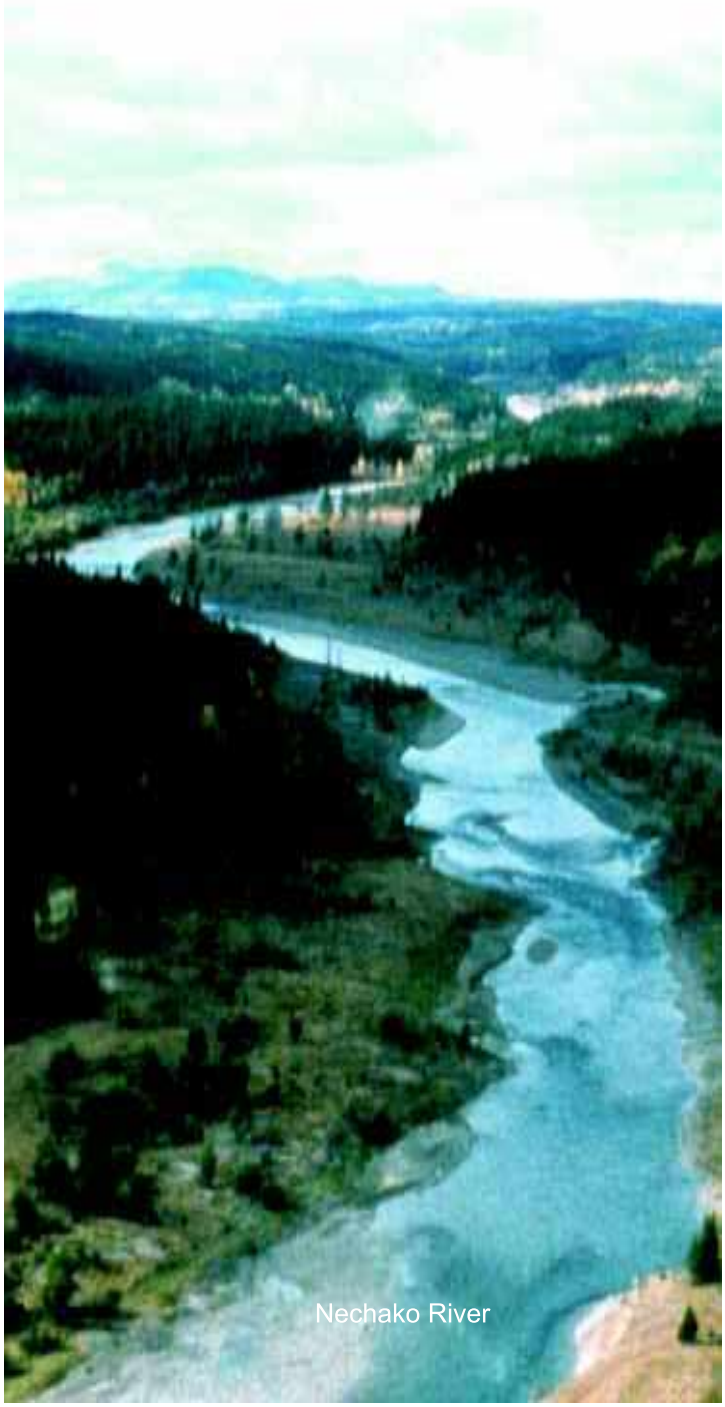
Nechako Environmental
Enhancement Fund



Nechako River

Report of the Nechako Environmental Enhancement Fund Management Committee

June 7, 2001

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In accordance with Schedule 4 of the 1997 Alcan / BC Agreement we are pleased to submit our report on the downstream enhancement of the Nechako Watershed area.

Jim Mattison

Charles Jago

Eric Sykes

Nechako Environmental Enhancement Fund
Management Committee

The Management Committee is pleased to acknowledge the contributions of Jim Wild and Jason Hwang of the federal Department of Fisheries and Oceans who acted as observers and provided us with advice during the preparation of our report. We are also grateful for the able assistance provided to us by David Marshall, Wenda Mason, Patricia Howie and the Fraser Basin Council.

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1. Introduction

As members of the Nechako Environmental Enhancement Fund Management Committee, we would like to begin this report by extending our appreciation to the many people who contributed to our efforts.

When we started on our mandate, we were told by some that "if the complexities of the Nechako were easy to sort out, we would have done it 50 years ago!" Despite this daunting task, we were impressed by the numbers of participants, the thoughtfulness of their contributions and the commitment of volunteer time that they dedicated to the future of the Nechako River.

We took in your comments, commissioned studies, met more than 40 times as a Committee and are pleased to present our findings and conclusions. Our task is to review, assess and report on options for the downstream enhancement of the Nechako watershed area. With your help we have done this.

Our review led us to conclude that a water release facility at Kenney Dam is the preferred option to provide the greatest benefits to both the Nechako watershed and the Cheslatta River and Murray-Cheslatta Lake system (Murray-Cheslatta system). We reviewed a number of water release facility options and selected the one that:

- has the greatest potential to result in excess cooling flows that can be "freed-up" and redistributed to support a wide range of interests in the watershed,
- allows for a more natural flow regime and reduces the high summer flows,
- creates conditions that will support rehabilitation of the Murray-Cheslatta system,
- has sufficient water temperature control ability to allow for adaptive management in the future; and
- provides a risk averse strategy for managing downstream fish and other aquatic species.

We are convinced that the water release facility we recommend will greatly enhance the Nechako and bring a wide range of benefits to the environment and communities in the Nechako watershed.

This report begins with an overview of our mandate, the principles we followed in carrying out our mandate, the process we used to engage people representing a broad range of interests, and a recent history of events that changed the Nechako River watershed area. We then set out our findings, conclusions and decisions regarding options for downstream enhancement of the Nechako; ways to address issues in the Murray-Cheslatta system and the Nechako Canyon; and our thoughts on watershed management and planning. The report ends with cost estimates and an implementation plan.

A glossary of terms, list of acronyms and list of studies is included in the appendices.

Mandate

The Nechako Environmental Enhancement Fund (NEEF) was established as part of a 1997 Agreement between Alcan and the Government of BC. This agreement addressed outstanding legal matters arising from rejection of the Kemano Completion Project by the Government of BC.

Schedule 4 of the Agreement (in Appendix D) established the NEEF Management Committee with a mandate to:

> review, assess and report on options that may be available for the downstream enhancement of the Nechako watershed area. These options may include, but are not limited to, the development of a water release facility at or near the Kenney Dam, or the use of the Nechako Environmental Enhancement Fund for other downstream enhancement purposes.

The Management Committee is required to “complete and deliver a report to the Province, Alcan and such other parties as appropriate”. The report is to include “its decision on the appropriate options…”, “a plan for the implementation of each of the selected options…”, “an independent report for each of the selected options…”, and “a program for the use of the funding…to meet the costs of each of the selected

options….". Schedule 4 indicates that decisions of the management committee are binding on the parties, subject to other terms in the Schedule. It also provides a cost-sharing formula for the Nechako Environmental Enhancement Fund such that Alcan will match funds provided by other parties up to a maximum contribution by Alcan of $50 million.

Jim Mattison (Ministry of Environment, Lands and Parks) chairs the Committee and represents the Government of BC's interests. Eric Sykes (consultant to Alcan) represents Alcan's interests. In absence of a federal appointment, the government of BC and Alcan appointed Dr. Charles Jago (President of University of Northern British Columbia) who sits as an impartial member. Subsequently, and at the request of the NEEF Management Committee, Jim Wild and Jason Hwang of the Department of Fisheries and Oceans participated as observers for the federal government.

Operating Principles

As members of the NEEF Management Committee, we adopted the following principles.

Openness & Transparency: The Management Committee seeks public input into the identification, assessment and review of options to enhance the Nechako watershed area. This public process will be carried out in an open and transparent manner.

Inclusiveness: The Management Committee will provide opportunities for input from all interested parties in order to provide opportunity for diversity of viewpoints.

Decision-Making: Members of the Management Committee will seek to make decisions by consensus. Decisions of the Management Committee will be binding on the parties.

Geographic Scope: The NEEF Management Committee will address matters related to the Nechako watershed area with a focus on the downstream area. This encompasses all tributaries to the Nechako, the reservoir and the river to its confluence with the Fraser River at Prince George.

Timeliness: The Management Committee will complete its work in a timely manner which does not compromise the thoroughness of the public process.

Cost-Effectiveness: The Management Committee will consult in a cost-effective manner in order to minimise costs where possible, without compromising effectiveness. The Committee will build on existing information.

Financial Accountability: The Management Committee will observe sound business practices in the way the Fund is managed.

Multi-Interest Involvement Process

We engaged a broad range of interests in our consultative process by opening up a dialogue to identify, explore and evaluate a range of options for the downstream enhancement of the Nechako watershed area. A full set of reports on the multi-interest involvement process, results and technical studies is available on the NEEF Web-site (http://www.nechako2001.com)

We kept community members and those with known interests in the Nechako informed of the process through community outreach events such as fall fairs, newspaper articles and advertisements, and through a series of direct-mail notices, newsletters and comment forms.

The two key consultation events were an open house and workshop in the fall of 1999 and a public meeting in the spring of 2000. Both were held in Vanderhoof and included a wide range of interests (see full reports listing participants and summarizing the input received).

The two-day workshop held on October 16 and 17th, 1999 began with discussion of a background report "Nechako River Summary of Existing Data", prepared by Rick Hoos, Rescan Environment Services. Discussion then focused on goals for downstream enhancement of the Nechako watershed area and how to proceed with the review of enhancement options.

The April 2000 Water Release Facility Seminar and Public Meeting was held to review the range of options for a Water Release Facility (WRF), discuss the objectives and interests for a WRF at Kenney Dam and consider next steps in the NEEF process. This included an update on our activities and a group discussion in response to a set of questions we posed to learn more about how to proceed with our work.

Apart from the two main consultation events, we met as a Committee with:

1. Provincial Ministers of Environment, Lands and Parks, and Finance (October 1999)
2. Federal Minister of Fisheries and Oceans in Ottawa (October 1999)
3. Alcan Executives in Montreal (October 1999)
4. The Steering and Technical Committees of the Nechako Fisheries Conservation Program (NFCP) (April 2000 and December 2000)
5. Representatives of the Cheslatta-Carrier Nation (May 2000)

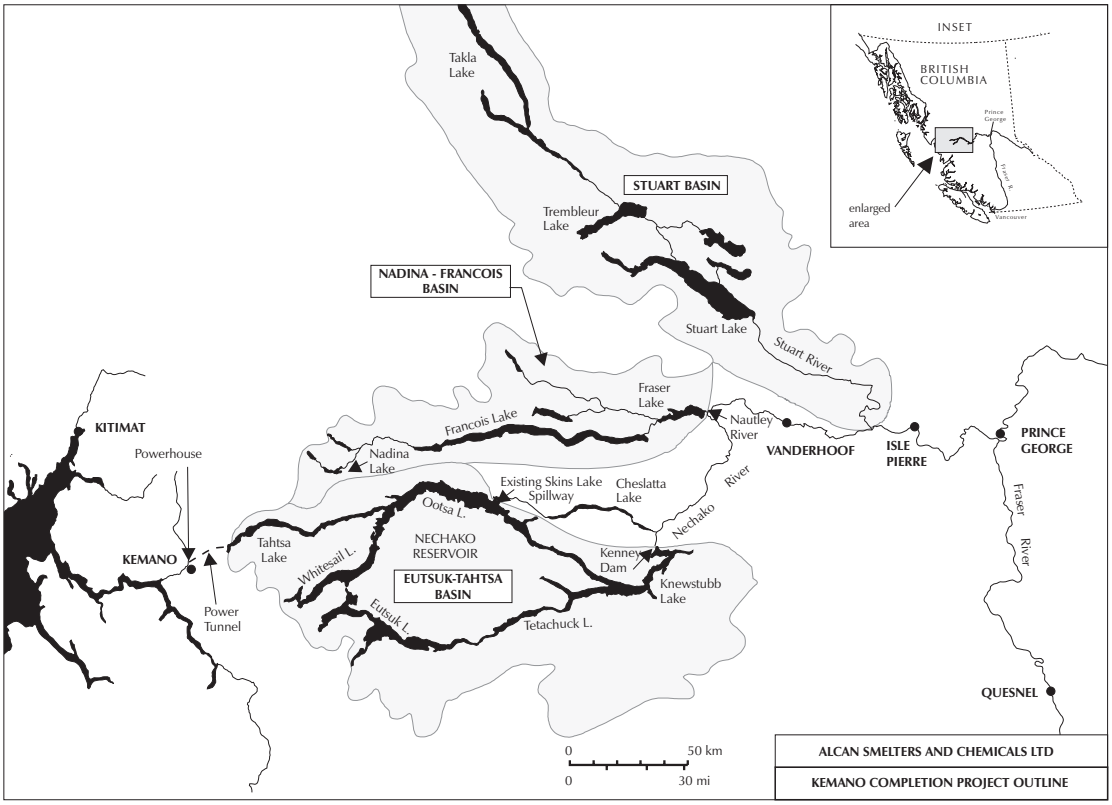
Members of the Management Committee also met with the Nechako Watershed Council and the Nechako River Alliance.

The total cost of our work, which included numerous consultant reports and multi-interest involvement, was approximately $650,000. This amount is within the budget established under Schedule 4 of the BC/Alcan 1997 Agreement.

Historical Context

The following historical overview is provided to set the context for our report. A map of the Nechako watershed is shown below.

Figure 1: Map of the Nechako Watershed



It has been more than fifty years since the Government of British Columbia invited Alcan to develop an aluminium industry in BC and the two parties signed their first agreement regarding the Nechako River. As a result of that agreement, Alcan was licensed to divert water out of the Nechako watershed to generate hydroelectric power for an aluminium smelter at Kitimat.

The "1950 Agreement" provided Alcan with water diversion rights to the Eutsuk/Tahtsa basin of the Nechako watershed and the Nanika watershed. The water rights were to allow Alcan to develop a hydroelectric facility to power an aluminium smelter in Kitimat. Alcan began storing water and generating power at the Kemano 1 hydroelectric facility in 1954.

The Kemano 1 facilities include the Kenney Dam, which impounds water from the Eutsuk/Tahtsa Drainage Basin creating the Nechako Reservoir. Water is routed to the Kemano Powerhouse through the Power Tunnel from the Tahtsa Intake at the western-most reach of the reservoir. The water then joins the Kemano River and flows into the Pacific Ocean. A spillway was constructed on Ootsa Lake to release water into Skins Lake. Flows from Skins Lake Spillway travel through the Murray-Cheslatta system and join the Nechako River below Cheslatta Falls. No water is released at Kenney Dam. As a result, the upper reaches of the Nechako Canyon have been de-watered since the 1950's.

In 1979, Alcan announced its intention to proceed with the final phase of the Kemano project. The project would have diverted more water from the Nechako River and a second dam would have been constructed on the Nanika River. Alcan applied to the BC Government for an Energy Project Certificate for construction of aluminium smelters in 1984, but placed further plans for smelter construction on hold due to low aluminium prices. During this period Alcan continued to plan for expansion of its hydroelectric facility given the 1999 deadline for development of its water rights.

In 1980 the Federal Fisheries Minister ordered Alcan to release more water into the Nechako River for fisheries purposes. Alcan challenged the original order, at which point the Department of Fisheries and Oceans (DFO) obtained a BC Supreme Court injunction requiring Alcan to comply with DFO's water flow requirements.

From 1980 to 1984 the government of BC, DFO and Alcan tried to reach consensus on appropriate flows. When it became apparent that a consensus could not be reached Alcan took the matter back to court in 1985. A tri-party agreement was reached out of court in 1987.

In the 1987 Settlement Agreement, Alcan relinquished water rights to the Nanika River water. River flows in the Nechako were established to protect chinook salmon and manage water temperatures during sockeye salmon migration. The 1987 Agreement also established the Nechako Fisheries Conservation Program (NFCP). The NFCP assesses habitat conditions and stock status. The 1987 Settlement Agreement sets out a conservation goal for the NFCP, "Conservation on a sustained basis of the target population of Nechako River chinook salmon including both the spawning escapement and the harvest…". The Government of BC is responsible for the management of resident fish.

Some local organisations and environmental groups did not accept the 1987 Agreement. In 1988, the Save the Bulkley Society filed a suit claiming that the 1987 Agreement fetters the discretion of federal officials under the Fisheries Act. In that same year, the Federal Court adjourned the action indefinitely.

Alcan began construction of the Kemano Completion Project (KCP) in 1988 and in October 1990, the KCP Guidelines Order confirmed that the federal Environmental Assessment and Review Process (EARP) did not apply to KCP.

That same month, the Carrier Sekani Tribal Council and a coalition of environmental groups filed a motion to overturn the 1987 Agreement and the KCP Guidelines Order and requested a full environmental review of the project. The summary application in this lawsuit was heard in 1991. The lawsuit went to trial in 1991 and the Federal Court Trial Division (FCTD) quashed the KCP Guidelines Order, ruling that KCP was subject to the federal Environmental Assessment and Review Process (EARP).

As a result, Alcan suspended work on KCP in 1991. At the time of the suspension, the project was approximately 40% complete and Alcan had incurred expenditures of approximately $535 million. Alcan appealed the FCTD decision. On this appeal the FCTD overturned its earlier decision and ruled that KCP was not subject to the EARP. The Carrier-Sekani Tribal Council and environmental coalitions applied for leave to appeal this decision in 1992. In 1993 the Supreme Court refused to hear their appeal.

The Government of BC established a public review of KCP by the BC Utilities Commission (BCUC) in January 1993. The BCUC report, including recommendations on the KCP, was submitted in December 1994. The BCUC neither approved nor disapproved the KCP. With respect to a water release facility, the report stated on page vi-3: "For these several reasons the Commission recommends that the Kenney Dam Release Facility should be used for water releases regardless of the future of the KCP". Then on page xxiii-5: "The Commission views these benefits as so significant that it recommends that the Facility ["Kenney Dam Release Facility] should be built whether or not the KCP proceeds." The Government of BC rejected the KCP in January 1995.

Following the rejection of the KCP, the Government of BC and Alcan agreed to explore means of finding an acceptable resolution to deal with the consequences of that decision. After failing to reach an agreement, Alcan launched two lawsuits against the Government of BC. Another set of negotiations led to the BC/Alcan 1997 Agreement that both parties signed in August 1997.

The 1997 Agreement resolved outstanding legal issues associated with the Government of BC's earlier rejection of KCP and contained a number of key legal provisions related to mutual and public interest including:

1. A Replacement Electricity Supply Agreement.
2. The return of the existing smelter to full capacity and incentives for early start-up of a new smelter.
3. A final water licence.
4. The establishment of the Nechako Environmental Enhancement Fund to seek options that may be available for the downstream enhancement of the Nechako watershed area. (The Agreement committed Alcan to match funds of up to $50 million for enhancement of the Nechako watershed area.)
5. The establishment of the Northern Development Fund of $15 million contributed equally by Alcan and the Government of BC.

The Agreement also contained a provision to facilitate the establishment of the Nechako Watershed Council (NWC). The Fraser Basin Management Board (now the Fraser Basin Council) had convened an unprecedented meeting of all interested parties at Stoney Creek in June 1996 to explore the possibility of designing a cooperative management approach to assure the long-term well being of the Nechako watershed. At the meeting it was agreed to form a working group to facilitate the development of the Nechako Watershed Council.

The NWC was inaugurated in June 1998 with representation from the communities in the region, aboriginal interests, government, Alcan, other primary interests and the general public. A second umbrella organisation of public interest and First Nations organisations, the Nechako River Alliance (NRA), was also formed in 1998 of groups and individuals who chose not to participate in the NWC.

Over the past three years, the Management Committee has consulted with the Nechako Watershed Council, the Nechako River Alliance, First Nations and many others. We value the work they have done and their contributions to our task of reviewing options for downstream enhancement of the Nechako watershed area. In particular, we appreciate the work of the NWC in its attempts to identify and resolve a wide range of outstanding issues in the Nechako watershed area.

2. Water Release Facility

"A WRF at the Kenney Dam appears to be the best way to resolve most of the important long standing complaints while simultaneously protecting the fish resources and allowing the flexibility for water management." (Vanderhoof public meeting, April 2000)

Options For Downstream Enhancement

The first open house and workshop held in Vanderhoof in October 1999 provided a strong indication that downstream enhancement can only occur with the establishment of a more natural flow regime in the River. A water release facility at Kenney Dam was believed to be able to facilitate a more natural flow regime and thus was identified as the preferred option for downstream enhancement of the Nechako River watershed area because it had potential to address the broadest range of interests. This view was reinforced and confirmed during the April 2000 public meeting.

At the heart of this view was the belief that a water release facility could access cooler water from lower levels of the reservoir so that less water would be required to meet summer water temperature requirements for fish in the Nechako. This would "free up" water that could be redistributed at other times of the year to mimic a more natural flow regime and meet other downstream needs. It also would allow for rehabilitation of the Murray-Cheslatta system, an important goal for all participants.

In addition to a water release facility, other options for downstream enhancement were suggested: e.g. in-stream works to improve fish habitat and spawning beds, creation of a long-term fund to support conservation and stewardship activities, improved cattle fencing, a fish hatchery, and vegetation work to improve habitat for birds. It was suggested that these options could be carried out in addition to a water release facility, but not instead of a water release facility, and that a water release facility would make these options possible or more effective. No single option was suggested as an alternative to a water release facility.

Water Release Facility Options

The Kenney Dam Release Facility Working Group (comprising representatives of the Government of BC and Alcan) outlined nine conceptual alternatives for a release facility at Kenney Dam in an April 1996 Interim Report. The price estimates ranged from $143 million to $365 million. A more recent summary of water release facility options prepared for us by Triton Environmental Consultants and Klohn-Crippen Consultants included eight options with price estimates ranging from $94 million to $234 million.

"A WRF is capable of addressing the widest range of issues and there is no doubt that it is preferable to address as many issues as possible at one time than trying to develop a whole bunch of mini solutions to each issue." (Vanderhoof public meeting, April 2000)

In reviewing the water release options, we began with the lowest cost option (Case A) and worked our way up to an updated Case E which is the least costly option of the eight options that were considered that also meets all of our objectives.

Each of the five options evaluated (see Appendix E for diagrams of the conceptual layout of updated Case E) varied in cost, range of features and outcomes: these are summarised below in Tables 1 to 3. The information presented in these tables is based on the conceptual designs used by the Kenney Dam Release Facility Working Group in 1995 and does not consider modifications that could be added to any of the options.

Costs

Cost estimates for these options were taken from reports of the Kenney Dam Release Facility Working Group based on the original water release facility designs for the Kemano Completion Project, proportionately increased for size of project and inflated to 1995 dollars. As those were only used for comparison purposes, no attempt was made to further update or refine those numbers. More detailed cost estimates have been developed for the selected option. These are presented in Section 6 of this report.

As the water release facility options incorporate more components, they become more costly. There are also costs associated with moving water through the Cheslatta Fan. The Fan is downstream of Kenney Dam, just upstream of the confluence with the Cheslatta River. This area has accumulated large volumes of sediment resulting from two washout events (more discussion to follow in Section 3).

Costs are shown in Table 1. Remember these are rough costs in 1995 dollars, based on conceptual designs (updated cost estimates for Case E are provided in Section 6).

Components

The key features of the WRF options relate to their:

- capacity to release high water flows;
- ability to intake water from the surface of the reservoir and/or at greater depths where the water is colder;
- ability to regulate the temperature of the water; and
- ability to release water into the Nechako as required and at all times of the year.

Case E is shown in Figure 2 because it illustrates all of the components identified in Table 1.

Figure 2: Diagram of Water Release Facility Components (Updated Case E)

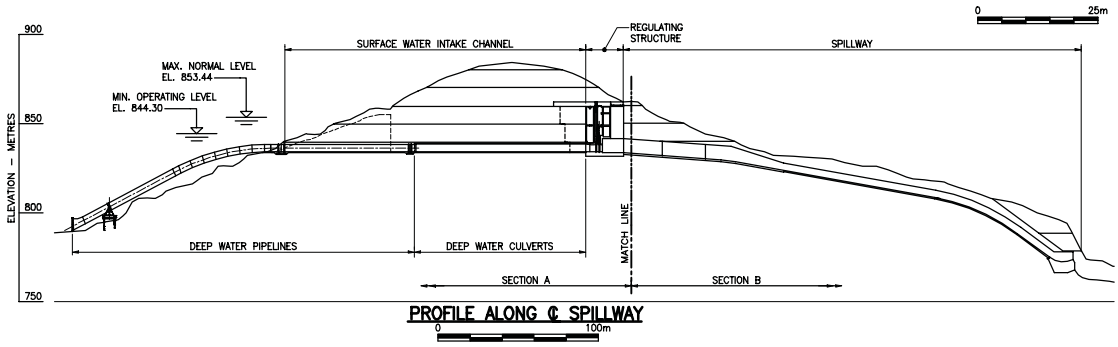


Table 1: Water Release Facility Components, by Option

WRF Option	A	B	C	D	E
Capacity at Kenney Dam (m^3/s)	450	450	170	450	450
Surface Intake					
Deep Water Intake					
Temperature Regulating Structure					
Flip Bucket Spillway (non-freezing conditions only)					
Low Level Outlet (year-round use)					
Total Cost (million $ in 1995 $)	**94**	**111**	**111**	**147**	**164**

Key: Component included	

Outcomes

In turn, the various components of the WRF result in different outcomes. Table 2 illustrates how the options result in different outcomes for the Murray-Cheslatta system, the Nechako Canyon, Cheslatta Falls and the Nechako Valley.

Table 2: Outcomes for Water Release Facility Options, by Case

Area Benefited	Objective	Component/Feature needed to meet Objective	A	B	C	D	E
Murray-Cheslatta	Move some or all of base flows to Kenney Dam year round	Low-level outlet					
	Remove Cooling Flows	Release Capacity >/= 450 m^3/s					
	Remove Floods <200 Year event	Capacity >/= 450 m^3/s					
Nechako Canyon	Re-water year round	Low-level outlet					
	Temperature Control	Deep and surface water intakes and regulating structure					
	Avoids Temperature Shears	Deep and surface water intakes and regulating structure and water mixing capability	N/A	N/A			
	Controls TGP up to 60 m^3/s	Low level outlet with hollow cone valve(s)					
Cheslatta Falls	Reduces TGP	Decreased flow over Cheslatta Falls					
	Avoids Temperature Shears	Temperature control at Kenney Dam and decreased flow releases from Skins Lake Spillway				*	*
Nechako Downstream of Cheslatta Falls	Better Temperature Management	Cooler/Colder water released closer to Cheslatta Falls					
	Temperature Control	Deep water intake at Kenney Dam with surface water released at Kenney Dam or Skins Lake Spillway					
	Potential For Flow Redistribution	Deep water intake					
	Potential For Power Generation	Low-level outlet					
Total Cost (million $ in 1995 $)			**94**	**111**	**111**	**147**	**164**

Key:	Listed outcome is possible

Table 2 Key:

N/A Not Applicable

** The success in meeting avoidance of temperature shear criteria will depend on relative amount of water released from Skins Lake Spillway and Kenney Dam.

Evaluation Process

Input received at the fall 1999 workshop and spring 2000 public meeting led to the development of our list of primary objectives. We used this list to evaluate water release facility options in terms of their ability to produce the objectives or create conditions to allow for the realisation of these objectives. Our list of primary objectives are as follows:

(i) A more natural flow regime (hydrograph) by reducing the current high-volume summer cooling flows

(ii) The ability to redistribute flows to enhance the downstream environment and, to the extent possible, meet the varied needs of downstream users

(iii) The creation of conditions to allow for the rehabilitation of the Murray-Cheslatta system

(iv) Continued protection of fish in the Nechako River

(v) Maintained or improved flood control

We also considered the cost of each option, looking for the most cost-effective facility.

In addition to the primary objectives listed above, we also recognized three secondary interests. First is the re-watering of the Nechako Canyon, recognizing that once a decision is made to re-water the Canyon it must remain watered without interruption. Second is the ability to generate hydroelectric power at Kenney Dam, and third is the ability to enable routine shut down of the spillway for maintenance without interrupting flows to the Nechako Canyon or requiring all flows to pass through the Murray-Cheslatta system.

Our review of the options began with the lowest cost options and progressed to more costly options with additional features. This was done to determine the most cost-effective way of meeting all of our primary objectives for a water release facility.

Evaluation Results

The results of our evaluation of the five options are shown below in Table 3. Our evaluation demonstrates that, based on the original conceptual designs, only WRF Option E is able to meet all of the primary objectives. The evaluation results are described below for each of the five options considered. Relevant technical studies are also summarised.

"What we need to do is to make this a naturally functioning ecosystem as much as possible. The broad question is, given the constraints of money and water volumes and Alcan's water management needs, how close can we get to making this river as natural as possible?" (Vanderhoof public meeting, April 2000)

Table 3: Objectives and Interests, by Option

	WRF Options				
Primary Objectives	**A**	**B**	**C**	**D**	**E**
More natural flow regime, reducing high-volume summer flows			■	■	■
Ability to redistribute flows			■	■	■
Maintained or improved flood control	■	■	■	■	■
Continued protection of fish (salmon and resident fish, i.e. white sturgeon) in the Nechako	■	■			■
Rehabilitation of the Murray-Cheslatta System		■			■
Secondary Interests	**A**	**B**	**C**	**D**	**E**
Re-watering of the Nechako Canyon (year-round)		■			■
Ability to add hydro generation at Kenney Dam		■			■
Alternative water release at Kenney Dam during routine spillway maintenance					■
Total Cost (million $ in 1995 $)	**94**	**111**	**111**	**147**	**164**

Key: Objectives/Interests met	■

Cases A and B

Cases A and B are the lowest cost options because they have only a surface water inlet. The Case A outlet has only a flip bucket spillway that is limited to non-freezing conditions. As a result, winter releases would be passed through the Murray-Cheslatta system reducing the potential for rehabilitation of that system. Case B provides a low-level outlet, thus allowing year-round releases at Kenney Dam and keeping high winter flows out of the Murray-Cheslatta system. Both Case A and B are sized to release flows up to the 1:200 year flood.

A technical review of the surface water inlet options done by Triton Environmental Consultants and Klohn-Crippen Consultants led us to reject Cases A and B. They provided evidence based on temperature modelling studies that the water drawn from a surface intake during the months of July and August would exceed 15°C in most years and would exceed 16°C in many years. Engineering solutions to draw waters at temperatures 2 - 3°C lower would be very costly and eliminate any cost advantage for WRF cases A and B over other options. Because of the high water temperatures to be expected from a surface intake, high summer cooling flows would have to continue, thereby removing the possibility to create a more natural flow regime. Moreover, the number of days when Nechako water temperatures would exceed 20°C could well increase above those experienced with the current flow regime.

Our Findings

- Cases A and B do not provide an effective way of achieving a more natural flow regime or meet downstream fish needs.

Case C

Case C is a cold water facility with a deepwater intake and a flip bucket spillway. This option has a lower capacity (170 m^3/s) than the other options. The lower capacity does not allow for rehabilitation of the Murray-Cheslatta system. Case C does not allow for winter releases at Kenney Dam and therefore neither supports the rehabilitation of fish habitat in the Nechako Canyon nor creates the potential to generate hydroelectric power. Also, the release of very cold water from the facility may result in temperature shears downstream and present risks to fish in the Nechako Canyon.

Our Findings

• Case C was eliminated because it does not allow for rehabilitation of the Murray-Cheslatta system or the Nechako Canyon and may present temperature shear risks to fish

Cases D and E

Finally we turned our attention to Cases D and E. Both feature the ability to control the temperature of released water. Case E differs from Case D in that it has a low-level outlet and can be operated year-round. Case E could move all releases out of the Murray-Cheslatta system (less than 1 in 200 year flood). Because it has a low-level outlet, it also keeps open the possibility of power generation at Kenney Dam.

Before making a final decision on a water release facility option, we commissioned the engineering firm SNC Lavalin to conduct a review of the conceptual design of Cases D and E. This due diligence effort confirmed that the design concepts are sound from a scientific and engineering standpoint and that the spillway, as designed, is not capable of winter releases (this is accomplished through a low-level outlet in Case E). SNC Lavalin introduces the possibility of modifying the spillway design so that year-round releases are possible by means of a pressure conduit controlled by a hollow cone valve at the downstream end, or by a narrow open channel incorporated into the spillway. This has the potential to reduce costs by eliminating the need for a low-level outlet (included in Case E but not D). With this modification, Case D would then be able to meet an additional primary objective, to rehabilitate the Murray-Cheslatta system, and meet a secondary interest, to re-water the Canyon year round.

While these potential modifications must be examined in more detail during the design phase, it is important to note that a low level outlet (in Case E) has the advantage of providing an alternate outlet during spillway maintenance. However, Case D may be able to be designed to allow for the maintenance of the WRF without de-watering the Canyon. The main advantage of Case E is that it also keeps open the possibility of installing a hydroelectric generator at Kenney Dam at some point in the future.

Due to concerns over the potential for temperature shears, we asked Klohn-Crippen Consultants to consider the addition of a mixing chamber to the high-level outlet in Case E as part of their work in updating the conceptual layout and cost estimate of Case E. A mixing chamber would mix the water from deep (cold) and surface (warmer) sources as it is released to avoid the potential temperature shears associated with the release of separate streams of water into the spillway. In the May 2001 Klohn-Crippen report it was shown that a mixing chamber is not necessary due to refinements to Case E that are expected to result in adequate mixing; model tests will be required to confirm this. If tests demonstrate that mixing is insufficient, then several relatively inexpensive options could be used to improve mixing (e.g. adding curved fillets to the chute sides or angled ramps to the floor of the chute).

Our Findings

- Case D, without the spillway modifications discussed above, has a flip bucket spillway that is limited to non-freezing conditions so the facility can not be operated year-round or re-water the Nechako Canyon year-round.
- A modified Case D with year-round releases from the spillway may allow for spills from Kenney Dam during maintenance but does not keep open the possibility for power generation.
- The updated Case E WRF conceptual layout meets all of the primary objectives and secondary interests.
- A mixing chamber is not required unless model tests demonstrate insufficient mixing. Other inexpensive options will be considered at that time if required.

Conclusions and Decisions

A long and thorough consultative process clearly demonstrated the preference for a Water Release Facility (WRF) at the Kenney Dam as the best means to secure the widest range of downstream enhancement benefits for the Nechako watershed. Many participants acknowledged that downstream enhancement of the Nechako River can only occur with the establishment of a more natural water flow regime in the River. A Water Release Facility (WRF) is the only way to achieve this objective.

D1. Cold Water Release Facility

We have decided that a Cold Water Release Facility be constructed at Kenney Dam to enable downstream enhancement of the Nechako Watershed.

The Cold Water Release Facility proposed meets all of the primary objectives and secondary interests at the lowest cost.

A Cold Water Release Facility (CWRF), allows for a more natural flow regime in the Nechako River and creates the conditions that will support rehabilitation of the Murray-Cheslatta system. These two benefits will result in significant environmental enhancement to the Nechako River and the species it supports. Rehabilitation of the Murray-Cheslatta system will also benefit the Cheslatta People who have deep historical, spiritual, economic and cultural connections to this system and wide ranging plans for its future. Additional environmental benefits will arise from the creation of fish habitat in the Upper Nechako.

" It is important to think in a broader context to ensure the greatest flexibility possible, we have to consider climate change as well." (Vanderhoof public meeting, April 2000)

A CWRF will result in excess water that can be redistributed to support a wide range of interests in the watershed. In turn, this will create a variety of social and economic development opportunities such as enhanced recreation and eco-toursim, expanded irrigation, new industrial development and a possible hydroelectric facility at Kenney Dam.

One of the long-term benefits of the selected CWRF (ie. the updated Case E conceptual layout) is that it has sufficient water temperature control ability to allow for adaptive management in the future. As we learn more about the needs of the river and the species it supports, we may want to alter the temperature, volume, and timing of water moving downstream to improve the health of the river. The temperature flexibility offered by the updated Case E conceptual layout will allow for this. It also provides a risk averse strategy for managing the downstream fish and other aquatic species in the event that climate change affects the health of the river or if the criteria for managing salmon change in light of new information. This also provides flexibility to adapt to the needs of White Sturgeon as more becomes known of the factors limiting their survival in the Nechako. If proposed federal legislation on endangered species is passed, this flexibility to control temperature may be a key factor in meeting legislated protection requirements for sturgeon.

Outstanding Issues

During the course of our work we raised a number of questions related to fish requirements in the Nechako watershed area. Experts from provincial and federal government fisheries agencies were brought together to consider a range of issues including water temperature, movement of water through the Cheslatta Fan, total gas pressure (TGP), temperature shear and re-watering of the Nechako Canyon.

These fish requirement issues still require further discussion and study among experts and participants in the Nechako Fisheries Conservation Program (including representatives of government agencies and Alcan).

3. Cheslatta Fan

The WRF options included plans for flowing water through the Cheslatta Fan in the Nechako River. The Fan was formed by two events when the Cheslatta River broke through to the Nechako just upstream of Cheslatta Falls in 1961 and 1972. About 900,000 cubic metres of material were deposited and about half of that remains in place today. The primary concern about moving water through the Fan is the potential negative impacts to chinook salmon spawning beds of sediments moving and depositing downstream.

For most options, the plan for moving water through the Fan included two channels - a non-erodible main channel and the existing outflow channel; a replacement section for the outflow channel, fish habitat complexing and a control structure at the upstream end of the outflow channel. The estimated cost of this plan was $38 million.

There was a great deal of interest among participants in considering less costly and more natural options for moving water through the Cheslatta Fan than originally proposed for the WRF options.

We asked Hay and Company Consultants Inc., with Aquatic Resources Ltd., to do a preliminary evaluation of options for passing flows through the Cheslatta Fan. Their work includes the following results:

- *"Thirteen options were assessed on the basis of 15 criteria. The options ranged from highly engineered solutions with armoured channels to a natural river-cut channel, with costs ranging from $40 to $0 million."*
- *"Deposition of mobilised sediment downstream emerged as a major potential impact as it may result in degraded quality of gravel salmon spawning beds, increased aquatic plants and decreased water fowl habitat."*
- *"Mitigation of the impacts of fine sediment was found to be possible with the discharges available."*
- *"A risk evaluation matrix was developed to compare the 13 options. This analysis concluded that the meandering pilot channel is the preferred option at this stage."*
- *"The meandering pilot channel would involve the excavation of a small, un-lined channel through the fan. With larger flows, this channel would develop naturally into a regime channel. Mitigation is possible to minimise or eliminate long term impacts associated with mobilised sediments. This is a low-cost option ($600,000)."*
- *"Further study is required to mitigate downstream sediment deposition impacts and refine the design of the pilot channel."*

Representatives from federal and provincial government fisheries agencies were informed of the above-noted report and were given an opportunity to discuss its contents. They expressed no objections in principle to the preferred option. They support the approach of returning the Nechako Canyon to a natural river ecosystem and are willing to work cooperatively with those who commission the cold water release facility and downstream works to ensure that any potential sediment issues are prevented or mitigated.

Our Findings

- The meandering pilot channel appears to be a cost-effective solution to moving water through Cheslatta Fan.
- A key benefit of the meandering pilot channel is that it will return the Upper Nechako to a natural river ecosystem allowing for improved fish and wildlife habitat.
- Further study is required to ensure that potential negative impacts to downstream fish and fish habitat are avoided or mitigated.

"We should look at other ways we could deal with the Cheslatta Fan. We need to think outside the box to find other solutions to these problems. There could be new ways to address these questions, alternative approaches and new technologies." (Vanderhoof public meeting, April 2000)

Conclusions and Decisions

D2. Cheslatta Fan

We have decided that the preferred option for moving water through the Cheslatta Fan is the meandering pilot channel.

This is the option best able to meet two important objectives: it is a long-term solution that will return the system to a more natural river ecosystem and it is cost-effective.

Outstanding Issues

Outstanding issues to be addressed in designing the channel and commissioning of the water release facility include sediment criteria for fish and appropriate mitigation plans. It is anticipated that adaptive management and a transition period of many years may be required to commission the facility and move water through the Fan area. Until the sediment issue and flows through the Cheslatta Fan are resolved, the Murray-Cheslatta system will have to maintain some larger cooling flows. However, effective synchronization of the flow regime in the Murray-Cheslatta system with Nechako Canyon flows will assist in the mitigation of the effects of sedimentation.

4. Murray-Cheslatta System

Creating conditions that will allow for rehabilitation of the Murray-Cheslatta system is an important expected benefit and the subject of much interest among a broad range of participants. We asked Northwest Hydraulic Consultants to conduct a preliminary assessment of the Murray-Cheslatta system to enhance our understanding of conditions required for rehabilitation of that system. Their key conclusions and recommendations follow.

- *"The primary objective for the system should be fishery rehabilitation, with tourism and recreation as secondary objectives, where they are consistent with fishery rehabilitation."*
- *"Flow releases from Skins Lake Spillway are required to rehabilitate fish habitat in the Cheslatta River, however, it is not known what annual release of seasonal pattern of flows is required. Further study is required to develop an adequate flow regime."*
- *"We recommend the minimum release practical to rehabilitate habitat as this is consistent with reduced flushing of Murray and Cheslatta Lakes and restoring their productivity."*
- *"We recommend mimicking a natural hydrograph and starting with small annual releases, perhaps of 5 m^3/s. Based on observation of the stream and its habitat, the annual release could be gradually increased, if required, to about 15 m^3/s."*
- *"Flushing flows are required to maintain substrate quality and channel morphology. One alternative is to divert part of the flood releases through Skins Lake Spillway during May."*
- *"Infrequent flood releases (200-year inflow) from the Skins Lake Spillway are not incompatible with rehabilitation of the Cheslatta River."*
- *"There are few advantages to constructing a weir and numerous disadvantages and consequently we do not support such an approach; nor do we support raising minimum water levels."*

Our Findings

- Rehabilitation of the Murray-Cheslatta system is a high priority goal among all interests and must be allowed for in the design of a water release facility.
- Operations at Skins Lake spillway must be maintained to allow for rehabilitation and flood control.
- Water volumes much lower than the current flow regime through the Murray-Cheslatta system are required for rehabilitation and these may be in the order of 5 - 15 m^3/s.
- The CWRF at Kenney Dam must be capable of handling floods up to the 1 in 200 year flows.
- We recognize that the volume of flows through the Murray-Cheslatta system have a direct effect on the potential for temperature shear issues downstream of Cheslatta Falls. This happens because water that passes through the Murray-Cheslatta system is warmer than water released through the CWRF. Case E was designed to address temperature shears based on an assumption of approximately 3 m^3/s of water moving through the Murray-Cheslatta system. As volumes of warm water from the Murray-Cheslatta system increase beyond 3 m^3/s it becomes more likely that temperature shear problems will occur in the Nechako River downstream of Cheslatta Falls. This supports the need for an adaptive management approach for determining the optimal flow regime in the Murray-Cheslatta system.

"The Cheslatta people supported a release facility at Kenney Dam in the 1991 Cheslatta Position Paper. It is the only option that exists for us that will allow for changes in the flows through the Murray-Cheslatta." (Vanderhoof public meeting, April 2000)

Conclusions and Recommendations

Rehabilitation of the Murray-Cheslatta system is one of the most important benefits of the Cold Water Release Facility.

R1. Rehabilitation of the Murray-Cheslatta System

The establishment of a Cold Water Release Facility at Kenney Dam will provide the conditions to enable rehabilitation of the Murray-Cheslatta system.

We recommend that:

(i) rehabilitation of the Murray-Cheslatta system be enabled by creating a more natural flow regime in the system; and

(ii) a more natural flow regime in the Murray-Cheslatta system be achieved by :

- removing Nechako River base flows from the Murray-Cheslatta system;
- removing cooling water flows from the Murray-Cheslatta system;
- removing flood flows up to the 1 in 200 year flows from the Murray-Cheslatta system, except the occasional flushing flows;
- adopting an adaptive management approach to create a more natural hydrograph with average annual flow rates through the Skins Lake Spillway beginning at 5 m^3/s and increasing gradually up to 15 m^3/s, if appropriate, and taking into account the possibility of temperature shears. (These reduced flows through the Murray-Cheslatta system can only be established following the commissioning of the Cheslatta Fan pilot channel); and
- establishing fish rehabilitation as the first objective of the adaptive management program.

Outstanding Issues

Further study is required to determine the optimal flow regime to begin adaptive management within the 5 - 15 m^3/s range. Impacts on the Murray-Cheslatta system and the Nechako River downstream of Cheslatta Falls (i.e. potential for temperature shears) must be considered. More work is also required to determine the optimal lake levels to support fish rehabilitation including the determination of limiting factors for fish and the optimal flow regime to encourage productivity. Consideration should also be given to rehabilitation activities such as fertilization to increase nutrient levels. Supporting interests such as recreation and economic development must also be considered where they do not interfere with fish rehabiliation.

5. Implementation Plan

The implementation plan includes recommendations regarding river management, a construction plan and schedule, recommendations regarding ownership and operation and recommendations regarding reporting during implementation.

River Management

Introduction

Our mandate, as set out in Schedule 4 requires that we provide, "a plan for the implementation of each of the selected options, including the identification of the appropriate party or parties to implement the options".

In keeping with this requirement, we have reviewed a number of models by which communities can participate, in an advisory capacity, in the implementation of the recommendations of our report, and in the ongoing watershed management and planning processes in the Nechako Watershed. We also want to respect the work of the Cheslatta-Carrier Nation and organisations such as the NFCP (Nechako Fisheries Conservation Program), the NWC (Nechako Watershed Council) and the NRA (Nechako River Alliance) who are engaged in various activities related to the Nechako watershed.

" Give the community the knowledge and power to be able to address the ongoing issues and make it easy for the community to manage the facility afterward by putting in place some adaptive management tools." (Vanderhoof public meeting, April 2000)

Management Structure

Throughout our deliberations we have considered the Nechako River, now and in the future, to be a managed river. Effective river management must be based on sound scientific knowledge and on principles relating both to environmental health and local community interests. We, therefore, propose that a process be embarked upon leading to an expanded mandate of the NFCP interacting with the NWC to achieve an adaptive river management system that is more broadly based, more transparent and open to public input, and more clearly tied to sound principles of environmental health and sustainability.

To this end, we offer our suggestions and recommendations for a process that will look at innovative approaches and will result in a cooperative management structure that builds on the existing mechanisms for managing water in the Nechako watershed by creating better linkages between those who have legal responsibilities for managing water and those in the community who have many and varied interests in how the water is managed. More specifically, we are recommending that the outcome of that process be closer linkages between the NFCP and the NWC and enhanced roles and responsibilities for both of those organizations as expanded to incorporate all relevant interests.

In developing a future management structure, we suggest that the federal and provincial governments and Alcan, (the existing partners managing the NFCP) consider expanding the mandate of the NFCP to include activities beyond salmon management as well as enabling more community input into its decision-making processes. We suggest that the existing partners managing the NFCP consider expanding the NFCP's current mandate by:

(i) managing the transition from the current STMP (Summer Temperature Management Program) to the optimal flow regime under the conditions of the proposed CWRF to ensure that the Nechako River is a healthy aquatic ecosystem; and

(ii) conducting continuing research in support of fish and fish habitat.

We recognize that enhanced roles and responsibilities for the existing NFCP would require a legal agreement among the federal and provincial governments and Alcan.

We also suggest that the NWC consider strengthening its function and structure within a revised management structure. An enhanced role for the NWC could include the following activities important to the Nechako watershed:

- advise the NFCP on the interests of the Nechako watershed residents;
- provide advice and input on the development of the optimal flow regime under the conditions of the proposed CWRF;

- establish a series of indicators, monitor and report on the environmental health of the watershed;
- conduct research in support of watershed management activities;
- provide an open forum for discussion and resolution of watershed issues; and
- manage a communications and consultation program with Nechako watershed residents.

R2. Implementation Plan: Management Structure

We recommend that:

(i) the federal and provincial governments and Alcan Inc. expand the mandate of the Nechako Fisheries Conservation Program (NFCP) to include activities beyond salmon management and include community input to its decision making ;

(ii) the Nechako Watershed Council (NWC) be given sufficient resources to operate as a financially viable organization capable of carrying out enhanced roles and responsibilities in the Nechako watershed; to that end:

- a total of $3 million be held in trust for ongoing administration of the NWC and for research to be carried out by the NWC; and
- the NWC be given two years from the release of the NEEF Report to establish itself as a legal entity and make a formal request for the $3 million to be placed in a NWC Endowment Fund (if this objective is not met, the $3 million be allocated to the CWRF).

(iii) the NFCP and the NWC jointly explore ways to improve the management of the Nechako watershed in conformance with the following principles:

- inclusiveness;
- openness and transparency;
- recognition of existing jurisdictional roles and responsibilities;
- recognition of the Nechako as a managed river; and
- financial viability.

Adaptive Management

The single most important outstanding issue to be resolved is determining an ecologically sound flow regime based on the conditions of existing water licences and legal agreements and taking into account the recent work of the NWC on an optimal flow regime for the Nechako River. Prior to and immediately following the installation of a Cold Water Release Facility at Kenney Dam, a significant amount of work needs to be done to determine appropriate flow regimes for the Nechako River and the Murray-Cheslatta system. In the absence of key information, we are unable to provide specific directions on interim and optimal flow regimes for the Nechako River. However, we are recommending the means by which an optimal flow regime can be determined while design work is being done for the Cold Water Release Facility.

Interim Flow Regime

When the Cold Water Release Facility first begins operation, an interim flow regime will be required to mitigate short-term sediment impacts downstream of Cheslatta Fan and determine optimal flows through the Murray-Cheslatta system. This will then be modified over time to enable the Nechako River to reach conditions of a healthy natural river, recognizing its managed state, and for the Murray-Cheslatta system to stabilize to a point where rehabilitation can occur. This will also allow for experimentation and research to be carried out to optimize flows through the pilot channel on the Cheslatta Fan and also provide an opportunity to complete and respond to the various outstanding issues that have been identified in this report such as water temperature requirements for specific salmon stocks and resident species, total gas pressure requirements and information relating to temperature shear requirements resulting from the operation of the Cold Water Release Facility.

Optimal Flow Regime

We believe that the eventual flows for the Nechako River must be based on scientific principles that recognize the need to ensure the long-term health of the River within the context of the existing legal framework and management process that will eventually be put in place.

Therefore, we believe that the NFCP should commission an objective scientific panel, such as an Expert Panel of the Royal Society of Canada, to propose an optimal flow regime for the Nechako River that will result in a healthy, more natural river, recognizing its managed state and respecting existing water licences and legal agreements and taking into account the recent work of the NWC on an optimal Nechako River flow regime. The interim flow regimes required to go from the current flows to the optimal flow regime would then be established by the NFCP.

Temperature modelling work recently carried out for us by Triton Environmental Consultants Ltd. will be helpful in understanding the natural water temperatures in the Nechako. Among their key findings was that existing Nechako River temperatures are lower than pre-impoundment (pre-Kenney Dam) flows during the cooling period flows of July and August.

R3. Implementation Plan: Optimal Flow Regime

We recommend that:

(i) the Nechako Fisheries Conservation Program (NFCP) incorporate the following minimum conditions into the determination of an optimal flow regime for the Nechako River:

- That Alcan's legal entitlements to water, and authority to manage the Nechako Reservoir are respected, including Alcan's ability to meet its attendant legal obligations;
- That the water freed up as a result of the CWRF is used primarily for Nechako downstream enhancement; and
- That the necessary amount (ie. 5-15 m^3/sec.) of water is allocated for release through the Skins Lake Spillway to establish the conditions necessary to support the rehabilitation of the Murray-Cheslatta system.

(ii) the NFCP, in meeting these conditions, ensure that an optimal flow regime addresses scenarios relating to:

- High flow years;
- Average flow years; and
- Low water years.

(iii) the NFCP commission an objective scientific body, preferably an expert panel of the Royal Society of Canada, to propose an optimal flow regime that will result in a healthy, more natural Nechako River. The work of the scientific panel is to take into account the following conditions:

- the managed state of the Nechako River;
- the recent work of the Nechako Watershed Council on Nechako River flow regimes;
- the conditions necessary for the rehabilitation of the Murray-Cheslatta system; and
- existing water licences and legal agreements.

To that end, we recommend that $150,000 be set aside from the Nechako Environmental Enhancement Fund to cover the costs associated with the work of the objective scientific panel.

Construction Plan

The May 2001 Klohn-Crippen Report, updating the CWRF conceptual layout and cost estimate includes a construction plan and schedule. The Plan addresses five major areas of work: surface-water intake channel, regulating structure, spillway and flip-bucket, low-level outlet and deep-water intakes and pipelines. The schedule is broken down into four major elements: general, civil, structures, and mechanical and electrical. The schedule estimates that from award of contract, it will take approximately 28 months to complete construction.

For details, please see construction plan and schedule in the May 2001 Klohn-Crippen Report.

CWRF Ownership and Operation

Schedule 4 of the 1997 Settlement Agreement states that Alcan will operate a Water Release Facility at Kenney Dam if built. Schedule 4 does not state who would own such a facility.

Ownership of a CWRF may require a cooperative approach especially if public and private funds are used to finance a CWRF. In addition, it is very likely that a CWRF will be subject to an environmental assessment review process under the provincial and/or federal government environmental assessment legislation. As such, a proponent will have to be identified to assume responsibility for the preparation of an environmental impact statement.

R4. Implementation Plan: CWRF Ownership

We recommend that:

(i) Alcan Inc. and the Government of BC create a joint venture agreement among funders to ensure the CWRF is constructed in an efficient, cost-effective and expeditious manner; and

(ii) the agreement be structured so that a public-private consortium designs, builds and owns the facility leaving Alcan Inc. with the responsibility to operate the facility.

Reporting

Part of our mandate included consultation with many interests. Until an expanded management structure for the Nechako watershed is established, we believe that it is imperative for Alcan Inc. and the Government of BC ensure that all interested parties are fully aware of actions that may take place following the release of our Report. To ensure that administrative tasks required following the release of our report are carried out we have contracted the Fraser Basin Council for the term up to March 31, 2002.

R5. Implementation Plan: Reporting

We recommend that Alcan Inc., the Government of BC and potentially the Government of Canada:

- designate the officials who will be responsible for coordinating the work associated with the implementation of the decisions and recommendations in our Report; and
- jointly publish an annual progress report (until an enhanced river management structure is established) on the status of the decisions and recommendations contained in this Report.

6. Cost Estimates

Cold Water Release Facility

We asked the engineering firm Klohn-Crippen to provide us with an updated conceptual layout and cost estimate for the CWRF Case E. Their report of May 2001 estimates the total construction cost for the updated CWRF Case E at $95,947,000. Costs are summarized in Table 4 below.

Table 4: CWRF Cost Estimate

ITEM	DESCRIPTION	ESTIMATED COST ($1,000)
01	Deep-Water Intakes and Pipelines	10,876
02	Deep-Water Culverts	1,171
03	Surface-Water Intake Channel	3,342
04	Regulating Structure	6,461
05	Spillway and Flip Bucket	7,478
06	Low-Level Outlet	8,884
07	General Site Works	2,454
08	Skeleton Bay Future Hydro	762
09	Fixed Indirect Costs (Mobilize)	1,388
10	Variable Indirect Costs	25,885
11	Fixed Indirect Costs (Demobilize)	573
12	Marine Mobilize and Demobilize	1,522
13	Contingency for Design/Conditions Variations	17,000
14	**Sub-Total Estimated Construction Costs**	**87,797**
15	Investigations and Preliminary Engineering	1,250
16	Detailed Engineering (4%)	3,600
17	Construction Services (3.75%)	3,300
18	**Total Estimated Project Cost**	**95,947**

Note:

The above estimate costs are in April 2001 dollars and include PST (provincial sales tax), but do not include Owner's costs, including financing and any costs associated with federal and provincial environmental review and permitting and also do not include escalation and GST (goods and services tax).

Design specifications used in the cost estimate for the updated CWRF Case E are as follows:

- A surface-water intake channel;
- A deep-water intake and pipelines;
- A high-level outlet regulating structure, capable of releasing water from surface and deep sources either one at a time or together, and a surface spillway equipped with a flip bucket energy dissipator; and
- A low-level outlet with the capability of releasing water from surface and deep sources either one at a time or together, and equipped with one or more hollow-cone valves for energy dissipation and dissolved gas control.

Specifications for the operating regimes, hydraulic capacities, seasonal operation, redundancy, temperature control, total dissolved gas and hydroelectric generation are included in the report.

Operating and routine maintenance costs are estimated by Klohn-Crippen to be in the range of $230,000 to $320,000 per year. As per Schedule 4, Section 16 of the BC/Alcan 1997 Agreement, "Alcan will operate, and manage the maintenance of the facility at its sole cost and expense."

Total Costs

The Hay and Co. report on options for moving water through Cheslatta Fan estimated costs for our preferred option, the meandering pilot channel, to be $600,000. These costs do not include measures required to mitigate potential sediment impacts related to moving water through Cheslatta Fan.

In our implementation plan, we set aside $3 million for a trust fund for the enhanced NWC, including $150,000 for an independent scientific panel.

The total costs for construction of a cold water release facility, a meandering pilot channel and funds to assist the enhanced NWC with its role in implementation of the plan are $99,697,000 (2001 dollars).

Table 5: Total Estimated Costs for Downstream Enhancement

CWRF Construction	$ 95,947,000
Meandering Pilot Channel	$ 600,000
Nechako Watershed Council Trust Fund	$ 3,000,000
Independent Scientific Panel	$ 150,000
Total Estimated Costs	**$ 99,697,000**

7. Compilation of Decisions & Recommendations

This section pulls together in one place, our two decisions (D1 and D2) and our five sets of recommendations (R1, R2, R3, R4, and R5).

Decisions

D1. Cold Water Release Facility

We have decided that a Cold Water Release Facility be constructed at Kenney Dam to enable downstream enhancement of the Nechako Watershed.

The Cold Water Release Facility proposed meets all of the primary objectives and secondary interests at the lowest cost.

D2. Cheslatta Fan

We have decided that the preferred option for moving water through the Cheslatta Fan is the meandering pilot channel.

This is the option best able to meet two important objectives: it is a long-term solution that will return the system to a more natural river ecosystem and it is cost-effective.

Recommendations

R1. Rehabilitation of the Murray-Cheslatta System

The establishment of a Cold Water Release Facility at Kenney Dam will provide the conditions to enable rehabilitation of the Murray-Cheslatta system.

We recommend that:

(i) rehabilitation of the Murray-Cheslatta system be enabled by creating a more natural flow regime in the system; and

(ii) a more natural flow regime in the Murray-Cheslatta system be achieved by :

- removing Nechako River base flows from the Murray-Cheslatta system;
- removing cooling water flows from the Murray-Cheslatta system;
- removing flood flows up to the 1 in 200 year flows from the Murray-Cheslatta system, except the occasional flushing flows;
- adopting an adaptive management approach to create a more natural hydrograph with average annual flow rates through the Skins Lake Spillway beginning at 5 m^3/s and increasing gradually up to 15 m^3/s, if appropriate, and taking into account the possibility of temperature shears. (These reduced flows through the Murray-Cheslatta system can only be established following the commissioning of the Cheslatta Fan pilot channel); and
- establishing fish rehabilitation as the first objective of the adaptive management program.

R2. Implementation Plan: Management Structure

We recommend that:

(i) the federal and provincial governments and Alcan Inc. expand the mandate of the Nechako Fisheries Conservation Program (NFCP) to include activities beyond salmon management and include community input to its decision making ;

(ii) the Nechako Watershed Council (NWC) be given sufficient resources to operate as a financially viable organization capable of carrying out enhanced roles and responsibilities in the Nechako Watershed; to that end:

- a total of $3 million be held in trust for ongoing administration of the NWC and for research to be carried out by the NWC; and
- the NWC be given two years from the release of the NEEF Report to establish itself as a legal entity and make a formal request for the $3 million to be placed in a NWC Endowment Fund (if this objective is not met, the $3 million be allocated to the CWRF).

(iii) the NFCP and the NWC jointly explore ways to improve the management of the Nechako watershed in conformance with the following principles:

- inclusiveness;
- openess and transparency;
- recognition of existing jurisdictional roles and responsibilities;
- recognition of the Nechako as a managed river; and
- financial viability.

R3. Implementation Plan: Optimal Flow Regime

We recommend that:

(i) the Nechako Fisheries Conservation Program (NFCP) incorporate the following minimum conditions into the determination of an optimal flow regime for the Nechako River:

- That Alcan's legal entitlements to water, and authority to manage the Nechako Reservoir are respected, including Alcan's ability to meet its attendant legal obligations;
- That the water freed up as a result of the CWRF is used primarily for Nechako downstream enhancement; and
- That the necessary amount (ie. 5-15 m^3/sec.) of water is allocated for release through the Skins Lake Spillway to establish the conditions necessary to support the rehabilitation of the Murray-Cheslatta system.

(ii) the NFCP, in meeting these conditions, ensure that an optimal flow regime addresses scenarios relating to:

- High flow years;
- Average flow years; and
- Low water years.

(iii) the NFCP commission an objective scientific body, preferably an expert panel of the Royal Society of Canada, to propose an optimal flow regime that will result in a healthy, more natural Nechako River. The work of the scientific panel is to take into account the following conditions:

- the managed state of the Nechako River;
- the recent work of the Nechako Watershed Council on Nechako River flow regimes;
- the conditions necessary for the rehabilitation of the Murray-Cheslatta system; and
- existing water licences and legal agreements.

To that end, we recommend that $150,000 be set aside from the Nechako Environmental Enhancement Fund to cover the costs associated with the work of the objective scientific panel.

R4. Implementation Plan: CWRF Ownership

We recommend that:

(i) Alcan Inc. and the Government of BC create a joint venture agreement among funders to ensure the CWRF is constructed in an efficient, cost-effective and expeditious manner; and

(ii) the agreement be structured so that a public-private consortium designs, builds and owns the facility leaving Alcan Inc.with the responsibility to operate the facility.

R5. Implementation Plan: Reporting

We recommend that Alcan Inc., the Government of BC and potentially the Government of Canada:

(i) designate the officials who will be responsible for coordinating the work associated with the implementation of the decisions and recommendations in our Report; and

(ii) jointly publish an annual progress report (until an enhanced River Management structure is established) on the status of the decisions and recommendations contained in this Report.

Appendix A: Glossary of Terms

Anadromous: Fish, e.g. salmon, which ascend freshwater streams from the sea to spawn.

Base flows: The minimum volume of water running through a river system at any given time.

Confluence: The place where flowing bodies of water such as streams or rivers join.

Deep water intake (on a water release facility): withdraws water from deep within the reservoir thus ensuring the water is always cold, typically +/- 10°C in the reservoir.

Flip bucket spillway: a spillway equipped with a flip bucket energy dissipator at the downstream end, which is shaped so that water flowing at high velocity is deflected upwards in an arc.

Flow regime: the pattern of water volume, depth and velocity over an annual cycle at a given point on a river or stream.

Hydrograph: a graphic representation of stage, flow, velocity or other characteristics of water at a given point as a function of time.

Meander: sharp, sinuous loop or curve in a stream, usually part of a series.

Nechako watershed area: This encompasses all tributaries to the Nechako, the reservoir and the river to its confluence with the Fraser River at Prince George.

Rehabilitation: restoration of the historic ecological functions of an area that has been subject to environmental degradation, e.g. to make more natural.

Schedule 4: Portion of the 1997 BC and Alcan Settlement Agreement containing provisions for establishment of the Nechako Environment Enhancement Fund.

Spillway: a structure over or through which water flow is discharged from a reservoir.

Surface water intake (on a water release facility): withdraws water from the surface of the reservoir, therefore water temperature varies depending on time of year.

Temperature profile: a graphic representation of the variation of temperature as it changes as a function of depth, e.g. from the surface to the bottom of the Nechako Reservoir.

Temperature shear: is the contact between a stream of colder water and a stream of warmer water before mixing of the two occurs resulting in a sudden and substantial change in temperature.

Total gas pressure: measure of the total dissolved gasses in water.

Appendix B: List of Acronyms

BCUC	BC Utilities Commission
CWRF	Cold Water Release Facility
DFO	Fisheries and Oceans Canada
EARP	Environmental Assessment and Review Process (now Canadian Environmental Assessment Act - CEAA)
FCTD	Federal Court Trial Division
m^3/s	cubic metres per second
MELP	Ministry of Environment, Lands and Parks
NEEF	Nechako Environment Enhancement Fund
NFCP	Nechako Fisheries Conservation Program
NRA	Nechako River Alliance
NWC	Nechako Watershed Council
TGP	total gas pressure
WRF	Water Release Facility

Appendix C: List of Studies Completed For or By the Management Committee

Reports are in order of publication date.

1. NEEF Newsletter 1, August 1999.
2. Report on Community Festival Displays, Praxis Pacific, October 1999.
3. Nechako River Summary of Existing Data, Richard Hoos, Rescan Environmental Services Limited, October 1999.
4. October 1999 Workshop Report and Appendices, Praxis Pacific.
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Appendix D:
Schedule 4 of the 1997 Agreement

SCHEDULE 4

[Reference Section 4]

ESTABLISHMENT AND ADMINISTRATION OF

THE NECHAKO ENVIRONMENTAL ENHANCEMENT FUND

1. Establishment of the Nechako Environmental Enhancement Fund.

The parties will establish and administer a Nechako environmental enhancement fund (the "Nechako Environmental Enhancement Fund") in accordance with this Schedule.

2. Establishment of Environmental Fund Management Committee.

The parties will establish a management committee (the "Management Committee") in accordance with this Schedule.

3. Structure of Management Committee.

Subject to sections 4 and 6, the Management Committee will be comprised of three persons: one appointed by Alcan, one appointed by the Minister of Environment, Lands and Parks (the "Environment Minister") and one appointed by the Federal Government.

4. Participation of the Federal Government.

The parties will jointly request the Federal Government to participate in the Management Committee. The request will remain open if the Federal Government does not elect to participate initially. If the Federal Government chooses to participate initially by so electing within 60 days of the joint request, it will be asked to select and appoint an appropriate Federal official to the Management Committee who will be invited to chair but may elect to sit only as a member. If the Federal Government elects to participate at a later date, it may then appoint such member and the number of members of the Management Committee will be increased from three to four persons.

5. Appointment within 90 days.

The parties will each appoint their representatives within 90 days of the execution of this Agreement. If a party fails to appoint its representative within this time period, that party will be deemed to have declined to appoint a representative, and the Management Committee will proceed with the remaining members.

6. Selection of the Third Member if no Initial Federal Participation.

If the Federal Government does not choose to participate in the Management Committee within 60 days of the joint request, then a third member will be appointed as follows:

(a) the parties will first attempt to select the third member by consensus;

(b) if the parties are unable to agree on a mutually acceptable third member within 60 days, then the parties will immediately thereafter request the Chair of the Fraser Basin Council to appoint an appropriate third member;

(c) the Chair of the Fraser Basin Council will be requested to appoint, within 30 days, a neutral individual with no affiliation to either party, who has appropriate experience with environmental issues and with consensus-based decision-making, who will be asked to chair the Management Committee;

(d) in order to assist the Chair of the Fraser Basin Council in making the selection, each party will provide to the Chair of the Fraser Basin Council a list of six potential members who meet the requirements of sub-section 6(c) and who are willing and able to sit as a member; and

(e) if the selected person subsequently becomes unable to serve, then the parties will request the Chair of the Fraser Basin Council to select a replacement member using the process set out in this section 6.

7. Appointment/Replacement of Chair.

If no member accepts the Chair on appointment or if the Chair resigns that position, the initial or replacement Chair will be selected by the majority vote of the members.

8. Management Committee Working Procedures.

The Management Committee will develop and implement its internal working procedures and the terms under which the Nechako Environmental Enhancement Fund will be established and administered, subject to the following basic requirements:

(a) all meetings will be called by the Chair or any two members and all members must be given reasonable notice of all meetings;

(b) a quorum of the Management Committee will be two members, unless the Management Committee consists of only one member, in which case quorum will be one; and

(c) the Management Committee will seek to reach decisions by consensus but if the majority concludes that, despite reasonable efforts, consensus cannot be reached, then decisions will be made by majority vote.

9. Costs of the Management Committee.

Each party will be responsible for the costs of the participation of its representative on the Management Committee and will share equally:

(a) the costs of operation of the Management Committee; and

(b) the costs of preparing the report referred to in section 12;

(c) up to an aggregate amount of $500,000, or such greater amount as may be agreed to in writing by the parties, provided that if any payment by the Province is delayed due to a need for statutory appropriation, Alcan's obligation to make a payment hereunder, and the Federal Government's obligation should it choose to participate, will be delayed for the corresponding period. If it chooses to participate, the Federal Government will also be responsible for the costs of the participation of its representative and a proportionate share of the costs under (a) and (b) above. However, if the third member must be selected under the provisions of section 6, then the parties will share equally the reasonable costs of the participation of the third member.

10 . Purposes of the Management Committee.

The purpose of the Management Committee is to review, assess and report on options that may be available for the downstream enhancement of the Nechako watershed area. These options may include, but are not limited to, the development of a water release facility at or near the Kenney Dam, or the use of the Nechako Environmental Enhancement Fund for other downstream enhancement purposes.

11. Consultation Process.

The Management Committee will consult with the Nechako Watershed Council, if formed, and any other stakeholders that the Management Committee considers appropriate. The Management Committee may approve funding for consultation purposes up to an amount of $100,000 a year. Alcan and the Province will share equally the cost of such approved funding unless the Federal Government chooses to participate in the Management Committee, in which case the Federal Government will be responsible for a proportionate share of the cost of approved funding.

12 . Management Committee Reports.

As soon as practicable after carrying out the consultation pursuant to section 11, the Management Committee will complete and deliver a report to the Province, Alcan and such other parties as appropriate, which report will include:

(a) its decision on the appropriate options for downstream enhancement of the Nechako watershed area;

(b) a plan for the implementation of each of the selected options, including the identification of the appropriate party or parties to implement the options;

(c) an independent report for each selected option providing a detailed estimate of the costs for implementation of the option, including any ongoing costs associated with the option;

(d) a program for the use of the funding described in section 15 below to meet the costs of each of the selected options and to provide for financial and project reporting.

13. Decisions Binding on the Parties.

Subject to the financial arrangements described below in section 15, and the other terms of this Schedule, the decisions of the Management Committee will be binding on the parties.

14. Formation of the Nechako Watershed Council.

Immediately following the execution of this Agreement, the Province will help to facilitate the formation of the Nechako Watershed Council (the "Council"), in order to provide advice to the Management Committee on the uses and priorities of the Nechako Environmental Enhancement Fund.

15. Alcan's Financial Contribution.

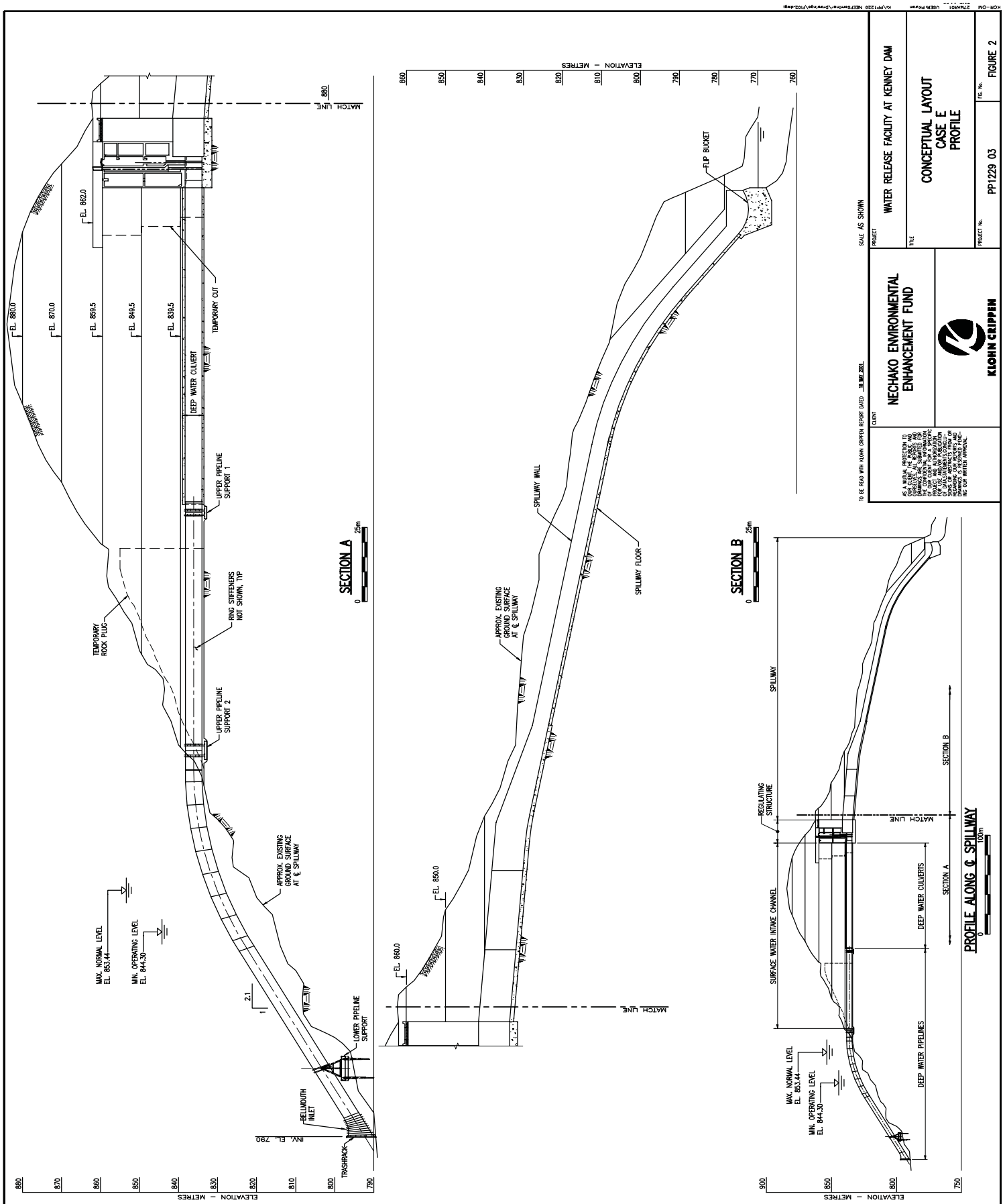
Funding of each of the selected options will be drawn down as required to meet the cash flow needs of the expenditure program established by the Management Committee for that option as provided in the report. Within 7 days after each contribution has been made into the Nechako Environmental Enhancement Fund by another person of 50% of each draw down for an option, Alcan will make a matching contribution into the Nechako Environmental Enhancement Fund. The aggregate and cumulative maximum of Alcan's contributions will be CAD$50,000,000 including any costs incurred by Alcan under section 9(b) or under section 11. Alcan will receive a credit against its obligation to contribute to the Nechako Environmental Enhancement Fund in an amount not exceeding, in the aggregate, CAD$10,000,000 for the total amount of the reduction or elimination of costs which would have been incurred in the development or implementation of any of the selected options to the extent that such reduction or elimination is shown to be achieved by the use of any design or engineering studies or reports prepared for Alcan prior to the date hereof on the Kenney Dam Release Facility as part of the Kemano Completion Project. These funds will be disbursed in accordance with the program for the use of funding developed by the Management Committee. The CAD$50,000,000 contribution by Alcan represents its total contribution to downstream enhancement under the program described in this Schedule, including the capital costs of any water release facility which may be selected and, whether or not a water release facility is built, Alcan shall not be required to contribute any further amount to a water release facility or other downstream enhancement. For greater certainty, this provision does not affect any responsibility of Alcan that exists in respect of its ownership of the Works.

16. Operation and Maintenance of a Release Facility.

If a water release facility is build under the program described in this Schedule, then once completed, Alcan will operate, and manage the maintenance of, the facility at its sole cost and expense. Alcan will not be responsible for the costs of maintenance, other than as set forth above, except to the extent that those costs are in part paid for by Alcan through its contribution to the Nechako Environmental Enhancement Fund under section 15 of this Schedule.

Appendix E: Conceptual Layout of Updated Case E

Cold Water Release Facility



Appendix E: Conceptual Layout of Updated Case E

Cold Water Release Facility