channel of the river. In this section of the river, the natural variation in water level is about 7 m, ranging from a minimum flow of about $4 \text{ m}^3/\text{s}$ to a flood flow of about $750 \text{ m}^3/\text{s}$. The rubber dam will be gradually inflated and deflated, to control the water level upstream for river flows in the range of $20 \text{ m}^3/\text{s}$ to $240 \text{ m}^3/\text{s}$. The weir design and control features will maintain a constant water level in the head pond with river flows of up to approximately $200 \text{ m}^3/\text{s}$.

The hydraulic (backwater) effects and upstream extent of the head pond become less pronounced as river flow increases and the rubber dam is partially deflated. During lower river flows, the rubber dam will be fully inflated and the upstream extent of the head pond will be at its greatest. As river flow increases, the rubber dam will be gradually deflated and flow velocities in the head pond will increase. Above $200 \text{ m}^3/\text{s}$,

the water level in the head pond area will rise, as it would under natural conditions. At flows of approximately 240 m³/s and above, the rubber dam will be fully deflated and completely collapsed against the weir sill at riverbed level, the weir submerged, and the natural constriction of the Canyon just downstream of the weir, not the weir, will control the water level in the river channel upstream.

Minimum bypass (compensation) flows, established in consultation with fisheries agencies, will be maintained below the weir for fish and fish habitat, and these will vary by month. Natural flows have been recorded as low as 3 m³/s. The power plant will not operate when the available flow for power generation is less than 5 m³/s. During low-flow periods, if the total flow is less than the minimum turbine flow (5 m³/s), plus the minimum bypass flow (4 m³/s from October to February), all available water will flow through the Canyon/Falls. When the total river flow is greater than the turbine capacity (90 m³/s) plus the minimum bypass flow, the excess water will flow through the Canyon/Falls.

The minimum bypass (compensation) flows by month are:

Month	Mean Monthly Natural Flow (m ³ /s)	Minimum Conservation Flow (m ³ /s)
January	14	4
February	14	4
March	26	5
April	127	37* (minimum 10)
May	313	223*(minimum 20)
June	242	152* (minimum 20)
July	72	8
August	21	7
September	18	6
October	19	4
November	19	4
December	16	4

*Average flow in canyon with the Project operating

The power plant will be located on a parcel of land on the Kettle River, approximately 4 hectares (ha) in area that is owned by the Proponent. The facility and the weir/intake are a permitted use under local government zoning bylaws (the Regional District of Kootenay Boundary – or RDKB). The tailrace will be located on a floodplain, which is inundated annually with high river flows. Construction of the Project will generate waste rock and alluvium that will require disposal. Most of this material will be stored on the Proponent's property. The Proponent has applied for tenure over approximately 4 ha of Crown land in the area of the weir and intake structures, for purposes of construction access and staging.

Environmental Effects and Proposed Mitigation Measures

The most significant potential environmental effects of the Project are identified as follows:

- at lower river flow (10 m³/s or less), a maximum increase in river depth of 1.2 m (at the weir), with backwatering effects (the head pond) of approximately 750 m of river channel upstream of the weir. This will alter fast water fish habitat to slower water fish habitat, and reduce habitat diversity. This rapid, riffle and pool sequence habitat is limited in the watershed and considered important summer habitat for rainbow trout production. At mean annual river flow (75 m³/s), the backwatering effects would

be reduced to approximately 420 m upstream, with the rubber dam partially deflated. At flows above 240 m³/s, there would be no backwatering effects.

- reduced river flows below the weir in approximately 800 m of the river channel (the length of the Cascade Canyon/Falls).
- clearing of approximately one hectare of land for purposes of weir and intake construction access and staging.
- waste rock disposal on the Proponent's property, covering an area roughly 130 m by 200 m (2.6 ha), and the potential for metal leaching or acid rock drainage.

The Proponent has made commitments to mitigate, monitor and compensate for potential impacts on fish and fish habitat in the Kettle River. This includes potential impacts on speckled dace (which is red-listed provincially) in the head pond area. The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) recommended in 2006 that speckled dace be listed as endangered under the federal *Species at Risk Act*. Subject to fisheries agency requirements, the head pond will be drained during periods of low flows when the facility is not operating from March through October, thus restoring fast water fish habitat.

The reduced flows in the Canyon will reduce dissolved gas supersaturation, and reduce or eliminate any gas bubble trauma (and associated potential fish mortality) that may exist downstream in the Kettle River. This may have added benefits in terms of eliminating stress on fish during periods of high water temperature.

Areas of vegetation temporarily disturbed during construction will be restored with native plant species. Excavated rock will be sampled and tested to determine if there is the potential for metal leaching or acid rock drainage. If necessary, secure waste rock storage and monitoring measures will be implemented to ensure that there is no threat of contamination to the Kettle River.

Socio-Economic Effects and Proposed Mitigation Measures

The Proponent estimates that construction of the Project will generate an estimated 105 person-years of employment, and that 60% of the workforce will be from the Kootenay Boundary area. Once operational, about \$474,000 per year will be spent on the operation and maintenance of the facility, and most of this money will be spent locally and regionally. Estimated annual tax revenues generated by the Project will include \$252,000 in regional and provincial taxes, \$2.14 million in income taxes, \$33,750 in corporate taxes and \$170,000 in water rentals. Once operational, the Project will create three long-term jobs.

Three properties adjacent to the head pond are situated below existing high water levels, and during flood events, power plant operation and withdrawal of 90 m³/s of water upstream of the Canyon, could reduce flooding on these properties, and thus have a beneficial effect extending 2.5 km upstream

The most significant socio-economic potential effects identified for the Project are as follows:

- Full recording of all water in the Kettle River basin during the low-flow period, which could potentially limit the issuance of future water licences for other uses/users upstream of the Project.

- Post-construction, changes to the appearance/character of the area which may be observed by some recreational users and tourists (hikers, cyclists, horseback riders, canoeists, kayakers, swimmers, etc.), such as a reduction in river flows in the Canyon/Falls below the weir, increased depth and reduced flow velocities in the head pond, and the physical presence of Project components. This would depend upon their familiarity with the area, time of year, river flow conditions, individual perceptions and the appearance (aesthetic quality) of Project components.
 - From the Trans-Canada Trail trestle crossing the Canyon the weir/intake structures will be visible a short distance upstream (at flows of approximately 240 m³/s and above the weir will be submerged, but the intake control structure will remain visible). The power plant and waste rock disposal site will be visible from Highway #395 and the Cascade Cove beach (across the river).
- Temporary and intermittent disruption to public access and recreational use of the area during construction, over a period of approximately 22 months, which will vary depending upon the location and timing of the specific activity.
- A range of effects on adjacent property owners and tourism operators:
 - The weir/intake will be visible to a riparian property owner, and during lower river flows, there will be more water in the river channel adjacent to three riparian property owners, associated with the creation of the head pond.
 - Construction of the weir and intake will disrupt and permanently alter trail access upstream of the Canyon for a trail ride/horseback and hiking tour operator, who believes that this, and the presence of the infrastructure, will permanently diminish the experience for guests.
 - During lower river flows, the weir and its head-pond-associated backwater effects will flood a rapid with a standing wave, and increase the water level at the bottom end of a second rapid. A kayak tour operator believes this will permanently diminish the experience (at the beginner level) for its guests during its core operating season. The sandbar/beach near the weir used for kayak and canoe take out will also be affected.
 - The power plant and waste rock disposal site on the Proponent's property will be visible from a riparian property located across the river, where a residence, recreational vehicle park and campground are located.
 - The top portion of the waste rock storage site on the Proponent's property will be visible from one location on the adjacent golf course.

To address the above potential adverse effects of the Project, the Proponent has committed to the following:

- The water licence for the Project would not take precedence over future water licence applications. To achieve this, the Proponent supports the creation, by Order in Council under the *Water Act*, of a Water Reserve on the Kettle River, upstream of the Project which would set aside water for all future purposes, other than for competing power generation purposes, with any future licences for such water taking priority over the Project's water needs.
- Construction work will be scheduled as much as possible outside Christina Lake's summer tourist season. A major portion of the work, including excavation and blasting, will take place from October through April. Closure of the Trans-Canada Trail will only take place in the vicinity of the trestle (downstream of the proposed weir), and then only for short periods during blasting (maximum 30 minutes), from October through March. Most of the excavated materials will originate from, and be stored on, the Proponent's property, reducing the necessity for haulage by heavy vehicles on public roads.

- Local interested parties will be consulted on the architectural design of the power plant building. Other structures will be designed to be as inconspicuous as reasonably possible. The waste rock storage site will be set back at least 20 m from property lines, leaving existing trees and other vegetation as a visual buffer, and additional trees and vegetation will be planted for screening purposes. The site will be contoured, covered with topsoil, vegetated with native grasses, and maintained.
- A new access trail will be constructed for the trail ride/horseback and hiking tour operator. Access to the gravel bar upstream of the weir will be improved for the kayak tour operator (and also for the public) for kayak and canoe take out. Subject to fisheries agency requirements, the head pond will be drained during periods of low flows when the facility is not operating from March through October, thus restoring the river rapids. The Proponent is committed to making best efforts to negotiate reasonable compensation with these two recreation/tourism operators for any loss of business attributable to construction or operation of the Project.
- Approximately \$1,000,000 will be budgeted for the construction of a museum and interpretive centre that would be part of the power plant building. Displays would incorporate First Nations cultural and heritage themes and other local history, including the significant power generation history of the site.

There has been, and continues to be, disagreement between the Proponent and opponents to the Project about its potential effects. Opponents of the Project, including the RDKB and local tourism businesses and associations, maintain that the economic costs from the loss of the Cascade Canyon/Falls outweigh the benefits of the Project, and the aesthetic and recreational value of the Canyon/Falls is an important, if not integral, component of the future tourism industry growth of the Christina Lake area.

The Proponent maintains that:

- the lake (Christina Lake) is the key natural feature of the area, and the reason why tourists and summer residents come to the area;
- the Falls will not be “lost” - viewers’ impressions of the Falls are subjective, and the beauty of the Falls is not directly proportional to the volumes of flow – if the Project is developed, the Falls will still provide an impressive and beautiful spectacle;
- there will be no construction disturbance within or along the Canyon;
- once operational, the Project will not prevent current recreational use from continuing in the future, but that there will be some negative perceptions among existing users relating to the change in appearance/character of the area; and
- the Canyon/Falls is closely surrounded by existing development, and is not situated in a wilderness setting.

The Proponent also maintains that:

- during high flow periods, it will be difficult to distinguish between natural flows and flows reduced by the Project;
- during operation, minimum weir bypass flows, ranging from 4 m³/s to 20 m³/s, will be maintained in the Canyon for fish and fish habitat, and these flows would frequently be exceeded;
- during periods of very low flow, the facility will not operate, and the Falls will retain their natural flow levels; and
- when operating, the Project would reduce average natural flows in the Canyon/Falls from June to September approximately as follows (*Note* – this is based on natural flows recorded for the five-year period 2001-2005 – estimates for the reduced flows

are skewed upwards for September by unusually high flows in 2004, and actual average reduced flows may be slightly lower than estimated here):

- June 1st to 15th - from 239 m³/s to 149 m³/s
- June 16th to 30th - from 155 m³/s to 65 m³/s
- July 1st to 15th - from 70 m³/s to 8 m³/s
- July 16th to 31st - from 29 m³/s to 8 m³/s
- August 1st to 15th - from 14 m³/s to 7 m³/s
- August 16th to 31 - from 9.4 m³/s to 7 m³/s
- September 1st to 15th – from 8.8 m³/s to 8.8 m³/s (essentially unchanged)
- September 16th to 30th - from 14.5 m³/s to 6 m³/s

There is also disagreement between the Proponent and the opponents to the Project about the proposed museum/interpretive centre, intended by the Proponent to enhance the potential beneficial effects of the Project on tourism. The Proponent maintains that the Project and the museum/interpretive centre will constitute new activities of interest to a broader population, and will increase tourism opportunities at this location, and visitation to Christina Lake more generally. Opponents of the Project question the viability of the museum/interpretive centre. They maintain that the museum will not enhance recreation and tourism. Rather, increased visitation to the area as a result of the museum will impact the quality of recreation tours offered by tourism operators, while the Canyon/Falls would generate more economic and community benefit if left in its natural state.

The Proponent has committed to further consultation with the community and the ONA about alternative uses of the funding that it has allocated for the museum/interpretive centre, to help in determining what investments would provide the most benefits. If the museum/interpretive centre is to be constructed and operated as previously proposed, the Proponent is committed to consulting with local residents, the RDKB and the ONA about its appearance, construction, and employment opportunities.

Conclusions

Environmental Effects

The Proponent has agreed to the requirements specified by MoE and Fisheries and Oceans Canada (DFO) for compensation related to fish and fish habitat. DFO has concluded that:

- Fish and fish habitat information requirements for the Project have been satisfied.
- Assuming a positive conclusion to the Federal/Provincial harmonized EA, DFO will be in a position to work with the Proponent and the ONA to finalize operational details of the Fish and Fish Habitat Compensation Plan, as a requisite for issuance of the required *Fisheries Act* section 32 and 35(2) authorizations for the destruction of fish (rainbow trout) and the harmful alteration, disruption and destruction of fish habitat.
- It is confident that any potential residual effects on speckled dace habitat could be appropriately mitigated. Regardless of whether the federal Minister of Environment accepts the COSEWIC recommendation to list the species as endangered under the federal *Species at Risk Act*, federal authorizations would still be issued, enabling the Project to proceed.

MoE has concluded that:

- The rapid, riffle and pool sequence habitat in the area of the head pond is limited in the watershed, and is considered important summer habitat for rainbow trout production. The Proponent's mitigation and compensation commitments significantly reduce the risk for aquatic productivity and biodiversity resulting from the Project.
- The additional information requested, and the commitments or clarification that MoE has sought with respect to water quality, and monitoring and environmental management plans, have all been satisfactorily addressed. The head pond would have a small temperature effect on the river, causing a small theoretical increase in the exceedance rates of the rearing guidelines for rainbow trout and mountain whitefish (*Note* - the Proponent has committed to undertaking monitoring prior to, and following, construction to verify predictions and set water quality objectives specific to the Project area).
- The Proponent has adequately addressed terrestrial biodiversity issues. This includes issues related to 11 wildlife species that are listed federally and/or provincially as endangered, threatened or of special concern that occur or which are likely to occur in or near the Project area.

The ONA expressed concern that Project flow reductions in the Canyon downstream of the weir will have a more negative impact on aquatic habitat than the environmental studies projected and should be re-evaluated.

The State of Washington Department of Ecology has indicated that concerns it identified about the possible effects of the Project on water temperature and TGP, and recommendations for water quality monitoring, were adequately addressed by the Proponent.

The Ministry of Energy, Mines and Petroleum Resources (MEMPR) has concluded that, if excavated materials with the potential for ML/ARD are encountered during the construction of the Project, the storage options identified by the Proponent, if engineered appropriately, should help to prevent ML/ARD, and will control any potential ML/ARD that occurs. Natural Resources Canada (NRCAN) has concluded that the Proponent adequately addressed the concerns it had identified with respect to the potential for ML/ARD, the sampling and testing programs, and disposal strategies for waste rock produced during construction of the tunnel.

Socio-Economic Effects

As the Project will fully record all the water in the Kettle River basin during the low flow period, and thus, potentially limit the issuance of future water licences for other uses/users upstream of the Project, the EAO, together with the Ministry of Environment, Water Stewardship Division (MoE-WSD) is recommending that, if the Project is approved, a Water Reserve be established by order in council on the Kettle River upstream of the Project, to set aside water for all purposes, and that future licences for such water will take priority over the Project.

The State of Washington Department of Ecology indicated that: it does not foresee any impairment issues relating to impacts of the Project on existing water rights and/or claims located within the Water Resources Inventory Area 60, the State's portion of the Kettle River watershed; the Project is requesting the equivalent of a non consumptive power right for hydropower generation; this type of run-of-river project will not impair

either upstream or downstream existing rights within Washington State; and the question regarding how any future water rights, if issued, may be affected has been considered.

The Ministry of Tourism, Sport and the Arts (MTSA-Tourism) has concluded that: the Proponent's proposed mitigation measures are effective in addressing many of the Project's potential impacts on the two commercial recreation tenure operations in the area (trail ride/horseback, and kayaking) to a sufficient degree that the operators will be able to offer viable, although altered, adventure tourism products to clients; and that the mitigative measures incorporated into the design, construction and operational phases of the Project to accommodate recreation and tourism interest, when implemented, are expected to effectively mitigate concerns related to tourism and recreation. MTSA-Tourism has also noted that it would be willing to work with tourism interests in the Christina Lake area to identify opportunities and resources for community tourism planning.

The EAO and federal RAs are satisfied that the Project will not likely result in significant adverse effects from a navigable waters perspective, taking into account the location and height of the weir, and the proposed operation of the Project.

Cultural/Heritage Effects

The EAO expects that there will be some site-specific impacts on traditional and present uses, including gathering and spiritual pursuits of the ONA associated with the Project area. However, providing that the Proponent's consultation and mitigation commitments are implemented, and that a *Water Act* reserve is established to prevent the Project from tying up all currently unrecorded water, it is the conclusion of the EAO that the ONA will be reasonably able to continue to exercise their asserted aboriginal rights in the Project area, and that the likelihood of significant adverse effects on the current use of lands and resources for traditional purposes by the ONA is low, should the proposed Project be approved.

The ONA has not expressed support for the Project, but is interested in discussing in detail the benefits opportunities that the Project might provide to Okanagan Nation peoples.

General Conclusions

Pursuant to the requirements of the BC *Environmental Assessment Act (BCEAA)*, EAO is satisfied that:

- the process and documentation generated as part of the EA review of the Project have adequately identified and addressed the potential adverse environmental, economic, social, heritage or health effects of the Project;
- public and First Nations consultation, and the distribution of information have been adequate;
- issues identified during the review process by the public, the ONA, and federal, provincial and local government agencies have been adequately addressed by the Proponent during the review of its application; and
- practical means have been identified to prevent or reduce to an acceptable level any potential adverse effects.

Pursuant to the requirements of section 16(1) under *CEAA*, the RAs have determined that, on the basis of this Screening Report, the Project is not likely to cause significant adverse environmental effects.

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List of Abbreviations/Acronyms

Additional Information	revised Proponent impact assessment (October 2003)
AIUS	Aboriginal Interests and Use Study
ANFO	ammonium nitrate – fuel oil solution
AR/SR	Assessment Report/Screening Report
ARD	acid rock drainage
BCEAA	British Columbia <i>Environmental Assessment Act</i> (SBC. 2002, c. 43)
blue-listed (provincial designation)	species of special concern
BNR	Burlington Northern Railway
CEAA	<i>Canadian Environmental Assessment Act</i> (SC 1992, c. 37)
CEA Agency	Canadian Environmental Assessment Agency
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
DFO	Fisheries and Oceans Canada
DGS	dissolved gas supersaturation
EA	environmental assessment
EAO	Environmental Assessment Office
EC	Environment Canada
EMP	Environmental Management Plan
GBT	gas bubble trauma
ha	hectare
HADD	harmful alteration, disruption or destruction of fish habitat
IHA	Interior Health Authority
IRIA	Canada <i>International River Improvements Act</i>
km	kilometre
LWBC	Land and Water British Columbia (former agency)
m	metre
mm	millimetre
ML	metal leaching
MLA(s)	Member(s) of the Legislative Assembly of BC
m ³ /s	cubic metres per second
MAL	Ministry of Agriculture and Lands
MEMPR	Ministry of Energy, Mines and Petroleum Resources
MoE	Ministry of Environment
MoE-WSD	Water Stewardship Division of Ministry of Environment
MoT	Ministry of Transportation
MTSA	Ministry of Tourism, Sport and the Arts
MTSA-Archaeology	Archaeology Branch, Ministry of Tourism, Sport and the Arts
MTSA-Tourism	Tourism Branch, Ministry of Tourism, Sport and the Arts
NAFTA	North American Free Trade Agreement
NRCan	Natural Resources Canada
NWPA	Canada <i>Navigable Waters Protection Act</i> (RS 1985, c.N 22)
ONA	Okanagan Nation Alliance
ON	Okanagan Nation
PAG	potentially acid-generating
Project, the	Proposed Cascade Heritage Power Project
Proponent, the	Powerhouse Developments Inc.
RA	federal responsible authority under CEAA
RDKB	Regional District of Kootenay Boundary

red-listed (provincial designation)
Specifications, the
SARA
TC
TGP
WAWG

extirpated, endangered or threatened species
Project Report Specifications
Canada *Species at Risk Act* (SC 2002, c. 29)
Transport Canada
total gas pressure
Water Availability Working Group

1. INTRODUCTION

1.1 Purpose of this Report

This Report is a joint provincial Assessment Report and federal Screening Report on the proposal by Powerhouse Developments Inc. (the Proponent) to construct and operate the Cascade Heritage Power Project (the Project).

Under the British Columbia *Environmental Assessment Act*, the purpose of the provincial Assessment Report is to:

- report on the adequacy of the public and First Nations consultation, and on the distribution of information on the Project by the Proponent;
- report on potential environmental, economic, social, heritage or health effects of the Project; and
- determine whether potentially significant adverse effects can be prevented or reduced to an acceptable level through practical means.

Under the *Canadian Environmental Assessment Act*, The purpose of the federal Screening Report is to:

- identify the potential environmental effects of the Project, including the environmental effects of any accidents or malfunctions that may occur in connection with the Project, and any cumulative effects that are likely to result from the Project in combination with other projects or activities that have been, or will be, carried out;
- consider the significance of the effects;
- report on comments from the public; and
- describe measures that are technically and economically feasible to mitigate any adverse environmental effects of the Project.

1.2 Project Overview and Scope

The Proponent, Powerhouse Developments Inc. of Vancouver, British Columbia, is a wholly owned subsidiary of Sea Breeze Power Corp. The Project was originally proposed by Powerhouse Energy Corp., which changed its name to International Powerhouse Energy Corp., and then to Sea Breeze Power Corp.

The Project is located in south-central British Columbia, on the Kettle River approximately 18 km east of Grand Forks, 2.5 km south of the community of Christina Lake (3.0 km south of the lake), at the site of the former Cascade Water Power and Light Co. Ltd. facility, which operated from 1897 until 1921 (see Appendix E - *Project Area*). The Kettle River, flowing through what is known as the Boundary area, flows south from BC into Washington State near Midway, re-enters BC west of Grand Forks, and flows back into Washington State south of Christina Lake (*Note* - approximately 112 km of the mainstem Kettle River is located in Canada, while 40 km is located in the United States). The Project is approximately 5 km upstream from the Canada/US Border.

The Project is a 25-megawatt (MW) run-of-river hydroelectric facility that will divert up to 90 cubic metres per second (m³/s) of flow from an 800-m-long stretch of the Kettle River

known as the Cascade Canyon and Falls. The assessment of the Project included the following components and activities:

- a powerhouse (power plant building) with: two generating units producing a total capacity of 25 MW (two 2.5-MW turbines, driving a 5-MW generator, and two 10-MW turbines, driving a 20-MW generator); and a substation containing switchgear and a transformer;
- a concrete intake weir structure, consisting of a 3.0-m high inflatable rubber dam, overflow abutment, low-level outlet and fishway;
- a power intake structure, immediately upstream of the weir, consisting of a tunnel entrance, intake closure gate, and trash racks to divert up to 90 m³/s of flow to the power plant;
- a 775-m-long underground tunnel from the intake to the power plant;
- an 80-m-long tailrace channel from the power plant to the river;
- construction access roads; and,
- a 300-m-long 69-kV power transmission line.

At one time, the Project also included a fish compensation works component that was proposed for the mainstem of the Kettle River upstream of the weir and head pond. This proposal was later abandoned, after discussion with fisheries agencies (see section 4.1.5 - *Fish Habitat Compensation*).

The power plant, substation, and a portion of the tailrace will be located on a 3.93-ha parcel of land owned by the Proponent. The Proponent has applied for tenure of approximately 4 ha of Crown land in the area of the weir and intake structures for purposes of construction access and staging.

1.3 Environmental Assessment Processes

1.3.1 Provincial Process

The Project originally proposed by the Proponent had a capacity for generating 15 MW of electricity. In 1993, the Project was designated as a regulated project under the *Utilities Commission Act* by Order in Council, and the Proponent filed an application for an Energy Project Certificate with the Ministry of Energy, Mines and Petroleum Resources. A review of the Project was initiated in 1994 under the Energy Project Review Process, and two public and agency comment periods were held. In 1995, the review of the Project was suspended until the Proponent could provide evidence of a market for its power. In 1998, provincial project justification requirements were changed for independent power producers. They were then expected to provide only a description of potential markets and the means of accessing them.

In June 1999, the Proponent submitted an Application for the Project with a larger generating capacity under the previous *Environmental Assessment Act*, RSBC 1996, c.119. Although the 25-MW energy project was below the 50-MW threshold for triggering a provincial EA under the former Act, it was deemed to be a reviewable project under that Act's transition provisions, under which the Act was automatically applied to any project in review under the *Utilities Commission Act* on the date that the previous *Environmental Assessment Act* came into effect (June 30, 1995).

The Proponent's 1992 water licence application under the *Water Act* for the original 15-MW Project sought approval for a maximum withdrawal of 60 m³/s. In July 1999, the Proponent revised its water licence application to seek approval for a maximum withdrawal of 90 m³/s for the 25-MW version of the Project.

BCEAA allows a proponent to apply for concurrent review of one or more applications for provincial approvals under other enactments required to carry out a project. When such applications are accepted for concurrent review, this means that they will be reviewed simultaneously with the review of a proponent's EA application, with a decision on the approval applications to be made by regulatory permitting authorities within 60 days of the granting of an EA Certificate to a project. In this case, the Proponent requested, and was granted, concurrent review of its application for a water licence under the *Water Act*, and also of its application for Crown land tenure under the *Land Act*.

No provincial authorizations, permits, tenures or licenses may be issued under any provincial statutes until the Project has first received an EA Certificate from provincial ministers. In addition, the issuance of an EA Certificate does not guarantee that the necessary permits and authorizations will be granted, since the Project must comply with the requirements of the appropriate provincial regulatory agencies. The "permitting stage" refers to the stage following an EA Certificate decision in which approvals may be issued by regulatory agencies. Key provincial regulatory agency approvals required for the Project in the permitting stage are identified in section 6 - *Permits and Authorizations*.

1.3.2 Federal Process

Under subsection 5(1) of the *Canadian Environmental Assessment Act*, SC 1992, c. 37, as amended (*CEAA*), a federal environmental assessment is required when, in respect of a project, a federal authority, for the purpose of enabling the Project to be carried out in whole or part:

- is the proponent;
- makes or authorizes payment or any other form of financial assistance to the proponent;
- sells, leases or otherwise disposes of lands; or
- issues a permit, or license or other form of approval pursuant to a statutory or regulatory provision referred to in the *Law List Regulations*.

These planned actions of federal authorities are commonly called "triggers". The Project was subject to a screening under *CEAA*, because the following approvals and authorizations listed on the *Law List Regulations* would be required:

- construction of the weir, intake, and tailrace will require an approval by Transport Canada (TC) under section 5(1) of the *Navigable Waters Protection Act*;
- entrainment of fish through the power plant intake will require an authorization by DFO under section 32 (killing of fish by means other than fishing) of the *Fisheries Act*; and
- any harmful alternation, disruption, or destruction of fish habitat will require an authorization from DFO under section 35 of the *Fisheries Act*.

CEAA requirements must be met prior to federal authorizations or permits being issued for the Project. After completion of the project review, a Screening Report is prepared. If it has been determined that the Project is not likely to cause significant adverse environmental effects, federal Responsible Authorities (RAs) may exercise any power or perform any duty or function that would permit the Project, or part of the Project, to be carried out, such as issuing a permit or authorization.

DFO and TC are the RAs for the *CEAA* review of the Project. The conclusions of DFO and TC are outlined in this Report. In reaching those conclusions, the RAs relied on, among other things, advice from Environment Canada (EC), and NRCan. DFO and TC conclusions do not include section 3.0 of this Report (*First Nations Consultation and Interests*), which the government of Canada does not adopt. References to aboriginal rights and title in this Report are included to meet provincial requirements.

1.3.3 Harmonized Process

Where a project is subject to review under both *BCEAA* and *CEAA*, the *Canada-British Columbia Agreement for Environmental Assessment Cooperation* (2004) provides for coordination of the EA processes to avoid uncertainty and duplication, and to facilitate a “one project – one review” approach. The harmonized assessment of the Project was conducted in accordance with the Agreement.

The provincial EAO and the federal Canadian Environmental Assessment Agency (CEA Agency) coordinated the EA process. The EAO role is to neutrally administer and manage environmental assessments, and to discharge the various powers and responsibilities of that office. Likewise, the CEA Agency, as the Federal Environmental Assessment Coordinator, is the principal point of contact for federal authorities during the assessment process, consolidating information requirements for the assessment, as well as coordinating the actions of federal authorities with those of the EAO.

This Report, produced by the EAO and federal RAs (DFO and TC), is intended to be a collaborative report that meets the requirements of an Assessment Report under *BCEAA* and the requirements of a Screening Report under *CEAA*. It summarizes the procedures followed during, and findings of, the environmental assessment of the Project, and will be the common basis for federal and provincial decisions. The provincial Minister of Environment and the Minister of Energy, Mines and Petroleum Resources will consider this Report and other accompanying materials in making their decision on the Application, and whether or not to issue an EA Certificate to the Proponent under *BCEAA*. The federal RAs will use this Report as the basis for completing a federal Screening Report, and to make their determinations under *CEAA* as to whether the Project is likely to cause significant adverse environmental effects.

1.4 Scope of Assessment

When the current, revised *Environmental Assessment Act*, SBC 2002, c.43 (*BCEAA*) was proclaimed on December 30, 2002, a transition order was issued for the Project. This order indicated that the previous review process would be replaced by one to be identified in a procedural order issued under section 11 of the *BCEAA*. In August 2003,

a section 11 order was issued to the Proponent, describing the scope, procedures and methods for the assessment of the Project. The assessment of the Project has been based on the scope of the Project (its components and activities), as described under section 1.2 - *Project Overview and Scope*. The scope of the assessment has included consideration of the potential effects of the Project with respect to: water management and quality; water availability; fish and fish habitat; wildlife and wildlife habitat; vegetation; transboundary effects; cultural and heritage effects; First Nations interests; socio-economic effects; land use issues; and practical means to prevent or reduce to an acceptable level any potential significant adverse effects.

For the purposes of *CEAA*, the scope of assessment defines the factors proposed for consideration in the environmental assessment, and their proposed scope. The RAs are required to consider the factors specified in section 16(1) of the *CEAA*, taking into consideration the legislated definitions of “environment”, “environmental effect” and “project”, prior to making a decision regarding whether to take action (e.g. grant funding, dispose of land, or issue a permit or authorization) that would permit the Project to proceed.

The factors considered in the environmental assessment, pursuant to section 16(1) of the *CEAA*, include the following:

- *the environmental effects of the Project, including the environmental effects of malfunctions or accidents that may occur in connection with the Project and any cumulative environmental effects that are likely to result from the Project in combination with other projects or activities that have been or will be carried out;*
- *the significance of the environmental effects referred to above;*
- *comments from the public that are received in accordance with the Act and the regulations;*
- *measures that are technically and economically feasible and that would mitigate any significant adverse environmental effects of the Project;*

As defined under *CEAA*, “environmental effect” means, in respect of a project:

- a) *any change that the project may cause in the environment, including any change it may cause to a listed wildlife species, its critical habitat or the residences of individuals of that species, as those terms are defined in subsection 2(1) of the Species at Risk Act*
- b) *any effect of any change referred to in paragraph (a) on*
 - i. *health and socio-economic conditions,*
 - ii. *physical and cultural heritage,*
 - iii. *the current use of lands and resources for traditional purposes by aboriginal persons, or*
 - iv. *any structure, site or thing that is of historical, archaeological, palaeontological or architectural significance, or*
- c) *any change to the project that may be caused by the environment.*

The factors considered under *CEAA* are similar to, though not identical to, those considered under *BCEAA*. Requirements specific to *CEAA* are discussed in the following sections of this Report:

- 4.6 - *Accidents and Malfunctions*
- 4.7 - *Cumulative Environmental Effects*
- 4.8 - *Changes to the Project Caused by the Environment*

- 5.2 - Compliance Effects Monitoring and Follow Up

1.5 Early Project Review History

The Proponent redesigned the Project in 2003, and submitted, in its Additional Information submission, a revised impact assessment based on the updated version of the Project. The following summarizes the early stages of the EA review of the Project, from its commencement under the previous *Environmental Assessment Act* in June 1999, to November 2003, when the EAO accepted the Proponent's Additional Information submission for formal detailed review. The later Project review history, following Project redesign, is reported in section 2.0 – *Consultation and Feedback* of this Report.

Key events in the early review history were as follows:

- On June 10, 1999, the Proponent submitted an Application for a Project Approval Certificate (Application) for the Project under the former *Environmental Assessment Act*, RSBC 1996, c.119.
- The EAO established a Project Committee to review the Proponent's June 1999 Application. The Project Committee consisted of representatives from federal and provincial government agencies, local governments, and First Nations.
- The EAO established a formal 55-day public comment period on the Application, which was extended to 73 days (June 22 to September 3, 1999) to allow the public ample opportunity to comment. Three public meetings were held in Christina Lake (July 14, August 17 and September 21) to hear the views of area residents and inform them of the status of the review. More than one hundred letters were received from the public during the comment period, of which the vast majority stated opposition to the Project. Issues raised included concerns with the EA review process itself, and also with potential adverse effects related to land use planning, water quality, fish, wildlife, water allocation, aesthetics, tourism, employment and the local economy. A petition opposing the Project was also received that consisted of approximately 1000 signatures.
- The Project Committee determined that the proposed public and First Nation consultation plans outlined in the Application were acceptable, and the EAO communicated this to the Proponent on July 28, 1999. The Proponent submitted a report summarizing its public consultation efforts on September 10, 1999, and a report summarizing its First Nations consultation efforts on September 29, 1999.
- On September 21, 1999, after considering the comments received on the Application and the Proponent's responses to these comments, the Project Committee concluded that the Application did not adequately describe the potential effects of the Project, or set out practical measures for mitigating or preventing all significant adverse effects. The Project Committee recommended that the Project undergo further review, and that the Proponent be required to prepare a Project Report in accordance with specifications (i.e. terms of reference) which the Project Committee would draft.

- The Project Committee prepared draft Project Report Specifications (the Specifications), taking into account issues that had been identified by federal and provincial government agencies, local governments, First Nations, and the public. A working group was established to review technical issues related to fish and fish habitat, and to provide feedback to the Proponent.
- The EAO established a formal 30-day public comment period on the draft Specifications (November 17 to December 17, 1999). A public meeting was held in Christina Lake (December 9) so that the purpose of the Specifications could be explained.
- The Project Committee reviewed all comments received on the draft Specifications and made final changes. On January 6, 2000, the EAO issued the final Specifications to the Proponent. Following this, the Proponent initiated studies and undertook to address the Specifications.
- On October 22, 2002, the Proponent advised the EAO that it had substantially redesigned the Project to address various issues and concerns that had been raised during the review of its Application – these were reflected by the information requirements set in the Specifications.
- On December 30, 2002, changes to the previous *Environmental Assessment Act* were proclaimed, and a transition order was issued to the Proponent, setting the framework for continuing the review of the Project under the revised Act (*BCEAA*). The order indicated that the previous review process would be replaced by one to be identified in a procedural order issued under section 11 of the *BCEAA*. In August 2003, an order was issued to the Proponent under section 11 of the *BCEAA* that described the scope, procedures and methods for the assessment of the Project.
- On August 19, 2003, the Proponent submitted documents to the EAO entitled the “*Cascade Heritage Power Project, Additional Information, Volumes 1 to 4*” (the Additional Information). This information was to be prepared pursuant to the Specifications. The Additional Information submission was screened to determine whether or not it contained all of the necessary information. Deficiencies were identified, and the EAO advised the Proponent of this on September 18, 2003.
- On October 24, 2003 the Proponent re-filed the Additional Information submission with revisions. The EAO determined that this version did contain the information stipulated in the Specifications, and the formal review began on November 18, 2003.

Public notification, access to information and consultation during the review of the Application and draft Specifications included the following measures:

- Local and regional (Boundary area) advertising (newspapers and radio) of: the availability of the documents for public review and comment; the comment period deadline (including a timeline extension for the Application review); the locations where information was available for viewing; and the locations and timing of open houses and public meetings.

- Copies of the Application and subsequent draft Specifications were made available for viewing at the EAO Project Registry in Victoria, through the EAO Internet Homepage, and in Christina Lake and Grand Forks.
- Letters from the EAO inviting comments were mailed to approximately 150 interested local citizens and regional and provincial organizations. Two EAO newsletters, one relating to the review of the Application (June 1999), and one to the review of the draft Specifications (November 1999), were distributed to residents of Christina Lake, and to others in the area who had previously expressed an interest in the Project. The Proponent sent letters to local and regional governments and key stakeholders, and distributed a brochure to 4,000 households in the Christina Lake and Grand Forks area.
- Open houses/public meetings were held in the community of Christina Lake, attended by the Proponent and the EAO, to provide information to the public about the Project and the EA review process. Meetings were also held with parties with a known interest in the Project.

2. CONSULTATION AND FEEDBACK

The Proponent's Additional Information submission for the Project reports on public consultation as follows:

- Response to Project Specification #5, Public Consultation, Volume 2, October 2003, includes: a summary of consultation activities previously carried out (March 2000 - June 2003); a summary of the issues identified by the public and how these would be addressed; and, a proposed consultation program for the review of the Additional Information submission.
- Section 5.0 of Volume 1, Main Report, October 2003, summarizes and discusses the primary issues raised by the public.

The EAO reviewed the past and proposed public consultation programs presented in the Additional Information submission. The programs were determined to be adequate.

2.1 Consultation Measures

Measures undertaken to consult with the public during the review of the Application and draft Specifications are summarized under section 1.5 - *Early Project Review History*. The following is a summary of the measures undertaken to consult with the public on the Additional Information submission, filed after the redesign of the Project:

- The EAO established a formal 61-day public comment period on the Additional Information submission, which was extended to 75 days (December 3, 2003 to February 16, 2004), to allow the public ample opportunity to comment.
- Public meetings were held during the comment period in Midway (on December 8, 2003), and Christina Lake (on December 9, 2003), during which the

Proponent made presentations about the changes to the design of the Project and the Additional Information submission, and the EAO explained the review process.

- The EAO and the (then) provincial permitting agency for land and water (Land and Water British Columbia – or LWBC) met with the Boundary Water Availability Committee on December 10, 2003, in Greenwood. This committee consisted of officials from local governments, industry representatives and members of the public.
- The EAO established a working group to provide comments and advice regarding the potential effects of the Project on water use and availability in the Kettle River watershed. Federal, provincial and Washington State government agencies, provincial and Washington State local governments, First Nations, and stakeholder organizations were invited to participate on this working group. The working group provided information to the EAO, and also to a consultant retained by the EAO to prepare a report on the effects of the Project on water allocation in the watershed.
- All written comments received during the public comment period, within the scope of the EA review, were provided to the Proponent for response and taken into consideration.

Public notification and access to documents during the review of the Additional Information submission included the following measures:

- The EAO posted, and made available to the public, information relating to the Project on its electronic Project Information Centre (e-PIC) at www.eao.gov.bc.ca. This Internet site contains the information generated since the EA review of the Project was initiated in 1999.
- Advertising was placed in four local area newspapers (in Christina Lake, Grand Forks, Greenwood and Rock Creek) and two Washington State newspapers, of: the availability of the Additional Information submission for public review and comment; the comment period deadline (including the timeline extension); the locations where information was available for viewing; and the locations and timing of open houses and public meetings.
- The Additional Information submission was made available on the EAO's Internet site (above). Printed copies of the Additional Information submission were made available to the public in Christina Lake and Grand Forks.
- The Proponent directly contacted local businesses, and sent letters to Chambers of Commerce and public organizations to inform them of the public meetings. Notices of the meetings were sent to be posted in local post offices and municipal halls. The Proponent also advertised information about the Project in some local newspapers and in periodic circulars, and on its own website.

Following the public comment period on the Additional Information submission, there were several suspensions of the legislated 180-day timeline for completing the EA review. These were as follows:

- On March 3, 2004, at the request of the Proponent, the EAO suspended the timeline to allow the Proponent more time to respond to the issues raised during the public comment period on the Additional Information submission. This information was later provided, and the timeline resumed on June 29, 2005.
- On June 30 and July 8, 2005, respectively, the RDKB and the City of Grand Forks advised the EAO that more time was needed to review the Proponent's responses to issues raised. On July 15, 2005, at the request of the Proponent, the EAO suspended the timeline to allow additional time for the RDKB and the City of Grand Forks to complete their review of this information.
- On August 15, 2005, at the request of the Proponent, the EAO extended the suspension of the timeline to allow the Proponent additional time to further address issues raised by all levels of government, First Nations, and the public, and to fulfill outstanding reporting requirements on its public and First Nations consultation measures.
- Following this, DFO initiated an assessment of the potential effects of the Project on the conservation status of speckled dace. This was undertaken prior to a federal *CEAA* screening decision on the Project, given awareness of the possibility that Speckled Dace were to be listed under the *Species At Risk Act* (see section 4.1.2 - *Fish*). The review timeline remained suspended while DFO undertook this assessment.
- The 180-day timeline for completing the EA review resumed on March 27, 2006, at the request of the Proponent, after a review of the DFO draft assessment on the conservation status of speckled dace.
- In June 2006, a time limit extension order was issued to allow potentially affected First Nations to review documentation concerning the potential effects of the Project on First Nations interests (see section 3.0 – *First Nations Consultation and Interests*). The 180-day time limit for completing the review was extended 37 days to June 30, 2006, and this time limit was extended for a further 12 days to July 12, 2006 to allow this task to be completed.

During the above suspensions of the legislated timeline for completing the EA review, the Proponent and the EAO continued to consult with local governments and the public about the Project. The following is a summary of the measures undertaken to consult on the Additional Information submission after the formal public comment period (which ended on February 16, 2004):

- The working group on water availability, which included local government and stakeholder participation, met on January 15, March 24, May 18, and September 30, 2004, to identify and review options for addressing concerns about the Project's potential effects on future water availability.
- The EAO established an 18-day public comment period (September 20 to October 8, 2004) for the consultant's report on the effects of the Project on water allocation in the Kettle River watershed. The report was presented to the public at advertised

meetings in Grand Forks (on September 29, 2004), and in Midway (on September 30, 2004).

- In June 2005, the EAO notified individuals, businesses, stakeholder organizations, provincial and Washington State local governments, and US agencies of the opportunity (until July 11, 2005) to provide comments on the Proponent's responses to their comments on the Additional Information submission.
- The Proponent made presentations regarding the redesign of the Project, and the revised potential effects assessment, and presented its commitment in support of a water reserve on the Kettle River to the mayor and council of Grand Forks on October 4, 2004, and also on July 25, 2005, and to the board of directors of the RDKB on July 28, 2005.
- In response to concerns from a number of organizations and individuals, the EAO requested that the Proponent provide more detailed information about the probable effects of the Project on tourism businesses and facilities potentially directly affected by construction and operation of the Project. This information was distributed by the Proponent to fourteen organizations and individuals in correspondence dated October 31, 2005. On November 17, 2005, the EAO sent letters to the same parties, requesting that they review the material and advise the EAO by December 16, 2005 whether or not it had influenced their concerns with respect to the Project.

On December 21, 2005, the Proponent submitted to the EAO a "*Summary of Public Consultation Activities*" on the Project from October 2003 to December 2005. This document: lists the public meetings that occurred; identifies the measures taken to notify the public about the Project and the opportunities provided for consultation; summarizes the issues raised by the public and the Proponent's responses to those issues; describes the potential impacts on tourism during the construction and operation of the Project; and lists the Proponent's commitments and assurances relating to the Project.

In January 2006, the EAO and the MTSA–Tourism met with two recreation tenure holders and a tourism business in Christina Lake, and also with the RDKB, to discuss their concerns about the potential effects of the Project on their businesses and recreation and tourism. The EAO and the MTSA met with the RDKB again in February 2006 to discuss their concerns.

2.2 Public Opinion and Issues

There was sustained public interest in the Project throughout its review. The EAO received approximately 486 written submissions during the formal 75-day comment period on the Additional Information submission. Submissions were received from individuals, stakeholder organizations, Boundary area businesses or business associations, and local governments.

Some submissions were from, or signed by, more than one individual. Overall, the 486 submissions represented approximately 529 individuals. Approximately 327 (67%) of the 486 submissions were form letters opposing the Project, and these had originated

from an Internet website. Approximately 159 (33%) of the 486 submissions were individualized submissions.

Overall, the vast majority of the submissions received (approximately 98%) stated concern about, and opposition to, the Project, or requested that it not be allowed to proceed. A small number of the submissions were in support of, or not opposed to, the Project. The issues of concern about the Project identified in the written submissions are summarized below under section 2.2.2 - *Public Issues*.

Website Form Letters/Emails

One member of the public established an Internet website with the banner “*Save the Cascade Canyon*”, dedicated to organizing opposition to the Project. This website made available for public use an electronic form letter/email, and provided email addresses for Members of the Legislative Assembly of BC (MLAs) and Members of Parliament, provincial and federal government Ministers, the EAO, and the Proponent.

This website was the source of approximately 327 submissions to the EAO, stating opposition to the Project. Approximately 308 of these were complete or largely unmodified replications of the form letter/email, and 19 contained excerpts from the letter/email. More than one name was indicated on some of the form letters/emails, and overall approximately 339 names were associated with the submissions.

Approximately 310 of the website form letters/emails were from individuals, 1 was from a Christina Lake Bed and Breakfast facility, and 16 submissions were from 11 different environmental, stakeholder or recreational organizations from outside of the Boundary area. The geographical origins of the form letters/emails were as follows:

- 15: Christina Lake - (*Note* -in addition, of the other submissions below, 2 indicated that the individuals (2) were former residents of the area, and 1 indicated that the individuals (2) had recreational property at Christina Lake);
- 15: Grand Forks;
- 58: Location unknown, no or incomplete address;
- 205: Other BC;
- 28: Other Canada; and
- 6: Other Countries (2 - State of Washington).

Individualized Submissions

Excluding the approximately 327 website form letters/emails noted above, the EAO received approximately 159 other written submissions on the Project during the formal public comment period. Of these, 26 were copied to provincial Ministers or MLAs. More than one name was indicated on some of the letters/emails, and overall approximately 190 names were associated with the 159 submissions. A few individuals commented more than once, raising different issues, and these are reported as separate submissions.

Of the 159 submissions, 148 (178 individuals) stated opposition to the Project, 9 stated support for, or were not opposed to, the Project, and 2 indicated no opposition, providing that certain conditions were met.

Approximately 130 of the 159 submissions were from individuals. There were a total of 29 submissions from different environmental, stakeholder or recreational organizations, Boundary area businesses or business associations, and local governments (*Note* - the feedback received from local governments is discussed separately below under section 2.3).

Of the 29 submissions from organizations or businesses, 27 stated opposition to the Project, 1 stated support for the Project, and 1 requested that approval of the Project only be considered subject to conditions. These organizations included the following from the Boundary area (opposed to the Project unless noted otherwise): 6 Christina Lake tourism operators/businesses; 1 Christina Lake business (supports the Project); Christina Lake Chamber of Commerce; Boundary Mining Association (Grand Forks); mining exploration company (mineral tenure holder in Kettle River drainage); and Kettle River Stockmen's Association (Rock Creek – should only be considered for approval if present and future irrigation needs take precedence over power generation).

The 159 submissions were from the following geographical origins:

- 47: Christina Lake (*Note* - in addition, of the other BC submissions below, 2 indicated that the individuals (2) were former residents of the area, and 1 indicated that the individual was possibly moving to the area),
- 18: Grand Forks,
- 9: Other Boundary area (Midway, Greenwood, Rock Creek, unknown address),
- 19: Location unknown, no or incomplete address,
- 42: Other BC,
- 2: Other Canada, and
- 22: Other Countries (20 - State of Washington).

Petitions/Signatures

During the public comment period one Christina Lake tourism operator included a petition with its submission, opposing the Project, and signed by 100 guests. These individuals were from the following locations: Christina Lake - 6; Grand Forks - 9; other BC communities - 31; other Canadian communities - 31; United States - 1; other countries - 17. The Grand Forks Community Trails Society also included a petition with its submission, opposing the Project, and signed by 19 visitors from the United Kingdom, 4 of whom also signed the above noted petition.

In October 2004, after the public comment period on the Additional Information submission, the EAO received, from the RDKB, a series of sign up sheets containing approximately 1,500 signatures and comments about the Cascade Canyon/Falls and the Project. It appears that information about the Project was located on or near the trail to the Falls, and that the sheets were signed by visitors to the area during the summer tourist season. The individuals, many from other communities in B.C., and from other provinces and countries, largely noted the beauty and spectacle of the Falls and indicated opposition to the Project.

2.2.1 Local and Regional Opinion

The Boundary area consists of three municipalities, the Village of Midway, the City of Grand Forks and the City of Greenwood. The surrounding unincorporated rural areas are designated as Area C (surrounding Christina Lake), Area D (surrounding Grand Forks) and Area E (West Boundary). All of this forms part of the RDKB, which consists of eight municipalities and five rural areas.

According to 2001 Census Canada figures, the population of the Boundary area is 12,230. Electoral Area C has a permanent population of 1,456. Area C includes the unincorporated village of Christina Lake and all rural areas from Paulson Bridge to the Gilpen Grasslands, and from the Canada/US border to the north end of Gladstone Provincial Park. The Christina Lake Chamber of Commerce website reports that in the summer months, the Christina Lake population increases to 6,000 with the seasonal influx of summer residents and tourists.

During the public comment period on the Additional Information submission, the EAO received, in total, the following number of submissions opposed to, or in support of, the Project from residents in the Boundary area, taking into account both website form letters/emails and individualized submissions (*Note* - these figures include submissions from Boundary area businesses and stakeholder groups, Christina Lake area tourism operators, and local governments):

- 62: Christina Lake (57 submissions/71 individuals opposed; 5 submissions/6 individuals in support);
- 33: Grand Forks (30 submissions/40 individuals opposed; 3 submissions/3 individuals in support); and
- 9: Other Boundary area - Midway, Greenwood, Rock Creek, unknown address (8 submissions/10 individuals opposed; 1 submission/1 individual conditional support).

In addition to the above, of the approximately 77 submissions opposing the Project with no or incomplete physical address information, the EAO confirmed that 4 of these submissions (4 individuals) were from Christina Lake, and 8 submissions were from Grand Forks (9 individuals).

Overall, from within the Boundary area, approximately 107 submissions, representing approximately 134 individuals, indicated opposition to the Project. (*Note* - Some of the remaining 65 submissions from unknown locations could also have also been from within the Boundary area.)

2.2.2 Public Issues

The issues raised by the public about the Project, and the Proponent's responses to these issues, are summarized in Appendix C – *Summary of Public Comments*. Many of these issues were similar to (or related to) those raised by the provincial and federal government agencies and local governments that participated in the technical review of

the Project. Their concerns are summarized in Appendix A – *Summary of Government Agency and Local Government Comments*.

The following is a summary of the main issues of concern as expressed by the public, including those identified in the website form letters/e-mails. The summary includes the issues raised by Christina Lake area tourism operators, businesses and related associations, other Boundary area businesses and business associations, and various environmental, stakeholder and recreational organizations.

Tourism and Recreation

- The community of Christina Lake has an economy that is reliant on tourism and recreation. Tourism businesses promote the Canyon/Falls as a local attraction to their guests.
- The Project would impact the visual aesthetics of the Cascade Canyon/Falls (reduce flows), and also of recreational uses in the vicinity, including hiking, use of the Trans-Canada (Spirit of 2010) Trail (bicycle touring), canoeing, kayaking, swimming, use of beaches, and recreational fishing. Tourism in the area would be impacted.
- Construction and/or operation of the Project would impact businesses within the immediate area, including guided kayaking/canoeing, guided horseback trail rides, a campground and a golf course.
- The Project would compromise the efforts and investments that have been made to develop/upgrade the Trans-Canada Trail through the Boundary area to enhance tourism.
- The Project would not provide any benefit to the local community other than short-term construction jobs. The economic potential of the Canyon/Falls would be greater if they were left in their natural state than if they were developed for power production.

Water Availability and Quality

- The issuance of a water licence for the Project would fully record the available water in the Kettle River, which, in future, would limit the ability of other users to obtain water licenses, and would potentially impact future economic development within the broader Boundary area.
- The construction and operation of the Project would negatively impact water quality, water temperature, and flows in the Kettle River.
- The construction (blasting) and operation of the Project may impact the water levels/flows or water quality of wells in the Project area.

Fish, Wildlife and Vegetation

- There are red-listed and blue-listed species present in the Kettle River, including a sub-species of speckled dace (fish) that is under consideration for listing under the federal *Species at Risk Act*.
- The Project would impact a variety of wildlife species in the area, including birds and snakes.
- The Project would impact provincially-listed plant communities.
- No development of any kind should occur within the habitat of species –at risk. Potential impact to listed species contradicts Canada's 1992 endorsement of the Convention on Biodiversity.

First Nations

- Significant First Nations sites that exist in the area should not be disturbed by this Project, including disturbances associated with the reduction of flows through the canyon.

Archaeology

- The canyon has been described as likely being the most important location for archaeological data in the area.

Land Use Policy

- The Cascade Canyon has previously been identified as a candidate for protected area status. The Canyon, with its unique features, should be preserved as a park/protected area. (*Note* - A recommendation on designating the site as a protected area was deferred by the Regional Protected Area Team until after a decision about the Project was made.)
- The Kettle River is a BC Heritage River. Rivers given this status were to be judged at a higher rather than lower level as to permitted uses, with more emphasis on protection and enhancement of ecological values. (*Note* - The designated portion is the mainstem of the West Kettle River upstream of Rock Creek and the Project area.)
- The Kettle River is one of the only major tributaries of the Columbia River that has not been dammed.

Energy Policy

- The provincial policy of encouraging independent power production potentially risks undermining economic development and economic diversity.
- The power generated by the Project will most likely be exported to the US. Conveying the rights to this water to a US firm essentially exports the rights to that water. Control over BC's natural resources should be retained by the province, the local communities and the people. If the Project is approved, a trust fund should be set up similar to the Columbia Basin Trust to ensure that local communities benefit.
- More energy conservation is needed, not more dams. Water is no longer a guaranteed renewable resource. Alternatives such as solar energy should be explored.
- There is a lack of a province-wide plan or strategy under which independent power projects are reviewed that would allow consideration of impacts on recreation on local and regional scales.

The above energy policy issues fall outside the scope of individual project reviews, and are more appropriately addressed in policy development forums. As noted under section 1.3.1 - *Provincial Process*, provincial project justification requirements were changed for independent power producers in 1998.

Process

- The EA process was too accommodating to the Proponent, and too much time was taken to complete the review. (*Note* - Some local residents were involved in organized opposition to the Project since the original proposal was subject to regulation under the *Utilities Commission Act* in 1993.)
- The public consultation conducted by the Proponent, and the information distributed, was confusing, misleading and too technical. Information from the Proponent was

not provided in a timely manner to allow stakeholders and members of the public to prepare for the public comment period.

- The EAO largely failed to ensure that stakeholders were kept informed and involved. Documents such as the minutes of public meetings were not distributed in a timely manner.
- Changes to the design of the Project and water license application made it difficult to assess the impacts of the Project.

The EAO believes that the process went to unusual lengths in this review to ensure that the public had adequate opportunities to receive and respond to information about this Project. Measures taken in this case which are not normally adopted in project reviews included holding four separate public comment periods, and suspending review timelines for considerable periods of time to consider and address issues raised by the public.

The technical review of specific potential Project effects is discussed below under section 4.0.

2.3 Local Government Opinion and Issues

The issues raised by local government about the Project, and the Proponent's responses to these, are summarized in Appendix A – *Summary of Government Agency and Local Government Comments*.

The RDKB has indicated that it did not support the Project in 1994, as proposed. In August 1999, the RDKB advised the EAO that the Board of Directors had passed a resolution stating that the Project is considered a regulated utility under the *Utilities Commission Act*, and is therefore a permitted use under zoning bylaw, and that, based on the available information, the Application appeared to contain practical mitigation or compensation measures to prevent or reduce to an acceptable level all significant adverse effects of the Project. Also in August 1999, the City of Grand Forks passed a resolution stating that the Project does not appear to affect the City.

The RDKB, City of Grand Forks, City of Greenwood and Village of Midway jointly submitted correspondence to the EAO during the comment period on the Additional Information submission, identifying issues that they considered to remain unaddressed, and requesting that a water license for the Project be granted only under two scenarios: 1) approval of the Application is postponed until all the issues identified are resolved to the satisfaction of local elected officials and stakeholders; or 2) a water license only be issued for the diversion of water at Cascade Canyon for generating hydroelectric power, in order that the license will not prohibit, diminish, threaten, restrict, or otherwise negatively impact the potential for local communities and citizens to apply for and obtain water licenses for future economic development on both sides of the international border.

The identified issues focused on the future availability of water in the Kettle River for other uses (see section 4.12 - *Water Resources*), and related to this: insufficient data; lack of timely notification to existing license holders and other unlicensed users; impacts

of any future licensing of wells for groundwater that is hydrologically connected to the river; protection of groundwater rights of BC and Washington State residents; current and future water needs in the Washington State reach of the Kettle Watershed in Ferry County upstream of the Project; potential impacts on BC and Washington State water licence holders; and other higher level (provincial) *Water Act* and water use policy issues.

The Washington State, Ferry County, Water Resource Inventory Area 60, Watershed Planning Unit, submitted correspondence agreeing with the above submission and approval scenarios from the RDKB, City of Grand Forks, City of Greenwood and Village of Midway, and stating concern about the potential for transboundary enforcement of water rights in the portion of the River that flows through Ferry County. (*Note* - Membership of these Planning Units includes the public at large, but they are run by local governments and authorized by the State.)

In January, 2004, the Proponent agreed to a binding commitment in an EA Certificate for the Project whereby the water license for the Project would not take precedence over any future water licence applications, providing that they were for non-competing purposes (i.e. not for power generation). (*Note* - Correspondence in regards to the above was published by the Proponent in local area newspapers in February, 2004.)

Despite this Proponent commitment, in January 2004, the City of Grand Forks advised the RDKB that, until assurances could be provided that there would be enough water in the Kettle River to support future growth of the regional community, it could not support the Province issuing a water license for the Project. In February 2004, the RDKB advised the EAO that its Board of Directors had adopted resolutions specifying that: issues regarding water availability for future use had not yet been adequately addressed, and would not be adequately addressed until the completion of the (EAO) consultant's report; the RDKB should be provided with an opportunity to submit further comments upon review of the report; and the RDKB supported the position on the Project taken by the City of Grand Forks.

In March 2004, the RDKB advised the EAO that it had adopted a resolution specifying that the RDKB Board of Directors opposes hydro power development at Cascade Falls. The Board based this resolution on the following considerations presented by the Director of Electoral Area 'C':

- Christina Lake is a tourism-oriented community, and the RDKB supports and encourages the growth of this industry.
- Local residents spent a considerable amount of time reviewing the Project. Formal surveys, public meetings and community feedback to the Electoral Area 'C' Director indicate that the majority of Christina Lake residents are opposed to the Project.
- Opposition to the Project is supported by a consultant's report prepared for the Kettle River Review Committee (stakeholder organization) that concluded that the benefit cost ratio of the Project would be negative.
- Christina Lake residents opposed to the Project believe that the economic costs from the loss of the Cascade Falls outweigh the benefits of the Project. Cascade Falls and canyon are unique natural features which generate tourist visits from many sources, including the Trans-Canada Trail, tourism package operators and

destination visitors. The aesthetic and recreational value of this unique feature is an important, if not integral, component of the Lake's future tourism industry growth.

In response to ongoing concerns from local governments and the public, the EAO developed terms of reference for a working group to provide comment and advice regarding the potential effects of the Project on water use and availability in the Kettle River watershed. The working group provided information to the EAO, and a consultant retained by the EAO to prepare a report on the effects of the Project on water allocation in the watershed and policy options that would mitigate potential effects.

The EAO report on the "*Potential Effects of the Cascade Heritage Power Project on the Allocation of Water in the Kettle River Basin, November 15, 2004*", by Aqua Factor Consulting Inc., concluded that "...the effect of the Project to record all the water in the Kettle River basin during the low flow period may be fully mitigated by an order in council that reserves the water for future allocation for all purposes..." (see section 4.12 - *Water Resources*). The working group supported this option (Case III), and the EAO committed that, if the Project were to be approved, it would recommend such a reserve.

In July 2005, the RDKB Board of Directors heard a presentation about the Project from the Proponent in response to the above-noted issues. In August 2005, the RDKB advised the EAO that it had adopted resolutions specifying that: the RDKB Board of Directors recommend to the appropriate authorities that they take into account the wishes of the residents of Christina Lake in making their decision related to the Project; and the RDKB Board of Directors supports the concerns of the Christina Lake residents and opposes the Project.

In 1999, the RDKB advised the EAO that, while the hydroelectric facility is a permitted use under zoning bylaw, any peripheral uses would require zoning bylaw amendments. In 2002, the RDKB clarified that land surrounding the Canyon is zoned as Rural 1, a general purpose rural zone, and under the general regulations of Zoning Bylaw No. 900 (1996), "Public Utility Uses", as essential services (excluding offices, garages and storage), are permitted uses in all zones, and with respect to the Project, the weir and generating facilities are a permitted use, but peripheral uses including offices and storage buildings are not allowed. In 2006, the RDKB confirmed that "Public Utility Uses, excluding offices, maintenance garages and storage areas" are listed as a permitted use under the bylaw, and the RDKB could not issue building permits for buildings and uses associated with the Project that are not permitted under the zoning bylaw.

2.4 Conclusions

The EAO reviewed the Proponent's past and proposed public consultation programs presented in the Additional Information submission, and determined these to be adequate. The EAO is satisfied that the public consultation measures and distribution of information undertaken by the Proponent during the environmental assessment process was sufficient.

Participation in the EA review of the Project by Washington State was undertaken in accordance with the “*Memorandum of Understanding Between the Washington State Department of Ecology and the British Columbia Environmental Assessment Office*”.

The RDKB advised the EAO that informal surveys, public meetings and community feedback to the Electoral Area ‘C’ Director (for the rural area surrounding Christina Lake) indicate that the majority of Christina Lake residents are opposed to the Project.

The EAO is satisfied that public comments about the Project received during the environmental assessment process, which were within the scope of the review, have been adequately considered in the assessment, and are captured in the discussion below under section 4.0 - *Potential Project Effects*.

3. FIRST NATIONS CONSULTATION AND INTERESTS

The EAO reviewed the past and proposed First Nations consultation programs presented in the Additional Information (Specification #45). The proposed consultation program was not considered adequate and a more detailed program was requested from the Proponent. This information was subsequently provided and determined to be adequate (see section 1.5 – *Early Project Review History*).

The Proponent's Additional Information on the Project reports on First Nations consultation as follows:

- Response to Project Specification #45, *Aboriginal Interests and Consultation, Volume 2, October 2003*, includes: identification of potential adverse impacts on the exercise and maintenance of First Nations interests; measures to prevent or mitigate any adverse impacts on any First Nations' interests; an update on First Nations information distribution activities and consultation activities undertaken from January 2000, and summary of issues identified and how these would be addressed; and proposes a consultation program for the review of the Additional Information.
- Section 6.0 of Volume 1, *Main Report, October 2003*, summarizes the changes made to the Project to prevent or mitigate adverse impacts on First Nations' interests, and identifies when and how this information was presented to the First Nations.

The issues and concerns raised by First Nations regarding the potential effects of the Project and the Proponent's responses to these are summarized in Appendix B. The technical aspects of these issues and concerns are dealt with in section 4 *Potential Project Effects*.

The following addresses potential effects of the Project on asserted aboriginal rights, including aboriginal title, and the current use of lands and resources for traditional purposes.

Aboriginal rights are recognized with respect to those practices, customs or traditions which were integral to the distinctive culture of the aboriginal group claiming the rights, prior to contact with Europeans. *Aboriginal title* is a form of aboriginal right. According

to *Delgamuukw*,¹ in order to support a claim for aboriginal title, a First Nation must show exclusive use and occupation prior to the assertion of British sovereignty in 1846. Other dates may also be relevant. Aboriginal title is a *sui generis*, inalienable right in land and, as such, is more than the right to engage in specific activities which may themselves be aboriginal rights. Rather, it confers the right to use the land for a variety of activities. Aboriginal title encompasses the right to exclusive use and occupation of land, the right to choose to what uses that land can be put, and that lands held pursuant to aboriginal title have an inescapable economic component. Existing aboriginal rights are now protected by s. 35 of the *Constitution Act, 1982*.

3.1 First Nations Setting

The Project is situated within the area indicated by Okanagan First Nations to be their traditional territory. The Okanagan Nations include the: Lower Similkameen Indian Band; Okanagan Indian Band; Osoyoos Indian Band; Penticton Indian Band; Upper Nicola Indian Band; Upper Similkameen Indian Band; and Westbank First Nation. The Okanagan Nation communities and Indian Reserves nearest to the Project are located in the Okanagan Valley approximately 144 kilometres west by road (the Osoyoos Indian Band and Indian Reserve). There are no Okanagan Nation Indian Reserves located within the Kettle River watershed.

The Okanagan Nation Alliance represents the collective interest of these seven member bands located in the Okanagan, Similkameen and Nicola Valleys. The Okanagan Nation Alliance (“ONA”), to the best of its ability, monitors, and reviews all major activities for adverse environmental, cultural and spiritual impacts. This is accomplished through ONA community cooperation and input. The ONA has indicated that it represents the aboriginal interests of the Sinixt in Canada.

The Project is situated within territory that appears to have been historically used by the Sinixt or Lakes people before the onset of the 20th Century. It would appear that today, most Sinixt people reside on the Colville Reservation in Washington State, and are registered members of the Colville Confederated Tribes. In 1956 the federal government declared the Sinixt to no longer exist in Canada and they are currently not recognized as a First Nation in Canada. The ONA indicates that when the Sinixt moved south of the Canada – US border, the Sinixt were integrated into the Okanagan Nation. Both the Sinixt and Coleville speak dialects of the Coleville-Okanagan language. There is significant ethnographic evidence which would indicate that while there was interaction between the Okanagan and Sinixt, the Sinixt people were a distinct group of Okanagan speaking people with a territory separate from the Northern Okanagan – the current ONA groups. The ONA indicates that the Sinixt and the Northern Okanagan shared the same language, culture, history and traditions, however ethnographic sources indicate that there would appear to be no overarching political or governance connection between the Northern Okanagan and the Sinixt people.

¹ *Delgamuukw v. British Columbia*, (1997) 153 D.L.R. (4th) at par. 143

3.2 First Nations Involvement in the EA Process

The EAO first met with representatives of the ONA and member bands (Westbank First Nation, Upper Similkameen Indian Band, Lower Similkameen Indian Band, Penticton Indian Band, and Osoyoos Indian Band) in December 1998 to discuss the Project and invite the ONA to participate in the EA review. Eleven other meetings and several site tours occurred during the EA review of the Project.

Representatives from the ONA participated in government agency working groups established by the EAO to review the Project (see section 4 Potential Project Effects, and 4.12.1 Water Availability in the Kettle River). This included participation in more than twelve meetings related to the review of the Proponent's original application for an environmental assessment certificate, development of specifications issued to the Proponent to address deficiencies in the Proponent's original application, and the review of the Proponent's additional information on the redesigned Project.

The EAO provided funding to the ONA to help cover participation costs during the EA review of the Project. In June 2006, further funding was provided, and two time limit extension orders were issued to allow the ONA to review documentation concerning the potential effects of the Project on their interests, and also to provide the time necessary for government to consider the ONA's review comments. The 180-day time limit for completing the review was first extended 37 days, to June 30, 2006, and then extended again, for a further 12 days, to July 12, 2006, to allow this task to be completed.

In 1999, the EAO contacted individuals claiming to be Sinixt people, and also the Colville Confederated Tribes in Washington State, advising them about the Project, and about the opportunity to provide comments to ensure that any issues and concerns were identified and addressed as part of the EA process. In September 1999, the EAO received comments about the Project from a spokesperson claiming to represent the Sinixt Nation, and from the Business Council of the Colville Confederated Tribes. These comments are posted on the EAO electronic Project Information Centre (e-PIC). During the EA review, the ONA expressed "concern for the effects on Colville communities (in the US) as they are relatives".

3.3 First Nations Involvement with the Proponent

The EAO also required the Proponent to undertake consultations with the ONA on the effects of the Project, and to report the outcome of these consultations to the EAO. The Proponent made early and ongoing efforts to consult the ONA about the Project. These included providing funding for the ONA and efforts to obtain agreements and arrangements to address any potential infringement of asserted aboriginal rights.

After the redesign of the Project, the Proponent met with representatives from the ONA and in several instances member bands, approximately twelve times between November 2002 and May 2006, to attempt to identify and address ONA concerns regarding the Project, and to discuss a possible community benefits proposal/agreement.

3.4 Information Sources

The ONA indicated that it established an informal technical and community group to provide it with advice on the Project. This included band technical representatives, community activists, Elders, and spiritual leaders. These individuals were asked to review and comment on information about the Project, and this included two formal site visits and discussions with professional engineers and planners from Powerhouse Developments Inc. (Proponent).

In 1999, the Proponent commissioned a report to document ONA traditional use activities in the Project area (an Aboriginal Interests and Use Study or AIUS). The ONA prepared the AIUS. The Upper Similkameen Indian Band, Lower Similkameen Indian Band, and Osoyoos Indian Band made available a draft of their *Aboriginal Interest Study for the BC Gas Southern Crossing Pipeline Project*, which crosses through the Project site.

In June 2004 representatives from the ONA, including Elders from the Lower Similkameen Indian Band, Upper Similkameen Indian Band, Osoyoos Indian Band, Penticton Indian Band, and Westbank First Nation (approximately 16 ONA participants), participated in a site visit with the EAO and Proponent. The ONA prepared a report on the site visit: "*Cascade Heritage Power Project Brief Report on the Elders Site Visit June 22-23, 2004*". This site visit was also captured on video, and copies were provided to ONA member bands.

The ONA invited technical and Elder representatives from each member band to attend a workshop on June 16, 2005, to review the Proponent's responses to written comments provided by the ONA and government agencies on the Proponent's additional information on the redesigned Project. A summary video of the June 22-23, 2004, Elders site visit was shown at the workshop. Feedback received during the workshop was provided by the ONA in a letter of July 11, 2005: "*ONA Comments on Powerhouse Developments Inc. Responses to ONA and Agency Comments*".

The ONA also provided additional information on technical issues regarding potential effects of the Project, which are potentially related to aboriginal rights, through correspondence during the environmental assessment (EA) process (Appendix B of the Assessment Report/Screening Report [AR/SR]).

3.5 Traditional Occupation and Use of the Project Area

The AIUS identifies ethnographic information, compiled by the Proponent from existing sources. This information indicates that First Nations known as the Colville (from the south) and the Lakes people² used the Cascade Falls fishery along the Kettle River around 1800, and used the river around the turn of the 20th century (Bouchard 1975; Bouchard and Kennedy 1984 and 1985; Kennedy and Bouchard 1975). The Lakes people made their home near the Arrow Lakes and were estimated at about 500 people prior to 1780. However, largely due to smallpox, the population had decreased to about

² Some members of the Colville Reservation in Washington State identify themselves as decedents of the Lakes people.

150 by 1820. Just prior to 1846, when the U.S. – Canada boundary was established under the Oregon Boundary Treaty, the Lakes People spent the majority of their time in their traditional homeland north of the international boundary. After 1846, the Lakes people gradually shifted their primary settlements and focus of subsistence activity southwards to the vicinity of Kettle Falls, Washington State. The reasons for this southward migration would appear to include the establishment of Fort Shepherd in 1856-57, just north of the Canada- U.S. border, which became an important centre for the Lakes people, and the establishment of the Colville Indian Reservation in Washington State in 1872. Notwithstanding the gradual movement south, there is evidence to suggest that the Arrow Lakes people continued to use the Arrow Lakes and Slocan regions up until the 1930's. On October 5, 1953, Annie Joseph, the last known surviving member of the Arrow Lakes Band, died. Canada subsequently declared the Arrow Lakes Band to be extinct and transferred the reserve to BC in 1956. According to Bouchard and Kennedy, the Okanagan and the Lakes people are distinct groups of Okanagan-speaking people with their own distinct territories. The ONA indicates that the Sinixt and the Northern Okanagan shared the same language, culture, history and traditions. However ethnographic sources indicate that there would appear to be no overarching political or governance connection between the Northern Okanagan and the Sinixt people.

The ONA also claim aboriginal rights and title to the proposed Project area. The Cascade Canyon area was known by an Okanagan-Colville name with reference to the barrier created by Cascade Falls (“end of fish going up”), and the origin of this fishery is noted in Okanagan mythology. Prior to the 1920s, basket traps were used at the falls to catch sockeye salmon. The Grand Coulee Dam on the Columbia River in central Washington State (constructed between 1933 and 1941) now permanently blocks anadromous fish from migrating upstream to historical spawning grounds, and salmon can no longer reach Cascade Falls.

The AIUS references archaeological information, compiled by the Proponent from existing sources, identifying approximately 11 relevant archaeological sites in the vicinity of the Project, and notes that these provide insight into the prior aboriginal use in the area. Site DgQn36, located approximately 300 meters (m) downstream from the Cascade Canyon falls, may have been a small seasonal village site. The Cascade and Falls locality has been described (Friesinger 1979) as an: “...important aspect of the archaeological resources of the Kettle River drainage area and is most likely the most important locality of the area in relation to 1) extensive occupation and aboriginal use, 2) antiquity, 3) yield of archaeological data...this area is a high priority locality.” The AIUS also notes that site DgQn27, known as a mythological site situated at the base of the Cascade Canyon Falls, is of great significance to the ONA. According to the Proponent's 1993 Heritage Resource Inventory and Assessment, this site is located downstream of the Canyon and Falls, across from the power plant site on the north side of the river. This site would not be physically impacted by the Project, but the power plant building, tailrace and waste rock storage area would be visible across the river from the site.

The AIUS provides Elder evidence with respect to the following key matters:

- “The interviews conducted during this project clearly indicated that within Okanagan living memory there are various ties with the geographic area around the study area.”

- “The area contains many plants: edible, medicinal and animal food, also roots, bark and needles used for basketry. There are plants used to make rope and fishing equipment (Indian Hemp). Also, the presence of different animal life: four legged, flying and crawling, these different animals were used by the Okanagan people for their survival.” The following species were identified in the area as being only a small proportion of those which are present and of importance to the ONA people:
 - Fauna: mule deer, whitetail deer, moose, elk, bear, chipmunk, squirrel, hawks, raven, crow, grouse, various small fowl, and various mosses/lichen.
 - Flora: ponderosa pine, lodgepole pine, fir, cedar, poplar, juniper, knickaknick, fireweed, Oregon grape, elderberries, alum, and buck brush.
 - Fish/Reptile: various fish (could not determine type), snakes, and lizards.

- As regards the Cascade Falls, the following quoted passages are significant:
 - “The significance of the Cascade Falls Canyon area is most profound and serious, and this type of site has a number of spiritual uses.” (Such uses may include: guardian spirit questing; rituals; spiritual cleansing; and connection to supernatural beings – these terms are in use provincially, although not necessarily accepted by the ONA.)
 - “The area is very important to the Okanagan People, as the waterway through the canyon is a natural area for spiritual practices. The fast moving water and rock formations within the natural spillway are components that were used for these practices. The Elders stated that any changes to the waterway would endanger the entire natural habitat.”
 - “It is critical that the Proponent understands that the site registered as DgQn27, known as a mythological site (*k’lhasaxem*), situated at the base of the Cascade Canyon Falls on the Kettle River may well not be protected if site alteration occurs.” (As noted above, according to the Proponent’s 1993 Heritage Resource Inventory and Assessment, this site would not be physically impacted by the Project, but the power plant building, tailrace and waste rock storage area would be visible across the river from the site.)
 - “The landscape area situated within the Cascade Falls canyon is very, very sacred.”
 - “Essentially there will be great sadness and personal destruction for people involved with this site if the proposed work is allowed to proceed. The area is sacred and a spiritual home to other beings. If these beings are further disturbed it will create a negative situation for all concerned.”

The “*Cascade Heritage Power Project Brief Report on the Elders Site Visit June 22-23, 2004*” prepared by the ONA notes that: “Elders explained that Okanagan people never stopped gathering, hunting, fishing etc. in this area until they were stopped by the government.”

3.6 Current Use of the Project Area for Traditional Purposes

The ONA communities and Indian Reserves nearest to the Project are located in the Okanagan Valley approximately 144 kilometres west by road (the Osoyoos Indian Band and Indian Reserve). There are no ONA Indian Reserves located within the Kettle River watershed.

According to the 1999 AIUS: “the study area is currently used for plant gathering (both medicinal and berries), for hunting purposes and provides habitat to a number of animals. However the strongest consideration was the spirituality surrounding the study area.”

The “*Cascade Heritage Power Project Brief Report on the Elders Site Visit June 22-23, 2004*” prepared by the ONA notes that: “Several Elders took the opportunity to have a ceremony to pray for the river.”

The ONA letter of July 11, 2005, “*ONA Comments on Powerhouse Developments Inc. Responses to ONA and Agency Comments*”, which included comments from Elders that attended the June 16, 2005, ONA workshop, noted that: “Descendents of the people of that area were at the meeting and they emphasized that families still go to the area every year for ceremonies and territories and require consistent and preferred access.”

3.7 Aboriginal Rights Issues Raised and Response by Proponent / Government

The following concerns were raised by the ONA with respect to the effect of the Project on aboriginal rights.

a) Potential adverse effects of the Project on water, fish, wildlife and vegetation resources.

Response: A number of commitments made by the Proponent, designed to mitigate potential effects, serve to address this ONA concern. Many of these were made in response to the concerns raised by the ONA as part of the Project Working Group (see 3.2 First Nations Involvement in the EA Process, and 3.4 Information Sources). These are discussed in section 4 Potential Project Effects under Part A Environmental Effects, and Appendix B Summary of First Nation Comments. Appendix D is a list of the Proponent’s Commitments and Assurances. Examples of Proponent commitments relevant to these concerns of the ONA include the following:

- Timing construction activities to minimize impacts on fish and wildlife.
- Incorporating fish passage into the weir design.
- Preserving wildlife trees wherever possible.
- Mitigation, monitoring and compensation measures and plans for fish and fish habitat during construction and operation of the Project.
- Mitigation and monitoring measures and plans for water quality during and post-construction.
- Mitigation and monitoring measures and plans for wildlife and vegetation during construction of the Project, and post-construction enhancement measures for

- wildlife and revegetation of areas temporarily disturbed using native species.
- Spill and emergency response plans and procedures to prevent and minimize effects of spills on water quality, fish and fish habitat, and wildlife.
- Funding for continued involvement of the ONA in providing input to the Project through review of environmental management and monitoring plans and reports. (This will provide an opportunity for use of ONA traditional ecological knowledge during Project construction and operation.)
- Opportunities will be offered to qualified members of the ONA in environmental field surveys and monitoring.

The Elders site visit in June 2004 took place after the completion of the AIUS and the redesign of the Project. The “Cascade Heritage Power Project Brief Report on the Elders Site Visit June 22-23, 2004” prepared by the ONA notes under “General Approval of the Project” includes the comment that “Some, but not all, participants felt the project was being handled very well and dealt with today’s realities of energy needs responsibly. Some liked that the plan is “cleaner” than the previous proposal.”

b) Potential adverse effects of the Project on archaeological sites, including a sacred mythological/spiritual site and continued consistent and preferred access for ceremonies.

Response: The Proponent has indicated that: during high flow periods, it will be difficult to distinguish between natural flows and flows reduced by the Project; during operation, minimum weir bypass flows ranging from 4 m³/s to 20 m³/s will be maintained in the Canyon for fish and fish habitat, and these flows will frequently be exceeded; and during periods of very low flow, the facility will not operate, and the Falls will retain their natural flow levels (see 4.1.1.2 Canyon, and 4.14.2 Post-Project Construction). The Proponent noted that for the calendar year 2004, if the Project had been operating, there would have been prescribed minimum flows through the Canyon for 219 days.

The Elders site visit in June 2004 took place after the completion of the AIUS and the redesign of the Project. The “Cascade Heritage Power Project Brief Report on the Elders Site Visit June 22-23, 2004” prepared by the ONA notes under “Environment/Spirituality – Disapproval of Project” that “Many Elders were in disagreement with profiting from the water because they feel that creator decides what happens with it.” Traditional use information from the Elders on the Cascade Falls Canyon is also documented in the AIUS, and some of this information is quoted in section 3.5 (see above).

If the Project proceeds, the Proponent will still be required to apply for an Alteration Permit, pursuant to the Heritage Conservation Act, which will authorize development activities within the boundaries of archaeological site DgQn-003 (described as a historical campsite that has been subject to previous disturbance). (See section 4.16 Archaeological Resources.) The power plant building, tailrace and waste rock storage area will be visible across the river from archaeological site DgQn27, a very sacred site to the ONA.

A number of commitments made by the Proponent, designed to mitigate potential effects, serve to address these ONA concerns. Some of these were made in response to the concerns raised by the ONA as part of the Project Working Group (see 3.2 First Nations Involvement in the EA Process, and 3.4 Information Sources). These are

discussed in section 4 Potential Project Effects under Part B Social-Economic, Heritage and Health Effects, and in Appendix B Summary of First Nation Comments.

Appendix D of the AR/SR presents the Proponent's Commitments and Assurances. Examples of Proponent commitments relevant to these concerns of the ONA include the following:

- The Proponent will not occupy, own or lease any land in the canyon and there will be no physical alteration to the canyon. Restrictions to access at the weir/intake and power plant sites will be minimized.
- While access to particular sites may be restricted during the construction phase, access will be provided to members of the ONA and Colville communities for ceremonial purposes and to conduct ceremonies, should they wish access prior to major Project construction stages. The designation of major activities, an appropriate notice period and other considerations will be decided in consultation with the ONA.
- Opportunities will be offered to qualified members of the ONA to participate in archaeological field surveys and monitoring.
- Prior to starting construction, further archaeological studies described in the Environmental Management Plan will be undertaken based on the outcome of consultation with the ONA and their participation.
- The Proponent will involve members of the ONA in further archaeological studies and in developing the Archaeological Monitoring Plan component of the Environmental Monitoring Plan.
- The Proponent has committed approximately \$1,000,000 for local community compensation measures, including the construction of a museum featuring First Nations history of the site (as well as the power generation history), or, based on further consultations with the ONA, alternatives to the museum. The intent is to use the funding to benefit the ONA and other local interests (the museum proposal is subject to further discussions with the community of Christina Lake and the ONA). If the museum is constructed, the ONA will be involved in designing the material to be displayed.

3.8 Other Matters Raised and Response by Proponent / Government

The following additional matters were raised by the ONA with respect to the effects of the Project:

- a) **The water licence for the Project could adversely effect the future allocation of water in the Kettle River watershed for other uses.**

Response: The EAO established a Water Availability Working Group to provide comment and advice, and retained a consultant to prepare a report, on the effects of the Project on water allocation in the Kettle River watershed (see section 4.12.1 Water Availability in the Kettle River). The ONA participated on this Working Group with government agencies. The consultants' report "Potential Effects of the Cascade Heritage Project on the Allocation of Water in the Kettle River Basin" concluded that the Project will fully record all the water in the Kettle River basin during the low flow period,

and potentially limit the issuance of future water licences for other uses/users upstream of the Project. The report further concluded that this effect may be fully mitigated by an order in council that reserves the water for future allocation for all purposes, and this was supported/recommended by the Water Availability Working Group, including the Water Stewardship Division of Ministry of Environment. The effect of the proposed reserve would be to ensure that the water rights of the Project power licence holder are always subordinate to the rights of any water licences for other purposes that may be acquired in the future on the Kettle River or its tributaries.

The Proponent agreed/committed to accepting a water licence subject to the creation, by order in council, of a water reserve on the Kettle River to set aside water for other users/uses, and that applications for such water will take priority over the Project.

The appropriate water reserve has been drafted by solicitors at the Ministry of Attorney General. The EAO and Water Stewardship Division of Ministry of Environment recommend that the Project, if approved, be subject to establishment of the water reserve.

- b) Potential adverse effects of the Project from the issuance of water rights that would be under foreign ownership, and possible lack of protection, if needed, under the North American Free Trade Agreement. Foreign and private ownership will affect the title (and rights) of the ONA. Adverse impact on ONA title through the loss of water rights to a foreign-based company and removal from a future claim.**

Response: Since a water licence for the Project would allow only a temporary (40-year) diversion of water for power purposes, this is not a bulk water sale issue. As the water would not be permanently removed from the watershed, a water licence would not create an obligation under NAFTA for the Province to allow the bulk sale of the water. Should the Province choose not to issue a water licence upon the expiry of the 40-year term, there would be no grounds for a claim under NAFTA. The National Energy Board (NEB) administers energy import and export licensing under NAFTA. In granting export approval, the NEB takes into account the effect on other provinces, the impact on the environment, and whether Canadian buyers have been provided fair market access.

The Proponent noted that Powerhouse Developments Inc. is a wholly owned subsidiary of Sea Breeze Power Corp., a publicly owned company traded on the Toronto Stock Exchange's TSX Venture Exchange, and the company is neither foreign nor private.

- c) Ongoing Proponent Commitments to First Nations**

The ONA reported to the EAO that it is pleased to have developed an honest and respectful working relationship with the Proponent, who has shown a genuine interest in ensuring the ONA has been given the opportunity to have its concerns about the Project raised and addressed.

On May 5, 2006, the Proponent and ONA met to discuss a benefits agreement that could address the ONA desire for employment opportunities. No further meetings or negotiations are currently underway or scheduled.

In this regard, the Proponent's commitments include the following:

"...

- PDI [Powerhouse Developments Inc.] will make best efforts to develop a consultation agreement with the ONA that will be in compliance with provincial regulations and permitting requirements. Topics for consultation will include, but are not limited to:
 - the frequency and scope of future meetings and commitments;
 - the Access Management Plan and Traffic Management Plan. The ONA will receive a copy of these plans;
 - archaeology;
 - development of the Environmental Management Plan and associated reports, which will be shared with the ONA;
 - appearance and operation of the visitor centre and museum facilities;
 - museum contents and exhibits (see also Section M 21 – Museum and Visitor Facilities); and
 - employment and business opportunities..."

The Proponent has also made a variety of other commitments intended to ensure ongoing liaison with the ONA and an opportunity for the Proponent and the ONA to work together on Project-related matters on an ongoing basis.

3.9 Conclusions

The process of notifying and consulting with the ONA about the Project has complied with the requirements outlined in the section 11 procedural order issued to the Proponent. All issues raised by the ONA during the review, which are deemed to be within the scope of the EA review, have been considered in the review process and the documents generated as part of the review.

During the EA review, the EAO and the federal RAs have considered the: Application; Additional Information; information provided by the ONA; ONA comments on the potential effects of the Project; responses by the Proponent and government agencies; and the discussions during Project Working Group meetings, site visits, and ONA-EAO meetings.

Based on this information the EAO is of the view that there will be impacts on the ONA asserted aboriginal rights from this proposed Project. Provided that the Proponent implements the actions described in the summary of commitments listed in Appendix D (Proponent's Table of Commitments and Assurances) of this AR/SR, and subject to the recommendation made by government agencies (EAO and Water Stewardship Division of Ministry of Environment) that if approved the Project be subject to establishment of a water reserve on the Kettle River (3.8a above), the EAO is satisfied that the ONA will be able to reasonably continue to practice their asserted rights in the area of the Project, and that the likelihood of significant adverse effects on the current use of lands and resources for traditional purposes by the ONA is low. These commitments seek to balance the ongoing importance of this site to the ONA and the future potential interests of the ONA with the current needs of this Project and the opportunity to contribute to satisfying the continuing and growing public need for power production.

4. POTENTIAL PROJECT EFFECTS

The Additional Information Submission

As outlined under section 1.5 – *Early Project Review History* above, the Proponent's Additional Information submission was prepared pursuant to the Specifications and section 11 order issued for the Project. Volume 1, Main Report, October 2003, of the Additional Information submission reports on the following:

- Section 1.0 contains the introduction;
- Section 2.0 describes the Project;
- Section 3.0 discusses how the Project would be operated;
- Section 4.0 discusses potential maintenance issues;
- Section 5.0 summarizes and discusses the primary issues raised by the public;
- Section 6.0 discusses consultation with First Nations;
- Section 7.0 assesses potential environmental impacts;
- Section 8.0 assesses potential cumulative environmental effects;
- Section 9.0 discusses cultural heritage issues;
- Section 10.0 assesses potential socio-economic and health effects;
- Section 11.0 describes proposed monitoring activities; and
- Section 12.0 lists the commitments the Proponent has made.

Volume 2, October 2003, of the Additional Information (two binders), contains the Responses to Specifications #2 - #26, and #27 - #51. Volume 3, October 2003, of the Additional Information (two binders) contains the Supporting Documents, Appendices 5-8, and Appendices 9-14.

Technical Review

The federal and provincial government agencies, local governments, First Nations, and agencies from the United States that participated in the technical review of the Additional Information submission included:

Government of Canada

Canadian Environmental Assessment Agency (CEA Agency)
Fisheries and Oceans Canada (DFO)
Transport Canada (TC)
Environment Canada (EC)
Natural Resources Canada (NRCan)

Province of British Columbia

Environmental Assessment Office
Ministry of Environment (MoE)
 Environmental Stewardship Division (ESD)
 Environmental Protection Division
 Water Stewardship Division (WSD) – formerly part of LWBC

Ministry of Agriculture and Lands (MAL)
Agriculture
Integrated Land Management Bureau – formerly part of LWBC
Ministry of Tourism, Sport and the Arts (MTSA)
Tourism Branch
Archaeology Branch
Ministry of Transportation (MoT)
Ministry of Energy, Mines and Petroleum Resources (MEMPR)
Ministry of Economic Development
Interior Health Authority (IHA)

Local Governments

Regional District of Kootenay Boundary (RDKB)
City of Grand Forks
City of Greenwood
Village of Midway

First Nations

Okanagan Nation Alliance (ONA)

United States

United States Department of Agriculture, Forest Service
State of Washington Department of Ecology
Washington State, Ferry County Board of Commissioners

Consideration of Potential Effects

The Proponent was required to respond to issues identified in government agency, neighbouring jurisdiction, First Nation and public comments received during the review of the Additional Information submission, where these comments were within the scope of the assessment.

The Proponent's "*Responses to Agency Comments on Additional Information, June 2005*" are contained: in a "*Main Report*", with Appendices B, D, E, F, G, H and I; in Appendices A and C; and in "*Hydrotechnical and Fisheries Assessment of Proposed Headpond and Fisheries Enhancement Works Addenda 1-12*".

The comments and issues raised during the review of the Additional Information submission, and the Proponent's responses to these, are summarized in the appendices of the present Report, as follows: Appendix A - *Summary of Government Agency and Local Government Comments*; Appendix B - *Summary of First Nation Comments*; and, Appendix C - *Summary of Public Comments*.

The Proponent has provided a summary of its commitments and assurances that reflects its responses to the comments received about the Project. This summary is provided in Appendix D - *Proponent's Table of Commitments and Assurances*.

The discussion of specific potential Project effects in the following sections of this Report (for example, for Fish Habitat) includes a summary of the Proponent's description and assessment of potential Project effects, and its findings or conclusions, mitigation

measures and commitments. This also reflects the Proponent's responses to comments from government agencies, local governments, First Nations, and the public, and any additional information or clarification provided.

PART A ENVIRONMENTAL EFFECTS

The following factors were included in the scope of the assessment of the potential environmental effects of the Project.

4.1 Fish and Fish Habitat

A Fisheries Technical Working Group was established to review and provide comment and advice on the potential effects of the Project on fish and fish habitat. This working group included biologists from DFO and MoE, and representatives of the ONA. Technical consultants (biologists and fluvial geomorphologist) working for the Proponent also provided input.

Kettle River

The section of the Kettle River in the vicinity of Grand Forks follows a broad valley, and is characterized by long reaches of runs (quiet steady flow) and pools, separated by riffles. However, at the Project site, the river enters a narrow gorge, Cascade Canyon, which is about 800 m long. In a series of cascades, the river drops approximately 36 m in elevation. Cascade Falls, near the downstream end of the canyon, is an impassable barrier to fish moving upstream.

The mean annual flow in the Kettle River at the Project site is approximately 74.85 m³/s. 84 percent of the flows are concentrated in the late spring and early summer months of April to July. The maximum mean monthly flow of 313 m³/s occurs in May, and the minimum mean monthly flow of 13 m³/s occurs in January. A flow of 20 m³/s or greater will occur 50 percent of the time, a flow of 55 m³/s or greater about 30 percent of the time, and a flow of 90 m³/s or greater, about 25 percent of the time. The estimated 1-in-20-year flood event for the river is approximately 750 m³/s, and the 1-in-200-year flood event is approximately 855 m³/s.

The fishery in the Kettle River is primarily supported by wild stocks of rainbow trout that are sustained by natural recruitment. Studies have indicated that the quality of angling in the river suffers due to the low abundance and small size of rainbow trout, and that this is likely the result of several factors that have contributed to low stock productivity and habitat limitation. These factors include low summer flow conditions and high water temperatures in the river.

Previous Dam

A 12.3-m-high dam was completed in 1902, just upstream of the Cascade Canyon at the location of the proposed weir. The dam was operated for 17 years, then abandoned. Analysis conducted by the Proponent found that:

- The dam increased the depth of the Kettle River at the dam site by approximately 6.5 m at a flow of 10 m³/s.
- The head pond was considerably deeper than the head pond that will be created by the proposed weir (approximately 1.1 m at a flow of 10 m³/s).
- The dam remnants significantly affected the upstream channel until the late 1990's. Although the depth of that head pond decreased over time, 1969 and 1988 aerial photographs show a head pond that is estimated to be greater than the head pond currently proposed.
- The Kettle River mainstem was backwatered for about 100 years by the original dam.

Project Design

The Project will divert water from the Kettle River upstream of the Cascade Canyon and Falls, and return the water to the Kettle River downstream of the Canyon. This will reduce flows in approximately an 800-m stretch of the river.

The Project is designed to operate as a run-of-river hydro-electric facility. The head pond created by the Project weir will be situated wholly within the natural water levels and channel of the river. During high flow periods, the weir would be completely submerged (at flows of approximately 240 m³/s or above), with the upstream water levels unchanged from natural conditions.

The sole purpose of the head pond is to provide sufficient depth to submerge the power plant water intake to avoid admitting air to the system. There is not enough water storage in the head pond to enable load factoring/shaping (i.e. altering the rate of flow through the power plant to generate more energy during times of the day when it has a higher value). The Project design does not allow for implementing storage in the head pond to increase power production in the future. This would not be possible without developing a significant amount of water storage.

Power production will follow the natural flow in the river, less flows required for fish in the Canyon below the weir. The exceptions to this will be when river flows exceed the full capacity of the turbines plus the flows required for fish, or when sufficient water is not available to operate the power plant and it is shut down.

Project Redesign

While undertaking work to address the Specifications, the Proponent redesigned the Project to address the concerns of, and feedback from, fisheries agencies regarding adverse effects on aquatic habitat, specifically that relating to section 35 of the federal *Fisheries Act*, and the harmful alteration, disruption or destruction (HADD) of fish habitat.

The redesign is consistent with the direction provided under: section 5.1 - Hierarchy of Preferences of the DFO "*Policy for the Management of Fish Habitat, 1986*"; and, section 3.1 - Project Design from DFO's "*Habitat Conservation and Protection Guidelines, second edition, 1998*".

The fisheries agencies (DFO and MoE) were primarily concerned over:

- the de-watering of fish habitat in the Canyon downstream of the weir, and the effects that this would have on the productive capacity of that habitat, and the productivity of fish stocks; and
- the degree of fast water riffle and rapid habitat that would be converted to slower water run and pool habitat as a result of the weir and head pond, and the effects that this would have on the productivity of fish stocks, such as adult rainbow trout.

The redesign, which was intended to maintain natural habitat and protects fish populations as much as possible, included:

- adopting fishery agency instream flow requirements for fish and fish habitat in the Cascade Canyon downstream of the weir;
- modifying and lowering the weir;
- modifying the power plant intake, and adding a turbine bypass system; and
- a detailed conceptual fish habitat compensation proposal in the river a short distance upstream of the head pond.

Downstream of the weir, the minimum release flow was increased from 1 m³/s to 4m³/s, and the proposed flow regime considers the shape of the natural hydrograph of the Kettle River, with increased release flows during the spring and early summer period.

The redesign included the use of an underground tunnel, as opposed to the surface canal originally proposed, to convey water from the intake to the power plant. This enabled the elevation of the intake structure to be lowered, which enabled the weir elevation to be lowered, and as a result, the size of the head pond was reduced.

The weir was redesigned as follows:

- The weir crest was lowered 2.3 m (to an elevation of 483.2 m above sea level), reducing by about 77% the length of river and area of aquatic habitat which would have been altered by the head pond, and the degree to which the remaining habitat would be affected. With the lower weir, the effect of the head pond extends upstream 420 m at mean annual flow (74.85 m³/s), and 750 m at low flows (10 m³/s or less), compared to 2,200 m at mean annual flow with the originally proposed weir crest elevation. The maximum change in water surface elevation at the lower weir crest would be 1.2 m, immediately upstream of the weir. The water surface elevation would be 0.7 m higher than under natural conditions for mean annual flow, and 1.1 m higher than under natural conditions for a low flow of 10 m³/s. In this section of the river, the natural variation in water level is about 7 m, from a minimum flow of about 4 m³/s to a flood flow of about 750 m³/s (about 1 in 20 years).
- The concrete overflow weir was replaced with a rubber dam. The rubber dam will be gradually inflated and deflated to control the water level upstream for river flows in

the range of 20 m³/s to 240 m³/s. Under flood flows, the rubber dam will be deflated and completely collapsed against the weir sill, which will be located at the riverbed level. This will allow bedload, suspended solids, and large woody debris to pass through the weir structure, as would occur under natural conditions.

- A low-level outlet sluice gate was included as the preferred method of releasing up to 20 m³/s of water through the Canyon. The low-level outlet will be used to maintain a constant water level in the head pond upstream of the weir for river flows up to 20 m³/s.
- A fish ladder that will continuously release 1 m³/s was added to permit fish passage from the upper reaches of the Canyon (above the Cascade Falls) to the river upstream of the weir. The fishway will permit fish to traverse the weir at all flows. However, if fish are moving in this area during flows in excess of 240 m³/s, they will not need the fishway, since the entire weir structure will be submerged.

The power plant intake structure was redesigned to achieve low intake velocities to minimize the entrainment of fish through the turbines. A turbine bypass system was added to control the ramping of flows, and to protect fish from being stranded in the event of a rapid change in flow through the turbines.

The conceptual fish habitat compensation plan proposed like-for-like compensation, replacing modified/lost habitat as close as possible to the site of impacts in the Kettle River. The plan included creating rapid habitat in the mainstem of the river, and modifying a side channel of the river to maintain water flows and provide shallow riffle habitat during the summer growth period for fish. Both compensation sites were a short distance upstream of the area affected by the head pond

Potential Project Effects

Potential effects from the construction and operation of the Project on fisheries resources in the Kettle River include impacts on:

- aquatic habitat, associated with the weir and power plant intake, head pond, changes to the flow regime downstream of the weir, and tailrace;
- water quality;
- fish populations, including red-listed and blue-listed species; and
- the recreational fishery.

The Additional Information submission provides specific information on the following:

- Fish and Fish Habitat (Specification #21)
- Red-Listed and Blue-Listed Species (Specification #22)
- Minimum Flows for Fish (Specification #23)
- Downstream Bedload Movement (Specification #24)
- Large Woody Debris (Specification #25)
- Ramping Rates and Stranding Potential (Specification #26)
- Emergency Shutdown (Specification #27)
- Fish Entrainment (Specification #28)

- Recreational Fishery (Specification #29)
- Mitigation and Compensation (Specification #30)
- Monitoring (Specification #31)

4.1.1 Fish Habitat

4.1.1.1 Head Pond (Upstream of Weir)

To determine the change in the aquatic habitat upstream of the weir, hydraulic modeling was conducted using the results of backwater analysis for 10 m³/s and for mean annual flow as a comparison. The predicted hydraulic conditions with the weir in place were compared to the natural hydraulic conditions. The results of the backwater analysis and hydraulic modeling were used in combination with fish habitat mapping to determine whether habitat units would be altered with the Project. The predicted amount of altered fish habitat with the Project was quantified based on the areas measured on the habitat map.

The head pond upstream of the weir will be entirely within the existing natural river channel. The combination of the low-level sluice gate and rubber dam in the weir design will provide control of water levels in the head pond at all flows up to flood levels, when the natural constriction at the mouth of the canyon becomes the flow control. This means that the water level in the head pond will be maintained at a constant level, not subject to fluctuations, throughout the year, with the exception of flood events.

In completing its assessment of potential Project effects, the Proponent concluded that:

- The maximum upstream extent of the head pond at a stream flow of 10 m³/sec flow is predicted to be 750 m. The maximum upstream extent of changes to the hydraulic characteristics of fish habitat in the mainstem at a flow of 10 m³/sec is less than this. The changes in hydraulic characteristics at 750 m will be so small that it would not be possible to measure them in the field.
- The hydraulic effects and upstream extent of the head pond becomes less pronounced as river flows increase and the rubber dam is partially deflated, and the maximum upstream influence of the head pond at a mean annual discharge of 75 m³/sec is estimated to be 420 m. As a consequence, the head pond will behave much like a river channel. Changes to fish habitat from the head pond, and potential losses to the productive capacity of fish habitat, will be less at higher flows.
- Water velocities will be reduced in the head pond during low-flow conditions. As river flows recede after spring run-off, the effects of the weir on the riverine habitat will become more pronounced. The overall result of habitat losses and gains in the head pond area is a conversion of rapid and riffle habitat and associated shear zones to run habitat, and an increase in run and pool habitat as a result of the backwater effect. Existing run habitat will remain run habitat, but will be deeper and slower. Pool habitat will remain pool habitat, with an increase in depth. Margin habitat is not expected to increase by a significant amount.

- Overall there would be a loss/conversion of approximately 5,920 m² of riffle and rapid habitat at a flow of 10 m³/s. At this flow, the first rapid section upstream of the weir will be flooded, and there will be a half-meter rise in water level at the bottom of the second rapid. At mean annual flow (75 m³/s), the first rapid section will be slightly reduced. At higher flows the effect will be that of slowing water below the first rapid section, without affecting the rapid itself.
- Overall, there would be a net increase of approximately 6,004 m² in wetted surface area (habitat) of glide and pool habitat at a flow of 10 m³/sec. (*Note* - This takes into account a loss of 638 m² of run habitat due to the footprint of the weir and power plant intake.)
- The overall effect of losses and gains of habitat on habitat productive capacity cannot be predicted with a high degree of certainty. The effect that these changes in habitat areas have on fish productivity is complicated, and depends on stream flow, season, species of fish etc:
 - The constant water level that will be maintained in the head pond, with the exception of flood events, will provide stable aquatic habitat.
 - For aquatic invertebrates, the amount of suitable habitat is predicted to decrease, except for red chironomid. Generally, stream-dwelling invertebrates tend to prefer shallow depths and moderate flow velocities, and this habitat type would be modified as a result of the backwater effect.
 - As run habitats are generally less productive than riffles and rapids, rainbow trout productivity is expected to be reduced, and there could be a potential loss of approximately 27 adult rainbow trout in the head pond area. Compensation will be provided to offset the loss of riffle and rapid habitat important for adult rainbow trout production.
 - In winter, the head pond has the potential to positively affect all species of fish by providing deeper water and a lower probability for the formation of frazil ice. (*Note* - Frazil ice can form in riffles and rapids when temperatures are very low. It can adhere to the river bed and form anchor ice, which can result in a loss of winter microhabitats.)

The predicted losses and gains of fish habitat area for each habitat type, and the net change of habitat area, are summarized in Table 1.

Table 1 Fish Habitat Losses and Gains

PROJECT COMPONENT	CHANGES IN THE SURFACE AREA (m ²) OF THE DIFFERENT HABITAT TYPES (DOES NOT INCLUDE RUN AND POOL HABITAT EXISTING PRIOR TO WEIR)					
	RAPID	CASCADE/ RIFFLE	RIFFLE	RUN	POOL	TOTALS
Headpond Before Weir	2723	4155	4155	11383	3284	21545
Weir Footprint				-538		-538
Intake Footprint				-100		
Headpond After Weir	0		0	23704	3845	27549
Net Change in Headpond Area	-2723		-4155	12321	561	6004
Habitat Lost due to 4m ³ /s Minimum Flow in Canyon		-796				-796
Net Project Change	-2723	-796	-4155	12321	561	5208

The Proponent has committed to providing compensation to offset the loss of rapid habitat in the head pond area, which is important for adult rainbow trout production, and to ensure no net loss of fish habitat (see section 4.1.5 - *Fish Habitat Compensation*).

4.1.1.2 Canyon (Downstream of Weir)

The methodology used to establish the minimum instream flow requirements for fish and fish habitat in the Cascade Canyon downstream of the weir was developed in consultation with the fisheries agencies (DFO and MOE). This methodology included the integration and analysis of data from: fish habitat mapping; hydraulic modeling; fish habitat modeling; habitat exceedances; depth-velocity matrices; invertebrate habitat modeling; wetted width; and fish observations made by snorkelling during low-flow conditions. Difficult and unsafe conditions limited access to the upper Canyon for field studies and the selection of transects.

Initially, the analyses focused on establishing an acceptable flow regime while considering both the fisheries resources and Project viability. A number of minimum release flow scenarios were compared to each other, and to the natural flow regime in Cascade Canyon, using 50 years of historical flow data. The computer models used for these analyses evaluated the hydraulic conditions for the various scenarios, and the corresponding amount of suitable habitat for selected fish and invertebrate species.

Natural flows have been recorded as low as 3 m³/s. A minimum release flow of 1 m³/s had been proposed in the original Project Application. In addition to this scenario, a number of minimum release flow scenarios were evaluated. Scenario 5D (Table 2) was selected, based on the modeling results, because it maintained suitable hydraulic conditions for fish and invertebrates in the Canyon. The minimum release flows in scenario 5D consider the shape of the natural hydrograph of the Kettle River, and range between 4 and 20 m³/s, the minimum release flow being higher during the spring and early summer months, and lower (4 m³/s) during the fall and winter months.

The maximum flow through the powerhouse will be 90 m³/s. Minimum flows through the Canyon will be maintained at the flows listed in Table 2, or the natural flow, if that is less. All surplus flow will spill through the Canyon reach.

The monthly minimum bypass flow through the canyon would frequently be exceeded:

- When the total river flow is greater than the turbine capacity (90 m³/s) plus the minimum bypass, the excess water would flow through the Canyon.
- The power plant will not operate when the flow available for power generation is less than 5.0 m³/s. During low-flow periods, if the total flow is less than the minimum turbine flow (5 m³/s), plus the minimum bypass flow (4 m³/s), all available water would flow through the canyon.

Table 2 Compensation Flows

Month	Mean Monthly Natural Flow (m ³ /s)	Minimum Conservation Flow (m ³ /s)
January	14	4
February	14	4
March	26	5
April	127	37* (minimum 10)
May	313	223*(minimum 20)
June	242	152* (minimum 20)
July	72	8
August	21	7
September	18	6
October	19	4
November	19	4
December	16	4

*Average flow in canyon with the Project operating

The results of the assessment for scenario 5D indicated that there would be no impact on rearing habitat for mountain whitefish or rainbow trout in the Canyon reach during the summer growing period, and that there would be a minor positive impact on overwintering habitat for rainbow trout. Overall, the assessment indicated that there would be no net impact on invertebrate habitat in the Canyon reach. Moderately positive effects on benthic invertebrate habitat were predicted in the warmer months, and moderately negative effects were predicted in the winter months.

In addition to the in-stream flow studies, an analysis of the change in wetted area in sections of the Canyon that were not accessible for direct measurements (for safety reasons) was undertaken, using air-photo interpretation for three flow conditions (48, 9.5 and 4 m³/s). This analysis quantified the change in wetted area in the Canyon for the proposed flow regime, compared to the natural flows in Cascade Canyon. The analysis indicated a decrease in wetted area in the two cascade/rapids sections of the Canyon of 14% and 24% when flow was decreased from 9.5 to 4 m³/s. In the steep-sided areas, the change in wetted width was insignificant.

In order to complete the information used to assess flow scenario 5D, a snorkel survey was conducted by Proponent and MOE biologists during a river flow of 4.5 m³/s. MOE biologists agreed that the hydraulic conditions observed in Cascade Canyon at this flow

would meet fish and fish habitat requirements. This flow is close to the proposed minimum release flow of 4 m³/s in scenario 5D.

In completing its assessment of potential Project effects, the Proponent concluded that:

- The flow regime downstream of the weir resembles a natural annual hydrograph that is expected to provide the diversity of hydraulic conditions necessary to sustain fish and invertebrate populations in the Canyon upstream and downstream of Cascade Falls.
- There would be an average reduction in wetted area, and a loss of approximately 796 m² of cascade/rapid habitat in the Canyon at the minimum flow of 4 m³/s.
- The movement of fish from the Canyon upstream would be ensured at all times of the year via the fishway (low to medium flows) and passage over or through the deflated rubber dam (high flows).
 - The smaller cascade at the proposed weir site is presently a barrier to the upstream movement of juvenile fish. Juvenile fish that pass over this cascade are thought to be lost to the upstream population. The fishway would improve this situation by allowing upstream passage for smaller fish.

The Proponent committed to providing compensation to ensure no net loss of fish habitat (see section 4.1.5 - *Fish Habitat Compensation*).

4.1.1.3 Tailrace (Downstream of Canyon)

The power plant will have a tailrace and tailrace channel (hereafter referred to as the tailrace) that is approximately 80 m long, and located on the right bank of a floodplain which is inundated annually with high Kettle River flows exceeding 200 m³/s. There will be a deep pool immediately downstream of the power plant. This pool will slope up to a channel that will return the water flow from the power plant to the river. The flow from the tailrace will be directed into a riffle at the downstream end of a large deep pool to maintain existing water levels.

The area of the floodplain which will be excavated for the tailrace is approximately 1,800 m². Under natural low-flow conditions, this area is almost completely dry. The upstream portion of the tailrace is not expected to encroach onto existing fish habitat, but the remaining portion will result in some habitat alteration.

The tailrace will contain water throughout the year, both when the power plant is in operation and when it is shut down. The upstream section will be lined with large angular shot-rock (slush-grouted rip-rap) that will provide habitat for fish. Downstream of this, approximately 50 m of the channel will have natural gravel/cobble/boulder substrate that will provide an increase in shallow riffle habitat for a variety of fish species for rearing and spawning, without the risk of dewatering and stranding.

Water levels in the Kettle River will not be affected by the excavation or operation of the tailrace. No material from the tailrace excavation will be placed along, or adjacent to, the excavated channel that would alter natural channel contours. Downstream of the power

plant, the river flow will be that which is naturally available, and will ramp (fluctuate) at its natural rate.

The potential for the tailrace discharge to alter channel morphology in the Kettle River downstream, particularly the large cut-bank on the left side of the River, will be assessed during the detailed design phase of the Project (see Section 4.1.3.5 - *Slope Stability*).

In completing its assessment of potential Project effects, the Proponent concluded that the tailrace will not result in a loss of fish productivity, since usable habitat will be locally increased, and no compensation is required.

4.1.2 Fish

4.1.2.1 Fish Populations

A total of 30 fish species have been reported in the British Columbia section of the river, including 8 species that are red-listed and blue-listed (these are provincial designations). Not all of these species have been confirmed to be present in the Project area.

The Project Application contains background information on the fisheries resource in the Kettle River, derived from literature reviews and the results of fisheries studies previously conducted on the river, and also includes information obtained by the Proponent during site visits. Subsequent studies undertaken to fulfill the requirements of the Specifications are reported in the Additional Information submission.

The distribution and abundance of fish species in the Kettle River within the area of the Project, including red-listed and blue-listed species, and their habitat preferences and life-histories, were investigated using a variety of techniques, including electro-fishing, minnow trapping, snorkelling surveys, creel surveys, and radio-telemetry studies. Biologists from DFO and MoE participated in some of the snorkelling surveys.

The effect that habitat changes will have on different species of fish depends on variables such as the time of year, life stages, and limiting factors. Limiting factors play an important role in determining the productive capacity of habitat. For example, the loss of summer rearing habitat will not decrease productivity if the availability and quality of winter habitat limits production. Studies have indicated that the low abundance and small size of rainbow trout in the Kettle River is likely the result of several factors that have contributed to low stock productivity and habitat limitation. These factors include low summer flow conditions and high water temperatures in the river.

Although the amount of wetted surface area will increase in the head pond, this does not necessarily mean that habitat will be increased for all fish species:

- The head pond may favour the production of some species during summer, such as red-sided shiners.
- Adult rainbow trout currently move out of the section of the river that will be affected by the head pond to seek winter habitat in other areas. Rearing adult rainbow trout, and possibly mountain whitefish, that prefer faster water velocities and shear zones

for feeding, may move out of the head pond earlier in the year (during summer and fall), as river flows and water velocities drop. It is difficult to predict the effect on rainbow trout production that such relocation may have.

- Smaller trout and whitefish, and other species of fish, are expected to remain in the head pond area during winter, in association with large cobbles and boulders. The slower water velocities in the head pond during winter are not expected to have a significant effect on these fish.
- Winter habitat of adult rainbow trout and whitefish would not be affected. Adult rainbow trout and whitefish currently move out of the head pond area in the fall as water temperatures drop, and seek out overwintering habitat upstream that contains deep pools.
- Spawning of adult rainbow trout would not be affected. Evidence of adult rainbow trout spawning was not observed in the head pond area. Spawning primarily occurs in tributaries to the Kettle River, and the movement of fish to these watercourses will not be impacted by the Project. The potential for spawning in the mainstem of the Kettle River is greater in areas upstream of the head pond area, where the substrate type is more suitable.
- Some species of fish, such as dace, sculpins, chub and largescale sucker, are expected to adapt to the hydraulic changes within the head pond area, and significant effects on the productivity of these species are not anticipated.

Of the red-listed species (endangered or threatened) and blue-listed species (of special concern), only speckled dace (red-listed), chiselmouth chub (blue-listed), mottled sculpin (blue-listed) and shorthead sculpin (blue-listed) were identified within the Project area. No definitive conclusions could be made regarding the habitats used by adult chiselmouth chub within the Project area (upstream and downstream of Cascade Falls), based on the data collected. Mottled sculpin are present in the Kettle River downstream of Cascade Falls. Differentiation between shorthead and slimy sculpins is difficult in the field. Shorthead sculpins are present downstream of Cascade Falls. Undifferentiated shorthead or slimy sculpins were collected upstream of the Canyon, but these were assumed to be slimy sculpins.

In completing its assessment of potential Project effects, the Proponent concluded that:

- The head pond would have both positive and negative effects on fish productivity, based on the time of year, species of fish, and the age class of the fish. In winter, the head pond has the potential to positively affect all species of fish by providing deeper water habitat (though there is already an abundance of this habitat type in the area). Potential losses in rainbow trout, and possibly mountain whitefish, productivity are expected to occur during summer and fall, when there is a reduction in fast water habitat and associated shear zones, which are both limited in the watershed. There could be a potential loss of approximately 27 adult rainbow trout in the head pond area.
- There would be no impact on rearing habitat for rainbow trout or mountain whitefish in the Cascade Canyon during the summer growing period, and there would be a minor positive effect on overwintering habitat for rainbow trout. The flow regime downstream of the weir is expected to provide the diversity of hydraulic conditions necessary to sustain fish populations.

- The fish ladder in the weir design will ensure that fish movement is maintained at all river flows.

Speckled Dace

Speckled dace are one of the most widely distributed freshwater species in western North America. Subspecies and distinct populations are recognized in the United States, and isolated populations are considered to be at risk. In Canada, speckled dace are only found in the Kettle River system, isolated upstream of Cascade Falls.

This restricted distribution in Canada is the reason that speckled dace were designated as a “species of special concern” and provincially red-listed. In 2002, the COSEWIC recommended that the status of speckled dace residing upstream of Cascade Falls be upgraded from a “species of special concern” to “endangered” under the federal *Species at Risk Act*. A contributing factor to this recommendation was the Cascade Heritage Power Project and the upstream extent of the head pond, prior to the redesign of the Project. With the redesign of the Project and reduction in the size of the head pond, the federal Minister of Environment decided not to accept this recommendation, and asked COSEWIC to review the status of the species in light of this new information. In April 2006, COSEWIC again made the recommendation that the species be listed as endangered under the federal *Species at Risk Act*.

The reason for the COSEWIC designation is stated thus: “...*The species is restricted to the Kettle River mainstem and two main tributaries in southcentral British Columbia, where it appears to be limited by the availability of suitable habitat. As this population is isolated above Cascade Falls, it cannot be rescued from downstream United States populations. The Kettle River is a flow-sensitive system that appears to be experiencing increasing frequency of drought conditions. The species is threatened by these reduced water flows and projected increasing water demands...*”

Speckled dace were found in the head pond area, but tended to be more abundant further upstream, and were present at the river margin in a variety of habitat types. In general, adult dace have a habitat preference for coarse substrate or other forms of cover, usually in riffles, and they occupy highly variable habitat.

The Proponent has maintained that there will not be a significant loss of speckled dace habitat with the head pond, and the Project is not expected to impact the speckled dace population in the Kettle River. The Proponent noted that:

- While speckled dace habitat would be generally reduced with the creation of the head pond, the areas with the highest abundance of this species are located upstream, and suitable habitat would remain available.
- The head pond will contain sufficient water velocities to remain riverine habitat suitable for speckled dace, and suitable habitat will still be available for speckled dace.
- The weir design would allow for normal flushing of fine sediment and maintain habitat (*Note* - sediment filling the spaces between boulders on the stream bed would result in a loss of habitat).

- The historic dam and head pond, which created backwater effects in the Kettle River for about 100 years, did not result in the potentially susceptible speckled dace going extinct. Since the weir forms a head pond that is significantly smaller than the one formed by the original dam, it can be concluded that the local speckled dace population is not at risk of extirpation due to the Project.

In late 2005 and early 2006 (prior to the April 2006 COSEWIC recommendation on the status of the species), DFO's Science Branch evaluated the potential effects of the Project on the persistence of the speckled dace population in the Kettle River system, and prepared the report: "*Impact of the Proposed Hydroelectric Development at Cascade Falls on the Conservation Status of Speckled Dace (Rhinichthys osculus) in the Kettle River, British Columbia*", Draft March 2006, by Dr. Mike Bradford. This was undertaken in consultation with, and peer-reviewed by, the Fisheries Technical Working Group for the Project (consisting of biologists from DFO, MoE, the ONA and the Proponent).

This was undertaken to: determine if the Project jeopardizes the survival or recovery of the species in advance of the federal Minister's decision on its status; inform DFO as to the feasibility for the issuance of an authorization pursuant to its regulatory obligations under the *Fisheries Act* and *SARA*; and ensure an appropriate EA conclusion consistent with the *Canada-BC Agreement on Species at Risk*.

The Report concluded that:

- speckled dace occupy at least 285 km of the Kettle River and its major tributaries, though the highest quality habitat is believed to occur in the 9 km immediately above the Canyon/Falls;
- it is estimated that less than 2% of the speckled dace population will be exposed to the impacts of the Project;
- it is unlikely that the head pond area will be rendered entirely unsuitable for speckled dace, although some reduction in productive capacity may occur; and
- the impact of the Project on the entire speckled dace population is considered to be small, and would present a negligible risk to its persistence.

These conclusions were based on very few data and a limited understanding of speckled dace habitat requirements and biology in the Kettle River.

The Proponent committed to monitoring the potential effects of the Project on speckled dace, and has developed a conceptual mitigation and compensation plan that would be implemented in the event that monitoring shows the species is being impacted by the operation of the Project ("*Habitat Enhancement Opportunities for Speckled Dace in the Lower Granby and Kettle Rivers*"). Suitable mitigation and/or compensation, to be approved by DFO, will be designed if monitoring shows that speckled dace are negatively affect by the Project.

The Proponent also committed to compile, in a single summary document, all aquatic and fisheries-related commitments, technical references and reports, to facilitate a final draft of the Fisheries Habitat Compensation Plan and authorizations from DFO.

DFO has concluded that it is confident that any potential residual effects of the head pond on speckled dace habitat could be appropriately mitigated. Regardless of whether the federal Minister of Environment accepts the COSEWIC recommendation to list the species as endangered under the federal *Species at Risk Act*, federal authorizations would still be issued, enabling the Project to proceed, if it is approved under *BCEAA* and *CEAA*.

4.1.2.2 Recreational Fishery

The bulk of the recreational fishery in the Kettle River is targeted towards immature rainbow trout, with up to 80% of the catch being less than 25 cm in fork length. The quality of angling in the river suffers, due to the low abundance and small size of rainbow trout.

Creel surveys conducted by the Proponent found that anglers prefer locations immediately upstream or downstream of the Canyon for fishing. Few anglers reported the Canyon as a preferred fishing location. Difficult and unsafe conditions limit angler access to the Canyon upstream of Cascade Falls. The large pool downstream of the Canyon, where the powerhouse and tailrace will be located, is a popular section of the river for angling, as well as other recreational activities.

Some fencing will be required around Project structures for safety reasons, including the weir, intake, powerhouse and tailrace. Fencing will be minimized, but there will be some reduction in accessibility to preferred angling locations. In addition to the accessibility constraints related to the footprints of the Project's components, provincial fishing regulations will prohibit angling within 23 m downstream of the weir and fishway, and the power plant.

In completing its assessment of potential Project effects, the Proponent concluded that:

- In the head pond, rapid habitat sought (seasonally) by fishermen would be modified to deep run habitat upstream of the weir (*Note* - as discussed under section 4.1.1 - *Fish Habitat*, the hydraulic effects and upstream extent of the head pond become less pronounced as river flows increase). Anglers that previously fished near the weir site may move to more suitable areas upstream of the impoundment where fish have migrated to. (*Note* - At higher flows, the river becomes more difficult to fish, and rainbow trout catch success is highest during summer low flows.)
- The rapids at the mouth of the Canyon, immediately downstream of the weir and fishway, will not be available for angling (due to safety and fishery regulation constraints). Otherwise, access to fishing locations in the Canyon above Cascade Falls is expected to remain unchanged from existing conditions, and this area is not a preferred fishing location. Angler access to the lower Canyon and large pools below Cascade Falls will not be affected by the Project. With the Project in operation, and given the minimum flows that will be maintained, accessible areas in the Canyon are expected to remain as suitable angling locations.
- The large pool downstream of the Canyon, where the powerhouse and tailrace will be located, will remain accessible to anglers, including the preferred fishing location

by the Canyon discharge, away from the tailrace. The water levels in this pool will not be affected as a result of the tailrace project.

4.1.3 Project Operation

In addition to the potential effects of the components of the Project (head pond, weir/fishway, flows downstream of the weir, and power plant/tailrace) on fish and fish habitat, a number of operational aspects were also considered and assessed by the Proponent, including: entrainment of fish and fish mortality (power plant intake and weir); ramping rates and fish stranding (including emergency shutdown); downstream movement of bedload, large woody debris and suspended solids; ice formation; and slope stability in the head pond area.

4.1.3.1 Fish Entrainment and Mortality

The potential for loss of fish through entrainment into the power plant intake was assessed based on the fish species and life stages that may be present in the zone of influence of the intake, and the time of year when they may be present. Conditions such as water flow, proportion of flow to the intake, approach velocity near the intake at the time of year, location of the fishway in relation to the intake structure, and attraction flow at the fishway were evaluated to determine how they would influence the potential for fish entrainment.

The potential for the entrainment of fish was determined to be very low, based on: the predicted low approach velocities near the intake structure; low number and probability of fish (particularly juveniles) expected to be found in the head pond habitat near the intake; lack of a major (anadromous) downstream migratory run; and the inherent tendency of fish populations located upstream of barrier falls to avoid downstream movement (*Note* - fish entering the Canyon are naturally flushed downstream and lost to upstream populations).

The position and orientation of the intake structure along the bank of the river, the location of the fishway immediately downstream, and the flows directed to the entrance of the fishway and low-level outlet, will guide fish moving downstream past the intake and towards the fishway. The 25-millimetre (mm) open gap between the trashrack bars (originally proposed as 60 mm) will prevent larger fish from being entrained.

Fish mortality from entrainment through the Project turbines is conservatively estimated to be 18.2%, based on available information for low-head hydroelectric projects and the turbine type. Fish screening at the intake is not required with the low potential for fish entrainment. Approach flow velocities at the intake and through the trash rack will be sufficiently low compared to fish swimming capabilities to avoid impingement of larger fish on the trash rack.

Speckled dace are weak swimmers. It is anticipated that some speckled dace, especially small juveniles, will be entrained into the intake, and some of these fish will either die due to injuries incurred when traveling through the turbines, or be more susceptible to predation in, and downstream of, the tailrace. The effect of entrainment on speckled

dace populations is difficult to predict with a high level of certainty. However, the population upstream of the canyon is not likely to be impacted given that:

- dace are naturally flushed down through the Canyon and over the Cascade Falls (*Note* - the population downstream of the falls is probably not self-sustaining, and their low abundance appears to be maintained by individuals from upstream);
- the intake will be located immediately upstream of the Canyon in deep water (excavated to a depth of approximately 5.2 m), and small juvenile dace are likely to avoid this habitat; and
- a small embayment will be constructed immediately upstream of the intake to provide a refuge area for small dace.

Spilling over the weir will occur during spring freshet when the river flow exceeds 90 m³/s, plus the minimum release flow through the Canyon. Water depth on the concrete apron of the weir will vary depending on the flow. There will be a short period at the beginning of spring freshet when water will spill directly onto the concrete apron. This would typically occur in mid-to-late April, when river flows are between 100 m³/s and 140 m³/s. During this period, fish spilling over the weir could suffer mortality due to the impact with the concrete apron. However, few fish are expected to move downstream towards the Canyon during this period. At the end of freshet, there may be a brief period of reduced water depth on the concrete apron and spilling over the weir.

In completing its assessment of potential Project effects, the Proponent concluded that:

- Fish entrainment into the power plant intake may occur on an incidental basis at extremely low levels, and is not expected to significantly impact fish populations upstream of the Canyon. Entrainment of speckled dace will not significantly affect the population of dace residing upstream of the Canyon.
- Mortality of fish spilling over the weir will be minimized because of the depth of water on the concrete apron during the main part of the freshet period.

The Proponent will undertake monitoring to determine whether the power plant intake velocities are as predicted, and whether fish entrainment (including red-listed and blue-listed species) is occurring. The species and number of fish passing through the turbines, and the associated mortality rates will be determined. The Proponent committed to providing compensation to offset a total loss of rainbow trout in the head pond (see section 4.1.5 - *Fish Habitat Compensation*).

MoE has concluded that entrainment of speckled dace is not likely to be an issue, given that flood flows will continue to flow through the Canyon, and downstream movement of dace and small fish will continue to occur if the species life-history stage does not have a natural instinct to find refuge habitats away from strong currents during snow-melt months. (*Note* - Generally, fish entering the Canyon are naturally flushed downstream and lost to upstream populations, and the Project, with entrainment of fish into the power plant intake, is not likely to result in increased losses over that which occurs naturally.)

4.1.3.2 Ramping Rates and Stranding

Rapidly increased river flows can flush out, and decreasing river flow can strand, fish eggs and alevins, juvenile fish and invertebrates. Juvenile fish, which have poor mobility

and prefer shallow water habitat on the river margin, are particularly vulnerable to stranding. The effects of flow fluctuations are influenced by river channel configuration, and reaches with gravel bars and side-channels are particularly susceptible.

In the Cascade Canyon, between the weir and the tailrace discharge, the habitat is mainly a series of large deep pools and cascades which are less vulnerable to flow fluctuations. There are a few riffle areas where stranding during extreme low-flow conditions could occur. Downstream of the tailrace, the river broadens and side-channel rearing areas and gravel substrates are more abundant, and potentially more vulnerable to flow fluctuations.

Operation of the Project will require up-ramping and down-ramping to modify minimum monthly release flows. The weir will have a low-flow outlet and inflatable rubber dam. The turbines will have individual wicket gates and bypass valves. Coordinated operation of these design features will allow for controlled ramping during normal operations, and will also allow for emergency, maintenance or low-flow shutdowns. The DFO ramping rate protocol to protect fish and fish habitat will be followed, and daytime/night time and seasonal ramping requirements met.

Events such as a power generation (equipment) or transmission line problem or failure could shut down the facility. In the event of an emergency shut down of any or all generating units, or any other condition requiring a rapid change in flow through the turbines, the bypass valves attached to the operating units will open at the same rate as the wicket gates on the turbines close down. Thus a steady flow in the river below the weir will be maintained, and there will be no change in the flow downstream of the power plant. If the shut-down of the power plant is for more than a few days, the bypass valves can be slowly closed and flows through the weir, either by the low-level outlet or over the rubber dam, can be increased at the same rate as it is being decreased through the bypass valves. This would control the ramping rate in the canyon with no unnatural changes occurring downstream of the power plant.

Potential blockage of the submerged intake structure (trash rack) for the power plant, for example, associated with debris accumulation (see section 4.1.3.3 - *Bedload, Large Woody Debris and Suspended Solids* below) or ice build up (see section 4.1.3.4 - *Ice Formation* below), will be monitored so that flow through the plant can be ramped down before any obstruction begins. Given the size of the intake trash rack area, blockage would occur over an extended period, and would not be a sudden event. In the event of human error, monitoring equipment would detect a drop in water level downstream of the trash rack, the turbines in the power house would shut down gradually, and the bypass valves would open. If the head pond upstream of the weir rises, a sensor will signal the low-level outlet gate to open further, or the rubber weir to deflate, to maintain a constant pool level. Flow through the Canyon and downstream will be ramped up as the flow through the plant is ramped down. Downstream of the power plant, the river flow will be that which is naturally available, and will ramp (fluctuate) at its natural rate.

An accidental surge flow (i.e. a sudden release of the head pond with no ramping) due to failure of weir controls could result in stranding of fish upstream of the weir. In the event of such a failure, upstream habitats will be monitored for stranded fish and fish salvages performed by a trained local response team (also see section 4.6 - *Accidents and Malfunctions*). Downstream of the weir, a surge would be somewhat attenuated through the Canyon, and because of the small volume of water in the head pond, the duration of

the surge would be short (a few minutes, depending on the natural flow in the river at the time).

In completing its assessment of potential Project effects, the Proponent concluded that the water control features incorporated into the design of the Project will provide for the ramping of flows at any desired rate, such that agency-approved ramping rates can be achieved, and the potential effects of flow fluctuations on fish and fish habitat from the operation of the Project will be mitigated.

The Proponent will develop a ramping protocol to be approved by fishery agencies and incorporated into the Habitat Mitigation and Compensation Plan, to monitor and mitigate for fish stranding. This protocol will include the establishment of a continuous recording gauge and permanent transect in the Kettle River, at a location approximately 600 m downstream of the power plant, to act as a control point for ramping. A contingency plan will be put in place to monitor any fish or fish egg stranding due to accidental operation of the hydraulic equipment.

4.1.3.3 Bedload, Large Woody Debris and Suspended Solids

The redesigned Project will effectively have no reservoir, and during large flow events, the river profile will be unchanged. Bedload moves through this reach of the river only under peak discharge conditions. Under such peak flows, the rubber dam will be completely collapsed against the sill. The sill will be at riverbed level, and any bed load will be able to move past the weir, as it would under natural conditions. During large-flow events, the flows diverted from the Canyon to the power plant will not be sufficient to reduce the capacity of the flows to move bedload through the Canyon and into downstream reaches.

The movement of large woody debris occurs almost exclusively during high flows. At higher flows, when the entire weir structure will be under water, floating material will move through the mouth of the Canyon as it does under present conditions. There is a possibility that some woody debris may accumulate seasonally behind the concrete weir wing wall on the north side of the river, but this would be floated downstream during the following freshet season. Any seasonal accumulation of woody debris at this location would provide improved habitat for fish. Blockage of the power plant intake would be expected to occur only during high flow conditions, when there is the largest amount of debris material in the water. The intake will be submerged, and the likelihood of blockage by material, most of which will be floating, is expected to be low.

The river is known to carry suspended solids during high-flow periods. The creation of the head pond is not expected to change this situation, since the stream velocities with the weir in place will only be marginally lower than the stream velocities under natural conditions. Consequently, suspended solids will move through the head pond as they do presently.

Bedload, large woody debris and suspended solids are mobilized during freshet flows. During such high river flows, the flow out of the powerhouse tailrace should not affect the movement of these materials downstream of the Project.

In completing its assessment of potential Project effects, the Proponent concluded that the natural downstream movement of bedload, large woody debris and suspended solids will not be affected by the Project.

The Proponent has committed to undertake monitoring to confirm the accuracy of bedload transportation predictions and bedload transport and deposition patterns through the head pond (see Appendix D - *Proponent's Table of Commitments and Assurances*).

4.1.3.4 Ice Formation

In winter, the formation of sub-surface frazil and anchor ice and ice jams can have detrimental impacts on fish habitat and fish, and could potentially affect operation of the Project.

With temperatures lowering rapidly below freezing, two conditions are normally responsible for the formation of frazil ice: a strong wind creating waves on a ponded or slow-moving water surface; or the presence of rapids, which expose more super-cooled water to the cold air. Once water is super-cooled, small disc-shaped ice crystals form in the water column. Turbulent water keeps this frazil ice suspended, but it may adhere to underwater objects to create anchor ice. Anchor ice can result in a loss of winter microhabitats, and can eventually fill the water column to form dams, and cause fluctuations in water levels.

Some occurrences of frazil ice formation can be expected during the normal course of a winter. However, the potential impact of frazil and anchor ice formation at the Project site is difficult to predict.

The head pond upstream of the weir will likely be ice-covered from late December to mid-February. With the head pond, the potential for the formation of frazil ice may be reduced in that section of the river. However, hydroelectric facilities with metal trash racks that are exposed above water level have experienced frazil ice formation at the racks as cold temperatures are conducted through the metal bars into the water. With the design proposed for the Cascade Project, the trash racks would be completely submerged at all flows. Experience at other run-of-river hydro plants shows that the best way to determine the onset of frazil ice conditions is by installing and monitoring water and air temperature sensors at the intake. It has also been shown that the only practical remedy for frazil ice formation is to shut down the plant until the condition ceases.

Downstream of the weir, the flow will pass through a series of riffles and ice-covered pools in the Canyon. The formation of frazil and anchor ice may occur in the Canyon and downstream of the tailrace, but the sequences of large pools in both areas should provide sufficient overwintering habitat and food supply for the limited number of fish expected to occupy these areas. Fluctuations in the amount of water passing through the Canyon would occur in the event of power plant shutdown or start up. The effect of increasing flow through the Canyon would potentially break up a thin ice cover, but would cause overflow at areas of well-established thick ice. The effect of decreasing flow would be to cause a void and the potential collapse of thin ice, or a large air space under thick ice. The effect on fish populations overwintering in the pools is considered minimal, as river flows do not fluctuate widely during the winter months, and it is likely

that the power plant will shut down for insufficient flow in early winter, and start up when flow is sufficient in late winter. If the power plant operates through the winter, the minimum release flow of 4 m³/s through the Canyon is expected to establish a stable ice cover over pools, with a sequence of open riffles.

Upstream of the Project, the formation of an ice jam could decrease river flows, which would cause the power plant to ramp down. If the flow falls below 9.0 m³/s, the power plant will shut down. If an ice jam releases, there could be a sudden increase in water level in the head pond area, and increased flow down the Canyon, which would also occur under natural conditions. The control system for the rubber dam and the low-level weir outlet would respond and release flow down the Canyon, and then re-establish the water level (low-river flow conditions) in the head pond over a short period of time.

In completing its assessment of potential Project effects, the Proponent concluded that:

- In winter, the head pond has the potential to positively affect all species of fish by providing deeper water and a lower probability for the formation of frazil ice.
- In regards to the trash racks for the power plant intake:
 - Conditions likely to result in the formation of frazil ice will be monitored. When such conditions are expected, water and air temperatures will be monitored at the intake, so that the plant can be ramped down before any obstruction of the trash racks begins. In this case, the sluice gate will be opened as the plant is ramped down to maintain a constant level in the head pond.
 - In the event of human error or failure of temperature monitors to indicate the potential of frazil ice, such that frazil ice begins to accumulate on the trash racks, the water level monitoring equipment in the head pond, and behind the trash racks, will signal a differential, and the plant will be ramped down. In this case, the flow through the Canyon and downstream will be ramped up as the flow through the powerhouse is ramped down.
- Downstream of the weir, the formation of frazil and anchor ice may occur, but the sequences of large pools should provide sufficient overwintering habitat and food supply for the fish occupying these areas.

The Proponent has committed to evaluating the effect of ice formation pre- and post-Project to determine whether a problem exists, and whether there are means to mitigate any impacts, such as the use of bubble curtains.

4.1.3.5 Slope Stability

In certain areas along the banks of the head pond, there are steep silt slopes, which tend to slump during peak floods. However, these silt layers are at elevations above that which would be affected by the weir and head pond. Immediately upstream of the intake structure, on the right bank of the river, there is a steep eroding bank. This bank is at an elevation where it is subject to erosion only at flood flows, when water levels are controlled by the restricted entrance to the Canyon. This bank will be re-contoured and rip-rapped to provide erosion protection during high flows. The lower portion of the bank, which will be inundated by the weir, is composed of cobbles and boulders, and is not subject to erosion.

Downstream of the tailrace there is a large sandy cut-bank on the left (opposite) side of the river. This is downstream from the large pool (Cascade Cove pool) at the base on the Canyon and the Cascade Cove beach (also on the left side of the river). Tailrace flow velocity will be modest (2 m per second) during low river flows, and reduced during higher river flows. The alignment of the outflow from the tailrace is at a shallow angle to the flow alignment of water passing straight down the river channel, and no backflow along the base of the cut-bank is expected.

In completing its assessment of potential Project effects, the Proponent concluded that:

- The river profile and velocity will not be changed by the Project at very large discharges. With the redesign of the Project, there would be no significant impact on slope stability in the head pond, and no change in the erosion of the river banks. During extreme flood events, the Project could lower the water level, slightly improving the slope stability.
- The velocity of the water from the tailrace will be sufficiently slow that no significant change in the erosive capacity of the water at the base of the sandy cut-bank is expected.

The Proponent has committed to monitoring the cut-bank downstream of the tailrace, before and during construction, and also during operation, to determine the potential for tailrace discharge to alter river channel morphology (Appendix D - *Proponent's Table of Commitments and Assurances*).

4.1.4 Project Construction

Construction of the weir (including the rubber dam, fishway, and low-level outlet), and power plant intake will require temporary cofferdams in the channel of the Kettle River. Construction of the tailrace will require a temporary berm in the river channel. Work in the river channel will be scheduled during a fisheries window from approximately September 15th to March 15th. The actual timing of activities will be established in consultation with fisheries agencies during the detailed planning of construction. The cofferdams will divert low autumn and winter flows, not exceeding the 10-year maximums for these months. Construction will be completed, and the cofferdams removed, before the end of the low-flow season.

The cofferdams for the weir and intake construction will be placed with minimum disturbance to the river bed. A first-stage cofferdam will enclose the area to be occupied by the right (south) weir abutment (including the fish ladder, the low-level outlet sluice, and the rubber dam) and power plant intake. The normal flow of the river will be diverted around the cofferdam and through the Canyon. Upon installation of the rubber dam, the first-stage cofferdam will be removed, allowing the Kettle River to be diverted unimpeded over the deflated rubber dam and through the low-level outlet. A second-stage cofferdam will then be constructed to permit construction of the left (north) wing wall and abutment. The berm for the tailrace will be constructed along the right (south) bank of the river, downstream of the powerhouse.

The construction of Project components has the potential to impact fish and fish habitat, such as by temporarily disrupting habitat, causing sedimentation downstream of work areas, and affecting water quality.

The Proponent has identified mitigation and monitoring measures to address potential Project-related construction impacts on fish and fish habitat, and has committed to implementing these measures in environmental management plans that will be finalized in consultation with DFO and MOE prior to the commencement of construction (see section 4.5 - *Environmental Management Plans*, and Appendix D - *Proponent's Table of Commitments and Assurances*).

Mitigation measures that will be applied during construction include the following:

- Instream works will be undertaken during low-flow conditions, and within a window approved by fisheries agencies.
- If present, fish will be removed (salvaged) from work areas prior to commencement of instream activities.
- Instream activities will occur in isolation of flowing water (*Note* - work sites will be isolated using cofferdams and berms or other accepted isolation techniques), and flow to downstream portions of the river will not be cut off at any time during construction.
- Any materials placed on the banks or within the active channel or floodplain of the river, or any other watercourse, will be free of substances deleterious to aquatic life.
- Work will be undertaken in a manner to prevent the release of silt, sediment or sediment-laden water, or any other deleterious substances, into the river or any other watercourse. Bare soils adjacent to the river will be protected using plastic sheeting, silt fencing and/or seeding and re-vegetation. Run-off will be diverted to containment facilities (sediment control ponds) or low-gradient swales containing sediment control features (e.g. gravel berms, filter cloth, silt fencing). Erosion and sediment control features will be inspected and maintained.
- Blasting will not occur directly under or in flowing water.
- Disturbance to vegetation in riparian areas will be minimized.
- All in-channel or active floodplain habitats that are temporarily disturbed during the construction of works will be restored following the completion of construction.

In completing its assessment of potential Project effects, the Proponent has concluded that the mitigation and monitoring measures that will be implemented through environmental management plans will minimize or prevent construction impacts to fish and fish habitat.

4.1.5 Fish Habitat Compensation

As discussed above, consistent with DFO's "*Policy for the Management of Fish Habitat, 1986*", the Proponent redesigned the originally-proposed Project to alleviate potential adverse effects on the productive capacity of fish habitats.

Despite this redesign and other mitigation that would be undertaken during the construction and operation of works, it was apparent that the Project would still result in the harmful alteration, disruption or destruction of fish habitat under section 35 of the

federal *Fisheries Act*. As summarized in Table 1 Fish Habitat Losses and Gains, this included:

1. a loss of habitat from the footprints of the weir and power plant intake;
2. a loss of habitat downstream of the weir in the Cascade Canyon, due to reduced flows; and
3. of most concern to fisheries agencies, the alteration/conversion of rapid and riffle habitat (limited in the reach of the Kettle River upstream of the Cascade Canyon) and associated shear zones considered important summer habitat for adult rainbow trout production to less productive run habitat, and an increase in run and pool habitat as a result of the weir and head pond (though the extent of this alteration was significantly reduced with the redesign of the Project).

As a result, in its redesign of the Project, the Proponent also included a detailed conceptual fish habitat compensation proposal for the mainstem of the Kettle River, a short distance upstream of the head pond. This plan, also consistent with DFO policy, proposed like-for-like compensation, replacing altered and lost habitat as close as possible to the site of impacts in the Kettle River. The plan included creating rapid habitat in the mainstem of the river, and modifying a side channel of the river to maintain water flows and provide shallow riffle habitat during the summer growth period for fish.

The Proponent investigated the feasibility and benefits of this compensation proposal, and consulted with the fisheries agencies. Several concerns were identified, including the alteration of additional riffle habitat and potential impacts on spawning habitat for speckled dace. Agreement was reached that the first preference of like-for-like habitat replacement under DFO policy would be abandoned. (*Note - Refer to the Proponent report "Cascade Heritage Hydroelectric Project Hydrotechnical and Fisheries Assessment of Proposed Headpond and Fisheries Enhancement Works, March 2005"*).

Consistent with the hierarchy of preferences under DFO policy, the Proponent examined other compensation options, and provided an alternative proposal that would restore degraded habitat in McCarthy Creek, a spawning stream identified by the Proponent as being utilized by rainbow trout spawners residing in the lower Kettle River, approximately 10 km upstream of the Cascade Canyon. The restoration would improve habitat conditions, using well-established techniques, particularly the quality and quantity of summer rearing and overwintering habitat for rainbow trout juveniles. (*Note – Again, refer to the above-noted Proponent report*).

The analysis completed by the Proponent estimated that there could be a potential loss of approximately 27 adult rainbow trout in the area of the river affected by the head pond, and that this loss should be adequately compensated for by an additional output of approximately 42 rainbow trout parr (juveniles) from McCarthy Creek.

However, given that the overall effect of habitat losses and gains from the Project on the productive capacity of habitat cannot be predicted with a high degree of certainty, the Proponent committed to ensuring no net loss of fish habitat, a guiding principle under DFO policy, by:

- monitoring the effects of the Project on fish habitat during construction and operation, and determining the actual change in productive capacity and effects on the production of rainbow trout and other species, including speckled dace;

- monitoring the effects of habitat restoration measures in McCarthy Creek to ensure that the compensation adequately offsets the effects of the Project; and
- providing additional compensation as may be required for rainbow trout or other fish species (such as additional winter habitat for rainbow trout, either in McCarthy Creek or a nearby tributary).

In regards to the Kettle River upstream of the weir (head pond), DFO and MoE disagreed with the Proponent's assessment of potential Project effects. Specifically, the agencies noted that:

- the relative scarcity and value of the habitat that will be affected was not acknowledged or factored into the calculations of fish habitat losses and gains (see Table 1);
- the Proponent did not acknowledge that there would be a harmful alteration, disruption or destruction (HADD) of fish habitat under section 35 of the federal *Fisheries Act*;
- no justification was provided to support a compensation target of 27 adult rainbow trout, or how this relates to, or accounts for, the loss of habitat productive capacity;
- as a result of the alteration of mainstem Kettle River habitat, there may be limited habitat available for the adult rainbow trout produced or resulting from the compensation proposal to occupy during the critical fisheries stream flow period of August through October (i.e. juvenile production may not be limiting the rainbow trout population in this area of the Kettle River); and
- the critical fisheries stream flow period of August through October corresponds with the period of the greatest extent/effect of the head pond.

Considering empirical data/observations in the field and based on professional judgement, the agencies concluded that:

- There would be a loss of productive capacity of habitat for rainbow trout and other species as a result of:
 - the overall conversion of fast water habitat to slower water habitat; and
 - the loss of the diversity in habitat sequencing described generally, from upstream to downstream, as rapid/run, pool/run, rapid/run, riffle/run, and riffle.
- The proposed compensation would not fully compensate for the loss of production of adult rainbow trout, and there would be a high risk that the goal of no net loss of productive capacity of habitat would not be achieved.

The Proponent responded by:

- Increasing the initial compensation target from 27 to 40 adult rainbow trout to achieve a 1.5:1 compensation ratio, based on a worst-case scenario that operation of the Project will result in a total loss of rainbow trout production in the 750 meters of mainstem Kettle River in the head pond area, and that this loss would occur every year. The Proponent has suggested that this is a conservative approach, and not likely to be the case.
- Committing to a comprehensive 10-year fish and fish habitat monitoring program to document the effects that operation of the Project will have on rainbow trout in the head pond area, and to reviewing the results annually, and in consultation with fisheries agencies, adjusting the compensation target if needed. (*Note* - The

monitoring program will include all species of fish, with emphasis on rainbow trout and red-listed and blue-listed species.)

- Undertaking initial assessments of three tributary streams where it is confident compensation works will be successful (McCarthy Creek, July Creek and the Granby River), and committing to conducting a more detailed assessment of these streams.
- Committing to deflating the rubber weir (unless otherwise directed by fisheries agencies), to maintain fast water habitats and diversity in habitat sequencing, during the months of August through October, whenever the flow is too low to generate power (i.e. when the river flow is at or below the agreed monthly minimum compensation flow plus 5.0 m³/s). Specifically, when the natural river flows are less than the following levels:
 - March 10 m³/s
 - April 15 m³/s
 - May – June 25 m³/s
 - July 13 m³/s
 - August 12 m³/s
 - September 11 m³/s
 - October 9 m³/s

Both emptying and filling of the head pond will be regulated at rates which meet DFO's recommendations with respect to ramping.

The Proponent also committed to compile, in a single summary document, all aquatic and fisheries-related commitments, technical references and reports to facilitate a final draft of the Fisheries Habitat Compensation Plan and authorizations from DFO.

The Proponent agreed to the requirements specified by MoE and DFO for compensation related to fish and fish habitat.

DFO has concluded that:

- fish and fish habitat information requirements for the Project have been satisfied; and
- assuming a positive conclusion to the Federal/Provincial harmonized EA, DFO will be in a position to work with the Proponent and the ONA to finalize operational details of the Fish and Fish Habitat Compensation Plan, as a requisite for issuance of the required *Fisheries Act* section 32 and 35(2) authorizations for the destruction of fish (rainbow trout) and the harmful alteration, disruption and destruction of fish habitat.

MoE has concluded that:

- The rapid, riffle and pool sequence habitat in the area of the head pond is limited in the watershed, and is considered important summer habitat for rainbow trout production. The Proponent's mitigation and compensation commitments significantly reduce the risk for aquatic productivity and biodiversity resulting from the Project.

4.2 Water Quality

Potential effects from construction and operation of the Project on water quality in the Kettle River include impacts associated with:

- high total gas pressure (TGP) levels and gas bubble trauma (GBT) to fish;
- increased water temperatures resulting from the head pond and impacts on fish;
- nutrient accumulations in the head pond;
- methyl mercury build up in organisms (bioaccumulation), caused by the head pond;
- increases in erosion, turbidity and suspended sediments/solids, and impacts on primary production and invertebrate and fish populations;
- introduction of nitrates as a result of blasting activities during construction; and
- metal leaching/acid rock drainage from stored excavated waste rock.

The Proponent's Additional Information submission provides specific information on the following:

- Water Quality Monitoring (Specification #11)
- Total Gas Pressure (TGP) (Specification #12)
- Water Temperature (Specification #13)
- Nutrient Accumulations in the Backwater Area (Specification #14)
- Methyl Mercury (Specification #15)
- Erosion, Turbidity and Pool Drawdown (Specification #16)
- Upstream Erosion, Turbidity and Suspended Solids (Specification #17)
- Nitrates (Specification #18)
- Acid Rock Drainage (Specification #19)

4.2.1 Total Gas Pressure (TGP)

Fish must have adequate dissolved oxygen to survive. Dissolved oxygen levels decrease as water temperatures increase. This issue becomes critical as water temperatures rise and approach the lethal limit for fish. Significant reductions in dissolved oxygen can debilitate or kill fish, even at low temperatures.

Water plunging into pools entrains air. This air, in the form of bubbles, is forced into solution by hydrostatic pressure, adding to the total dissolved gas pressure. Once total gas pressures (TGP) rise above local atmospheric pressure, the water is supersaturated with dissolved gases. High TGP levels and dissolved gas supersaturation (DGS) can cause gas bubble trauma (GBT) - and potential mortality - to fish that may exist downstream (i.e. gas becomes supersaturated in the bodily fluids of fish).

Monitoring has established that the Cascade Canyon/Falls produces significant DGS downstream in the Kettle River, and that signs of GBT is currently present in fish species (including speckled dace). Monitoring data and modeled/predicted TGP levels show that there is a severe TGP problem in the Kettle River below Cascade Falls during periods of high flows (spring and early summer).

Monitoring data and modeled/predicted temperature levels show that existing peak (summer and early fall) Kettle River water temperatures far exceed the B.C. guidelines for mountain whitefish and rainbow trout (brown trout and brook trout). The high TGP and high water temperature problems are related, in that the temperature stresses that fish experience follow shortly after a period of high stress from TGP. Consequently, fish may be more susceptible to the high temperatures than they would otherwise be.

In completing its assessment of potential Project effects, the Proponent concluded that in regards to dissolved oxygen, TGP, DGS and GBT:

- In general, the mainstem Kettle River appears to be well aerated, and there is no reason to expect that the Project will have any effect on dissolved oxygen levels. There is no oxygen deficit occurring at times when water temperatures are highest.
- The Project will significantly reduce dissolved gas supersaturation (DGS) in the Kettle River as a result of reduced flows in the Canyon (when the power plant is operating), and dilution of the DGS produced by the residual water that passes through the Canyon with the flow from the turbines. It is anticipated that the aquatic environment below the Project will be improved because of lower Total Gas Pressure (TGP) levels.
- Based upon risk assessment analyses, the Project (when the power plant is operating) will significantly reduce or eliminate any gas bubble trauma (GBT) and potential mortality to fish that may exist downstream of the Cascade Canyon/Falls. This may have added benefits in terms of eliminating the cumulative stress on fish of both TGP/DGS and temperature during periods of high water temperature.

The Proponent has committed to monitoring TGP prior to, and during, Project construction, and for one year following the initiation of power plant operations, to confirm that the above predicted benefits are occurring.

4.2.2 Water Temperature

Summer water temperatures in the Kettle River currently rise above what is considered safe for many fish species. This is due, in part, to solar and atmospheric heating and, in part, to higher-temperature water entering the Kettle River from Christina Creek.

With the Project in place, reduced water velocities and increased water surface area may increase temperatures during the summer and early fall, both in the head pond and downstream. Overall, it is anticipated that the duration and severity of any potential increase in temperature may vary from year to year, depending on run-off conditions, weather and Project operations.

Two methods were used to assess the potential effects of the Project on water temperatures in the Kettle River: a comparison of historical water temperature data, the *BC Water Quality Guideline for Water Temperature*, and the proposed monthly release flows from the weir (Table 2 - *Compensation Flows*); and temperature modelling, using more recent water and air temperature data for the study area.

In completing its assessment of potential Project effects, the Proponent concluded that in regards to water temperature in the Kettle River:

- Existing peak (summer and early fall) Kettle River water temperatures far exceed the B.C. guidelines for mountain whitefish and rainbow trout (brown trout and brook trout).

- The presence of the Project head pond is not expected to increase downstream average temperatures significantly. The predicted increases are less than 0.1 degree Celsius (0.01° C to 0.03° C), and are below the detection limits of monitoring instruments. However, given the already high natural water temperatures during the summer and early fall, even further temperature increases this small may have incrementally small impacts on the river's fish populations below the head pond.
- Since the predicted increases in Kettle River water temperatures associated with the Project are quite small, it is anticipated that the differential impacts on fish populations will be minor.
- The change in primary and secondary production associated with the predicted temperature rise is expected to be undetectable, although there will be a small incremental change that could be either positive (increased productivity) or negative (reduced productivity).
- The increase in average temperature (less than 0.1° C), is expected to persist downstream of the Project, perhaps to the Canada/US border.
- There may be compensating effects between the existing high water temperatures and the expected reduction in dissolved gas levels associated with the Project.

The redesign of the Project and smaller head pond (see section 4.1 - *Fish and Fish Habitat*) significantly reduced the temperature increase predicted with the original Project proposal. During periods of low river flow in the months of August, September and October, when the power plant is not operating, the head pond will be drained to mitigate impacts on fish and fish habitat. When this occurs, the predicted small increases in water temperature resulting from the head pond may also be further reduced or eliminated.

The Proponent has committed to monitoring water temperatures, beginning one year prior to construction, during construction and during operation of the Project, to confirm predicted Project effects.

MoE estimated that the head pond would have a small temperature effect on the river, causing a small theoretical increase in the exceedance rates of the rearing guidelines for rainbow trout and mountain whitefish. MoE noted that the Proponent had committed to undertaking monitoring prior to, and following, construction to verify predictions and set water quality objectives specific to the Project area.

4.2.3 Nutrients

The dams and reservoirs of hydroelectric facilities can decrease flow, increase water residence times, and trap sediments and nutrients (nitrogen and phosphorus), conditions under which eutrophication can occur. These facilities can also inhibit the downstream transport of organic debris and matter, which are essential food sources for fish and other organisms.

Reservoirs with shorter water residence times trap a smaller percentage of nutrients, because some of the nutrient mass is flushed out before being used for algal growth. The water residence time in the head pond of the Project is estimated to be approximately 37.2 minutes at a low flow (10 m³/s), and 6.3 minutes at mean annual flow (74.85 m³/s). These retention rates are considered to be low.

In completing its assessment of potential Project effects, the Proponent concluded that, in regards to nutrient transport in the Kettle River, the types of impacts commonly associated with hydroelectric facilities, and the redesign of the Project (see section 4.1 - *Fish and Fish Habitat*, and section 4.1.3 - *Project Operation*):

- Given the low resident times of water in the head pond, nutrients are expected to move rapidly through the head pond in solution, or attached to suspended sediments. Nutrient trapping in the head pond, through processes such as biological uptake (accelerated growth of algae and aquatic plants) and sedimentation, is not expected to be an issue.
- The Project will not prevent natural flooding events and the natural downstream movement/transport of bedload, large woody debris (i.e. logs) and other debris such as branches, twigs and leaves, and organic matter.
- Existing bedload movement patterns will not be changed by the operation of the Project.
 - Sediments may be temporarily deposited at the upper end of the head pond, but will be re-suspended and flushed annually during freshest flows.
 - The Project will not result in sediment/silt collecting on the river bottom downstream and burying fish spawning and rearing habitat.
- Other problems associated with large storage reservoirs, such as decreased oxygen levels, changes in water chemistry and water stratification, are not expected, given the small size of the head pond and low residence times of water passing through it.

The Proponent (see Appendix D - *Proponent's Table of Commitments and Assurances*) has committed to:

- Conducting a baseline study on algal growth in the head pond area during low flows, beginning one year prior to instream construction activities, to determine the species composition of attached periphyton, chlorophyll (a) content, and nutrient concentrations.
- A monitoring program to confirm the accuracy of bedload transportation predictions and bedload transport and deposition patterns through the reservoir.

MoE has concluded that the additional information requested, and the commitments or clarifications required with respect to nutrient issues, have been satisfactorily provided.

4.2.4 Methyl Mercury

Large-scale reservoirs that flood the surrounding land above all previous water levels can result in a rise in rates of methyl mercury production by micro-organisms in

sediments, leading to the bioaccumulation of methyl mercury in fish, and having potential consequences to human health.

During low flows (maximum extent of the Project head pond) and freshet flows (when the weir has no effect on river levels), water levels in the Kettle River will remain within the normal annual range along its river banks, entirely within the existing natural channel, and no flooding of new terrestrial soils or vegetation will occur. Some limited areas of riparian vegetation within the floodplain of the river will be affected.

In completing its assessment of potential Project effects, the Proponent concluded that in regards to methyl mercury and the redesign of the Project (see section 4.1 - *Fish and Fish Habitat*, and section 4.1.3 - *Project Operation*), no accumulations of methyl mercury are expected to occur as a result of the Project.

The Proponent has committed to conducting fish tissue analysis (muscle and liver) one year prior to construction, and one year after commencement of Project operations.

4.2.5 Erosion and Sedimentation

During construction, there is the potential for erosion and the introduction of both sediments from instream works and run-off from disturbed areas adjacent to the river. During operations, there is the potential for erosion and the introduction of sediments from both fluctuating water levels (head pond) and channel alteration (tailrace).

Sedimentation can result in detrimental impacts on primary producers, invertebrate populations, and fish populations. Increased sediment levels can: clog fish gills; reduce the suitability of spawning habitat; hinder the development of eggs, larvae and juveniles; infill pools and riffles, and reduce rearing habitat; modify migration patterns and displace fish to less suitable habitats; reduce food abundance and feeding efficiency; and reduce tolerance to disease and toxicants.

In completing its assessment of potential Project effects, the Proponent concluded that:

- The mitigation and monitoring measures that will be implemented through environmental management plans will minimize or prevent construction impacts on fish and fish habitat (see section 4.1.4 - *Project Construction*, and section 4.5 - *Environmental Management Plans*).
- The river profile and velocity will not be changed by the Project at very large discharges. With the redesign of the Project, there would be no significant impact on slope stability in the head pond, and no change in the erosion of the river banks. During extreme flood events, the Project could lower the water level, slightly improving slope stability (see section 4.1.3.5 - *Slope Stability*).

The head pond will be entirely within the existing natural river channel, and will not flood or inundate any forested areas. No clearing of vegetation is required, other than a small amount of riparian shrub vegetation within the river channel floodplain upstream from the weir location.

Immediately upstream of the intake structure, there is a steep eroding bank. The Proponent has committed to re-contouring and rip-rapping the bank at this location to provide erosion protection during high flows.

The potential for the tailrace discharge to alter channel morphology in the Kettle River downstream, particularly the large cut-bank on the left side of the River, will be assessed during the detailed design phase of the Project.

During operation, the Proponent has committed to carrying out visual monitoring of bank stability and erosion or sedimentation following each freshet season or other flood event.

MoE has concluded that the additional information requested, and the commitments or clarifications required with respect to erosion and turbidity issues, have been satisfactorily provided.

4.2.6 Nitrates

During construction, there is the potential for nitrates to be introduced into the Kettle River from blasting activities.

The Proponent has committed to: not blasting directly under or in flowing water; adhering to the federal "*Guidelines for the Use of Explosives in or near Canadian Fisheries Waters, 1998*"; and implementing a protocol for discharging water to a suitable location for ground disposal. Blasting near the river will be undertaken in isolation of flowing water (within cofferdams or above water levels) during timing windows that will minimize impacts (late autumn and winter low-flow conditions).

Seepage water and drainage from blasting areas will be collected and appropriately contained, and treated before discharge. ANFO-type (ammonium nitrate – fuel oil solution) explosives will not be used for the underground excavation. (*Note* - The performance of these inexpensive explosives is adversely affected by water moisture/vapour, and they will dissolve in water.)

In completing its assessment of potential Project effects, the Proponent concluded that:

- The redesign of the Project (replacing the surface canal for conveying water to the power plant with a tunnel) significantly reduces the risk of nitrate-contaminated water reaching the river.
- The mitigation and monitoring measures that will be implemented through environmental management plans will minimize or prevent construction impacts on fish and fish habitat (see section 4.1.4 - *Project Construction*, section 4.5 - *Environmental Management Plans*, and Appendix D - *Proponent's Table of Commitments and Assurances*).

The Proponent committed to identifying locations suitable for disposal of seepage water from blasting, and also to obtaining approval from agencies prior to construction.

4.2.7 Acid Rock Drainage

Metal leaching or acid rock drainage from surface and underground materials excavated, exposed or disturbed by the Project has the potential to affect water quality and aquatic resources in the Kettle River.

Metal leaching (ML) and acid rock drainage (ARD) are naturally-occurring processes that are caused when minerals containing metals and sulphur (called sulphides) come into contact with both air and water. When sulphides are exposed to water and the oxygen from air, they rust (or oxidize). This oxidizing of sulphides can also produce acid. If this acid is mobilized and carried by water, the process is called 'acid rock drainage'. The acid in ARD can leach metals from surrounding rocks, causing drainage that has high amounts of dissolved metals (such as iron, aluminum, copper, lead, silver or zinc). This process is called 'metal leaching'. Other metals can also be leached from rocks in non-acidic drainage (such as selenium and zinc, molybdenum, nickel, arsenic and antimony).

Not all rocks that contain sulphide minerals will become acid-generating. Whether this will occur depends on the amount of neutralizing minerals and materials (such as limestone) that are present in the rocks. If there is balance, or if there is an excess of neutralizing minerals, the rocks may not generate ML/ARD.

The process of excavation greatly increases the amount of rock surfaces that can be exposed to oxygen and water. The potential for environmental impacts depends on many factors, including the amount of metals in the drainage, the amount of acid-neutralizing ability in nearby rocks and water, the amount of dilution available in streams and the sensitivity of the receiving environment. If the potential for leaching of acid and metals is identified through test work, there are strategies that can be used to prevent and manage ML/ARD.

The redesign of the Project (see section 4.1 - *Fish and Fish Habitat*) included an underground tunnel to convey water from the intake to the power plant, and this reduced by approximately 60% the volume of waste rock that would have been associated with the originally proposed surface canal. Construction of the Project will require the excavation and disposal of material composed of both alluvium (unconsolidated loose material deposited by a river/stream – i.e. sand and gravel) and rock. In total, approximately 35,450 m³ of alluvium (6,000 m³ from the tailrace site, and 29,450 m³ from the intake and weir sites), and 81,675 m³ of rock (72,900 m³ from the intake tunnel, power plant and tailrace sites, and 8,775 m³ from the intake and weir sites) will be excavated.

The main disposal site for rock and alluvium will be located on the Proponent's 3.93-ha property, on two benches above the Kettle River, well above the possible maximum high water or flood level. There would be segregation of potentially acid-generating (PAG) and non-PAG material. PAG material would be stored in the existing tunnel from the historic powerhouse. If the volume of PAG rock is greater than that of this tunnel, PAG material would be stored at the main disposal site.

In the worst case scenario of storing a maximum volume of PAG rock at the main disposal site, the site would cover an area of roughly 130 m by 200 m (2.6 ha). This is also based on storing all of the spoil alluvium and rock material from the weir/intake site, which will not be the case, since some of this material, provided it is not PAG material,

will be used for construction purposes. If none of the excavated material is identified as PAG material, then the existing tunnel would not be used for storage, and the dimensions of the storage area may be somewhat larger than 130 m by 200 m, but the configuration of the area would be different, because there would be no segregation of materials (more material would be placed on the lower river bench). The estimated maximum height of the rock storage area on the upper river bench would be approximately 5 m to 8 m.

The Proponent conducted and reported on ML/ARD investigations in 1999, 2001, 2002 and 2005. These scoping-type investigations included geological mapping and assessment, analysis of rock samples collected at the Project site, and identification of mitigation strategies. It was determined that the greater majority of the surface and underground materials disturbed by the Project will likely not generate ML/ARD. However, surface geological mapping indicates that some of the excavated rock may be PAG.

The Proponent has committed to ML/ARD testing, mitigation and monitoring measures that adhere to the recommendations of federal and provincial agencies. These measures included the following (see Appendix D - *Proponent's Table of Commitments and Assurances*):

- prior to construction, obtaining and testing representative samples along the tunnel alignment (drilling), and also in areas to be excavated for the powerhouse and tailrace;
- on-site sampling and testing of materials during excavation, and routine analyses in a commercial laboratory to corroborate the testing;
- supplying to agencies, for their review, detailed plans for monitoring and decision making protocols, together with detailed engineering plans for safe storage of PAG rock, should this be necessary;
- segregation and secure long-term storage of PAG rock; and
- ongoing maintenance of storage structure(s), and monitoring of seepage and runoff prior to discharge.

The secure storage solutions, should this be necessary, include encapsulating PAG rock/material in:

- the dry conditions of the existing tunnel (historic power project) which would be sealed at both ends (a capacity of approximately 2,000 m³ of the rock excavated for the Project); and
- if necessary (i.e. if the volume of PAG rock is greater than that of the existing tunnel), a conventionally engineered rock pile that is contoured and capped with a multi-layer composite (including both geomembranes and geo-textiles) to provide secure storage with zero water infiltration, to be located on a bench of the river above the high water level, within the 3.93-ha parcel of land owned by the Proponent.

In completing its assessment of potential Project effects, the Proponent concluded that, with the testing, mitigation and monitoring measures that will be implemented, and the secure waste rock disposal/storage options proposed, potentially acid-generating (PAG) materials should pose no threat of contamination to the Kettle River.

MEMPR has concluded that if materials with the potential for ML/ARD are encountered during the development, use of both the historic tunnel and elevated bench with cover for secure storage are sound approaches that, if engineered appropriately, should help to prevent and control any potential ML/ARD that occurs.

NRCAN has concluded that the Proponent adequately addressed the concerns that NRCAN had identified with respect to potential ML/ARD, the sampling and testing programs, and the disposal strategies proposed for waste rock produced during construction of the tunnel.

4.2.8 Water Quality Monitoring

Kettle River water quality data collected by Environment Canada from 1979 to 2002 is summarized in the Additional Information submission under Water Quality Baseline and Monitoring Programme (Specification #10). This includes data on physical parameters (hardness, pH, turbidity and conductivity), major ions (alkalinity, calcium, chloride, fluoride, magnesium, potassium), nutrients (phosphorus, nitrogen), and metals. Some gaps in the available baseline data were identified, due to quality assurance problems and contamination of samples.

Specification #11 of the Additional Information submission, and Appendix D - *Proponent's Table of Commitments and Assurances* in this Report, describe the water quality monitoring and reporting program that the Proponent has committed to developing and undertaking in consultation with agencies.

The program will provide additional pre-Project, construction-stage and post-Project baseline water quality information for the Kettle River, including detailed information on chemical, physical and biological conditions for a range of flow and seasonal conditions (spring, pre-freshet period; high flow, freshet period; post-freshet, high temperature period; and fall, low-flow period). Samples will be collected at four sites, above the head pond, within the head pond, immediately downstream of the tailrace, and near the Canada/US border. Additional sites will be selected to monitor potential water quality impacts during construction.

The program will include the reporting of all data collected, and an assessment to compare these data with historical baseline information. If changes in water quality associated with the Project operation are noted, and such changes are determined to have a potentially negative impact on the aquatic environment, adjustment of Project operations will be undertaken to alleviate noted problems. If despite operational adjustments, water quality problems persist, agencies will be consulted to develop appropriate mitigation.

The program will be implemented one year prior to the commencement of any instream construction, and will continue for at least three years after the commencement of operations. Following this, the Proponent will prepare Water Quality Objectives for the Kettle River for the area of Project influence, to guide long-term operational and compliance activities related to water quality, thereby ensuring that the Project does not have any negative effects on water quality in the river.

Monitoring of water and composite sediment samples will measure a full suite of metals, including inorganic mercury, as well as dissolved oxygen, turbidity and temperature. Analysis of sediment samples will include particle size, total organic carbon and total metals. In addition, benthic invertebrate and algae (periphyton) populations will be sampled and characterized at the water quality sampling sites/locations.

MoE has concluded that the additional information requested, and the commitments or clarifications required with respect to water quality monitoring, have been satisfactorily provided.

4.3 Wildlife Habitat, Wildlife and Vegetation

Project Area

The Project is located in a dry valley of the Kettle River, in an area where the forest cover has been modified by farming, rural dwellings, transportation infrastructure, a gas pipeline and other human activities.

Potential Project Effects

The footprint of the Project includes the following:

- The approximately 750-m-long head pond upstream of the weir, which will be contained entirely within the existing natural river channel.
- The underground tunnel to convey water from the head pond to the power plant (*Note – As discussed under section 4.1 - Fish and Fish Habitat, through Project redesign, this replaces a 800-m-long surface canal and penstock.*)
- The power plant, located near the site of the previous powerhouse, and spoil/waste alluvium and rock disposal areas, which will be located entirely within the 3.93-ha parcel of land owned by the Proponent.
- The approximately 300-m-long transmission line connecting the power plant to the electrical grid, which will be located entirely within existing right-of-ways.
- Access and staging area (approximately 4 ha) for the construction of the weir and power plant intake structures, which will utilize an existing right-of-way and trail.

The spoil/waste alluvium and rock will be disposed of in up to three locations - on the 3.93-ha parcel of land owned by the Proponent, in the vicinity of the weir and power plant intake site, and in the existing tunnel from the historic power project. The existing tunnel will only be used for disposal of PAG rock, if any is excavated (see section 4.2.7 - *Acid Rock Drainage*). Some of the waste material from the weir/intake site, provided that it is not PAG material, will be used for access road improvement, for raising and levelling the 1-ha construction staging area, for backfilling structures, and for rip-rap. The remaining material will be hauled to the main disposal site on the Proponent's 3.93-ha property.

Potential effects from the construction and operation of the Project on wildlife, wildlife habitat and vegetation include:

- the alteration of aquatic habitat utilized by wildlife (head pond, changes to the flow regime in the Cascade Canyon downstream of the weir, and tailrace area);
- flooding of riparian habitat (head pond);
- temporary construction noise and disturbance of wildlife;
- accidental wildlife mortality; and
- surface disturbance and clearing of vegetation.

The Additional Information submission provides specific information on the following:

- Wildlife Protection (Specification #32)
- Vegetation Mapping (Specification #33)
- Plant and Animal Species and Habitats at Risk (Specification #34)
- Ungulates (Specification #35)
- Wildlife Trees (Specification #36)
- Migratory Birds (Specification #37)
- Construction – Potential Wildlife Effects (Specification #38)
- Monitoring – Wildlife and Vegetation (Specification #39)

4.3.1 Wildlife Habitat

The approximately 750-m-long head pond upstream of the weir will flood upstream riparian habitats (see section 4.1 - *Fish and Fish Habitat*). The extent of this impact will be minor, since:

- the head pond will be created entirely within the existing natural river channel;
- the difference in water elevation at the weir will be up to 1.2 m, and this will decrease as the distance from the weir increases; and
- most of the head pond area is already devoid of vegetation, due to annual scouring during freshet flows.

A small amount of riparian shrub vegetation upstream from the weir location will be cleared before the head pond area is flooded. The head pond will not flood or inundate any forested areas, and no timber removal will be required. The head pond may attract waterfowl and shorebirds. The tunnel to convey water from the intake to the power plant will avoid surface disturbance in the Canyon. The majority of the area that will be affected by the tailrace is cobble, sparsely vegetated with emergent cottonwood and willow. There is a small raised cobble bar in the tailrace area with 4-5 cottonwood trees and associated ground vegetation, which may be disturbed. A small amount of habitat will be lost due to the footprint of the weir, intake and power plant structures.

Minimal surface disturbance is expected as a result of access roads to the site. The access route for the construction of the intake and weir structures will run from the south side of the Kettle River, along the Burlington Northern Railway (BNR) right-of-way. An existing trail through Crown land on the south side of the river will be enlarged from the BNR right-of-way to the bank of the river. The approximately 1-ha flat area located on the south river bank is proposed as a staging area for construction equipment and

material. This area will be cleared, except for a few wildlife trees along the river bank.

A total of 47 high value wildlife trees were identified in the Project area. Most of the wildlife trees in the vicinity of the Project components can be preserved. Wildlife trees are most vulnerable at the staging area for the weir and power plant intake, and near the tunnel rock disposal site. Removal of a small number of these trees (up to 5) may be unavoidable in these areas during clearing, road improvement and other Project-related activities. A maximum of 2, but likely none, of the wildlife trees identified in the other Project areas will need to be removed or otherwise adversely affected.

No new clearing or cutting of trees is required for the 300-m transmission line, which will follow existing cleared right-of-ways.

Aggregate materials for Project construction will either be taken from Project excavations or purchased from local suppliers. No off-site borrow pits will be developed for the Project.

Construction activities will be undertaken in a manner intended to minimize impacts on wildlife habitat. Measures that will be applied during and post-construction to mitigate the effects of the Project on wildlife habitat include the following (also see section 4.3.2 - *Wildlife*, and section 4.3.3 - *Vegetation*).

- Preservation of wildlife trees will be ensured through design plans for the work sites.
- Areas to be cleared will be clearly marked prior to commencement of clearing. Trees or plant communities that are to be protected will be marked and/or surrounded by fencing to ensure their protection.
- As many as feasible of the large veteran (old growth) ponderosa pines on top of the south riverbank in the vicinity of the access route to the intake will be retained.
- Wildlife trees that cannot be retained will be compensated for, using established techniques, and the compensation will be monitored to ensure success.
- Areas of vegetation temporarily disturbed during construction will be restored with native plant species, and monitored in accordance with the specifications in the Wildlife and Vegetation Protection Plan.

In completing its assessment of potential Project effects, the Proponent concluded that:

- The amount of aquatic habitat utilized by wildlife that will be altered and lost as a result of Project components will be small, and is considered to be insignificant in relation to the carrying capacity of regional habitats for most wildlife species.
- The head pond is expected to have little or no impact on riparian vegetation.
- The steep rock walls of the Canyon offer limited suitable habitat for most wildlife species and no change to the habitat is expected as a result of the diversion of river flows from the Canyon to the power plant.
- The small amount of habitat that will be lost due to the footprint of the weir, intake and power plant structures is considered to be insignificant in relation to the carrying capacity of regional habitats for most wildlife species.

MoE has concluded that the Proponent has adequately addressed terrestrial biodiversity issues.

4.3.2 Wildlife

Wildlife occurring, or which may occur, in the general Project area includes mule deer, white-tailed deer, black bear, cougar, bobcat, wolf, coyote, snowshoe hare, porcupine, yellow-bellied marmot, Columbia ground squirrel, red squirrel, north-western chipmunk, pocket gopher, deer mouse, several species of voles and bats, and game birds such as ruffed grouse, blue grouse, ring-necked pheasant, wild turkeys, and mourning dove. A relatively high number of migratory birds is expected to occur in the general Project area, although the breeding habitat occupied by many species is located at higher elevations, or is restricted to localized habitats such as wetlands, which are not present in the immediate Project area.

The Project is expected to have minimal affect on ungulate, raptor or waterfowl populations within the zone of potential Project influence. High quality deer winter ranges are located both north and south of the Kettle River, and the Project area upstream of the Canyon is an important wildlife crossing corridor for deer. However, although used year-round by deer, the valley bottom is not an important winter range, and movement is not expected to be affected by the head pond. No raptor nests were observed in the vicinity of the various proposed Project components. Potential impacts on amphibians are expected to be very low.

There are thirteen wildlife species documented in, or which likely occur in, the Project area that are "listed" federally and/or provincially – see Table 3. This list of "priority species" was selected by the Proponent because of known locations within the general area of the Project (in similar biogeoclimatic zones), and because the Project could potentially disturb them. The white-headed woodpecker was added to the list after sightings (unconfirmed) were reported in 2006. Known locations were taken into account when conducting species-specific field surveys and conducting searches for critical habitat features within and adjacent to the proposed Project footprints. Searches in the surrounding area, removed from expected disturbance, were also conducted in order to identify potential areas of conflict.

Table 3. Listed Wildlife Species in the Project Area

Species	BC Status	SARA*
Harlequin Duck (Pacific Population)	Yellow	
Great Blue heron, <i>herodias</i> subspecies	Blue	
Canyon Wren	Blue	
Racer	Blue	
Townsend's Big-eared Bat	Blue	
Western Rattlesnake	Blue	1-T
Western Skink	Blue	1-SC
Rubber Boa	Yellow	1-SC
Western Screech-Owl, <i>macfarlanei</i> subspecies	Red	1-E
Lewis's Woodpecker	Red	1-SC
White-headed Woodpecker	Red	1-E
Fringed Myotis	Blue	3-SC
Gopher Snake, <i>deserticola</i> subspecies	Blue	1-T

* E=Endangered, T=Threatened, SC=Special Concern

No harlequin ducks were observed in the Project area, and nesting activity is unlikely, due to limited amounts of suitable shoreline vegetation and the current level of human disturbance. It is not anticipated that Great Blue Herons would be affected by noise from construction. Although some suitable habitat occurs in the Project area, few herons were noted in the bird surveys conducted (*Note* - the closest rookery is sited in Rock Creek, approximately 45 km from the Project area). Bats were not found to be utilizing the historic power plant tunnel. No evidence of snake hibernacula (den sites) was observed during surveys (some small den sites are known in the area but these are not within any of the proposed footprints), and no other habitat features were identified which would be critically important for other wildlife species.

In 2006, EC indicated that surveys for Lewis's woodpecker may have been conducted too early in the year to detect this species. EC also recommended that the Proponent consult MoE on impact mitigation measures and monitoring requirements for the western screech-owl. MoE conducted surveys in the Project area for both of these species in June 2006. No Lewis's woodpecker nesting or foraging behaviour was detected in the immediate Project area, and the area appeared to lack suitable nesting features and foraging habitat. No western screech-owls were seen or heard during the survey, and habitat at the site appeared to be of low suitability for nesting/breeding use, and of moderate suitability for foraging use.

The Proponent reported the types of negative impacts that can adversely affect a number of rare wildlife species. For reptiles, these include habitat loss, habitat degradation, barriers to dispersal, and harassment from both humans and their pets.

For birds, negative impacts are strongly associated with habitat loss, reduced habitat effectiveness, collisions with vehicles, and loss of nest sites. The Proponent indicated that the greatest potential for negative impacts as a result of the Project will be during construction, either resulting in displacement or direct mortality of some individuals. Traffic along the access road to the weir/intake site may result in the direct mortality of snakes. The 1-ha weir/intake construction staging area will be built in a previously disturbed site, and while trees will be removed, a number of identified wildlife trees will be retained. The powerhouse will be constructed adjacent to the previous powerhouse footprint, with little disturbance to the limited amount of vegetation currently there.

Local wildlife populations can be affected by roads and trails that allow public access, since this may lead to harassment and mortality. Much of the area in the vicinity of the Project is currently disturbed by highways, multi-use trails, transmission line and gas pipeline right-of-ways, rail lines and an industrial work yard. As a result, development of the Project is not expected to provide greater access than what is already available.

Wildlife are not expected to be impacted by the power plant intake, as redesigned, with the tunnel replacing the surface canal for conveying water. The depth of water covering the intake openings, the predicted low approach velocities near the intake, the trash rack bars on the structure, and the debris-catching boom upstream, will prevent wildlife from entering the intake.

Construction activities will be undertaken in a manner intended to minimize impacts on wildlife. Measures that will be applied during and post-construction to mitigate the effects of the Project on wildlife include the following (also see section 4.3.1 - *Wildlife Habitat*, and section 4.3.3 - *Vegetation*):

- Prior to construction, additional surveys, using appropriate methods and during appropriate timing windows, will be conducted to determine whether the listed species identified in Table 3 are present in the Project area, and could potentially be adversely affected by construction activities. Further surveys and/or monitoring will be conducted during construction. Details will be finalized, in consultation with regulatory agencies, in the Wildlife and Vegetation Protection Plan.
- If listed species identified in Table 3, or other species, are confirmed in the Project area, and could potentially be adversely affected by construction activities, appropriate mitigation and/or compensation measures will be established in consultation with agencies.
- Species-specific surveys for the listed bird species identified in Table 3 will be conducted during the nesting season, prior to the start of, and during, construction. If occupied nest sites are found, appropriate mitigation measures, such as set-back buffers and construction activity time restrictions, will be established, in consultation with agencies.
- Site clearing (removal of trees and vegetation) will take place outside the bird breeding/nesting season.
- Wildlife trees have been identified and tagged. Suitable wildlife trees, especially large diameter deciduous trees, will be retained where possible.
- Noise-related construction activities (blasting) will be undertaken during seasonal timing windows (fall and winter), when important breeding or life-cycle requirements of birds (nesting) and mammals are less likely to occur.

- The poles for the 300-m transmission line will be designed to discourage bird perching and nesting activities.
- Suitable markers will be installed on the transmission line where it crosses the river, to minimize the risk of bird collisions.
- Nest boxes will be erected in suitable locations in and around the Project.
- Fencing will be installed around work areas during construction, to prevent accidents involving wildlife.
- All refuse generated during construction will be disposed of in a manner intended to prevent wildlife from being attracted to work sites.
- A record of accidental wildlife kills in the study area will be kept during the construction and operation of the Project, to determine whether there are any interactions that could affect the long-term viability of native populations.
- The power plant intake structure will be monitored during operations to determine whether any wildlife species are being impacted.
- A record will be kept of the wildlife species associated with the wildlife trees in the Project area, and those species which use the head pond.
- Specific measures that will be undertaken during construction, to minimize impacts on snakes, include: monitoring for snake presence and use of snake-proof fences to direct snakes to undisturbed habitats; relocation of rocks and cover objects from areas frequented by work crews to locations outside the work area, in order to avoid potential interactions; and relocation of rattlesnakes that are encountered. Hiding cover and basking sites will be provided during reclamation of work sites.
- Post-construction, plans will be developed, in consultation with local property owners and tenure holders, to discourage motorized vehicles from using the access road to the weir/intake site.

In completing its assessment of potential Project effects, the Proponent concluded that, overall, because the Project area and the footprint of Project components are small, and habitat has already been disturbed by the previous hydroelectric power project and subsequent human activities, any impacts on wildlife from the construction or operation of the Project are anticipated to be of short duration, and probably insignificant.

MoE has concluded that the Proponent has adequately addressed terrestrial biodiversity issues. Given the habitat attributes present in the immediate Project area, the Proponent's commitments, and the opportunity for review and input into the Wildlife and Vegetation Protection Plan prior to construction, MoE has concluded that the risk to western screech-owls, Lewis's woodpeckers, and white-headed woodpeckers (all red-listed species) from the Project is low.

4.3.3 Vegetation

Vegetation resources were assessed in a 100-m corridor on either side of the Kettle River, extending from 2 km upstream of the proposed weir site to approximately 0.5 km downstream of the Canyon. Areas impacted by Project construction and operations which lie outside this corridor, are located on land that has been heavily disturbed/modified in the past, and are mainly restricted to privately owned land. The leased land in the staging area extends beyond 100 m from the river, and surveys were conducted in this area.

Natural forest cover occurs on both the north and south banks of the Kettle River in the Project area, where it is interspersed with rocky outcrops. Forest cover is more extensive on the south bank than the north bank, which has been significantly affected by land use activities.

On the north bank of the river, the Project area is a composite of fields, pasture, orchards, roads, a recreational vehicle park, and narrow discontinuous mixed stands of young ponderosa pine, cottonwood and Douglas-fir. On the south bank of the river, upstream of the Canyon, predominately young Douglas-fir forests are interspersed with rural homes. Immediately downstream of the old powerhouse site, the river channel widens to include floodplains with ponderosa pine and cottonwood. Mixed Douglas-fir and ponderosa pine border a golf course further downstream on the south bank of the river, while dense stands of western red cedar occur downstream on the north bank.

The river margin is mostly cobble, and sparsely vegetated, although there are several shallow, sandy, floodplain areas both upstream and downstream of the Canyon. For the most part, these sandy floodplain areas are barren, or contain a mixture of early seral communities of sedges, grasses, forbs, willows and cottonwood. However, a few of the floodplain areas (upstream of the proposed impoundment and weir site, and downstream of the powerhouse site on both sides of the river) support small clusters of large cottonwood trees in close proximity to the river margin.

The Project will not impact either vegetation classified as environmentally sensitive in the areas adjacent to the Canyon, or a steep escarpment on the north bank of the river downstream of the Canyon.

The head pond created by the weir will cause little if any flood damage to vegetation along the riverbanks. The weir site is largely unvegetated. No new clearing or cutting of trees is required in the transmission line route. The tailrace location, situated on an active floodplain, was shifted so that excavation and related activities will not infringe on a rare plant community (cottonwood trees and associated ground vegetation).

Areas of mature forest cover that will be impacted by construction activities are limited in extent, and do not contain any rare plants or rare plant communities. The grassy slope above the intake site contains several provincially yellow-listed species (ecological communities and indigenous species which are not at risk). Other Project sites that will be impacted by construction are located in previously disturbed areas, and support early seral vegetation, dominated by grasses, shrubs and immature trees.

The access route to the intake and weir structures and the staging area runs from the south side of the Kettle River, following the BNR Right-of-Way and a trail through Crown land, to reach the river. Access will require removal of mostly second-growth forest cover (ponderosa pine, Douglas-fir, and birch) and shrubs (e.g. beaked hazelnut, Douglas maple, snowberry, and Oregon grape). Grasses, shrubs, and immature tree regeneration dominate vegetation communities in the already-disturbed areas of the power plant and waste rock disposal/fill sites.

Construction activities will be undertaken in a manner intended to minimize impacts on vegetation. Measures that will be applied at work sites during and post-construction to mitigate the effects of the Project on vegetation include the following (also see section 4.3.1 - *Wildlife Habitat*, and section 4.3.2 - *Wildlife*):

- Developing and implementing a design plan, which will retain as many as feasible of the large veteran (old growth) ponderosa pines along the river bank in the vicinity of the access route to the intake.
- Avoiding, wherever possible, red-listed and blue-listed plant species and communities, or those which are listed as “of concern”, or which are locally rare or unique.
- Use of bioengineering techniques for bank stabilization (e.g. at the intake site).
- Planting native coniferous and deciduous tree plugs and plugs/cuttings of native shrubs, to restore species diversity and structural complexity.
- Seeding native grass and herb species in disturbed areas to provide quick ground cover, to deter colonization of weed species and stabilize the riverbank.
- Weed control measures.

Hiking paths, and bike and horse trails are found on both sides of the Cascade Canyon. A horse trail encircles the proposed staging area. Completion of the pedestrian trestle bridge over the river on the Trans-Canada Trail, and improved access to Canyon trails from Highway #395, are expected to increase access and visits by the public to the Canyon area. This could result in impacts on vegetation, and wildlife habitat alteration through trampling, erosion, and indiscriminate trail construction.

The Proponent concluded that:

- The overall impact of the Project on native vegetation would be low. Impacts will be short-term, and limited to regionally common vegetation associations with a high probability of re-establishing a pre-construction plant community within three years following completion of restoration measures.
- The reduced flows between the weir and the power plant will have little impact on vegetation in the Canyon. The steep walls on both sides of the river are formed in bedrock, and are largely barren, except for ledges which support bryophytes and scattered vascular plants. No rare bryophyte species (mosses, liverworts or hornworts) were found in the spray zone of the Canyon. Except during extremely high flows, the spray zone is limited to the small area surrounding the Falls, and during high-flow events, the water diverted to the power plant is generally not significant in terms of the generation of spray.
- The Project itself is not expected to increase public use of the Canyon. Most people are expected to visit the power plant and museum/interpretive centre, which are across Highway #395 from the Canyon.
- There are no significant factors that would limit revegetation of sites that are temporarily disturbed by Project construction. A moderately steep embankment at the site of the intake structure will be stabilized and re-planted.

Post-construction, the Proponent has committed to monitoring vegetation within its property and leased land, as well as over immediately adjacent Crown lands, to assess any changes from increased public use.

MoE has concluded that the Proponent has adequately addressed terrestrial biodiversity issues.

4.4 Transboundary Effects

The Project (power plant) is located on the Kettle River approximately 5 km upstream of the British Columbia and Washington State (Canada and United States) border. The Additional Information submission provides specific information on potential transboundary effects under specification #40. Potential transboundary effects from the construction and operation of the Project include impacts on: river flows and water levels; water quality; fish and aquatic habitat; and wildlife and migratory birds.

Potential transboundary effects from the construction and operation of the Project, and the mitigation and monitoring or compensation measures identified to address these potential effects, are discussed in this Assessment Report under the following sections:

- water quality in the Kettle River - section 4.1.3 - *Project Operation*, section 4.1.4 - *Project Construction*, and section 4.2 - *Water Quality*,
- fish and aquatic habitat in the Kettle River - section 4.1 - *Fish and Fish Habitat*, section 4.2 - *Water Quality*,
- wildlife and migratory birds in the Project area - section 4.3 - *Wildlife, Wildlife Habitat and Vegetation*.
- environmental management plans - section 4.5 - *Environmental Management Plans*.
- accidents and malfunctions - section 4.6 - *Accidents and Malfunctions*.
- water availability in the Kettle River upstream of the Project - section 4.12 - *Water Resources*.

In completing its assessment of the Project, the Proponent reached the following conclusions in regards to any potential effects downstream of the power plant and the British Columbia and Washington State border:

Flows and Water Levels

- The Project is designed as a run-of-river hydroelectric facility with no provision for water storage. There is not enough water storage in the head pond to enable load factoring/shaping. Downstream of the power plant, the river flow will be that which is naturally available, and will ramp (fluctuate) at its natural rate.
- Coordinated operation of Project component design features will allow for controlled ramping during normal operations, and for emergency, maintenance or low-flow shutdowns. A ramping protocol will be established that includes a continuous recording gauge and permanent transect in the Kettle River, sited at a location approximately 600 m downstream of the power plant.
- In the event of an emergency shut down of any or all generating units, or any other condition requiring a rapid change in flow through the turbines, there will be no change in the flow downstream of the power plant.

Water Quality

- During construction, the only potential for water quality impacts would be if the de-watering and containment systems were to fail. The implementation of environmental management plans and monitoring measures, including those for

accidents and malfunctions and spill contingencies, will ensure that the integrity of water quality in the Kettle River downstream of Project construction sites is not compromised.

- The greater majority of the surface and underground materials disturbed by the Project will not result in ML/ARD. A portion of the new tunnel, the power plant foundation and the tailrace may encounter PAG rock. During construction, sampling will be conducted for PAG rock, and if encountered/confirmed, excavated PAG rock will be segregated, and stored securely (see section 4.2.7 - *Acid Rock Drainage*), so that no oxidation products can be flushed into the Kettle River.
- During operation:
 - the natural downstream movement of bed load, large woody debris and suspended solids will not be affected by the Project.
 - the small head pond is expected to have a negligible effect on mean water temperature; and
 - the diversion of water through the tunnel to the power plant will have a positive effect on (i.e. will reduce) naturally occurring high total gas pressure (TGP) values below Cascade Falls.
- A water quality monitoring program will provide additional pre-Project, construction-stage and post-Project baseline water quality information for the Kettle River, including detailed information on chemical, physical and biological conditions for a range of flow and seasonal conditions. One of four sampling sites will be located near the Canada/US border, to monitor potential water quality changes before the river flow enters the US.

Fish and Aquatic Habitat

- The construction and operation of the Project is predicted to have no negative effects on existing fish populations downstream to the Canada/US border.

Wildlife and Migratory Birds

- Adherence to construction windows and monitoring measures should ensure prevention of any transboundary (Canada/United States) effects from the Project involving wildlife, including migratory birds.

Environmental Management Plans

- Mitigation and monitoring measures that will be implemented through environmental management plans, including those to address accidents and malfunctions, will minimize or prevent potential impacts from construction and operation of the Project.

The Proponent sought and received an exception under the *International River Improvements Act (IRIA)* for the Project from the federal Minister of Environment. Section 3 of the *International River Improvements Regulations* states that an international river improvement is excepted from the operation of the *IRIA* if the improvement has, or will have, in its operation, an effect of less than 3 cm on the level or less than 0.3 m³/s on the flow of water at the Canadian boundary. The Proponent provided the information required under subsection 3(2) of the regulations, and stated that the Project is a run-of-river hydro-electric facility with insignificant storage and, therefore, will not affect water flow or level at the international border. Environment Canada concurred with the Proponent's interpretation that the Project qualifies as an exception from the operation of the *IRIA*.

The Proponent has identified mitigation and monitoring measures to address potential adverse construction and operational effects from the Project, and has committed to implementing these measures in environmental management plans that will be finalized in consultation with agencies prior to the commencement of construction.

The State of Washington Department of Ecology has indicated that concerns it identified about the possible effects of the Project on water temperature and TGP, and recommendations for water quality monitoring, were adequately addressed by the Proponent. In regards to the potential effects of the Project on availability of water in the Kettle River for other future uses, the Department of Ecology indicated that: it does not foresee any impairment issues relating to impacts of the Project on existing water rights and/or claims located within the Water Resources Inventory Area 60, the State's portion of the Kettle River watershed (see section 4.12.1 - *Water Availability in the Kettle River*).

4.5 Environmental Management Plans

The Additional Information submission provides specific information on environmental management plans for construction and operation of the Project under specification #42. The management plans that will be implemented include the following (see Appendix D - *Proponent's Table of Commitments and Assurances*):

- Environmental Management Plan
 - Fish and Fish Habitat Plan (including Habitat Mitigation and Compensation Plan)
 - Erosion and Sediment Control Plan (including Siltation Contingency Plan, and Erosion Contingency Plan)
 - Wildlife and Vegetation Protection Plan
 - Access Management Plan
 - Traffic Management Plan
 - Occupational Health and Safety Plan
 - Accidents and Malfunctions and Emergency Response Plan (including Petroleum, Hazardous and Solid Waste Management Plan, and Spill Contingency Plan)
 - Communications Plan
- Environmental Monitoring Plan
 - Monitoring component of the Fish and Fish Habitat Plan
 - Mitigation and Compensation Plan
 - Compensation Monitoring Plan
 - Water Quality Monitoring Plan (including Water Quality Objectives for the Kettle River)
- Archaeological Monitoring Plan

The Proponent will retain independent, qualified environmental monitor(s) to be present on-site during construction of the Project components. They will prepare monitoring reports, have the authority to stop construction activities, and report any environmental issues or accidents to the appropriate authorities.

In completing its assessment of potential Project effects, the Proponent concluded that the mitigation and monitoring measures that will be implemented through environmental management plans will minimize or prevent potential impacts from construction and operation of the Project.

MoE has concluded that the additional information requested, and the commitments or clarifications required respect to environmental management plans, has been satisfactorily provided.

4.6 Accidents and Malfunctions

The Additional Information submission, under specification #43, provides an assessment of the environmental effects of potential accidents and malfunctions that may occur during construction and operation of the Project.

Potential accidents and malfunctions could include the following.

- During construction and operation: spills involving the transport, to and from the development by road, of goods which are potentially harmful to the environment (e.g. petroleum products, special wastes or other hazardous materials); and spills related to waste management at the Project site (including solid and liquid waste disposal).
- During construction: fuel and lubricant spills during vehicle maintenance activities; equipment coolant leakage or spills during transport to the site; spillage of construction materials; and coffer dam failure.
- During operations: coolant and lubricant spills; surge release of impounded water; intake blockage; and emergency shutdown events.

Potential accidents and malfunctions will be addressed through best management practices, adherence to relevant guidelines, engineering (design) and construction requirements (codes), and the implementation of the following:

- Erosion and Sediment Control Plan (including Siltation Contingency Plan, and Erosion Contingency Plan)
- Accidents and Malfunctions and Emergency Response Plan (including Petroleum, Hazardous and Solid Waste Management Plan, and Spill Contingency Plan)
- Emergency shut down design and control features for the facility

Spills and Wastes

Vehicles transporting goods potentially harmful to the environment will be equipped with appropriate spill kits, and staff will be trained in the use of the kits. Spill kits and trained personnel will be readily available on-site during construction and operation of the Project. Should a spill of a substance potentially harmful to the environment occur, the spill contingency plan and appropriate clean up procedures will be implemented immediately. Any spill of a substance which is potentially toxic to aquatic life, where of reportable quantities, will be reported to the Provincial Emergency Program. Structures and equipment supports for operation of the Project will be designed in accordance with relevant regulations, to contain and collect any spills for appropriate disposal.

Appropriate permits will be obtained for any material being transported that is classified under the provincial *Environmental Management Act*. The management of waste (including solid and liquid waste disposal) during construction and operation of the Project will conform to relevant regulations and bylaws. Refuse will be disposed of in an appropriate manner, to prevent the attraction of wildlife.

Structure Failure

Structures required for construction (i.e. coffer dams) will be designed by qualified personnel. In the event of a structure failure, the release of deleterious substances (including sediments) into the aquatic environment may occur, and spill and siltation contingency plans would be implemented immediately. During operation, surge flows due to failure of weir controls could result in stranding of fish in side channels upstream of the weir. In the event of such a failure, upstream habitats will be monitored for stranded fish, and fish salvages will be performed by a trained local response team. During operation of the Project, appropriate signage and fencing will be utilized to warn and protect the public from the sudden release of impounded water through the Canyon.

Emergency Shutdown

Also see section 4.1.3 - *Project Operation* for additional discussion regarding this topic.

Intake blockage would be expected to occur only during high flow conditions, when there is the largest amount of debris material in the water. The intake will be submerged, and the likelihood of blockage by material, most of which will be floating, is expected to be low. Given the size of the intake trash rack area, blockage would build up over an extended period, and would not be a sudden event. Water level sensors would detect a drop in water level downstream of the trash rack, causing the turbines in the power house to shut down gradually, and the bypass valves to open. If the head pond upstream of the weir rises, a sensor will signal the low-level outlet gate to open further, or the rubber weir to deflate, to maintain a constant pool level.

In the event of an accident or malfunction that results in an emergency shutdown of the power plant, such as a power line or generation problem, the bypass valves attached to each operating turbine will respond simultaneously, maintaining the same flow through the powerhouse and downstream of the weir.

4.7 Cumulative Environmental Effects

The Additional Information submission provides an assessment of the potential cumulative environmental effects of the Project under section 8.0 of the main report and specification #41. The *CEAA* describes cumulative environmental effects as those that are likely to result from the Project in combination with other projects or activities that have been or will be carried out.

The Proponent's assessment of cumulative environmental effects gave consideration to the following factors:

- Scope, including geographic scope and temporal scope.
- Past projects, including mining and smelting, hydroelectric power generation, forestry and railways.
- Other current and future projects and factors, including municipal sources of effluent, agriculture, and Kettle River water quality.
- Potential direct environmental and socio-economic effects of the Project, including those related to Project construction, power plant operation, altered river levels in the impoundment area, and the transmission line.
- Potential residual effects with the proposed mitigation and compensation measures in place.

In completing its assessment, the Proponent reached the following conclusions in regards to past, present and future projects and the potential cumulative effects of the Project:

- No significant cumulative environmental effects have been identified as a consequence of historical mining and smelting, hydroelectric projects, forestry operations, or the operation of railways.
- The Project is located downstream of the Grand Forks Aquifer, and would have no impact on either recharge or use of water from the Aquifer.
- No significant cumulative environmental effect on water quality in the Kettle River is expected to result from the Project facilities.

In completing its assessment of potential cumulative effects, the Proponent identified the following residual effects associated with the potential direct effects of the Project:

Potential Residual Environmental Effects

- A loss of, or effect on, vegetation and wildlife habitat due to the infrastructure footprint (Project construction and operation).
- An effect on birds associated with the transmission line.
- An impact on fish populations due to fish entrainment (into the power plant intake) and associated turbine mortalities.
- A net positive effect on TGP (i.e. a reduction), benefiting all aquatic species in the Kettle River downstream of the Project. (*Note* - The direct effect of the Project on water temperature will be biologically insignificant, and the cumulative effect will be insignificant. Since fish are more susceptible to the effects of high TGP levels at high water temperatures, reduced TGP levels would be beneficial in mitigating the effect of a minimal increase in mean water temperature.)

Potential Residual Socio-Economic Effects

- An impact on the appearance (aesthetics) of the cascades in the Canyon and Cascade Falls associated with a reduction in river flows below the weir.
- A reduction in access for anglers.
- A loss of kayaking features.
- Noise impacts.
- Availability of water licences in the future.

4.8 Changes to the Project Caused by the Environment

The Additional Information submission provides an assessment of potential changes to the Project that may be caused by climatic change (see section 2.3.5 of the Main Report, and specification #6 Hydrological Assessment), and geologic stability (see section 2 of the Main Report, and specification #20 Geological Investigation).

Climatic Change

In completing its assessment, the Proponent reached the following conclusions in regards to the potential effects of climatic change on the Project:

- There is a fairly consistent opinion that, in central BC, average temperatures will continue to rise with global climatic change. This could have the following effects on the hydrologic regime of the Kettle River:
 - The winter boundary between snowfall and rain will rise to higher elevations, resulting in a much higher percentage of the winter precipitation over the Kettle River drainage basin falling as rain. This will tend to increase late autumn and winters flows, and augment energy production during the season when it is most valuable.
 - The average spring freshet, which is mainly snowmelt, will be smaller. This will have no effect on the Project, as there is currently a very large surplus of water during this season.
 - The summers will be hotter and drier, resulting in reduced flows in late summer and early autumn. This will reduce energy production, but the effect will not be great during the early autumn period, because recorded flows are already marginal for power production at this time.
- Considering the above factors, climatic change will probably result in a seasonal shift of power production with no overall reduction.

Geologic Stability

In completing its assessment, the Proponent reached the following conclusions in regards to the potential effects of geologic stability on the Project:

Geology of the Site Area

- Soil and bedrock mapping did not reveal any significant geological engineering issues which would cause concern for the Project. Drilling investigations will be conducted along the tunnel alignment, and in the powerhouse area, to provide geotechnical information for the detailed design of these Project components.

Slope Stability

- With the redesign of the Project and reduced water levels during low flows, there will be no significant impact on river bank slope stability in the head pond.
- As the river profile and velocity will not be changed by the Project at very large discharges, there will be no change in the rate of erosion of the head pond river

bank. During extreme flood events, the Project could lower natural water levels in the head pond area (as a result of diverting a portion of river flow to the power plant), slightly improving river bank slope stability.

Seismicity

- The Kettle River fault is a major north-striking, east-dipping normal fault that separates rocks of the Kettle River-Grand Forks complex from rocks of the Christina Lake area. The fault is assumed to continue northwards from the junction of the Kettle River and Canada/US border, through the middle of Christina Lake, and could pass through the Project site. This location is only an estimate. The fault is not constrained, and could be going through any part of the valley. The Kettle River fault is an old structure, dating back 50 million years, and is unlikely to pose any earthquake-related problems for the Project.
- Instability due to seismic loading is not anticipated to be a problem for either the weir/intake site, the tunnel or the powerhouse site. Issues related to seismicity will be resolved during the final design of these structures.

NRCAN has noted and concluded that:

- The Kettle River fault, although not currently confirmed as an active fault, is a very large tectonic feature and could remobilize in an earthquake. Since parts of Christina Lake are known to be too warm to freeze in winter (possible hot springs), there is evidence that the fault is deep-seated and may be potentially active.
- The Kettle River fault zone could underlie the whole valley, or may be located next to the landscape scarp between the bridge area and the powerhouse site. This scarp is fairly convincing circumstantial evidence of a large fault zone in the area. The fault could run through the powerhouse and tailrace area.
- The Proponent has adequately addressed concerns in regards to slope stability and erosion, geological investigation and geological engineering issues.
- The Kettle River fault is not in a very active earthquake zone, and is unlikely to cause earthquake-related problems for the Project.. Evidence that this fault could be located in the property (Project site) should be included on the Proponent's geology map for the area.
- If there were to be a modern earthquake, it would be important for seismic safety for the powerhouse to be sited on bedrock rather than on alluvial sediments.

4.9 Conclusions

The EA review of the Project has considered: the information contained in the Additional Information submission filed on the redesigned Project; comments from the public, ONA, federal and provincial government agencies, US agencies, and local governments; and supplemental information provided by the Proponent, including responses to issues identified on its main submissions.

The Proponent has identified mitigation, monitoring and/or compensation measures to address potential construction-stage and operations-stage Project impacts on fish and fish habitat, water quality, wildlife and wildlife habitat, and vegetation, and has committed to implementing these measures in environmental management plans that will be

finalized in consultation with the appropriate agencies prior to the commencement of construction.

The Proponent agreed to the requirements specified by MoE and DFO for compensation related to potential fish and fish habitat impacts. DFO has concluded that:

- Fish and fish habitat information requirements for the Project have been satisfied.
- Assuming a positive conclusion to the Federal/Provincial harmonized EA, DFO will be in a position to work with the Proponent and the ONA to finalize operational details of the Fish and Fish Habitat Compensation Plan, as a requisite for issuance of the required *Fisheries Act* section 32 and 35(2) authorizations for the destruction of fish (rainbow trout) and the harmful alteration, disruption and destruction of fish habitat.
- It is confident that any potential residual effects on speckled dace habitat could be appropriately mitigated. Regardless of whether the federal Minister of Environment accepts the COSEWIC recommendation to list the species as endangered under the federal *Species at Risk Act*, federal authorizations would still be issued enabling the Project to proceed.

MoE has concluded that:

- The rapid, riffle and pool sequence habitat in the area of the head pond is limited in the watershed, and is considered important summer habitat for rainbow trout production. The Proponent's mitigation and compensation commitments significantly reduce the risk of impacts on aquatic productivity and biodiversity resulting from the Project.
- The additional information requested, and commitments or clarifications required with respect to water quality, and monitoring and environmental management plans, has been satisfactorily provided. The head pond would have a small temperature effect on the river, and could cause a small theoretical increase in the exceedance rates of the rearing guidelines for rainbow trout and mountain whitefish (*Note* - the Proponent has committed to undertaking monitoring prior to, and following, construction, to verify predictions and set water quality objectives specific to the Project area).
- The Proponent has adequately addressed terrestrial biodiversity issues. This includes issues related to 11 wildlife species that are listed federally and/or provincially as endangered, threatened or of special concern that occur or which are likely to occur in or near the Project area.

The State of Washington Department of Ecology has indicated that the concerns that it identified about the possible effects of the Project on water temperature and TGP, and recommendations for water quality monitoring, were adequately addressed by the Proponent.

The ONA expressed concern that Project flow reductions in the Canyon downstream of the weir will have a more negative impact on aquatic habitat than the environmental studies projected, and should be re-evaluated.

MEMPR has concluded that if materials with the potential for ML/ARD are encountered during the development, use of both the historic tunnel and the elevated bench (with a cover placed over the waste pile) are sound approaches for secure waste storage that, if engineered appropriately, should help to prevent and control any potential ML/ARD that occurs.

NRCAN has concluded that the Proponent has adequately addressed its concerns with respect to the potential for ML/ARD, the associated sampling and testing programs, and the disposal strategies for any PAG waste rock produced during construction of the tunnel.

PART B SOCIO-ECONOMIC, HERITAGE AND HEALTH EFFECTS

The following factors were included in the assessment of the potential socio-economic, heritage and health effects of the Project.

4.10 Project Rationale

Although the Proponent is not required to provide evidence of a market for the power that would be produced by the Project, the Additional Information submission, under specification #46, provides information on potential markets for the power and the means of accessing them, to demonstrate the rationale for the Project.

The Proponent noted that the Project is consistent with provincial energy policy, as described in the document "*Energy for our Future: A Plan for BC*". This incorporates the policy that the private sector will develop all new electricity generation, with BC Hydro being restricted in the future to improvements at existing plants.

The Proponent also highlighted the Canadian ratification of the Kyoto protocol, and how the Project, a run-of-river hydroelectric project, would likely be classed as a "green" electrical energy producer that can aid in the offsetting of greenhouse gas emissions.

The Project lies within the FortisBC electricity utility service area. FortisBC and BC Hydro offer wholesale transmission services to other utilities or independent power producers looking to "wheel" electricity to other parties. The Proponent indicated that electricity generated from the Project could be marketed within the FortisBC service area, within BC or out of the province to Alberta or the US (*Note* - BC Hydro actively trades power throughout the western US and Alberta through its subsidiary, Powerex).

4.11 Employment and Revenue

The Additional Information submission, under specification #47, provides information on the number of jobs and the tax revenue that will be generated by the Project.

The Proponent estimates that the Project will be constructed over a 22-month period. While major equipment components will be sourced from outside the region, construction materials and skilled trades will be sourced locally and regionally to the extent possible. It is estimated that approximately 60% of the workforce would originate from the Kootenay Boundary area. Construction would generate an estimated 105 person-years (26,230 person-days) of employment. No construction camp would be required. Once operational, the Project would create three long-term jobs.

Once operational, the Proponent estimates that about \$474,000 per year will be spent for ongoing operation and maintenance of the power generating facilities, and that most of this money will be spent locally and regionally.

The Proponent estimates that, at a net taxable value of \$10 million, annual tax revenues generated by the Project will include \$252,000 in regional and provincial taxes, \$2.14 million in income taxes, \$33,750 in corporate taxes and \$170,000 in water rentals. A portion of these tax revenues would fund community infrastructure, health and education facilities and public amenities.

4.12 Water Resources

Potential effects from the Project on water resources include those related to water availability and water quality in the Kettle River, and groundwater wells in the Project area. The potential effects on water quality in the river are discussed under section 4.1.4 - *Project Construction*, and section 4.2 - *Water Quality*. Use of river water for drinking purposes downstream of the Project was not identified. Wells form all of the known sources of drinking water in the Project area.

4.12.1 Water Availability in the Kettle River

The Additional Information submission provides an assessment of potential effects of the Project on the availability of unlicensed water in the Kettle River for future use (see section 2.4 of the main report, and specification #8). Estimates are provided of the increase in the use of water for domestic, waterworks and irrigation purposes in the Canadian portion of the Kettle River basin, upstream of the Project.

The Proponent concluded that:

- the existing volumes of water licensed for consumptive uses in the Boundary region are more than sufficient to accommodate potential upstream demand for the foreseeable future;
- new licencing for consumptive uses, unless supported by storage, is expected to be constrained by the need to maintain low flows for fish habitat; and
- if consumptive use withdrawals were to increase by 50% of the current licensed amounts, the amount of water available for power production during low-flow periods would be reduced, but would not significantly impair the viability of the Project.

Concerns were raised during the review of the Additional Information submission that the Project will fully record all the water in the Kettle River basin during the low-flow period, potentially limiting the issuance of future water licences for other uses/users upstream of the Project, and thereby impacting the future economic development within the Boundary area.

The EAO, MoE - Water Stewardship Division, and MAL met with representatives of the Boundary Water Availability Committee on December 10, 2003, to answer questions

relating to water availability. This Committee consisted of representatives from local governments and stakeholder groups.

The EAO established a Water Availability Working Group (WAWG) to provide comment and advice and retained a consultant (professional engineer), Aqua Factor Consulting Inc., to prepare a report on the effects of the Project on water allocation in the watershed. The WAWG consisted of government agencies, local governments, First Nations, and stakeholder groups, including the following:

Water Availability Working Group

Environmental Assessment Office (EAO)
EAO Consultant (Aqua Factor Consulting Inc.)
Ministry of Environment, Water Stewardship Division (MoE-WSD)
Ministry of Agriculture and Lands (MAL)
Regional District of Kootenay Boundary (RDKB)
City of Grand Forks
City of Greenwood
Village of Midway
Okanagan Nation Alliance (ONA)
State of Washington Department of Ecology
Washington State, Ferry County Board of Commissioners
Boundary Water Availability Committee
Community Futures Development Corporation of Boundary Area
Boundary Mining Association
Citizens for a Bi-National Review of the Dam (Washington State)

The WAWG met on January 15, March 24, May 18, and September 30, 2004, to identify and review options for addressing concerns about the Project's potential effects on future water availability. The Proponent also participated in the meetings.

During this period, the Boundary Water Availability Committee tabled a Survey on Water Use in the Kettle River Drainage (March, 2004) by the Community Futures Development Corporation of Boundary Area. This survey examined water sources, usage, past growth and projected future growth, water shortages and trends in meeting future water needs. Key issues identified (by 62 respondents) included: a significant lack of information provided to all citizens with a potential impact from the proposed water licence for the Project; a concern that licenced users are subject to different policing than unlicensed users; recognition of an encroaching drought situation experienced by many over the last 2 to 4 years; and lack of a planning mechanism to address the issues around water availability on a Boundary-wide basis.

The EAO established an 18-day public comment period (September 20 to October 8, 2004) for the consultant's draft report on the effects of the Project on water allocation in the Kettle River watershed. The report was presented to the public at advertised meetings in Grand Forks on September 29, 2004, and Midway on September 30, 2004. The WAWG had the opportunity to review and comment on the report prior to it being finalized.

The EAO received five submissions during the comment period. One submission was from a stakeholder group participating in the WAWG (Citizens for a Bi-National Review of the Dam). One submission was from a stakeholder group (Kettle River Review

Committee) whose representative was participating in the WAWG as a member of the Boundary Water Availability Committee. Three submissions were from individuals. The submissions indicated opposition to the Project, and concern about water availability, and raised questions about the final draft of the consultant's report on water availability. Questions were also raised about possible North American Free Trade Agreement (NAFTA) implications if a water licence for the Project were to be granted. Comments that were within the scope of the EA review of the Project were taken into consideration in finalizing the report.

The Consultant's final report, entitled: "*Potential Effects of the Cascade Heritage Power Project on the Allocation of Water in the Kettle River Basin, November 15, 2004*", notes or concludes that:

- *"...If the Project is approved and a water licence granted according to the usual procedures, the licence would have a date of precedence of 1992. As the Project would have the capacity to technically record all the water in the Kettle River except during the high flow period, the effect would be that the holder of any licence upstream of the Project with precedence after 1992 would have to provide storage water to support the licensee's use of water, or the holder of the licence would have to curtail the diversion and use of water whenever the flow is insufficient to meet the maximum requirements of the Project.*
- *The effect of the Project to record all the water in the Kettle River basin during the low flow period may be fully mitigated by an Order in Council that reserves the water for future allocation for all purposes (Case III).*
- *The water available in late summer and early fall during a drought with a return period between five and ten years is enough to meet the demand under current allocations. The current usage of water is estimated to be about half of the current water rights.*
- *The natural flow is seldom sufficient to provide the flow recommended by the fishery agencies for the preservation of fish. Stopping the use of water may not be effective in the preservation of fish in the mainstem rivers because the aquifers may absorb the increase in flow and factors other than low flow may be the cause of the stress on the fishery..."*

The Proponent has agreed to accept a water licence for the Project that would not take precedence over future water licence applications. The effect of a water reserve established by order in council would be that a licence may only be granted for the Project with a date of precedence after the date of the order, and licences for any other use of water (excluding power generation) may be granted with precedence over any licence issued for the Project.

The WAWG supported this option (Case III), and the EAO, together with MoE-WSD, the Ministry responsible for water allocation, agreed that if the Project were to be approved, it would recommend such a reserve.

The State of Washington Department of Ecology indicated that: it does not foresee any impairment issues relating to impacts of the Project on existing water rights and/or

claims located within the Water Resources Inventory Area 60, the State's portion of the Kettle River watershed; the Project is requesting the equivalent of a non consumptive power right for hydropower generation; this type of run-of-river project will not impair either upstream or downstream existing rights within Washington State; and the question regarding how any future water rights, if issued, may be affected has been considered.

The Boundary Water Availability Committee concluded that, regardless of whether the Project is approved, there are water availability issues in the Boundary area.

In regards to possible NAFTA implications if a water licence for the Project were to be granted, the EAO understands that, since a water licence for the Project would allow only a temporary (40-year) diversion of water for power purposes, this is not a bulk water sale issue. As the water would not be permanently removed from the watershed, a water licence would not create an obligation under NAFTA for the Province to allow the bulk sale of the water. Should the Province choose not to issue a water licence upon the expiry of the 40-year term, there would be no grounds for a claim under NAFTA.

4.12.2 Wells

The Additional Information submission provides an assessment of potential effects of the Project on wells in the Project area (see section 4.1.4 of the main report, and specification #9). In the Specifications, the MoE noted that the head pond was unlikely to have an adverse impact on wells. This was prior to the redesign of the Project, which resulted on a reduction of the head pond by 77%.

The Proponent identified four properties within the head pond area. Three properties had water wells which are used for domestic water supply, and one did not have a well on site. The Proponent concluded that there will be no adverse impacts upon these wells, or on the use of portable pumps to draw water from the river (under licence) in the head pond area. The Proponent also concluded that, with proper techniques, blasting is not expected to have an effect on wells in the Project area.

The Proponent committed to:

- quarterly monitoring of both water level and water quality (in relation to drinking water quality guidelines), subject to obtaining owner permission, in all operating wells within one km of rock blasting, beginning prior to the start of blasting, and continuing until construction is complete, then annually for 3 years;
- undertaking test blasts with seismographs installed to measure vibrations at various distances, to determine the limiting charges that will be permitted during rock excavation;
- rectifying, at its own cost, harmful effects on the quantity or quality of water supply at impacted wells, where these are attributable to the Project; and
- prior to construction, relocating an existing well that is on the Proponent's property in the tailrace area to a location where water volume and quality meets or exceeds the well.

4.12.3 Floodplain

The Proponent documented that portions of three properties adjacent to the head pond are below existing high water levels, and indicated that during flood events, power plant operation, and the withdrawal of 90 m³/s upstream of the Canyon, could reduce flooding on these properties, thus having a beneficial effect extending 2.5 km upstream.

The Proponent committed to ensuring that the rubber weir will not be inflated during high flows, which might threaten the floodplain upstream.

4.13 Noise

Concerns were raised during the review of the Additional Information submission about noise from turbines and other equipment operating inside the power plant, and from transformers and circuit breakers. The Proponent submitted supplemental information to that provided in its original Application. This considered potential noise at three locations - the beach at 180 m across the river (Cascade Cove beach), the nearest residence, at 210 m, and the nearest boundary of the Christina Lake Golf Course, at approximately 270 m from the power plant transformers.

The degree to which the predicted noise levels will be audible at these locations will depend upon the background noise levels. Background noise levels at the beach will likely be dependent upon the water level in the river, whereas the background noise levels at the residence and golf course may be governed by distant road traffic.

The Proponent concluded that, since the predicted noise levels from both the power plant equipment and the transformers will be below normal background noise levels, noise from the Project will be inaudible at these locations on virtually all occasions.

The Proponent committed to placing the transformers behind the power plant building, and to following the recommendations of an acoustic engineer in designing the building envelope, to ensure that it will provide suitable sound attenuation.

4.14 Recreation and Tourism

Potential effects from the Project on the local economy include impacts on recreation and tourism. The Additional Information submission, under specifications #47 and #48, provides specific information on recreation and tourism uses in the Project area, and how these would be affected. The area supports several tourism businesses, and also supports use by residents and visitors interested in hiking/walking, viewing the Canyon/Falls, trail riding, cycling, fishing, kayaking/canoeing and swimming. Hiking paths and bike and horse trails are found on both sides of the Cascade Canyon. A horse trail encircles the proposed weir/intake construction staging area. Access to the area has been improved as a result of both the completion of the pedestrian trestle bridge over the river on the Trans-Canada Trail and improvement of access to Canyon trails from Highway #395.

During the course of the EA review of the Project, concerns were raised by the RDKB, tourism businesses and associations, and the public in regards to the potential impacts of the Project on recreation and tourism use of the Cascade Canyon/Falls. These are summarized under section 2.2.2 - *Public Issues*, and section 2.3 - *Local Government Opinion and Issues*. There is strong local concern that the Project will compromise the aesthetic appeal of the Canyon/Falls. The RDKB, and local tourism businesses and associations, maintain that the economic costs from the loss of the Cascade Canyon/Falls outweigh the benefits of the Project, and the aesthetic and recreational value of the Canyon/Falls is an important, if not integral, component of future tourism industry growth of Christina Lake. It was also reported that it took years for the community of Christina Lake to recover from adverse impacts associated with the construction of the Southern Crossing gas pipeline that passes through the area, using the Trans-Canada Trail right-of-way and the trestle crossing over the Canyon.

4.14.1 Project Construction

The potential effects during the construction of the Project over a period of approximately twenty-two months include the following:

- Temporary and intermittent disruption of access and recreational use of the area during construction. This varies, depending upon the location and timing of the specific activity.
 - Closures of the Trans-Canada Trail (weir/intake site) and control of access to portions of the Proponent's property (both the power plant and excavated materials disposal area) for safety reasons.
 - Noise from blasting and visual impacts noticeable from the Trans-Canada Trail along the approaches to, and at the trestle crossing, the Kettle River, and from the river.
 - Noise from blasting (power plant foundation), equipment hauling and the stockpiling of excavated materials (from the construction of the weir/intake, tunnel and tailrace) on the Proponent's property, audible from Cascade Cove beach (across the river), the Highway #395 overlook, adjacent portions of the golf course, and closer portions of Cascade Village.
 - Dust from equipment hauling and the stockpiling of excavated materials on the Proponent's property, adjacent to the golf course.
 - Visual impacts from equipment hauling and the stockpiling of excavated materials, noticeable from Cascade Cove beach, the Highway #395 overlook and adjacent portions of the golf course.
 - Visual impacts during construction of the transmission line, from Cascade Cove beach and the Highway #395 overlook.
- Temporary and intermittent increased traffic from construction vehicles (along Highway #3 and #395; along Ponderosa Road; at the entrance/turn-off to Cascade Village, at the golf course and restaurant; and along the street accessing the Proponent's property).

In completing its assessment of potential Project effects, the Proponent concluded that:

- Temporary impacts on recreation and tourism during the construction period (approximately twenty-two months) will be mitigated by scheduling a major portion of

the work that would be expected to have visual, noise or other impacts in the autumn, winter and early spring periods, outside the Christina Lake summer tourist season.

- Most of the work in the weir/intake area will take place in low-flow periods in two consecutive years from October through April. Closure of the Trans-Canada Trail will only take place in the vicinity of the trestle (over the Kettle River) for short periods during blasting (maximum 30 minutes, from October through March).
 - Excavation of the tunnel will precede construction of the power plant, and is scheduled from October through February.
 - Excavation and blasting in the power plant area is scheduled from February through April.
 - Tailrace excavation is scheduled for October and November.
- Workers and visiting professionals involved in constructing the Project will seek accommodation in the Christina Lake area, and this should help to compensate for any temporary impacts to tourism.
 - Access to the Canyon will not be disturbed.
 - Most of the excavated materials will be stored on the Proponent's property, reducing the necessity for haulage on public roads.
 - Dust will be controlled.

MTSA-Tourism has concluded that the proposed mitigative measures that the Proponent has incorporated into the design, construction and operational phases of the Project to accommodate recreation and tourism interests, when implemented, are expected to effectively mitigate concerns related to tourism and recreation.

4.14.2 Post-Project Construction

Post-construction, the potential effects from the Project on recreation and tourism include the following:

- Change in the appearance/character (aesthetics) of the cascades in the Canyon and the Cascade Falls from a reduction in river flows below the weir.
- Change in the appearance/character (aesthetics) of the Canyon area from the physical presence of the components of the Project (weir and intake structures, power plant structure and substation, transmission line, and main waste rock disposal site).
- Change in the appearance/character (aesthetics) of the river upstream of the weir, with increased depth and reduced flow velocities in the head pond.
- Restrictions or changes to public access.

Arguably, such effects could/will, to some degree, depend upon an individuals' familiarity with the area, and time of year and river flow conditions, and would be subject to individual perceptions. (*Note* - The weir/intake will be visible to a riparian property owner, and during lower river flows, there will be higher water levels in the river channel adjacent to three riparian property owners when the head pond is created. The power plant and waste rock disposal site on the Proponent's property will be visible from a

riparian property located across the river – it has a residence, recreational vehicle park and campground).

The Proponent assessed the potential effects of the Project on existing tourism and recreational activities, and provided a visual illustration (using photographs) of the impacts of the Project's proposed flow regime on the aesthetic appeal of the Falls (see Appendix F – *Range of Flows in the Canyon/Falls*). The Proponent concluded that, once operational, the Project will not prevent current recreational use from continuing in the future (the exception being that the tailrace area and the area immediately downstream of the weir and fishway will not be available for angling, due to safety and fishery regulation constraints), but that there will be some negative perceptions among existing users relating to the change in appearance/character (aesthetics) of the area. The opponents of the Project disputed the Proponent's conclusion that the net effects of the Project on tourism are expected to be positive, given the introduction of new activities of interest to a broader population base that will increase tourism opportunities.

In responding to the concerns raised that the economic costs from the loss of the Cascade Canyon/Falls outweigh the benefits of the Project, and the aesthetic and recreational value of the Canyon/Falls is an important, if not integral, component of the future tourism industry growth of Christina Lake, the Proponent noted, or has committed to, the following:

- The lake (Christina Lake) is the key natural feature, and is the main reason tourists and summer residents come to the area.
- There will be no construction disturbance within or along the Canyon. The redesigned Project, which incorporates an underground tunnel, has eliminated the surface disturbance that would have occurred from the canal. The Canyon/Falls is closely surrounded by existing development, including Highways #3 and #395, a railway, transmission lines, gas pipeline, the Trans-Canada Trail (which follows the old Kettle Valley Railway), Cascade Village, rural residential development, a recreational vehicle park and campground, and a golf course.
- The Falls will not be lost, and viewers' impressions of the Falls are subjective - the beauty of the Falls is not directly proportional to the flow. The Falls will still provide an impressive and beautiful spectacle. During high-flow periods, it will be difficult to distinguish between a natural flow and a flow reduced by the Project. During operation, minimum weir bypass flows ranging from 4 m³/s to 20 m³/s will be maintained in the Canyon for fish and fish habitat, and these flows would frequently be exceeded. During periods of very low flow, the facility will not operate, and the Falls will retain their natural flow levels. When operating, the Project would reduce average natural flows in the Canyon/Falls from June to September approximately as follows (Note – this is based on natural flows recorded for the five-year period 2001-2005 - estimates for the reduced flows are skewed upwards for September by unusually high flows in 2004, and actual average reduced flows may be slightly lower than estimated here):
 - June 1st to 15th - from 239 m³/s to 149 m³/s
 - June 16th to 30th - from 155 m³/s to 65 m³/s
 - July 1st to 15th - from 70 m³/s to 8 m³/s
 - July 16th to 31st - from 29 m³/s to 8 m³/s
 - August 1st to 15th - from 14 m³/s to 7 m³/s

- August 16th to 31 - from 9.4 m³/s to 7 m³/s
 - September 1st to 15th – from 8.8 m³/s to 8.8 m³/s (essentially unchanged)
 - September 16th to 30th - from 14.5 m³/s to 6 m³/s
- Local interested parties will be consulted on the architectural design of the power plant building. Other structures will be designed to be as inconspicuous as reasonably possible. The entire weir structure will be submerged when river flows are in excess of 240 m³/s (the estimated 1-in-20-year flood event for the river is approximately 750 m³/s), but the intake control structure will remain visible.
 - The redesigned Project, with underground tunnel, reduces waste rock by approximately 60% from the originally proposed surface canal. The edges of the main waste rock disposal site (an area located on the Proponent's 3.93 ha property, and covering roughly 130 m by 200 m (2.6 ha), with an estimated maximum height of approximately 5 m to 8 m) will be set back at least 20 m from property lines, leaving existing trees and other vegetation as a visual buffer. Additional trees and vegetation will be planted to augment the visual barrier. The site will be contoured, covered with topsoil, vegetated with native grasses, and maintained.
 - Restrictions to public access will be minimized. Fencing at the weir and intake will be reduced to encompass only these structures and the riverbanks for approximately 75 m upstream. The public will continue to have access for recreational fishing and swimming at the original powerhouse site (foundation). There will be a fence extending 100 m from the power plant building along the south bank of the tailrace. The Cascade Cove beach, used by the public, is on the opposite side of the river.
 - Non-vehicular access to the construction roadway leading from the railroad right-of-way to the intake area will be restored. In consultation with local property owners and tenure holders, plans will be developed to discourage motorized vehicles from using the access road to the weir/intake site.

MTSA-Tourism has concluded that the proposed mitigative measures that the Proponent has incorporated into the design, construction and operational phases of the Project to accommodate recreation and tourism interests, when implemented, are expected to effectively mitigate concerns related to tourism and recreation.

4.14.3 Local Businesses

The Project has the potential to directly affect several businesses in the immediate vicinity that are supported by tourism. These businesses are opposed to the Project. The potential effects from the operation of the Project on these businesses include the following:

Guided Trail Ride/Horseback and Hiking Tour Operator (Canyon, Upstream of Weir, and Trans-Canada Trail)

- Construction of the weir and intake will disrupt and permanently alter trail access upstream of the Canyon for this Licence of Occupation (commercial recreation tenure) holder, who believes that this, and the presence of the infrastructure, will permanently diminish the experience for guests.

Guided Kayak/Cycling Tour Operator (Upstream of Weir and Trans-Canada Trail)

- During lower river flows, the maximum backwater effects from the weir (head pond) will flood a section of rapids with a standing wave (closest to the weir), and increase water depth at the bottom of a second rapid further upstream. This Licence of Occupation (commercial recreation tenure) holder believes that this will permanently diminish the experience for guests (who are at the beginner level) during the core operating season. The sandbar/beach near the weir, which is used for kayak and canoe take out, will also be affected (reduced in size).

Recreational Vehicle Park/Campground and Residence (Downstream of Canyon)

- The power plant building, tailrace area and waste rock disposal site will be visible (across the river) from locations on this riparian property and the residence on this property (approximately 210 m from the power plant building), and from the Cascade Cove beach (accessed via this property by the public for swimming and fishing).
- Activity in the area of the power plant and museum/interpretive centre site will be visible during operation.

Cascade Cove Pool and Beach (Downstream of Canyon)

- The Proponent concluded that: river levels at this location (approximately 180 m from the power plant building across the river) will not be affected; the flow from the tailrace will not have significant effects on hydraulic conditions in the pool or beach stability; and water turbidity will not be affected (also see section 4.1.1.3 - *Tailrace*, and section 4.2.5 - *Erosion and Sedimentation*).

Golf Club (Adjacent to Proponent's Property)

- The top portion of the main waste rock storage site will be visible from one location on the golf course.

(Note - The Proponent concluded that noise from the power plant will be inaudible on virtually all occasions at the Cascade Cove beach, the residence at the recreational vehicle park/campground, and the golf course. See section 4.13 - *Noise*.)

To address the above potential effects, the Proponent noted, or has committed to, the following:

- A new access trail will be constructed for the trail ride horseback and hiking tour operator. In consultation with local property owners and tenure holders, plans will be developed to discourage motorized vehicles from using the access road to the weir/intake site.
- Access to the gravel bar upstream of the weir will be improved for kayak and canoe take out, and, subject to fisheries agency requirements, the head pond may be eliminated during low flows, when the facility is not operating, thereby restoring river rapids.
- Post-construction restrictions to public access will be minimized. Fencing at the weir and intake will be reduced, to encompass only these structures and the riverbanks for approximately 75 m upstream.
- Local interested parties will be consulted on the architectural design of the power plant building. Other structures will be designed to be as inconspicuous as reasonably possible.

- The waste rock storage site on the Proponent's property will be set back at least 20 m from the property lines, leaving existing trees and other vegetation as a visual buffer, and additional trees and vegetation will be planted. The rock storage structure will be covered with topsoil, vegetated with native grasses, and maintained.
- Temporary impacts during the construction period (approximately twenty-two months) will be mitigated by scheduling a major portion of the work expected to have visual, noise or other impacts in the autumn, winter and early spring, outside the Christina Lake summer tourist season. Closure of the Trans-Canada Trail will only take place in the vicinity of the trestle (over the Kettle River) for short periods during blasting (maximum 30 minutes). This will not occur during the period of April 1st to September 30th. Dust will be controlled.
- Best efforts will be made to negotiate reasonable compensation with the Licence of Occupation holders for any loss of business attributable to construction or operation of the Project.

In addition to the effects noted above, the Licence of Occupation holders have expressed concern that increased visitation to the area as a result of the Proponent's proposed museum and interpretive centre, intended to compensate for potential impacts on recreation and tourism, will impact the quality of the recreation tours they offer (see section 4.14.5 - *Enhancement*).

MTSA-Tourism has concluded that there will be measurable and permanent impacts on the two commercial recreation tenure operations in the area (trail ride/horseback, and kayaking) if the Project proceeds, but that the Proponent's proposed mitigation measures are effective in addressing many of the impacts to a sufficient degree that the operators will be able to offer viable, although altered, adventure tourism products to clients.

4.14.4 Navigable Waters

Potential socio-economic effects from the Project include impacts on navigable waters. Navigation in the Project area is mainly recreational, includes kayaking and canoeing, and occurs mainly upstream of the proposed weir and downstream of the tailrace. A few extreme kayakers have run the Canyon section between the proposed weir and power plant.

The *Navigable Waters Protection Act (NWPA)* provides the federal government with the authority to require that the construction or placement of any structure or physical works in, upon, over, under, through, or across any navigable waterway in Canada is reviewed and approved under Section 5 of the Act. The definition of "navigable waters" under the Act includes any body of water capable of being navigated by floating vessels of any description for the purpose of transportation, commerce or recreation.

Based on this navigable waters definition and a preliminary assessment of navigability of the affected waterway, the Project is subject to review and approval under the *NWPA* for the three key Project components, namely:

- Construction of the weir
- Construction of the intake and tunnel for the diversion of flows

- Construction of the tailrace

The construction of the weir will create a seasonal head pond. During low flows, backwatering effects will occur to a maximum of approximately 750 m upstream. An issue raised during the review was that the head pond will result in the loss of two eddies used as “play features” for kayakers. Kayaking and canoeing occurs mainly from May to September, but it is expected that a large percentage of the activity takes place in July and August, with flows in the range of 20 m³/s to 70 m³/s. Flows in late August and September are often at or below 10 m³/s.

The backwater effects and upstream extent of the head pond are greatest at lower river flows. As river flow increases the backwater effects and upstream extent of the head pond become less pronounced. The Proponent’s research showed that at flows of 20 m³/s to 40 m³/s, the first set of rapids upstream is “flooded out”, and at flows of 75 m³/s the rapids is at about 75% of its natural condition. The second set of rapids upstream is unaffected when flows are greater than 20 m³/s. The Project will have some effect on the kayaking and canoeing experience for this 750 m section of the river. However, the remainder of the Kettle River (approximately 111 km of the mainstem) will be unaffected, and will continue to be available for different levels of kayaking and canoeing. The Proponent has committed to improving access to the gravel bar upstream of the weir in the Kettle River for kayak and canoe take out.

In addition, the plant will not operate and the head pond will be drained, unless otherwise directed by the fisheries agencies, when river flows are less than:

- March 10 m³/s
- April 15 m³/s
- May – June 25 m³/s
- July 13 m³/s
- August 12 m³/s
- September 11 m³/s
- October 9 m³/s

The possibility of placing in-stream features into the river to try to replace the lost standing wave and rapids was also discussed. However, the Proponent’s research indicated that any in-stream feature would likely be destroyed by the high flows during spring freshet. In other areas where this has been attempted, the created features have not withstood natural high flows. In addition, there was discussion regarding the possibilities of constructing some kayaking features associated with the tailrace. In this case, the slope would appear to be too shallow and the length too short to create any features that would meet the needs of kayakers for whitewater “rodeo-type” features.

Post-construction the weir and associated fencing will not prevent access downstream to the Canyon for extreme kayakers wishing to attempt the Canyon section between the proposed weir and power plant.

During the harmonized environmental assessment, the EAO and the RAs have considered: the Application and Additional Information submission; supplemental information provided by the Proponent; public, government agency and ONA comments

on the potential effects of the Project, the responses to comments made by the Proponent; and the discussions of the working groups.

Based on the information in this Report, providing that the Proponent conducts the mitigation as indicated above, and implements the actions described in the Summary of Commitments listed in Appendix D – *Proponent's Table of Commitments and Assurances*, the EAO and federal RAs are satisfied that the Project will not likely result in significant adverse effects from a navigable waters perspective, taking into account the location and height of the weir, and the proposed operation of the Project.

4.14.5 Enhancement

To enhance the potential effects of the Project on recreation and tourism, the Proponent originally proposed to develop walking trails, viewing sites and a picnic area along the Canyon upstream of the power plant. The RDKB indicated that a privately owned and operated park would likely require zoning amendments, and this proposal was dropped, based on feedback received from the Christina Lake community. The Proponent also proposed to construct a museum and interpretive centre as part of the power plant building. The Additional Information submission, under specification #44, provides information on the historic resources of the site and the proposed museum/interpretive centre.

The museum/interpretive centre, if developed, would be part of the power plant building, with viewing windows to the turbine/generator area. The museum displays will incorporate First Nations history and the power generation history of the site. Displays on First Nations history in the area will be developed in consultation with the ONA. Displays on power generation history, considered by the Proponent to be very significant, will discuss the Cascade Water Power and Light Co. Ltd. facility, which operated at the site from 1897 until 1921. This facility was one of the first in the world to use three-phase 60-cycle alternating current generation and transmission, and supplied power to Grand Forks, Greenwood and Phoenix as well as to the mines and two smelters in the area. The brick and stone powerhouse stood until 1997, when a heavy snow load collapsed the roof and walls.

Specification #44 required the Proponent to commit to taking reasonable efforts to preserve the historic bulkhead and spillway. The original Project design included an open cut channel that would have passed through, and made it difficult to preserve, these features. The redesigned Project with underground tunnel to convey the water for power production from the intake to the power plant, will have no impact on this bulkhead and spillway.

A walkway will provide access to the old powerhouse foundation and a view of the old penstock, where interpretive signage will be provided. The public will continue to have access for recreational fishing and swimming at the original powerhouse site (foundation). Excavated material from the tunnel will be used to create a raised bench along the southeast side of the river. The trees along the bank of the river will be preserved, and the raised area will be landscaped and used for parking (for approximately 20 vehicles) and a picnic area.

The Proponent has committed approximately \$1,000,000 for tourist facilities associated with the Project, and has indicated that the major portion of these funds will be allocated to the museum/interpretive centre, and associated parking and picnic facilities.

However, there is disagreement between the Proponent and opponents to the Project, including the RDKB, about the proposed museum/interpretive centre to enhance the potential effects of the Project on recreation and tourism. The Proponent maintains that the Project and museum/interpretive centre will introduce new activities of interest to a broader population, increasing tourism opportunities at this location and visitation to Christina Lake more generally. Opponents of the Project maintain that the museum will not enhance recreation and tourism, and that increased visitation to the area as a result of the museum will impact the quality of recreation tours offered by tourism operators. They assert that the Canyon/Falls would generate more economic benefit by leaving it in its natural state.

The RDKB indicated that the museum/interpretive centre is not what the community of Christina Lake needs, and that it would prefer that the money the Proponent has allocated for this be invested in other efforts to boost local tourism. In response to this, the Proponent has committed to further consultation with the community and the ONA about alternative uses of the funding, and which use would provide the most benefits. If it is determined that the museum/interpretive centre will be constructed and operated as previously proposed, the Proponent will consult with local residents, the RDKB and the ONA about its appearance, construction, and employment opportunities.

MTSA-Tourism has indicated that it would be willing to be part of those discussions if desired by the community and the Proponent, and that it would be willing to work with tourism interests in the Christina Lake area to identify opportunities and resources for community tourism planning.

4.14.6 Land Use

In 1999, the Cascade Canyon was being considered as a candidate protected area for the West Kootenay-Boundary region. The site was rated as having regionally significant natural and recreational values, and as a provincially significant cultural feature (the former Cascade Water Power and Light Co. Ltd. facility). (*Note* - the Canyon is a unique physical feature in the Boundary area, adjacent to the Trans-Canada Trail/Kettle Valley Rail line, and offering opportunities for resource viewing, natural resource and cultural/heritage interpretation.).

At that time, it was determined that a decision on designating the site as a protected area would be deferred until the outcome of the environmental assessment of the Project was known. Collectively, the specifications required the Proponent to report on the potential impacts on these values, and how these could be prevented or mitigated.

In completing its assessment of potential Project effects, the Proponent has noted, concluded, or committed to, the following:

- The redesigned Project, with underground tunnel to convey the water for power production from the intake to the power plant, will have no impact on the historic bulkhead and spillway.

- There will be no construction disturbance within or along the Canyon. The redesigned Project, with underground tunnel, removes the need for the surface disturbance that would have occurred with the surface canal.
- Once operational, the Project will not prevent current recreational use from continuing in the future. Restrictions to public access will be minimized, and will occur only in the immediate area of the weir/intake and power plant/tailrace.
- The Falls will not be lost and viewers' impressions of the Falls are subjective - the beauty of the Falls is not directly proportional to the flow. The Falls will still provide an impressive and beautiful spectacle. During high-flow periods, it will be difficult to distinguish between natural flows and flows reduced by the Project. During operation, minimum weir bypass flows ranging from 4 m³/s to 20 m³/s will be maintained in the Canyon for fish and fish habitat, and these flows would frequently be exceeded. During periods of very low flow, the facility will not operate and the Falls will retain their natural flow levels.
- A museum and interpretive centre could be constructed as part of the power plant building, with displays on First Nations history and the power generation history of the site, and viewing windows to the turbine/generator area. Interested parties will be consulted on the architectural design of the power plant building. A walkway will provide access to the old powerhouse foundation, and to a view of the old penstock, where interpretive signage will be provided. The public will continue to have access for recreational fishing and swimming at the original powerhouse site (foundation).
- The area is not characteristic of wilderness. The Canyon/Falls is closely surrounded by existing development, including Highways #3 and #395, a railway, transmission lines, gas pipeline, the Trans-Canada Trail (old Kettle Valley Railway), Cascade Village, rural residential development, a recreational vehicle park and campground, and a golf course. The Project should not interfere with consideration of the Canyon as a candidate protected area.

4.15 Transportation

The Additional Information submission, under specification #49, provides information on the Project's potential effects on public transportation. The Proponent confirmed access requirements for the Project, and assessed traffic impacts on the highway system for both construction and operational purposes, noting that:

- Due to limited parking space, construction employees would be moved to and from worksites by company-provided transport.
- Deliveries of construction materials would be heaviest with the concrete pour for the weir, which will require approximately 37 deliveries staged at 15-to-20-minute intervals over a total duration of 12 hours. Pours at the power plant site will be smaller, and will be staged over a longer period, so that traffic volumes will be less. The nearest concrete batch plant is located in Grand Forks, and the heaviest truck traffic expected to be generated on Highway #3 and #395 will be one ready-mix truck about every 15 to 20 minutes.

- During operations, some improvement to the access from highway #395 to Second Avenue may be warranted for the tourist season, with the anticipated increase in traffic generated by the museum/interpretive centre.

The Ministry of Transportation has indicated that, if the Project proceeds, it will require:

- Permits to construct for any works/construction within Ministry rights-of-way or underneath infrastructure (such as the proposed tunnel under highway #395 or new power lines). Conditions/criteria would be determined upon receipt of an application with engineering details.
- Permits for access sites to be used during construction.
- Review of access sites and specific work sites within highway rights-of-way to determine if construction traffic will impede regular road users, and if mitigative measures or off-site improvements are required.
- Details of any proposed long-term access for public parking for the museum/interpretive centre or picnic facilities, to ensure that design and safety standards are met.

The Proponent has committed, prior to construction, to developing a traffic management plan, including addressing: permitting issues for access and/or works within highway rights-of-way; impacts of anticipated traffic volumes on existing highway users and the Highway #3/Highway #395 intersection; control and safety of construction traffic turning from the highway to Project sites; visitor access requirements and potential mitigation measures, if required during construction; and the potential for long-term planning and improvements, and undertaking any related mitigative measures considered necessary.

The Ministry of Transportation has concluded that the Proponent has satisfactorily addressed all of its concerns, and indicated that, if the Project proceeds, it will review permitting issues with the Proponent prior to construction.

4.16 Archaeological Resources

Based on the Proponent's 1999 Application, the MTSA-Archaeology concluded that the Project would not have any significant effects on archaeological resources, and that no further archaeological work would be required. No impacts on archaeological sites were anticipated as a result of the head pond, and identified conflicts with a protected archaeological site would be addressed through a *Heritage Conservation Act (HCA)* Alteration Permit.

The Proponent's redesign of the Project included a proposed road corridor that was outside the area originally assessed for archaeological resources, and this was identified in the 2003, Additional Information submission. The MTSA-Archaeology noted that the re-routed access crosses an area of some archaeological potential, and required further inspection (preliminary field reconnaissance) of the area. The Proponent provided this information and committed to undertaking further archaeological site investigations prior to construction (see Appendix D - *Proponent's Table of Commitments and Assurances*).

In regards to the interests of the ONA in further archaeological site investigations, the Proponent made the following commitments:

- Opportunities will be offered to qualified members of the ONA to participate in archaeological field surveys and monitoring.
- Prior to starting construction, further archaeological studies described in the Environmental Management Plan will be undertaken based on the outcome of consultation with the ONA and their participation.
- The Proponent will involve members of the ONA in further archaeological studies, and in developing the Archaeological Monitoring Plan component of the Environmental Monitoring Plan.

The MTSA-Archaeology has concluded that the Project will not adversely affect archaeological resources which are subject to the provisions of the *HCA*. The potential for the revised road access to adversely affect any unrecorded archaeological resources is considered to be low or nil. If the Project proceeds, the Proponent will be required to apply for an Alternation Permit, which will authorize development activities within the boundaries of a recorded archaeological site (DgQn- 03).

The lower portion of the proposed access road will encroach on a historical site (related to the original hydroelectric facility). This is not subject to the provisions of the *HCA*. No additional archaeological work is required for this site.

4.17 Health

The Additional Information submission, under specification #50, provided information on the Project's potential effects on public Health, including turbidity in the Kettle River, sewage disposal, drinking water for workers, and garbage waste disposal.

Potential impacts on turbidity are discussed under sections 4.1.3 - *Project Operation*, 4.1.4 - *Project Construction*, 4.2.5 - *Erosion and Sedimentation*, and 4.2.8 - *Water Quality Monitoring*. The Proponent concluded that construction-stage mitigation measures, contingency plans, and monitoring should minimize occurrences of unnatural turbidity. The Proponent also indicated that it is not aware of any use of river water for drinking purposes downstream of the Project in Canada - all known sources of drinking water are from wells.

The Proponent noted that: a construction camp would not be required for the Project, and sanitary facilities in the form of portable toilets will be installed close to work sites, with disposal at approved off-site locations; bottled water would be provided to construction workers; separate toilet facilities will be provided for operating staff, and for the museum/interpretive centre, in compliance with applicable regulations; and bottled water would be available for operating staff and for sale to the public.

To ensure compliance with the Water Quality Monitoring Plan, septic field systems within 300 m of rock blasting will be monitored, following discussions with owners, to check for any changes in the functioning of the system(s). The area monitored will be expanded if the results suggest a greater area of potential impact.

The Interior Health Authority has concluded that, if the Project proceeds, its interests will be addressed during the design and permitting stage through the Proponent's commitments and compliance with relevant legislation.

During the EA review, the public expressed concern about safety associated with blasting for construction of the weir and tunnel in the vicinity of the Southern Crossing gas pipeline that uses the Trans-Canada Trail right-of-way and the trestle crossing over the Canyon. The Proponent obtained a permit from Terasen Gas, the owner/operator of the pipeline, to construct the tunnel under the pipeline. Terasen specified that they will have an inspector on-site during this portion of the construction.

4.18 Conclusions

The EA review of the Project has considered: the information contained in the original Application; the Additional Information submission on the redesigned Project; comments from the public, ONA, federal and provincial government agencies, US agencies, and local governments; and supplemental information provided by the Proponent, including the Proponent's responses to identified issues.

The Proponent has identified mitigation, monitoring and or compensation measures to address the Project's potential construction and operations-stage impacts on water availability in the Kettle River, wells, noise, recreation and tourism, transportation, archaeological resources and public health, and has committed to implementing these measures during the detailed design stage, or in management plans that will be finalized in consultation with the appropriate agencies or parties prior to the commencement of construction.

Since the Project will fully record all the water in the Kettle River basin during the low-flow period, potentially limiting the issuance of future water licences for other uses/users upstream of the Project, the EAO, together with MoE-WSD, is recommending that, if the Project is approved, a water reserve on the Kettle River upstream of the Project be established by order in council, to set aside water for all purposes (other than power development), with future licences for such water taking priority over the Project.

The State of Washington Department of Ecology indicated that: it does not foresee any impairment issues relating to impacts of the Project on existing water rights and/or claims located within the Water Resources Inventory Area 60, the State's portion of the Kettle River watershed; the Project is requesting the equivalent of a non consumptive power right for hydropower generation; this type of run-of-river project will not impair either upstream or downstream existing rights within Washington State; and the question of how any future water rights, if issued, may be affected has been considered.

MTSA-Tourism has concluded that: the proposed mitigative measures that the Proponent has incorporated into the design, construction and operational phases of the Project to accommodate recreation and tourism interests, when implemented, are expected to effectively mitigate concerns related to tourism and recreation; and, the Proponent's proposed mitigation measures are effective in addressing many of the Project's potential impacts on the two commercial recreation tenure operations in the area (trail ride/horseback, and kayaking) to a sufficient degree that the operators will be

able to offer viable, although altered, adventure tourism products to clients. MTSA-Tourism has also indicated that it would be willing to be part of discussions related to the proposed museum and interpretive centre, if desired by the community and the Proponent, and that it would be willing to work with tourism interests in the Christina Lake area to identify opportunities and resources for community tourism planning.

The EAO and federal RAs are satisfied that the Project will not likely result in significant adverse effects from a navigable waters perspective, taking into account the location and height of the weir, and the proposed operation of the Project.

MoT has concluded that the Proponent satisfactorily addressed all of its concerns, and indicated that, if the Project proceeds, it will review permitting issues with the Proponent prior to construction.

MTSA-Archaeology has concluded that the Project will not adversely affect archaeological resources subject to the provisions of the *HCA*.

IHA has concluded that, if the Project proceeds, its interests will be addressed during the design and permitting stage, through the Proponent's commitments and compliance with relevant legislation.

5. REVIEW CONCLUSIONS

5.1 Basis of Conclusion

The conclusions from the review of the Project, which has been conducted pursuant to both federal and provincial EA legislation, are based on the following documents and review procedures:

- The Proponent's Application for an EA Certificate under BCEAA;
- The Proponent's Table of Commitments and Assurances, as updated and consolidated in Appendix D;
- The BCEAA review procedures, as defined in the section 11 and section 13 orders;
- The assessment collectively carried out by the Project Working Group and subgroups comprised of federal and provincial government agencies, US agencies, local governments, and the ONA, with input from the public (as outlined in Appendices B and C).

5.2 Compliance Effects Monitoring and Follow Up

As summarized in Appendix D – *Proponent's Table of Commitments and Assurances*, the Proponent has committed to developing environmental protection plans for Project construction and operations that provide a more detailed description of how various environmental impacts will be avoided, managed and mitigated. The Proponent has also committed to undertake measures for compliance, environmental effects monitoring, and follow-up. A number of these measures involve consultation and collaboration with the ONA.

In addition to the Proponent's commitments towards environmental management and monitoring, the Proponent would also be required to comply with specific mitigation, monitoring and reporting requirements for pre- and post-construction operations, as well as habitat compensation operations required by subsequent federal authorizations and approvals.

5.3 Overall Conclusion

The general conclusion of the assessment is that there are no likely significant adverse effects as a result of the Project, with the implementation of proposed commitments, including compliance effects monitoring and follow-up measures (see Appendix D – *Proponent's Table of Commitments and Assurances*).

Conclusion of EAO

Pursuant to the requirements of *BCEAA*, EAO is satisfied that:

- The process and documents generated as part of this EA review adequately identify and address the potential adverse environmental, economic, social, heritage or health effects of the Project;
- Public and First Nations consultation, and the distribution of information to the public and First Nations, have been adequate;
- Issues identified during the review process by the public, the ONA, federal and provincial government agencies, US agencies, and local governments have been adequately addressed by the Proponent during the review of the Application and other supporting documentation; and
- Practical means have been identified to prevent or reduce to an acceptable level any potential adverse effects.

The provincial Minister of Environment and the Minister of Energy, Mines and Petroleum Resources will consider this Report and other accompanying materials in making their decision on the Application and issuance of an EA Certificate to the Proponent under *BCEAA*.

Conclusion of Federal Responsible Authorities

Pursuant to the requirements of section 16(1) under *CEAA*, the RAs have determined that, on the basis of this Screening Report, the Project is not likely to cause significant adverse environmental effects.

The federal responsible authorities for the Project (DFO and TC) will reach/issue a conclusion about the screening of the Project under *CEAA*, based on this joint provincial and federal assessment/screening Report. This conclusion will include consideration of the following:

- the environmental effects of the Project, including the environmental effects of malfunctions or accidents that may occur in connection with the Project and any

cumulative environmental effects that are likely to result from the Project, in combination with other projects or activities that have been or will be carried out;

- the significance of the effects referred to above;
- comments from the public; and
- measures that are technically and economically feasible, and that would mitigate any significant adverse environmental effects of the Project.

6. PERMITS AND AUTHORIZATIONS

The “permitting stage” refers to the stage following an EA Certificate decision in which statutory authorizations may be issued by regulatory agencies. The key provincial permits and licences required in the permitting stage for constructing and operating the Project are identified below. Federal approvals and authorizations required for the Project are identified in section 1.3.2 - *Federal Process*.

Water Act (MoE-WSD)

- Water licence
- Section 9 approval (changes in and about a stream)

Land Act (MAL, Integrated Land Management Bureau)

- Licence of occupation for construction of Project components on Crown land, and Crown lease or statutory right-of-way authorizations for components post-construction

Heritage Conservation Act (MTSA-Archaeology)

- Alteration Permit

Highway Act (MoT)

- Permits to construct for any works/construction within Ministry rights-of-way or underneath infrastructure (such as the tunnel under highway #395 or new power lines). Conditions/criteria to be determined upon receipt of an application with engineering details
- Permits for access sites to be used during construction

Forest Act and Forest Practices Code of British Columbia Act (Ministry of Forests)

- Cutting Permit

Zoning (RDKB)

- The weir and generating facilities are permitted uses under the RDKB general regulations of Zoning Bylaw No. 900 (1996)

Construction/Building Permits

- *Health Act*
- *Drinking Water Protection Act*
- *Sewerage System Regulation*

7. APPENDICES

Appendix A	Summary of Government Agency and Local Government Comments
Appendix B	Summary of First Nation Comments
Appendix C	Summary of Public Comments
Appendix D	Proponent's Table of Commitments and Assurances
Appendix E	Project Area
Appendix F	Range of Flows in the Canyon/Falls