NEEF

Nechako Environmental Enhancement Fund

British Columbia

Nechako River
Summary of Existing Data

October 1999

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E R R A T A

Following are revisions to the Report **"Nechako River – Summary of Existing Data"** (October 1999)

Page 2-13, Second Paragraph, Last Sentence:

The last sentence in the second paragraph, i.e. *"Design approval for the Cheslatta Fan Channel was obtained from the NFCP in July 1993"*, should be replaced with the following:

> *"The Nechako Fisheries Conservation Program gave a qualified approval for the design of a non-erodible channel (subject to nine items being addressed) and indicated final approval for the design of a channel would follow only after a regime channel concept had been considered further by the Kemano Completion Project and the Technical Committee."*

Page 5-10, Figure 5-7:

The top line in the Legend should read *"Adult Sockeye Migration Routes".*

Page 5-15, Section 5.6.5, Waste Water Dilution:

The two sentences at the bottom of this page should be replaced with the following:

> *"Fort Fraser and Vanderhoof are the two main sources of sewage discharged to the Nechako River. Recently the firm, Urban Systems, was commissioned by Vanderhoof to undertake a study of their present sewage treatment system, which consists of retention lagoons, and to recommend options for enhancing treatment from this major point source in the future."*

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LIST OF ACRONYMS AND ABBREVIATIONS

ACRONYMS

av.	average
BCUC	British Columbia Utilities Commission
BC	Province of British Columbia
CSTC	Carrier-Sekani Tribal Council
CWRFW	Cold Water Release Facility Working Group
DFO	Department of Fisheries and Oceans
EARP	Environmental Assessment and Review Process
FBC	Fraser Basin Council
FBMB	Fraser Basin Management Board
FCA	Federal Court of Appeal
FCTD	Federal Court Trial Division
IPSFC	International Pacific Salmon Fisheries Commission
KCP	Kemano Completion Project; (Alcan's final proposed stage in the Nechako River diversion project, begun in 1950)
KDRF	Kenney Dam Release Facility
KDRFW	Kenney Dam Release Facility Working Group
KEMANO 1	Alcan's 1950 original project
KRWG	Kemano River Working Group
LTWA	Long term water allocation
MELP	Ministry of Environment, Lands and Parks (BC)
MEM	Ministry of Energy and Mines (BC)
NEC	Nechako Environmental Coalition
NEEF	Nechako Environmental Enhancement Fund
NFCP	Nechako Fisheries Conservation Program
NRA	Nechako River Alliance
NRWG	Nechako River Working Group
NWC	Nechako Watershed Council
PMF	Probable maximum flood
STMP	Summer Temperature Management Program
STP	Sewage Treatment Plant
STWA	Short term water allocation
TGP (tgp)	Total gas pressure in water

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ABBREVIATIONS OF UNITS OF MEASUREMENT

ac	a measurement of land area equal to 4840 sq. yards, or 43,560 sq. feet (or equals .4047 hectare)
°C	degrees centigrade
cfs	cubic foot per second (equals .0283 cms)
ha	hectare (equals 2.471 acres)
km	kilometre (1000 metres)
kV	kilovolt; measurement of voltage (1000 volts)
m	metre, a unit of measure (100 cm)
m. asl	metres, above sea level
MW	megawatt; measurement of power (one million watts)
m^3/s	cubic metre per second

CONVERSION FACTORS

1 cubic foot per second (cfs) = 0.283 cubic metres per second (m^3/s)
1 cubic metre per second m^3/s) = 35.315 cfs

1. INTRODUCTION

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Almost 50 years have passed since Alcan was first granted a conditional water license by the Province of British Columbia to divert water from the Nechako River (Photo 1-1) to generate hydroelectric power for its aluminum smelter at Kitimat.

Photo 1-1 Fall scene of the Nechako River Valley below Fort Fraser.

The management of water within the Nechako Watershed has long been a complex and contentious issue. Millions of dollars, an enormous amount of time and extensive human capital have been invested by industry, government, the general public and other interests to study and address the impacts of changing flows on the aquatic ecosystem and downstream human users of the Nechako Watershed.

After the Kemano Completion Project (KCP) was rejected by the Province of British Columbia in 1995, Alcan and the Province signed the B.C.-Alcan 1997 Agreement to address outstanding legal matters. As part of this Agreement, the Nechako Environmental Enhancement Fund (NEEF) and its three-person Management Committee were established 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.

In deciding how to allocate the enhancement fund, the Management Committee wishes to consider the views of the Nechako Watershed Council and its members, aboriginal communities, other primary interests, and the public. Recently, a multi-interest involvement process has been initiated to help to identify, explore and evaluate the available options for achieving the enhancement objectives for the Nechako Watershed area. The process includes a variety of activities such as open houses, workshops, meetings, interviews, newsletters, questionnaires and other forms of media.

During the summer of 1999 the NEEF information booth was set up at the following dates and community events:

August 12-15 Prince George Exhibition

August 20-22 Nechako Valley Exhibition, Vanderhoof

August 27-29 Bulkley Valley Exhibition, Smithers

September 6 Fall Fair, Fort Fraser Town Hall

The next major event will be a two-day workshop and open house scheduled for October 16 and 17, 1999 in Vanderhoof. To assist with discussions at the upcoming workshop and for subsequent phases of the multi-interest involvement process, in July 1999, the NEEF Management Committee retained the services of Mr. Richard Hoos, M.Sc., R.P.Bio. and Vice President of Rescan™ Environmental Services Ltd., to prepare this resource document on the current state of knowledge of the Nechako River and Watershed.

Report Limitations:

It is important to stress that due to the extensive amount of available information and the limited timeframe for completion of this report, the material presented has been drawn from a fairly narrow range of readily available published data (see attached references).

The goal of this report was to provide a common understanding of the available technical information, and not necessarily to represent the full range of issues and opinions presented by members of the public and scientists over many years of debate on the Nechako River.

2. BACKGROUND

2. BACKGROUND

The hydroelectric potential of northwestern British Columbia was identified as early as the 1930s. Discussions about using this hydroelectric potential for the establishment of an aluminum smelting industry in the region were first initiated by Alcan and the Province of British Columbia in the 1940s. Construction on Alcan's Kemano I project began in 1951 resulting in impacts on, and changes to, the Nechako River and its watershed.

To provide context for this report and future dialogue amongst interested parties, a chronology of the key events that have influenced and shaped the Kemano hydroelectric development as it exists today is provided. This is followed by brief descriptions of the existing Kemano I development infrastructure, the cancelled Kemano Completion Project and current concepts for a Kenney Dam Cold Water Release Facility.

2.1 Chronology of Key Events

1930s	Government Surveys identify the hydroelectric potential of the region.
1943	Meetings between Alcan officials and B.C. Government on regional development.
1948	Alcan examines feasibility of building aluminum smelter after invitation from the B.C. Government.
1949	B.C. passes Industrial Development Act. The Act allows the Government to give Alcan water rights in the Nechako and Nanika rivers.
1950	B.C. enters agreement with Alcan (1950 Agreement) and grants a conditional water license to divert water from the Nechako and Nanika rivers. Alcan to receive permanent water rights in 1999 for the installed generating capacity.
1951	Construction of first phase of Kemano power project (Kemano I) begins.
1954	Kemano I completed.
1978	B.C. Hydro extends power grid into Northwestern B.C.
1978	Alcan retained Envirocon, now Triton, to study the environmental effects of its final phase of development.
1979	Alcan announces intention to proceed with the final phase of the Kemano project. The project would divert more water from the Nechako River and a dam would be constructed on the Nanika River.
1980	Federal Fisheries Minister orders Alcan to release more water into the Nechako River. Alcan did not agree and challenged the order. The Department of Fisheries and Oceans (DFO) obtains a B.C. Supreme Court order requiring Alcan to comply with DFO levels for water flow.

1982	The Attorney General of British Columbia added to the dispute between the DFO and Alcan. The Attorney General takes the position that water flows are under Provincial jurisdiction and cannot be appropriated by the Federal Government.
1984	Alcan applies to the B.C. Government for Energy Project Certificate for construction of aluminum smelters. Application is withdrawn as result of low aluminum prices. Kemano completion project placed on hold.
1985	Initial trial date set for Alcan/Provincial Government lawsuit against DFO concerning jurisdiction over flows in the Nechako.
August 1987	Final trial date set to determine jurisdiction over water flows. Trial postponed while parties attempt to reach a settlement.
September 1987	Settlement Agreement signed by Alcan and the Provincial and Federal Governments. The agreement settles the litigation started in 1980. Alcan relinquishes rights to the Nanika River. River flow levels are established to protect the chinook salmon resource in the Nechako River and to manage water temperatures in the Nechako during the sockeye migration.
	The 1987 Settlement Agreement also established two committees, a Steering Committee and a Technical Committee, to implement the terms of the Agreement. The overriding objective of both committees was and remains the conservation of Nechako River chinook and sockeye salmon populations. The Nechako Fisheries Conservation Program (NFCP) of studies, which continues to the present, was initiated under the auspices of the 1987 Settlement Agreement.
1988	Save the Bulkley Society files a suit alleging that the 1987 Settlement Agreement has fettered the discretion of federal officials under the Fisheries Act. Action adjourned indefinitely.
1988	Alcan begins construction of the Kemano Completion Project (KCP).
1988 & 1989	The Federal Minister of Transport issues a series of Exemption Orders under the Navigable Waters Protection Act.
October 1990	Federal Cabinet enacts the KCP Guidelines Order which exempts the KCP from the Federal Environment Assessment and Review Process (EARP).
October 1990	The Save the Bulkley Society and the Carrier Sekani Tribal Council file motions, seeking orders quashing the 1987 Settlement Agreement and the Exemption Orders. A full environmental review of the project is requested.

1990	Alcan signs a 20-year contract with B.C. Hydro for the sale of electricity, beginning in 1995. Alcan signs a 50-year Coordination Agreement with B.C. Hydro.
1991	The 1990 lawsuit goes to trial (Carrier-Sekani *et al.* v. Canada), the Federal Court Trial Division (FCTD) quashes the Exemption Order and rules that the project is subject to the EARP process.
1991	Alcan suspends work on the KCP.
May 1992	Federal Court of Appeal (FCA) reverses 1991 FCTD decision. Appeal to Supreme Court of Canada launched.
June 1992	Provincial Government initiates review of government options by Murray Rankin regarding Alcan's Kemano Completion Project.
October 1992	Rankin Report completed.
January 1993	The Provincial Government establishes a public review of the KCP to be conducted by the British Columbia Utilities Commission (BCUC) under sections 6 and 20 of the Utilities Commission Act.
February 1993	Supreme Court of Canada refuses to hear appeal of the 1992 FCA decision.
April 1993	BCUC Community Scoping Meetings are held in Prince George, Fort Fraser and Kitimat.
November 1993 - August 1994	The BCUC completes eight days of community hearings and 79 days of technical hearings.
December 1994	The BCUC submits its report and recommendations on the KCP Review to the Lieutenant Governor in Council of the Province of British Columbia.
January 1995	The Province of British Columbia rejects the KCP.
July 1995	The provincial government and Alcan agree to negotiate a framework agreement to deal with the rejection of the KCP.
April 1996	The provincial government and Alcan release the report 'Conceptual Alternatives for a Release Facility at Kenney Dam'.
June 1996	The former Fraser Basin Management Board (FBMB) hosts an exploratory workshop at Stoney Creek, attended by more than 100 people who reflect the broad range of interests in the Nechako. The purpose is to determine if there is a willingness to work together to find solutions to the outstanding issues, and, if so, how might such a joint effort be undertaken. At the conclusion of the workshop, about ten participants volunteer to form a task or working group to further develop the ideas generated during the discussions about how to create a cooperative management process for the watershed.

September 1996	The Nechako Working Group hold its first meeting in Smithers. The Group confirms its terms of reference for an overall cooperative management process. During the discussion, the idea is proposed to create a Nechako Watershed Council. One topic of concern is how the proposed Council might interact with the B.C.-Alcan negotiations. The date for the next workshop is set for November 30, 1996, in Smithers.
November 1996	The former FBMB hosts a second workshop, attended by about 75 people representing the range of interests in the Nechako Watershed. Assisted by FBMB staff, the Nechako Working Group presents an update on the tasks it completed and its recommendations for consideration by the participants. The workshop participants unanimously support the recommendation to begin to develop terms of reference for a Nechako Watershed Council. The Nechako Working/Transition Group is formed and charged with completing the task of forming the Watershed Council.
January 1997	Alcan files suit against the Province of British Columbia with respect to rejection of the KPC.
August 1997	The Province of British Columbia and Alcan sign the BC-Alcan 1997 Agreement which addresses outstanding legal matters arising from the cancellation of the KCP. This agreement also grants Alcan a permanent water license for the water necessary to operate the facilities constructed up to that time; and establishes the Nechako Environmental Enhancement Fund (NEEF); the Northern Development Fund and associated committees.
June 1998	Cold Water Release Facility Workshop held in Vanderhoof.
June 1998	Nechako Watershed Council (NWC) formally established.
June 1998	Inaugural meeting of the Nechako River Alliance NRA).

Source: Adapted from BCUC (1994).

2.2 Kemano I Project Facilities

Construction of the first phase of the Kemano hydroelectric project (Kemano I) was begun by Alcan in 1951 and completed in 1954. The Kemano I facilities consist of:

- Kenney Dam;
- Nechako Reservoir;
- Skins Lake Spillway:
- Power Tunnel;
- Kemano Powerhouse
- Kemano to Kitimat Transmission line;
- Temporary Murray Lake Dam; and
- The Communities of Kemano and Kitimat.

Figure 2-1 shows the geographic location of the major Kemano I project components and brief descriptions of each component follow (BCUC 1994).

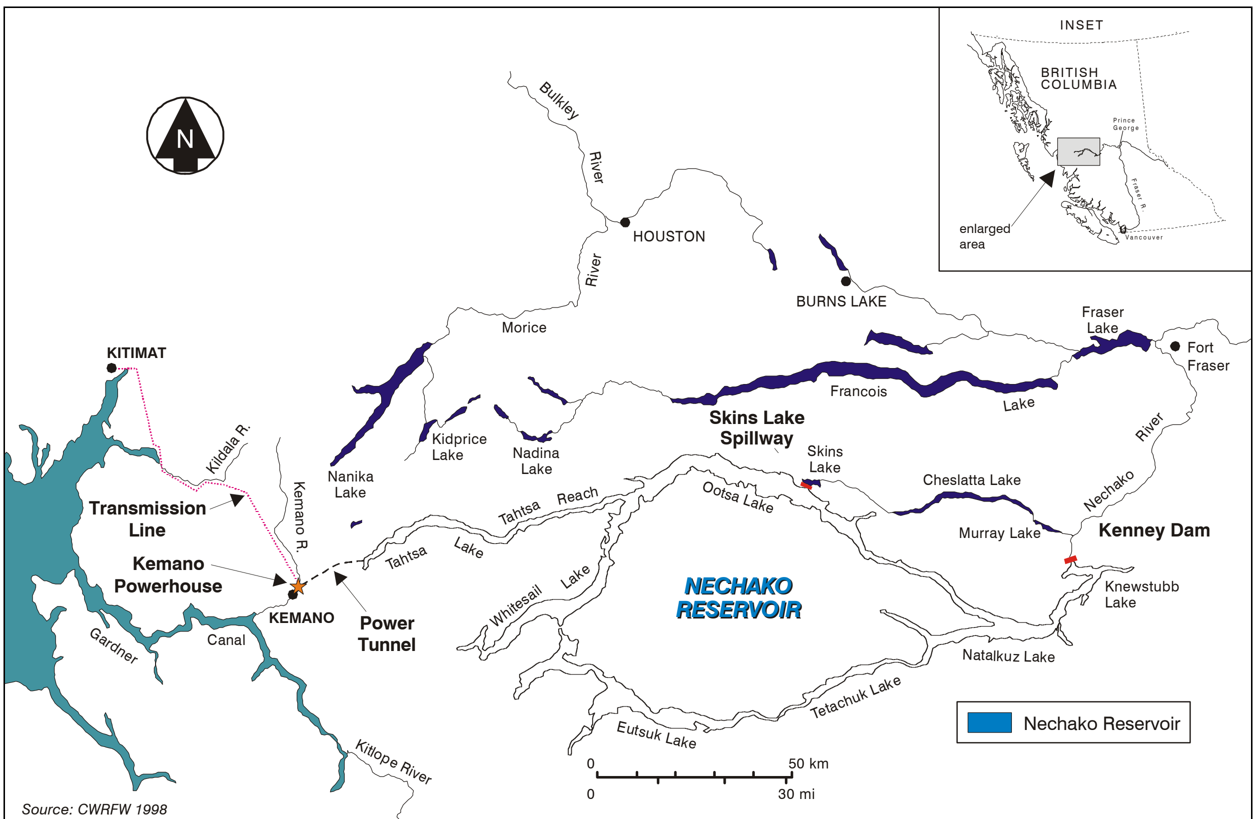

Figure 2-1: Location of Existing Kemano Facilities

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Photo 2-1 Kenney Rockfill dam constructed for the Kemano I Project to create the Nechako Reservoir.

Photo 2-2 Skins Lake Spillway built to release water from the Nechako Reservoir into the Nechako River via the Murray/Cheslatta System.

Photo 2-3 Cheslatta Falls where water from the Nechako Reservoir enters the Nechako River.

Kenney Dam: The Kenney Dam is a rockfill dam located in the Nechako Canyon (Photo 2-1). The dam has a maximum height of 95 metres and a top length of 450 metres. The dam impounds water from the Eutsuk/Tahtsa Drainage Basin. No water is released at the Kenney Dam.

Nechako Reservoir: The reservoir that was created by the construction of the Kenney Dam has a surface area of approximately 1,200 square kilometres and an available storage capacity of 7,100 million cubic metres (Photos 2-1 and 2-2)

Skins Lake Spillway: The spillway is located approximately 80 kilometres west of the Kenney Dam on Ootsa Lake (Photo 2-2). The spillway is equipped with two steel gates which can be raised to release water from the reservoir into the Murray/Cheslatta system which joins the Nechako River at Cheslatta Falls (Photo 2-3). The spillway releases flows for fisheries purposes as well as excess water inflows as necessary for flood control purposes. Since 1987, flow releases for fisheries have been made under the provisions of the 1987 Settlement Agreement.

Power Tunnel: This tunnel is 7.6 metres wide and approximately 16 kilometres long (Figure 2-2).

It extends from Tahtsa Lake through Mount Dubose to the Kemano Powerhouse. The reservoir is 800 metres above the powerhouse. Water from the Nechako watershed, an easterly flowing drainage basin, is diverted to the west through the power tunnel into the Kemano River.

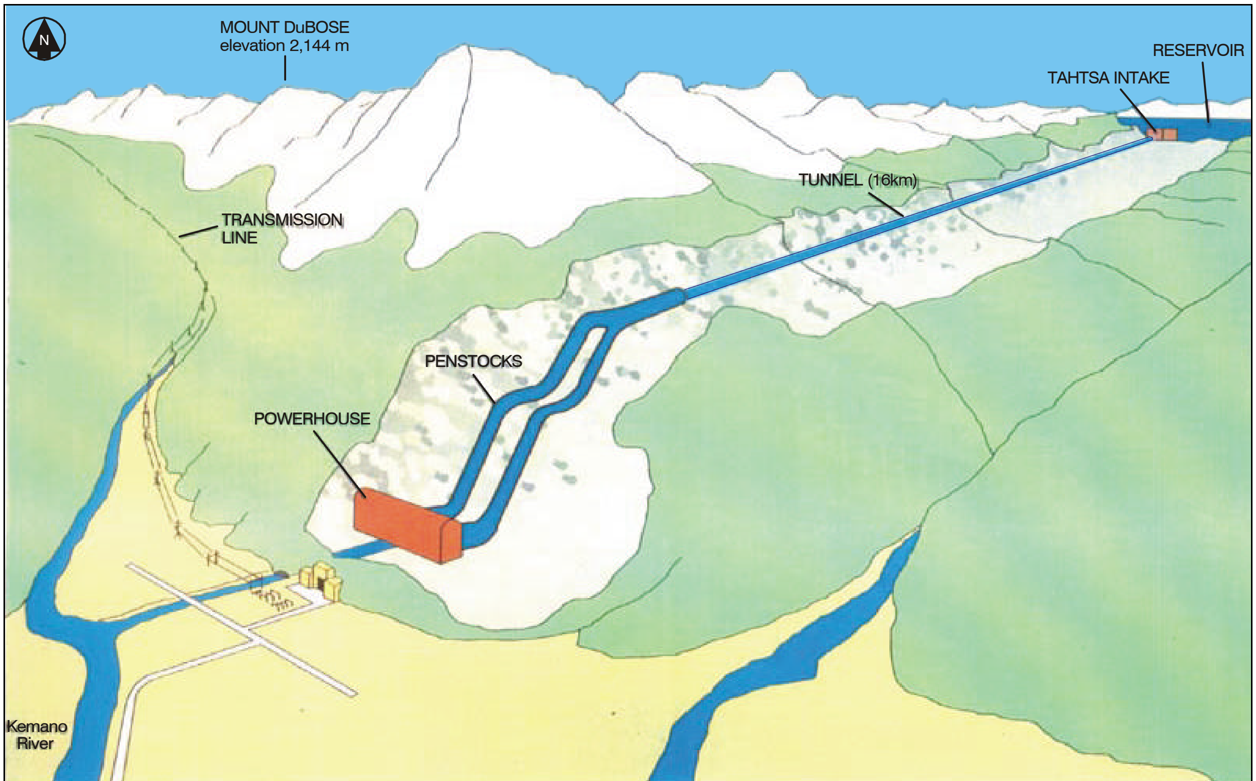

Figure 2-2: Schematic of Existing Kemano Hydro-Electric Generating Station a4549f

Kemano Powerhouse: The Kemano Powerhouse is located inside Mount Dubose (Figure 2-2). It consists of eight turbine generators with a total capacity of 1,000 MW. The tailrace from the powerhouse discharges into the Kemano River.

Kemano to Kitimat Transmission Line: Power generated at Kemano is transmitted via a 300 kV power line which stretches for 82 kilometres from Kemano to Kitimat. The power line follows the Kemano River north from Kemano and crosses Kildala Pass to the Kildala River Valley. It then traverses Green Mountain to Minette Bay and finally crosses the Kitimat tidal flats to the smelter at Kitimat. The portion of the line that traversed Kitimaat Village was relocated in 1999.

Communities of Kemano and Kitimat: The community at Kemano was established for the operation and maintenance of the power facilities. Kitimat was established as a centre for the smelting of aluminum. The present population of Kitimat is about 11,000. On April 29, 1999, in efforts to improve its global competitiveness, Alcan announced a change in the way it operates and maintains its power house at Kemano, thereby eliminating the need for permanent family residences in the Kemano Valley over the next two years (Alcan 1999).

Temporary Murray Lake Dam: A temporary dam was constructed at the outlet of Murray Lake to store the inflow from the Murray/Cheslatta system for release, as requested, to assist fish migration in the lower Nechako during the early years in the 1950s when the reservoir was filling. The dam was removed in 1956 after filling of the Nechako reservoir was completed.

2.3 Kemano Completion Project

In the late 1970s Alcan announced its intention to complete the Kemano hydroelectric development. Alcan referred to this phase of development as the Kemano Completion Project (KCP) to distinguish it from an earlier project known as Kemano II. According to Alcan, Kemano II was an energy project proposed by the British Columbia Energy Commission which included some of the watersheds in the Alcan project but also encompassed watersheds over which Alcan had no water rights. Kemano II did not proceed beyond the drawing boards (BCUC 1994).

There were a number of versions of the final phase of development (KCP) and construction began on some components of the proposed project in 1988, including new work on the West Tahtsa intake, a second power tunnel through Mount Dubose, excavation and partial completion of the second powerhouse at Kemano and site preparation work along a proposed new transmission line right-of-way. However, work ceased when the project was voluntarily suspended by Alcan in the summer of 1991 due to ongoing litigation, and it was subsequently rejected by the Province of British Columbia in January 1995.

Nevertheless, for the purposes of this document a brief review of the proposed KCP project components as summarized by the BCUC (1994) is provided.

The final version of the KCP retained some of the components included in earlier versions of the proposed development such as the construction of a second tunnel through Mount Dubose, a second 300 kV transmission line between Kemano and Kitimat, and the dredging of Tahtsa Narrows. The proposed project also involved modifications to some of the Kemano I facilities; namely, the construction of a two level cold water release facility at the Kenney Dam, generally referred to as the Kenney Dam Release Facility (KDRF), an increase in the height of the Skins Lake Spillway, and modifications to the Kemano powerhouse control room to include controls for the KCP generating units.

Kenney Dam Release Facility: A cold water release facility was to be installed at the Kenney Dam (Figure 2-3). This facility would have replaced the Skins Lake Spillway for the release of water from the Nechako Reservoir into the Nechako River. The proposed KDRF consisted of a surface and a deep water intake; both were designed to accommodate up to 170 m^3/s of water. The deep water intake was to be located 60 m below the normal maximum operating level of the reservoir. The KDRF had a low-level and high-level outlet. The low-level outlet, with a capacity of 30 m^3/s, was to release water through a hooded hollow cone valve to an existing diversion tunnel. The high-level outlet would transmit up to 170 m^3/s of water to a concrete baffle block spillway. The hooded valve and the baffle blocks were designed to provide gas pressure equilibration to the water being released from the reservoir into the Nechako Canyon. The KDRF as proposed would have resulted in the rewatering of the Nechako Canyon.

Cheslatta Fan Channel: The Cheslatta Fan, an alluvial deposit created by a breakout of the Cheslatta River, is located about 7 km downstream from the Kenney Dam. The rejected KCP included plans for constructing a lined channel, 1,100 m long at Cheslatta Fan to prevent further erosion of the fan.

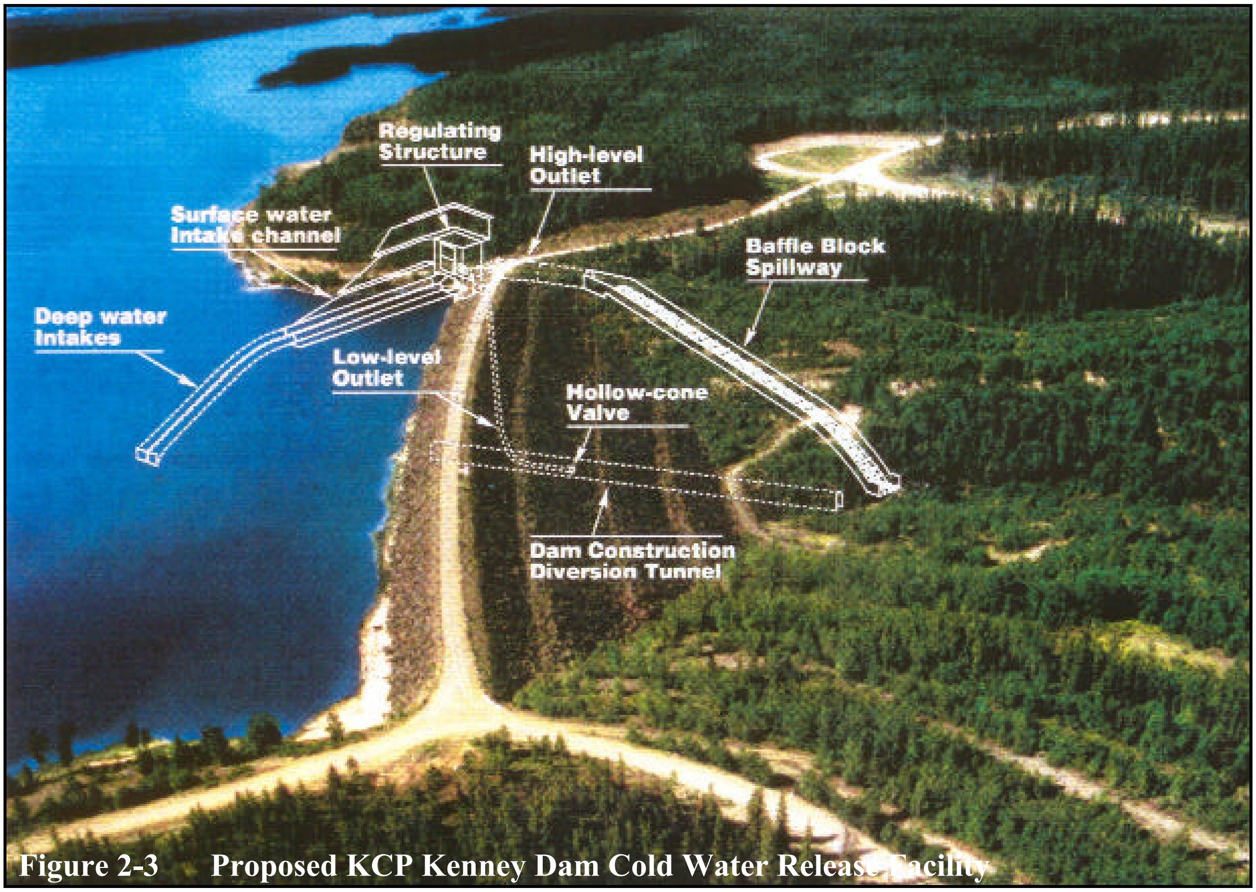

Figure 2-3 Proposed KCP Kenney Dam Cold Water Release Facility

Modifications to Skins Lake Spillway: The height of the spillway gates was to be increased to accommodate flood surcharges up to 1.1 m. Flood surcharges over this level, with an expected occurrence of once in 200 years on average, were proposed to be released through the Skins Lake Spillway.

Tahtsa Narrows: A channel 3.3 km long was to be dredged through Tahtsa Narrows to allow water to flow to the power intakes under lower reservoir operating levels.

West Tahtsa Intake: A new water intake to accommodate a maximum water flow of 106 m^3/s was to be constructed about 450 m to the south of the existing intake. The intake was designed to have a gate capable of closing the intake under full flow conditions. A trash rack was included to prevent large debris from entering the intake and power tunnel.

New Power Tunnel: A tunnel parallel to the existing tunnel was proposed to connect the West Tahtsa intake and the penstock for a new powerhouse. A cross tunnel, with butterfly valves to control the separation of flows, would connect the two power tunnels towards the Kemano end to balance the heads between the two tunnels. The penstock was to be lined with a steel liner.

New Powerhouse: The KCP powerhouse was to be located adjacent to the existing Kemano I facility. Four power generating units were proposed in the new powerhouse, each with a capacity of 135 MW for a total maximum capacity of 540 MW. Water from these units was to discharge through a tailrace tunnel and a tailrace channel to the Kemano River. Tail water levels were to be controlled by a weir located downstream from the powerhouse.

The total installed capacity of Kemano I and KCP was planned for 1,420 MW while the firm energy capacity of the system was to be 1,105 average annual MW.

New Kemano to Kitimat Transmission Line: A single circuit 300 kv line was to be constructed between Kemano and Kitimat. The new route followed much the same alignment as the existing line. Two new transmission lines were to be constructed outside of the Kitimaat Band reserve. An existing line across the reserve would be removed.

In 1988, Alcan began construction of the KCP. Subsequent litigation resulted in voluntary suspension of the project in 1991. At the time of suspension, the KCP was about 40% complete and Alcan had incurred expenditures of approximately $535 million (BCUC 1994). Table 2-1 summarizes the construction status of the major KCP components at the time of project suspension.

2.4 Post-KCP Kenney Dam Cold Water Release Facility

Following British Columbia's 1995 decision to reject the KCP, the Province and Alcan agreed to explore the possibility of finding a mutually acceptable resolution to deal with the consequences of this decision. The exploratory discussions led to the establishment, in April, 1995, of various working groups, each designed to provide input to the overall resolution of the various outstanding issues. One of these groups was the Kenney Dam Release Facility (KDRF) Working Group.

The KDRF Working Group included representatives of the Province and Alcan. The B.C. team was represented by officials from the Environmental Assessment Office, the Ministry of Environment, Lands and Parks, B.C. Hydro and Power Authority, and BriMar Consultants Ltd. In addition to Alcan officials, the Alcan team included representatives from Klohn-Crippen Consultants Ltd. and from Triton Environmental Consultants Ltd. Its mandate was to examine and analyze the environmental and technical aspects, benefits and costs of a release facility and related auxiliary works at the Kenney Dam to further enhance environmental conditions along the Nechako River.

In 1996 the KDRF Working Group produced an Interim Report (KDRF 1996) which outlined various conceptual layouts for a release facility and provided a general discussion of these alternatives. The following text is largely extracted from KDRF (1996), updated as appropriate by more recent information from the Cold Water Release Facility Workshop sponsored by Alcan and held in Vanderhoof in June 1998 (CWRFW 1998).

To assist readers in understanding the current concepts for a release facility, it is useful to begin with a brief review of the former KDRF design that was an integral component of the rejected KCP. However, it is important to keep in mind that this facility was designed for the protection and conservation of fish resources in the context of the reduced flows which would have been released into the Nechako River under the KCP, not in the context of the larger flows which will continue to be released as a result of the Province's rejection of the KCP.

Table 2-1
Construction Status of the Major Components of the KCP at the Time of Project Suspension

Nechako Reservoir and Watershed		
West Tahtsa Intake	Excavation of open cut	completed
	Blasting of channel intake	completed
	Access road to existing intake	completed
	Structural, mechanical and electrical work	-
	Installation of gates	-
	Removal of rock plug	-
	Removal of 4,000 m^3 of rock from intake tunnel	-
Kenney Dam	Cold water release facility and spillway work	-
Skins Lake Spillway	Increase height of spillway	-
Cheslatta	Fan channel work	-
Kemano Watershed		
Power Tunnel	Adit tunnel	completed
	Power tunnel	half completed
	Excavation of surge shaft	-
	Chamber for penstock valve	-
Penstock	Penstock shaft	half completed
	Installation of steel liners	-
	Installation of penstock valve	-
Powerhouse	Excavation of powerhouse tunnel, transformer chambers, ventilation tunnel, tailrace and cable tunnels	completed
	Concrete, electrical and mechanical work	-
	Installation of four turbines	-
	Generator and valves	-
	Excavation and riprap of tailrace channel	-
Switchyards	Site preparation work: Kemano	completed
	All other work	-
Transmission line	Logging of marketable timber in right-of-way	completed
	Clearing	quarter completed
	All other work	-

Source: BCUC (1994).

2.4.1 KDRF Design with KCP

2.4.1.1 Performance Design Criteria

The principal performance criteria for the KCP version of the KDRF were:

(a) **Long Term Water Allocation Release (LTWA) as specified in the 1987 Settlement Agreement.** This consisted of a year-round mean-annual base flow of 19.6 m^3/s, varying on a monthly basis up to a maximum of 30 m^3/s, with additional water for cooling purposes to meet downstream water temperature criteria at Finmore for migrating sockeye salmon in July and August (not to exceed 21.7°C more frequently than one in 200 years on average, and not to exceed 20°C more frequently than 3.88 days per year on average). The year-round release criteria dictated a facility which could release water in freezing winter conditions. The cooling water release criteria dictated a facility which could release specific quantities of water at a controlled 10°C with a maximum capacity of 170 m^3/s;

(b) **Reduced excess flood inflow release from the Skins Lake Spillway to less than once in 200 years, on average, to provide flood protection for the Murray-Cheslatta system.** Studies showed that, given water releases necessary to meet fish conservation and power generation objectives, flood control objectives could be achieved within the capacity dictated by the cooling water requirement, using appropriate flood forecasting and attenuation procedures; and

(c) **Total Gas Pressure (TGP) control for all releases to less than 103% at 1 km below Kenney Dam to avoid exposing fish to elevated levels of dissolved gas.** This requirement dictated a facility which would both reduce the level of dissolved gases (oxygen, nitrogen) in the source water (primarily the deep, cold water) and prevent the reabsorption of gases from air entrained during release.

Other criteria included: managing monthly releases to meet the Comptroller of Water Rights flood control objectives in the lower Fraser River and to achieve Nechako Fisheries Conservation Program objectives; releasing flows in a manner which would avoid dramatic temperature changes; and the provision of controlled flow build-up.

The KDRF design under KCP met these criteria with the release facility illustrated in Figure 2-3

Table 2-2
Summary of KCP Design Criteria

Low level outlet capacity	30 m^3/s
Temperature control	10°C, 170 m^3/s maximum
Spillway capacity	170 m^3/s
Skins Lake Spillway	operation once in 200 years on average
TGP Control	less than 103% for all releases

Source: KDRF 1996.

and summarized in Table 2-2.

The KDRF design under the KCP was subjected to a full technical review by the NFCP Technical Committee, as required under the 1987 Settlement Agreement. The review, involving 74 technical reports and submissions, began in the spring of 1991 and final approval was received in March 1993. The KDRF design was also reviewed by the Comptroller of Water Rights over a period of eight months and was accepted in July 1992.

In addition, the KCP version of the KDRF included a design for the Cheslatta Fan Channel which provided a non-erodible riprap-lined main channel to convey the design flow of 210 m^3/s (170 m^3/s from the KDRF plus the estimated 200-year flood inflow from the canyon of 40 m^3/s). A control structure at the upstream end of the channel was designed to regulate flows into the existing channel, and would have provided fish access to upstream areas from the Nechako River. A section of new channel would have linked the upstream and downstream sections of the side channel where it was unavoidably interrupted by the main channel. Design approval for the Cheslatta Fan Channel was obtained from the NFCP in July 1993.

2.4.2 KDRF Design without KCP

In the absence of the KCP, Alcan remains legally required by the terms of the 1987 Settlement Agreement to release Short Term Water Allocation (STWA) flows into the Nechako River. The components of the STWA are similar to the post-KCP Long Term Water Allocation (LTWA), but the mean-annual base flow is 36.8 m^3/s, almost twice the mean-annual base flow specified under the LTWA. Current monthly releases can vary from a minimum of 27.6 m^3/s to a maximum of 54.6 m^3/s (almost twice the post-KCP release), and the maximum cooling water releases are much larger (283 m^3/s instead of 170 m^3/s) because surface water is released through the Skins Lake Spillway rather than the 10°C water which would have been released from the KDRF.

Without the KCP, the KCP version of the release facility would not achieve the original objectives under current conditions because:

(a) The amount of water to be released from the Nechako Reservoir for flood management purposes exceeds the capacity of the KDRF, therefore requiring frequent operation of the Skins Lake Spillway. This would compromise the Murray-Cheslatta flood control objective;

(b) The warmer water originating from the Skins Lake Spillway together with the longer travel time through the Murray-Cheslatta Lake system would impair the temperature control provided by the KDRF; and

(c) Skins Lake Spillway releases would impair the dissolved gas control provided by the KDRF, at least below Cheslatta Falls, because of the gas absorption in the plunge pool below the falls.

As a result, other alternative conceptual layouts for a release facility at the Kenney Dam needed to be identified by the KDRF Working Group. The components, size and cost of this facility or facilities would depend upon the objectives that the facility was designed to achieve. Therefore, the KDRF Working Group identified a list of potential objectives for such a facility. This list included objectives established previously for the KDRF under KCP. The potential objectives considered included:

(a) **Skins Lake Spillway Operation Reduced to Once in 200 years on Average:** Preliminary studies indicate that a facility or facilities at Kenney Dam would need to have a maximum capacity of about 450 m^3/s to meet this objective. An underground low-level outlet with a capacity of about 60 m^3/s would be required to release the STWA base flows plus surplus inflows in the winter.

(b) **Skins Lake Spillway Operation Eliminated:** To achieve this objective, the facility or facilities would need to have essentially the same capacity as the Skins Lake Spillway. A capacity of 1,900 m^3/s would be sufficient to pass the Probable Maximum Flood (PMF) releases.

(c) **Improved Temperature Management:** A surface water release facility or facilities with a capacity of 283 m^3/s at the minimum reservoir operating level could assume the current temperature management role of the Skins Lake Spillway. Temperature management would be somewhat improved because of the shorter travel time for releases to reach Finmore and the avoidance of warming in Cheslatta and Murray lakes.

(d) **Temperature Control:** To achieve this objective, the facility or facilities would need to be capable of selective withdrawal, by having separate deep and surface water intakes, and be capable of withdrawing, mixing and releasing water from both intakes in any proportion. The amount of water which would need to be released would depend upon the release water temperature; the warmer the water, the larger the quantity needed to be released to meet downstream water temperature targets.

(e) **Reduced Dissolved Gas:** To meet this objective, the facility would need a low-trajectory flip bucket spillway. Because of topographical, geotechnical, and other constraints, such a spillway would have to be located on the left side of the canyon.

(f) **Dissolved Gas Control:** Under this objective, the facility would need to have one or more baffle-block spillways, depending upon the capacity.

(g) **Redistribution of Summer Cooling Flows:** If a selective withdrawal feature made it possible to meet temperature control objectives with smaller cooling flows, then the water potentially freed up could be made available for redistribution throughout the year to meet other objectives.

2.4.3 KDRF Alternatives without KCP

Nine alternatives were initially identified by the KDRF Working Group. Conceptual layouts were developed and preliminary cost estimates prepared based upon the cost estimate for the previous KCP version (Alternative 1). Details of these alternative conceptual layouts are presented in Table 2-3. Alternative 1 (KDRF designed for KCP) was not considered further because the water to be released in the absence of the KCP exceeds its design capacity. All of the remaining alternative conceptual layouts have in common an enlarged low-level outlet through which required base flows would be released.

Alternatives 1M and 1A do not have sufficient capacities to limit operation of the Skins Lake

Table 2-3
Summary of Release Facility Alternatives

Non Viable Alternatives				Viable Alternatives						
CRITERIA	**1**	**1M**	**1A**	**2**	**2A**	**3**	**4**	**4A**	**5**	**6**
Low Level Outlet Capacity (m^3/s)	30	60	60	60	60	60	60	60	60	60
Temperature Control* (max. release m^3/s)	170	170	170	170	170	170	-	170	-	170
Spillway Capacity (m^3/s)	170	170	283	450	450	450	450	450	1,900	1,900
TGP Control** (max. release m^3/s)	170	170	283	170	283	450	-	-	-	170
Skins Lake Operation Frequency (years)	3-5	3-5	10	200	200	200	200	200	close	close
Cost ($ million)	143	148	182	217	238	234	111	164	176	365

Note: Costs include Cheslatta Fan Channel construction and other associated works.

*** In the absence of additional detailed hydrothermal modelling studies it cannot be confirmed that control up to this flow or greater can be achieved.**

**** Flows in excess of those stated would not have TGP control.**

Notes:

Alternative 1	**Existing KCP/KDRF design (selective withdrawal and baffle-block spillway)**
Alternative 1M	**Alternative 1 but with low-level outlet capacity increased**
Alternative 1A	**Alternative 1M but with two baffle-block spillways**
Alternative 2	**Alternative 1M plus separate 280 m^3/s stilling basin spillway**
Alternative 2A	**Alternative 1A plus separate 167 m^3/s stilling basin spillway**
Alternative 3	**Alternative 1M but with three baffle-block spillways**
Alternative 4	**Surface water intake and flip bucket spillway**
Alternative 4A	**Alternative 4 but with selective withdrawal**
Alternative 5	**Surface water intake and 1,900 m^3/s flip bucket spillway**
Alternative 6	**Alternative 1M plus a separate 1,730 m^3/s stilling basin spillway**

Source: KDRF 1996.

Spillway to no more frequently than once in 200 years on average. Continued operation of the Skins Lake Spillway would also impair the temperature and gas control features provided by these alternatives. Accordingly, these alternatives were not considered for further analysis by the KDRF Working Group.

The remaining seven alternatives would reduce the operation of the Skins Lake Spillway to no more frequently than once in 200 years, on average. Of these seven alternatives, the least costly would also provide some improvement in temperature management and possibly reduced dissolved gas compared to the current situation. As components are added, costs increased. The preliminary costs for each alternative are summarized in Table 2-4. These alternatives could be further refined, but represent the basic types. During the 1998 Cold Water Release Facility Workshop, two other concepts were presented but all fall within the range of the basic types previously identified.

Table 2-4
Preliminary Costs of Alternative Release Facilities

	Skins Lake Spillway Operation 1 in 200 yrs	Skins Lake Spillway Operation Eliminated
Improved Temperature Management - and Reduced TGP	Alt. 4: $111 million	Alt. 5: $176 million
Temperature Control* to 170 m^3/s -and Reduced TGP	Alt. 4A: $164 million	
Temperature Control* to 170 m^3/s		
- and TGP Control up to 170 m^3/s**	Alt. 2: $217 million	Alt. 6: $365 million
- and TGP Control up to 283 m^3/s**	Alt 2A: $238 million	
- and TGP Control up to 450 m^3/s**	Alt 3: $234 million	

Note: Costs include Cheslatta Fan Channel construction and other associated works.
*** In the absence of additional detailed hydrothermal modelling studies it cannot be confirmed that control up to this flow or greater can be achieved.**
**** Flows in excess of those stated would not have TGP control.**
Source: KDRF 1996

2.4.4 Recent Consideration of KDRF

The KDRF Working Group (1996) and more recently, the participants in the 1998 Cold Water Release Facility Workshop, have been considering the pros and cons of the KDRF. The cost of the KDRF (1996) options range from $111 million to $365 million in 1996 dollars. Since then, as part of presentations to the Nechako Watershed Council, two additional options have been identified, one of which is a $94 million surface release facility. However, before final decisions are made in this direction a number of important issues will need to be factored in.

To begin with, it is important to recall that the original Kenney Dam cold water release facility (KDRF) associated with the rejected Kemano Completion Project (KCP) was justified by the value of the water it made available for power generation, not by its downstream benefits. The question for today is whether or not it is worth building such a release facility at the Kenney Dam solely on the basis of downstream benefits (KDRF 1996).

Depending on its configuration, a release facility could permit colder water to be released into the Nechako River during summer periods, which could allow the present larger summer cooling flows to be reallocated to other times of the year. However, as a result of the effects of large flows in the Nechako River during other times of the year, if substantial amounts of water need to be released to control reservoir water levels, this would generally occur during July and August. Therefore, even with a water release facility with selective withdrawal capability, high summer flows would still be expected on a frequent basis. Again, depending upon its configuration, it could also reduce or eliminate the use of the Skins Lake Spillway, which would facilitate plans for rehabilitating the Murray/Cheslatta System (KDRF 1996).

Studies to date have determined that a water release facility can be built at the Kenney Dam. The design of such a facility would be largely dictated by flood release capacity, rather than the capacity to release cooling flows as was the case under the KCP.

Thus, before any final decisions are made on the possible construction of a water release facility at the Kenny Dam, further engineering, environmental and socioeconomic studies, including a full cost-benefit analysis, will be needed. The current 10 year review of the Nechako Fisheries Conservation Program of studies will be addressing fisheries and river quality issues that should be studied in the years ahead.

3. THE AGREEMENTS

3. THE AGREEMENTS

3.1 The "1950 Agreement"

The legal rights originally awarded to Alcan resulted from the Industrial Development Act of 1949 and an agreement between Alcan and the Province of British Columbia (the "1950 Agreement"). This agreement provided Alcan with water diversion rights to the Nechako River as well as the Nanika River and favorable water rental rates. These water rights were granted to Alcan to develop a hydroelectric facility to power the aluminum smelter which was subsequently built at Kitimat. The water rights granted to Alcan under the 1950 Agreement were to be exercised prior to December 31, 1999 and were to apply to any operating facilities constructed for hydroelectric operation prior to the deadline (BCUC 1994).

3.2 The 1987 Settlement Agreement

In 1980, Alcan proposed to use the remaining portion of the water rights granted to them under the 1950 Agreement to build a total of three smelters in the region. This was followed by years of scientific and engineering studies by government and Alcan, with a focus on delivering acceptable fisheries conservation measures. During this time Alcan and the Federal Department of Fisheries could not agree on the amount of water to be released into the Nechako River to protect the salmon fisheries. As a result, in 1980 DFO obtained an injunction from the B.C. Supreme Court which required Alcan to release additional flows that DFO considered necessary for the protection of the salmon fisheries. In 1985, Alcan petitioned the courts for a permanent resolution of the flow requirements, but before going to court, the federal government, the Province of British Columbia and Alcan agreed to enter private negotiations to find a technically acceptable solution to the conflict (BCUC 1994).

The 1987 Settlement Agreement between Alcan and the governments of British Columbia and Canada achieved an accord that all three parties deemed to be a satisfactory solution, including a combination of flows and remedial measures for the Nechako River. This provided the blueprint for the since cancelled KCP.

Under the 1987 Settlement Agreement Alcan gave up its rights under the 1950 Water License to divert the Nanika River and also agreed to construct a cold water release facility at Kenney Dam, as well as to construct and pay for other remedial measures needed to maintain set numbers of chinook salmon and to protect sockeye salmon populations migrating through the Nechako River. Alcan was to pay half of the cost of the monitoring, all of the cost of the conservation measures and to share in the administration costs of a program to maintain the Nechako River fishery. DFO was to pay the other half of the monitoring costs and all of the applied research costs. The **Nechako Fisheries Conservation Program** (NFCP) was established with representation from the three signatory parties and an independent expert.

The DFO agreed to forego further legal challenges to the 1950 Agreement, pay for half the NFCP's costs of monitoring, and all the costs of applied research. The Province agreed to implement a freshwater fishery management strategy, and to amend Alcan's Water License and the 1950 Agreement to reflect the abandonment of Alcan's rights to the diversion of the Nanika River (BCUC, 1994).

The Settlement Agreement established two committees, a **Steering Committee** and a **Technical Committee**, to implement the terms of the Agreement. The Steering Committee is responsible for overall program direction and budget approval. The Technical Committee is responsible for planning, designing, recommending and carrying out projects and for recommending spillway water releases to meet the needs of the Nechako River Chinook and sockeye populations.

Under the NFCP, in-river conservation strategies have been developed, tested, implemented at a pilot scale, monitored and, if required, revised. Specific water releases from the Nechako Reservoir have been made for fisheries conservation purposes. Fish stock and habitat performance has been monitored, in-stream and/or side channel remedial measures have been tested and a variety of applied research studies have been carried out since the beginning of the NFCP (NFCP 1996).

3.3 The B.C.-Alcan 1997 Agreement

Following rejection of the Kemano Completion Project by the Province of British Columbia in 1995, the Province and Alcan signed a framework agreement to develop a solution to the rejection decision. After several rounds of difficult negotiations, the B.C.-Alcan 1997 Agreement was signed on August 6, 1997.

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

- A Replacement Electricity Supply Agreement (in lieu of the rejected KCP).
- The return of the existing smelter to full capacity and incentives for early start-up of a new smelter.
- A final water license.
- The establishment of the Nechako Environmental Enhancement Fund.
- The establishment of the Northern Development Fund.

The Nechako **Environmental Enhancement Fund** (NEEF) was created to seek options that may be available for the downstream enhancement of the Nechako River Watershed area. To administer the NEEF the Agreement provided for a three-person **Management Committee** charged with the responsibility to review, assess and report on options that may be available for the downstream enhancement of the Nechako Watershed area.

The Agreement also contained a provision to facilitate the establishment of the **Nechako Watershed Council**. The Nechako Watershed Council was inaugurated in June of 1998 and has representation from the communities in the region, aboriginal interests, government, other primary interests and the general public.

The Agreement committed Alcan to match funds up to $50 million for the future downstream enhancement of the Nechako Watershed area.

4. NECHAKO ORGANIZATIONS

4. NECHAKO ORGANIZATIONS

4.1 Nechako Fisheries Conservation Program

The 1987 Settlement Agreement led to the establishment of the Nechako Fisheries Conservation Program NFCP). The NFCP was and continues to be implemented by a **Steering Committee** and a **Technical Committee**. The Steering Committee, comprising senior representatives of the Federal Crown, Alcan and the Province of B.C. provides direction and oversees the implementation of the program.

Technical Committee membership consists of three scientific/technical experts (and three alternates), one from each of the signatories to the Agreement, and one independent expert. All decisions of the Technical Committee are reached by consensus.

4.1.1 Strategic Framework

A strategic framework has been used by the Technical Committee to direct the overall plan. It has focussed on specific and measurable elements of habitat and chinook ecology. The framework provides guidelines for testing and executing remedial measures, the monitoring of stock and habitat performance and research into the ecology of Nechako River chinook (NFCP 1996).

As part of the Strategic Framework an evaluation framework was initiated in 1992/93 by the Technical Committee to assist in the interpretation of results for cause and effect linkages between physical and biological field projects. This will make it possible to establish decision points or levels of change where action should be taken and whether or not progressive procedures should be put into place. This is an essential element of the long-term planning and evaluation processes (NFCP 1996).

4.1.2 Activity Flow Charts

As part of the strategic framework, the Technical Committee developed three flow charts to assist in understanding how committee activities are directed (NFCP 1996). These include:

1) A Decision Chart used in the evaluation of selection, implementation and success of Remedial Measures (Appendix A-1);
2) A NFCP Early Warning Monitoring Program used to assess trends reflected by monitoring programs targeted at juvenile chinook life histories, and to suggest action to be taken in response to these trends (Appendix A-2); and
3) An assessment of the Conservation Goal which presents an assessment of achievements and shows the extrinsic and intrinsic factors that may affect Nechako River chinook production (Appendix A-3).

4.1.3 First Nations Involvement

Since the beginning of the NFCP, First Nations technicians have worked with the crews on the field projects, with the long-term goal of assuming crew management responsibility for field projects. The majority of their work has been carried out on monitoring projects, including carcass recovery on the Nechako and Stuart rivers, juvenile outmigration, fry emergence and habitat complexing.

4.1.4 NFCP Reports

The Technical Committee provides information on the Nechako Fisheries Conservation Program through an annual report and technical reports on all of the projects carried out. Since the NFCP Program began in 1987, more than 180 technical reports have been prepared. Appendix B provides a list of all reports prepared by the NFCP to date. These reports provide detailed information on specific projects and test results of remedial measures, fisheries, habitat and stock monitoring and applied research.

4.2 Nechako Environmental Enhancement Fund Management Committee

The Nechako Environmental Enhancement Fund (NEEF) was established in 1997 through Schedule 4 of the 1997 B.C. Alcan Agreement. NEEF is administered by a three-person **Management Committee:**

- Jim Mattison, Ministry of Environment, Lands and Parks (Chair);
- Eric Sykes, former Vice President of B.C. (Corporate) Alcan; and
- Dr. Charles Jago, President, University of Northern British Columbia.

The committee is charged with the responsibility 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 Kenney Dam, or the use of the NEEF for other downstream enhancement purposes.

In carrying out its mandate, the NEEF Management Committee is committed to the following key principles.

Openness & Transparency: The Management Committee will seek public input into the identification, assessment and review of options for the downstream enhancement of 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 or, if necessary, by majority vote. Decisions of the Management Committee will be binding on the parties.

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 minimize 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.

Geographic Scope: The NEEF Management Committee will address matters related to the Nechako River Watershed 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.

The 1997 Agreement committed Alcan to match funds up to $50 million for future watershed enhancement projects. In addition, the agreement provided a start-up management budget of $500,000 and up to $100,000/year for public consultation purposes.

Most recently, NEEF funding has been used to facilitate the implementation of the current multi-interest involvement process designed to identify, explore and evaluate the range of options that may be available for the downstream enhancement of the Nechako Watershed area.

4.3 Nechako Watershed Council

Schedule 4 of the 1997 B.C-Alcan Agreement also contained a provision to facilitate the formation of the **Nechako Watershed Council** (NWC). The Nechako Watershed Council was inaugurated in June of 1998 and has representation from the communities in the region, aboriginal interests, government, other primary interests and the general public.

Membership on the NWC is open to all organizations willing to participate. Meetings are held every one to two months and at this time the NWC has 23 active member organizations.

The primary purpose of the NWC is to enhance the long-term health and viability of the Nechako Watershed with consideration for all interests, and to provide a forum to address water management and related issues in the watershed and to work toward cooperative resolution of these issues.

4.4 Nechako River Alliance

The Nechako River Alliance (NRA) is an umbrella group of public interest and First Nations organizations, formed in June 1998, for organizations and First Nations committed to work together to address issues left unresolved by the 1997 agreement between Alcan and the Government of British Columbia (NRA 1998). The NRA was formed by groups and individuals who opted not to participate in the NWC.

4.5 First Nations

There are a number of First Nations with an interest in the Nechako watershed. While many of their concerns have been reflected by others, they also have other concerns regarding the river and related decision-making processes.

The Carrier-Sekani Tribal Council (CSTC) is a political affiliation of eight First Nations in the region; they are as follows: Wet'suwet'en First Nation (Broman Lake), Burns Lake Band, Nadleh Whut'en Band, Nak'azdli Band, Saik'uz (Stoney Creek) First Nation, Stellat'en First Nation, Takla Lake First Nation and Tl'azt'en Nation. The CSTC has stated that it does not recognize the 1997 Agreement and opposes the Nechako Environmental Enhancement Fund. This has come about because the CSTC was not consulted in the formulation of the Agreement and because there was no recognition of the Carrier-Sekani being in treaty negotiations. The CSTC has indicated that it will not participate in NEEF in an official capacity but has been assured that the opportunity to contribute in the process is always available.

The Cheslatta Carrier Nation are not members of the CSTC but also have concerns about the 1997 Agreement. They are currently involved in litigation with Canada and the Province of British Columbia over the aboriginal right to fish for food. Their primary concern relates to a lack of recognition by both parties of the decision-making authority of the Cheslatta. The Cheslatta also have long-standing historical grievances with Alcan and the Department of Indian Affairs and Northern Development over the flooding of burial grounds during the original filling of the Nechako Reservoir.

The Stoney Creek First Nation (Saik'uz) is located south of Vanderhoof. They are involved in litigation with Alcan and the B.C. Ministry of Transportation and Highways over the Kenney Dam road, which was constructed in the 1950s. They are also members of the CSTC.

The Lheidli T'enneh are located near Prince George. They left the CSTC approximately ten years ago, and since then relations have been strained between the Lheidli T'enneh and the CSTC.

Two other First Nations groups are located in the Burns Lake/Fraser Lake area. They are the Nee Tahi Buhn and Skin Tyee. Neither of these Nations are members of the CSTC.

5. CURRENT STATUS OF THE NECHAKO RIVER SYSTEM

5. CURRENT STATUS OF THE NECHAKO RIVER SYSTEM

The following information on the current status of the Nechako River system is drawn from material prepared previously by the KDRF Working Group (1996), updated or modified as appropriate by information from other sources as referenced.

5.1 Nechako Reservoir

The Nechako Reservoir was originally created to store water for hydroelectricity generation. Since 1980, the reservoir has also been used to manage water releases for fisheries protection and conservation in the Nechako River. During periods of relatively small reservoir inflows, water is released from reservoir storage to provide sufficient water for the fisheries releases and to meet electrical energy demands. During periods of relatively large inflows, water is stored in the reservoir and releases are managed for public safety. The Nechako Reservoir is the largest regulated storage facility in the Fraser River system, and the Comptroller of Water Rights requires that reservoir releases do not contribute unnecessarily to peak flood flows in the Fraser River.

The estimated average annual inflow into the Nechako Basin upstream of Kenney Dam for the period 1930 to 1998 is 194.9 m^3/s. The range of annual inflows has varied from a minimum of 127.3 m^3/s in 1970 to a maximum of 343.9 m^3/s in 1976. Inflow to the reservoir comes mainly from melting of the winter snow pack, supplemented by spring and summer rainfall. The largest inflows occur in May, June and July. June inflows average 495.3 m^3/s, whereas the smallest average inflows, 68.7 m^3/s, occur in March (Triton 1999).

The outflow from the Nechako Reservoir for power generation through the Kemano I powerhouse averaged about 115.0 m^3/s for the period 1980 to 1998, with a maximum average monthly powerhouse flow of 139 m^3/s. The power generation related to this flow can vary with the reservoir elevation which determines the head on the turbines. The hydraulic limitations in the power tunnel currently restrict the maximum power tunnel flow to about 147 m^3/s at the maximum normal reservoir level of 853.4 m.

Under the 1987 Settlement Agreement, Alcan is obligated to release flows from the Skins Lake Spillway into the Nechako River for the protection and conservation of fish resources. Base flow releases average 36.8 m^3/s per year, and have varied from a minimum of 29 m^3/s in September to a maximum of 49 m^3/s in April-June. Above and beyond these base flows, Alcan is required to release summer cooling flows in July and August for the protection of sockeye salmon migrating through the Nechako River to their spawning grounds in other systems. These cooling flows have averaged about 16.1 m^3/s per year on an annualized basis from 1981 to 1998, and can vary from a minimum instantaneous flow of 170 m^3/s to a maximum of 283 m^3/s at Cheslatta Falls (Triton 1999).

In addition to the releases through the Kemano I powerhouse and releases for fisheries purposes, surplus inflows to the Nechako Reservoir are released periodically from the Skins Lake Spillway, in consultation with the Comptroller of Water Rights, to control reservoir water levels. As mentioned, the largest Nechako Reservoir inflow volume results mainly from snowmelt in the spring and early summer.

The potential inflow volume is forecast from the measured snowpack at snow courses within and adjacent to the watershed. Measurements are taken and forecasts are updated monthly from February to June.

Flood releases are scheduled when the forecast volume of inflow is greater than the combined volume of storage available in the reservoir and the amount scheduled to be released for fisheries and power generation purposes. Excess inflows are accommodated by pre-spilling in advance of freshet in order to increase the available storage. These spills are managed in consultation with the Nechako Fisheries Conservation Program (NFCP) and the Comptroller of Water Rights. The interests of fisheries conservation and downstream flooding are important considerations when decisions are made to reduce the probability of forced releases in May and June, during peak flows in the Fraser River.

The period from 1980 to 1998 was one of relatively small inflows (except for 1996 and 1998). Total outflows from the Nechako Reservoir through the Skins Lake Spillway averaged 63.7 m^3/s per year during this period. Within this total, releases for fisheries purposes averaged 55.5 m^3/s per year. These releases, together with natural inflows from the Murray-Cheslatta system, have met the fisheries protection target at Cheslatta Falls defined as the Short Term Water Allocation (STWA) under the 1987 Settlement Agreement.

5.2 Nechako Canyon

Since the construction of the Kenney Dam in the early 1950s, the nine kilometres of the Nechako River between Kenney Dam and Cheslatta Falls, (which includes the Nechako Canyon), have essentially been de-watered. Water that currently flows down the canyon results from local inflows that peak during spring freshet or major rain events but are normally much lower in late summer. Over the last 45 years, the lack of major flows through the canyon has allowed both inorganic and organic materials to accumulate on the canyon floor and walls.

Rainbow trout inhabit the pools remaining in the canyon. As well, some juvenile chinook salmon rear in the outflow channel across the Cheslatta Fan, which is located below the canyon and upstream from the confluence with the Murray-Cheslatta system at Cheslatta Falls.

5.3 Murray-Cheslatta System

All fisheries and surplus flows released from the Nechako Reservoir currently pass through the Skins Lake Spillway into the Murray-Cheslatta system. The largest sustained spills experienced by the system to date occurred in 1976, when the inflow volume into the Nechako Reservoir approached that of the 200-year flood. Because releases through the Skins Lake Spillway have been much greater than the natural flows in the Cheslatta River, the bed of the Cheslatta River has been scoured up to 20 m below the former valley floor. The channel beds consist mainly of gravel and cobble material, and large gravel bars and bedrock exposures are common. Tributaries to the Cheslatta River are also deeply incised.

The resulting sediments have been transported downstream to form a delta where the Cheslatta River enters Cheslatta Lake. Most of the sediments settle in Cheslatta Lake but some fine sediments, along with some sediments eroded from the outlets of both Cheslatta and Murray lakes, pass through the lakes and enter the Nechako River at Cheslatta Falls. Cheslatta and Murray lakes have higher than natural water levels and variable shorelines generally consisting of sands and gravels. The scouring of the bed of the Cheslatta River, along with the increased flushing rate of the lakes, has altered the limnology and reduced the productivity of this system.

Salmonids in this area include rainbow trout, kokanee, bull trout char, and lake trout. Rocky Mountain and lake whitefish are also present, together with various sucker, dace, and shiner species. No anadromous species occur in the area because Cheslatta Falls is a natural barrier to fish migration. Rearing and spawning habitat occurs only in about five of the 20 or so tributary streams that flow into Murray and Cheslatta Lakes. Habitat capability is also currently limited by such factors as fluctuating flows, turbidity, and channel structure changes.

The Kenney Dam Cold Water Release System previously proposed as an integral component of the rejected KCP project had been designed to reduce summer flows to more natural levels. If completed this would have benefited the Murray/Cheslatta Lake system by eliminating the surcharges which have caused shoreline erosion and the destruction of shoreline trees and fish food organisms. It was also anticipated that lake flushing rates would have slowed down considerably, leading to greater productivity for freshwater fish in the Murray/Cheslatta system (BCUC 1994).

In anticipation of the implemented KCP, the Cheslatta Nation had developed a Cheslatta Redevelopment Project (CRP) in parallel with a Fisheries Management Plan prepared by the Province of British Columbia. The CRP addressed the restoration of the lakes, the identification and establishment of historic sites, the creation of recreational opportunities and included a significant element of training for band members (BCUC 1994).

Plans for rehabilitation of the Murray/Cheslatta system remain on hold, but it is anticipated that they would be reactivated in the future if a suitable cold water release facility, such as one of the options discussed at the June 1998 Coldwater Release Facility Workshop (1998) is eventually approved and installed at or near the Kenney Dam.

5.4 Nechako River

5.4.1 Flows

Nechako River flows come mainly from three drainages, the Eutsuk-Tahtsa (the Nechako Reservoir) flowing through the Skins Lake Spillway, the Nadina-Francois draining through the Nautley River, and the Stuart-Takla draining through the Stuart River (Figure 5-1). Only one of these drainages (Eutsuk-Tahtsa) is regulated. Under the 1987 Settlement Agreement, Alcan is required to release certain quantities of water from the Nechako Reservoir into the Nechako River.

The relative contributions of flows from each drainage, based on the period 1981 to 1998, are

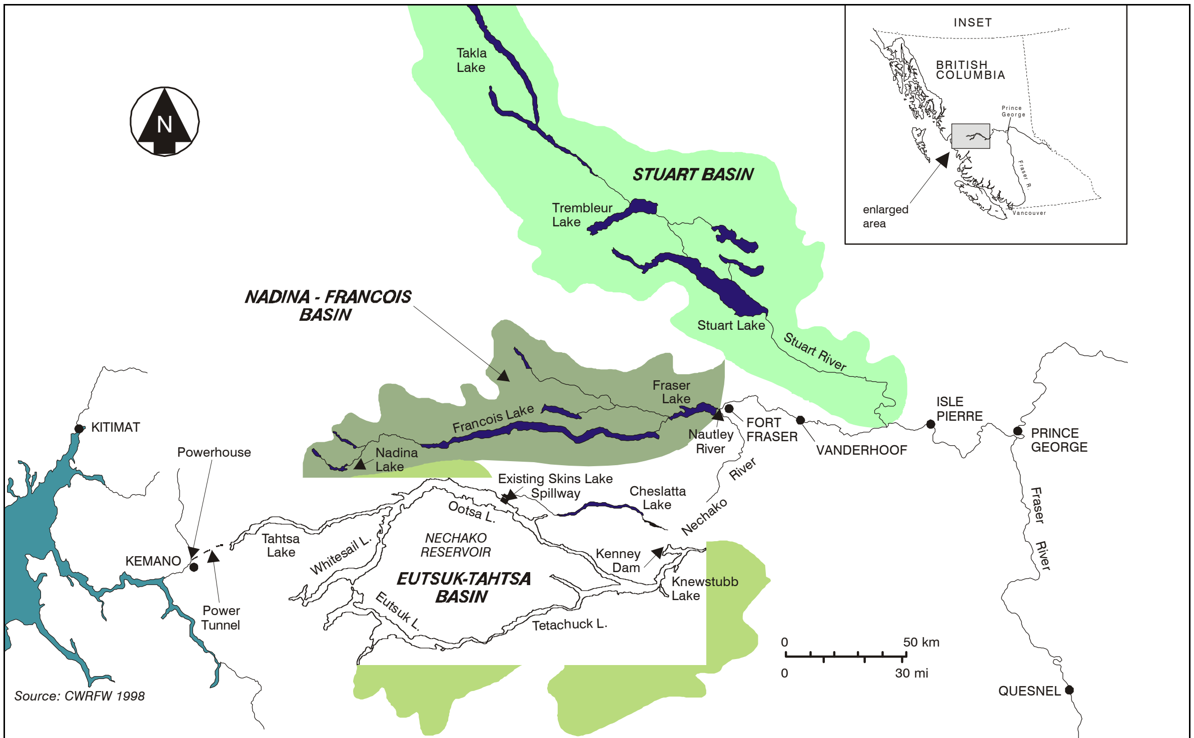

Figure 5-1: Major Drainage Basins of the Nechako Watershed

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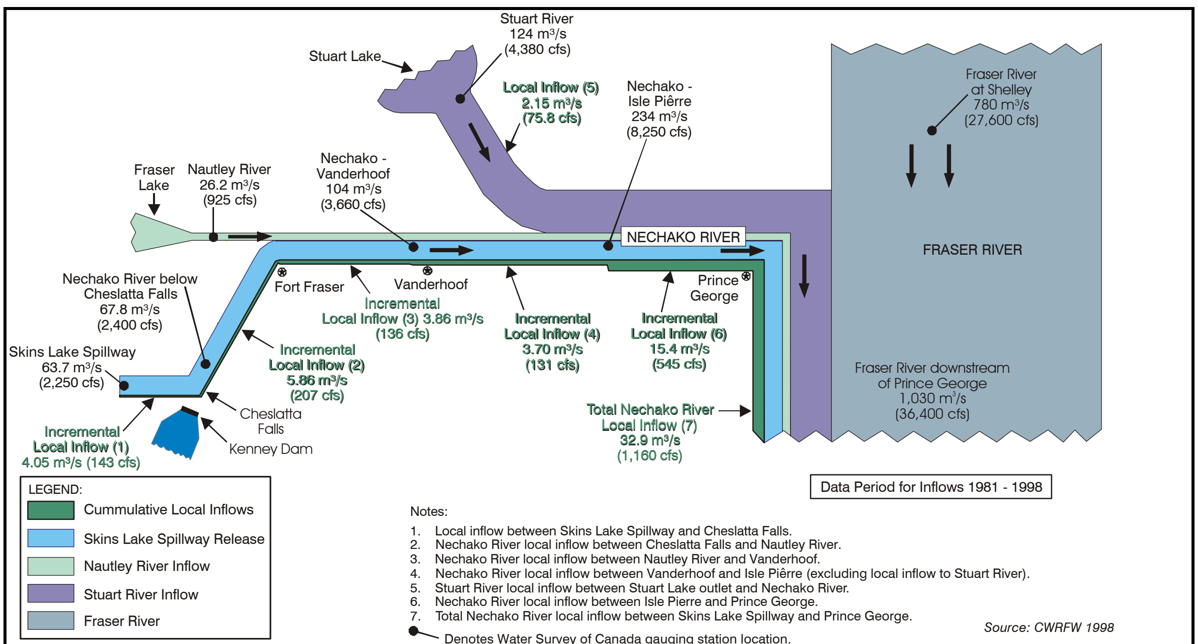

Figure 5-2: Schematic of Nechako River Inflows (1981 to 1998)

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shown schematically in Figure 5-2 (CWRFW 1998).

At Isle Piêrre, 54.0% (126.15 m^3/s) of the flow is contributed by the Stuart-Takla drainage (which includes flows recorded at the outlet of Stuart Lake plus local inflows between the outlet of Stuart Lake and the Nechako River confluence). A further 11.2% (26.2 m^3/s) of the flow at Isle Piêrre comes from the Nadina-Francois drainage, and 27.3% (63.7 m^3/s) of the flow at Isle Piêrre comes from the Nechako Reservoir. The remaining 7.5% (17.5 m^3/s) of the Nechako River flow at Isle Piêrre is comprised of local inflows (CWRFW 1998).

Mean annual flows recorded for the Nechako River at various downstream locations during the period 1981 to 1997 are summarized in Table 5-1. Mean monthly flows for the Nechako River below Cheslatta Falls and at Vanderhoof for the same period up to 1998 are illustrated in Figures 5-3 and 5-4, respectively.

Table 5-1
Nechako River Mean Annual Flows (1981 to 1998)

	River Flow		Contribution as a % at:		
	m^3/s	cfs	Fort Fraser	Vanderhoof	Isle Piêrre
Nechako River at Cheslatta Falls	67.8	2,394	92.0%	65.4%	29.0%
Local Inflows	5.9	207	8.0%	5.6%	2.5%
Nechako River at Fort Fraser	73.7	2,601	100.0%	71.0%	31.5%
Nautley River	26.2	925		25.3%	11.2%
Other Local Inflows	3.9	136		3.7%	1.7%
Nechako River at Vanderhoof	104	3,663		100.0%	44.4%
Stuart River	124	4,379			53.1%
Local Inflows	5.9	207			2.5%
Nechako River at Isle Piêrre	233.6	8,249			100.0%

Source: CWRFW 1998.

5.4.2 Water Temperature

In warmer years, water temperatures of the Nechako River from Fort Fraser to Prince George are known to exceed 20°C, as the Nautley and Stuart rivers, both of which drain large lake systems, join the main stream (BCUC 1994).

As temperatures increase toward that level, fish, particularly sockeye salmon, can become progressively more stressed, more vulnerable to disease and more prone to delay in their migration. As a consequence they have been known to die *en route* or arrive at the spawning grounds only to die before or during spawning (BCUC 1994).

This concern was recognized by DFO, the International Pacific Salmon Fisheries Commission (IPSFC) and Alcan's environmental team during the early 1980s and culminated in a 1987 agreement between DFO and Alcan reached shortly before the 1987 Settlement Agreement that established objectives for temperature monitoring and control on the Nechako upstream of its confluence with the Stuart River. Specifically, the Agreement on Temperature Monitoring and Control

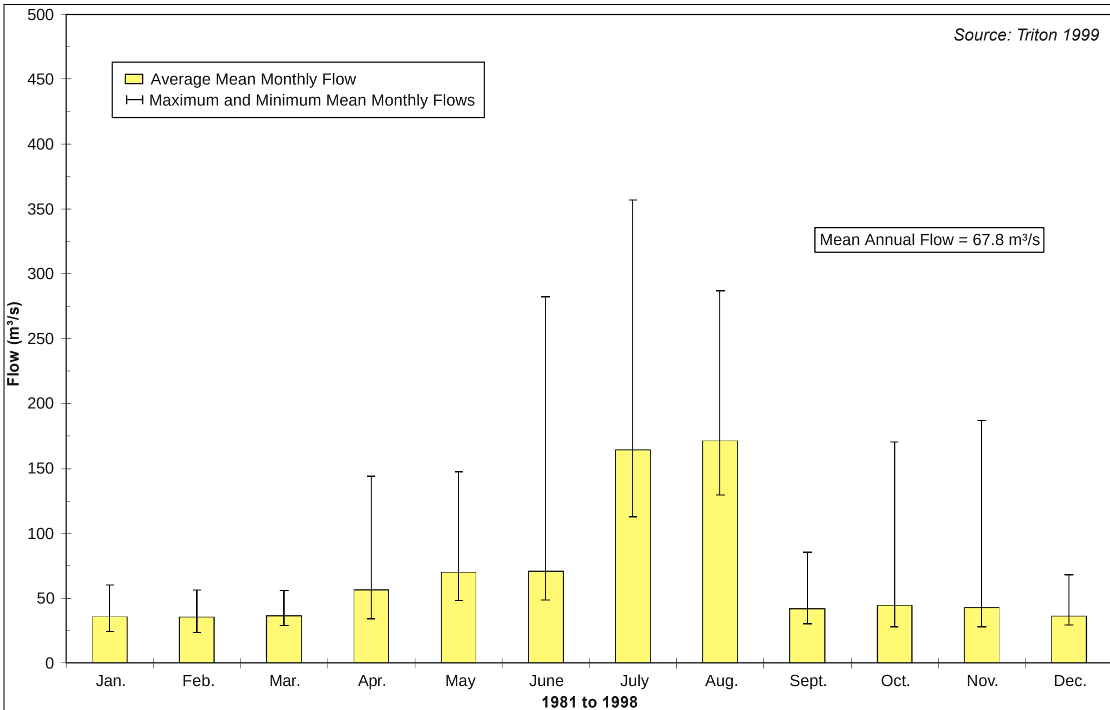

Figure 5-3: Nechako River Below Cheslatta Falls Mean Monthly Flows, 1981 to 1998 a4552f

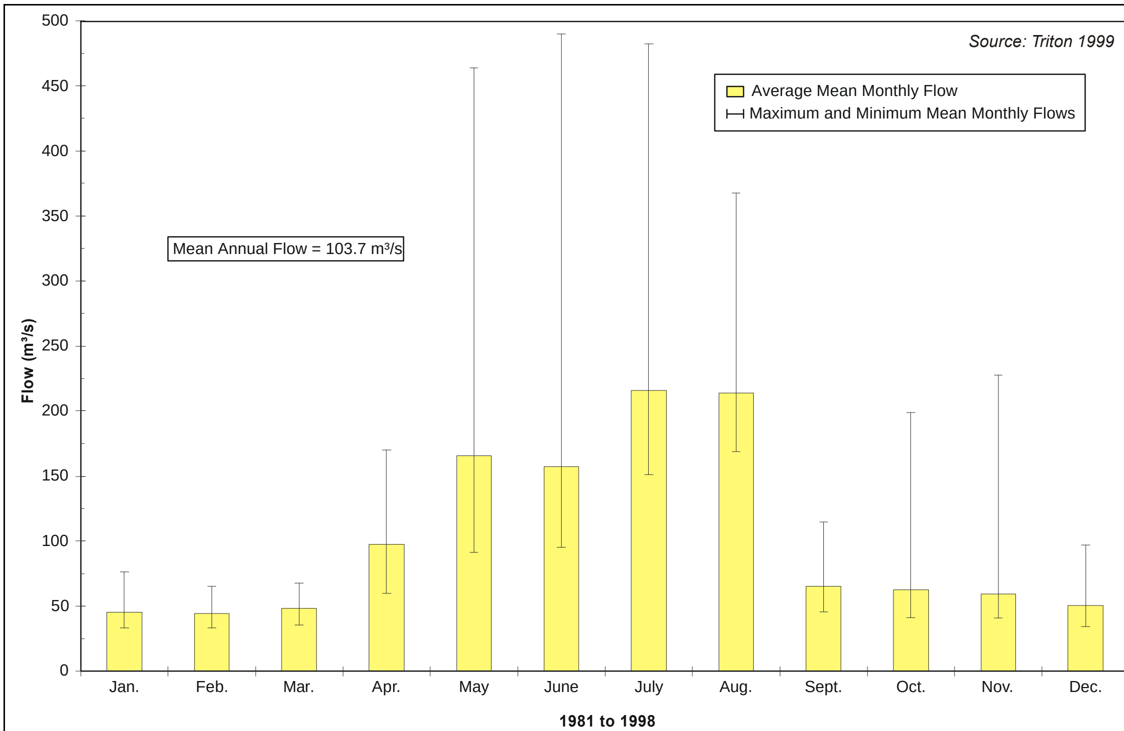

Figure 5-4: Nechako River at Vanderhoof Mean Monthly Flows, 1981 to 1998 a4553f

provided for a minimum flow of 170 m^3/s, plus additional cooling water releases as required and determined by a "computer model" and the "protocol". The latter determines the flow adjustments required to manage temperatures in the Nechako River upstream of the Stuart from July 20 to August 15 in each year (BCUC 1994).

The computer model(s) and operating protocol referred to as the Summer Temperature Management Program (STMP) was developed by Alcan and had been reviewed and approved for use by DFO and the IPSFC.

The models and operating protocol of the STMP were subsequently incorporated into the 1987 Settlement Agreement. Since that time, the program has been implemented annually under the auspices of the NFCP Technical Committee.

As a result of the implementation of the STMP, more water has been released from the reservoir for sockeye conservation during some periods than natural inflows would provide. Table 5-2 shows water temperatures in the Nechako River before and after the implementation of the STMP, and compares the frequency of occurrence of certain water temperature exceedences in the Nechako River with those in the unregulated Stuart River (CWRFW 1998). These data illustrate the degree of extreme temperature management achieved in the Nechako River since the implementation of the STMP. Extreme water temperatures in the Nechako River have decreased in frequency since 1983 despite meteorological conditions being warmer. By comparison, the occurrence of extreme water temperatures in the unregulated Stuart River have increased by a factor of about two times. Figures 5-5 and 5-6 present the water temperature data for the most recent three years for the Nechako and Stuart rivers, respectively (DFO 1999). The effect of the particularly warm 1998 summer season and the relatively cool summer of 1999 on water temperature can be readily seen. Based on the available data, under current conditions, the Stuart River is typically a more significant contributor to sockeye thermal stress than is the Nechako. Downstream of their confluence, cooler Nechako flows tend to modify the warming influence of Stuart flows in most years.

Table 5-2
Frequency of Water Temperature Exceedences (days/yr)

Date Period	Nechako River (at Finmore) greater than 20°C	Stuart River (at confluence with Nechako) greater than 20°C
1953-1982 (before STMP)	3.2	5.0
1983-1998 (after STMP)	2.9	7.6
Difference	**-0.3 (-9%)**	**+2.6 (+52%)**

Source: CWRFW 1998.

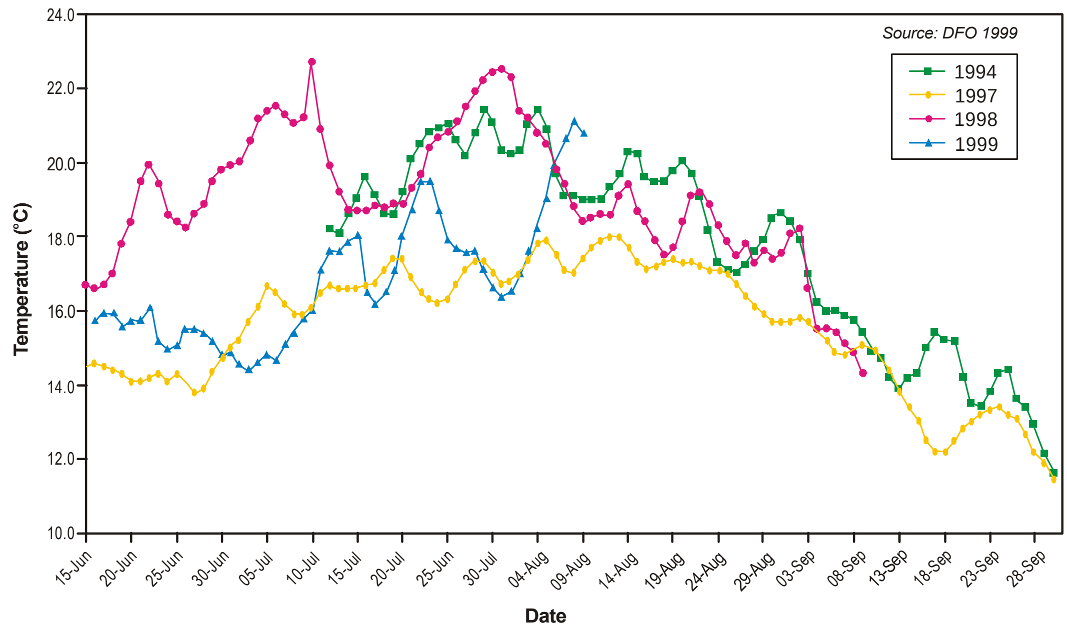

Figure 5-5: Mean Daily Temperatures in the Lower Nechako River above Prince George

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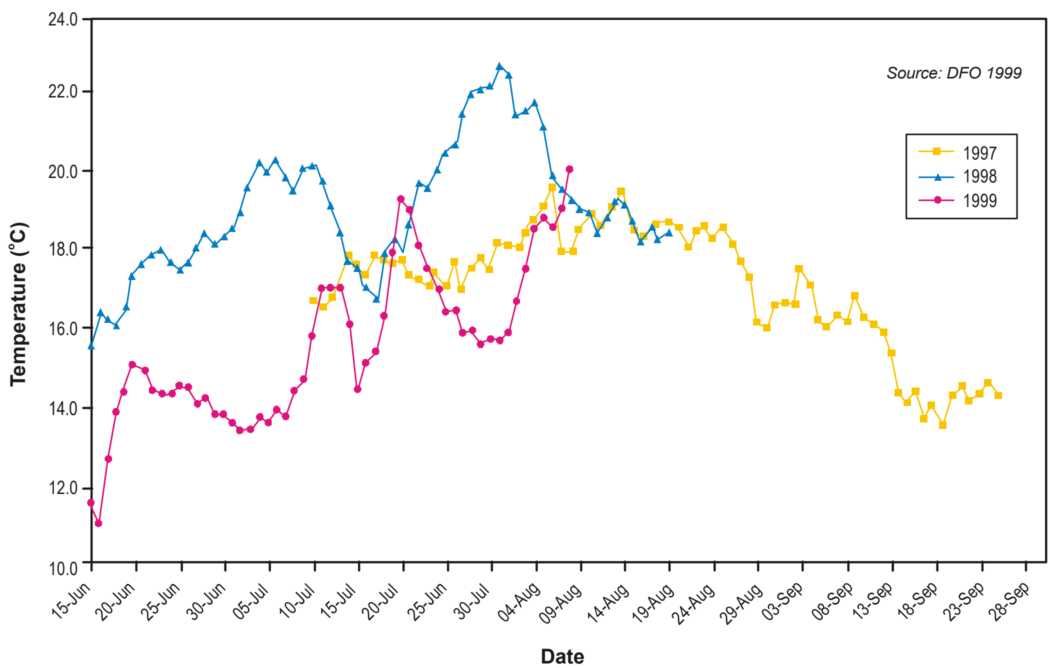

Figure 5-6: Mean Daily Temperatures in the Stuart River at the Outlet of Stuart Lake

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5.5 Fisheries of the Nechako System

5.5.1 Sockeye Salmon

The most significant fisheries resource of the Nechako drainage basin is the sockeye salmon. They represent more than 99% of all salmon in the Nechako system, and are estimated to be worth an average of $26 million annually to the commercial fishery.

There are five major runs of sockeye salmon (Early and Late Stuart, Early and Late Nadina and Stellako) which use the Nechako River as a migration corridor during the summer/fall spawner migration. Individual fish take four to seven days to migrate through the Nechako River corridor (Table 5-3) *en route* to spawning grounds in the Nadina-Francois and Stuart-Takla tributary drainages (Figure 5-7). They do not spawn in the Nechako River. The total escapement of sockeye has generally increased in most years; record numbers of spawners were recorded in the 1993 dominant run year, with a total escapement of 2.7 million spawners (Figure 5-8).

Table 5-3
Typical Sockeye Salmon Run Timing

Stuart River		
	Early	July 10 - August 11
	Late	August 1 - September 8
Nadina		
	Early	July 18 - August 18
	Late	July 25 - August 25
Stellako		August 12 - October 5

Source: CWRFW 1998.

However, over the past three years, high discharge levels in 1997 and 1999 and high water temperature in 1998 have caused significant *en route* losses to Fraser/Nechako sockeye salmon (DFO 1999). As of August 9, 1999, very few Early Stuart sockeye had been sighted by First Nations (CSTC) and DFO observers in the Stuart/Takla area. This run was then extremely late and large *en route* mortality had likely occurred. In particular, increasing discharge and high turbidity in the Hells Gate area have posed a major impediment to migrating salmon this year, causing delays of up to three weeks. These fish were not expected to continue their migration as water levels decline and may not have survived to spawn (DFO 1999).

5.5.2 Chinook Salmon

The chinook salmon resource is also of importance in the Nechako River, but has a much lower commercial value (an estimated average of $57,000 annually) than the sockeye resource. In addition, it is very difficult to assess the contribution of Nechako stocks to the commercial, salt water, recreational and aboriginal fisheries because they do not occur in large numbers and are indistinguishable from the other upper Fraser stocks.

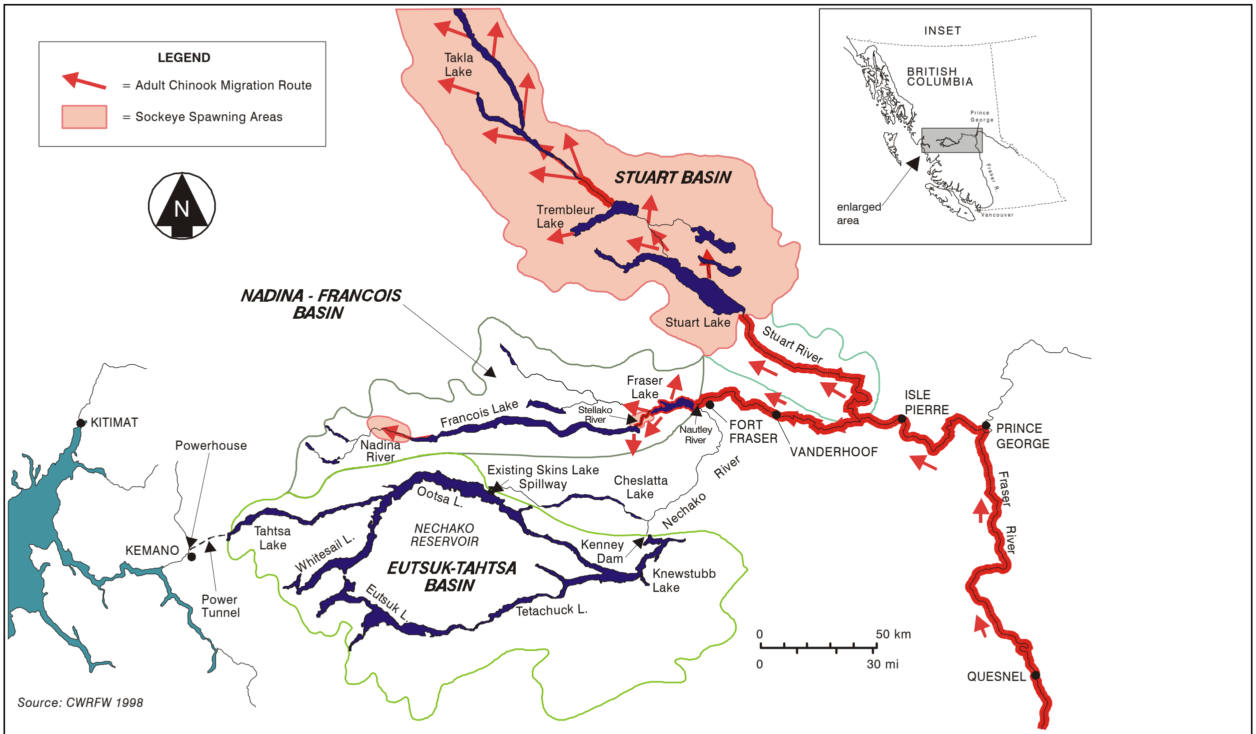

Figure 5-7: Sockeye Migration and Spawning Areas in the Nechako Basin

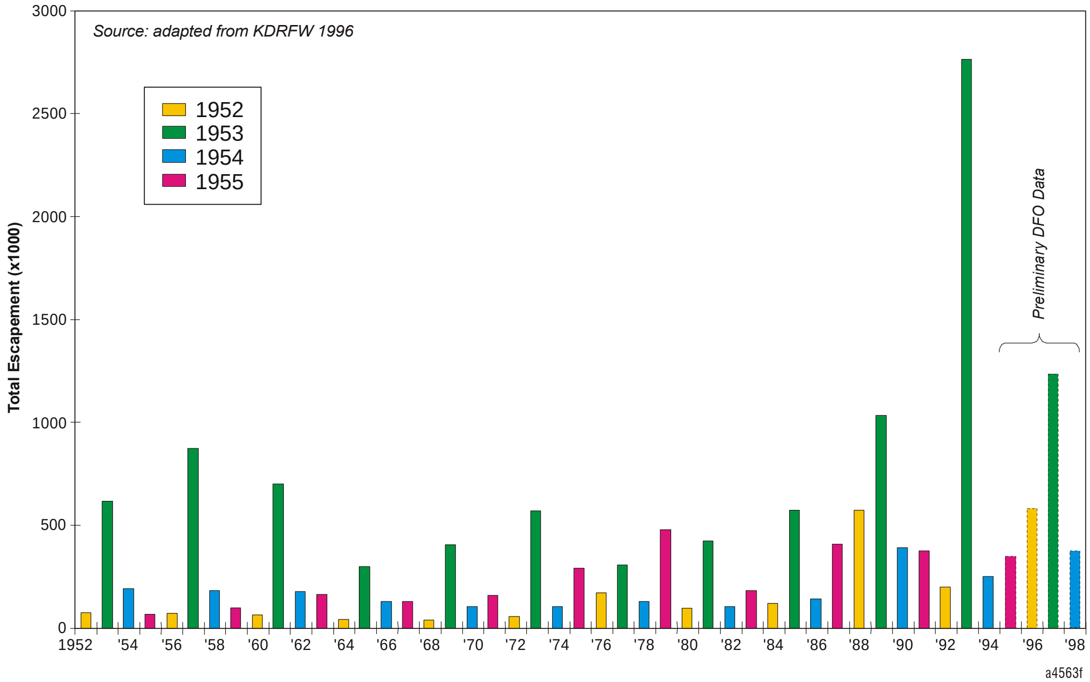

Figure 5-8: Total Escapement of Sockeye Salmon that Migrate through the Nechako River
(Sum of Early and Late Stuart, Early and Late Nadina and Stellako Runs)

Chinook salmon use the Nechako River during all phases of their freshwater life history (Figure 5-9). Adult chinook spawn in various sections of the river from Cheslatta Falls to Vanderhoof, depositing eggs which incubate in the gravel over the winter. Juvenile chinook emerge from the gravel in spring to begin rearing in the mainstem Nechako for varying lengths of time. Most of these juveniles leave the upper Nechako in June each year. The remainder spend the winter in the river and leave the following year as yearling migrants. Adult chinook return to the river from the ocean three to six years later.

To conserve the Nechako chinook salmon stocks, the 1987 Settlement Agreement includes a provision that established a target escapement of 3,100 chinook adults, with a range of 1,700 to 4,000. This range was developed on the basis of the best collective judgement at the time and uncertainties about rates of exploitation in the various fisheries (BCUC 1994).

Recognizing these limitations the NFCP decided to refine the comparison with other upper Fraser stocks by selecting the Stuart River as an indicator relative to the Nechako River. Figure 5-10 presents the Stuart chinook escapement data collected by the NFCP during the period 1988 - 1998 and Figure 5-11 summarizes spawner counts for Nechako River chinook during the same period.

5.5.3 Resident Fish Species

Other species of fish using the Nechako River include Rainbow trout, bull trout, char, mountain whitefish, various sucker species, red-sided shiners and northern squawfish. In addition, white sturgeon are known to use the Nechako River downstream of the Nautley River confluence.

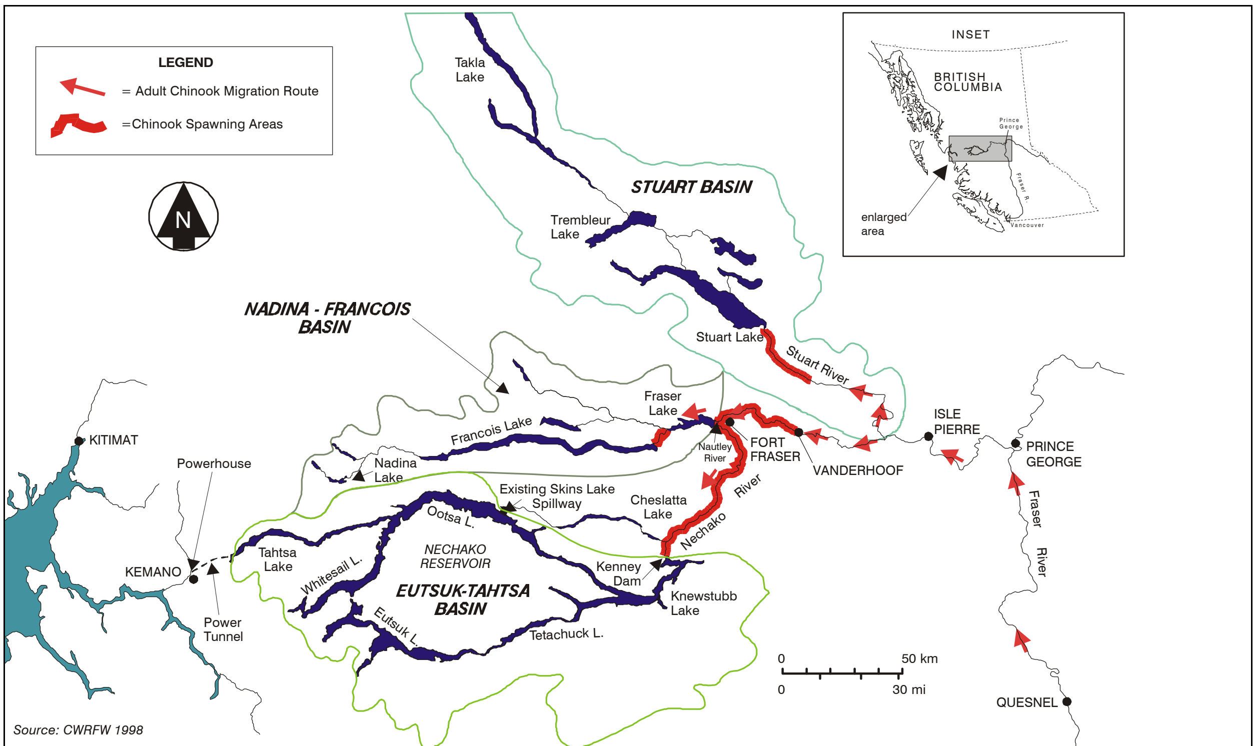

Figure 5-9: Chinook Migration and Spawning Areas in the Nechako Watershed

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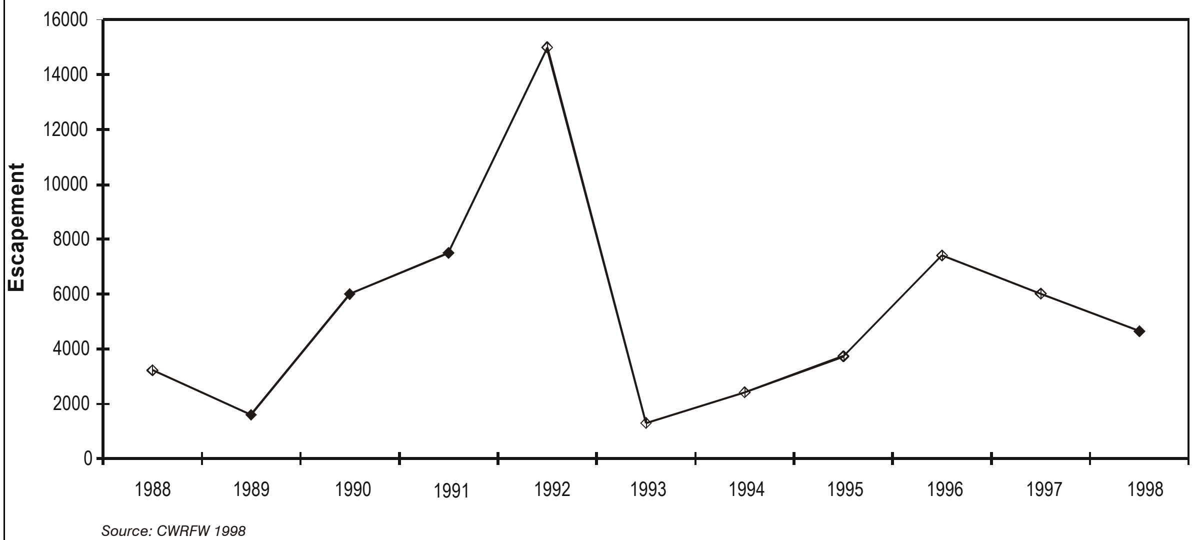

Figure 5-10: Stuart River Chinook Escapement, 1988 - 1998

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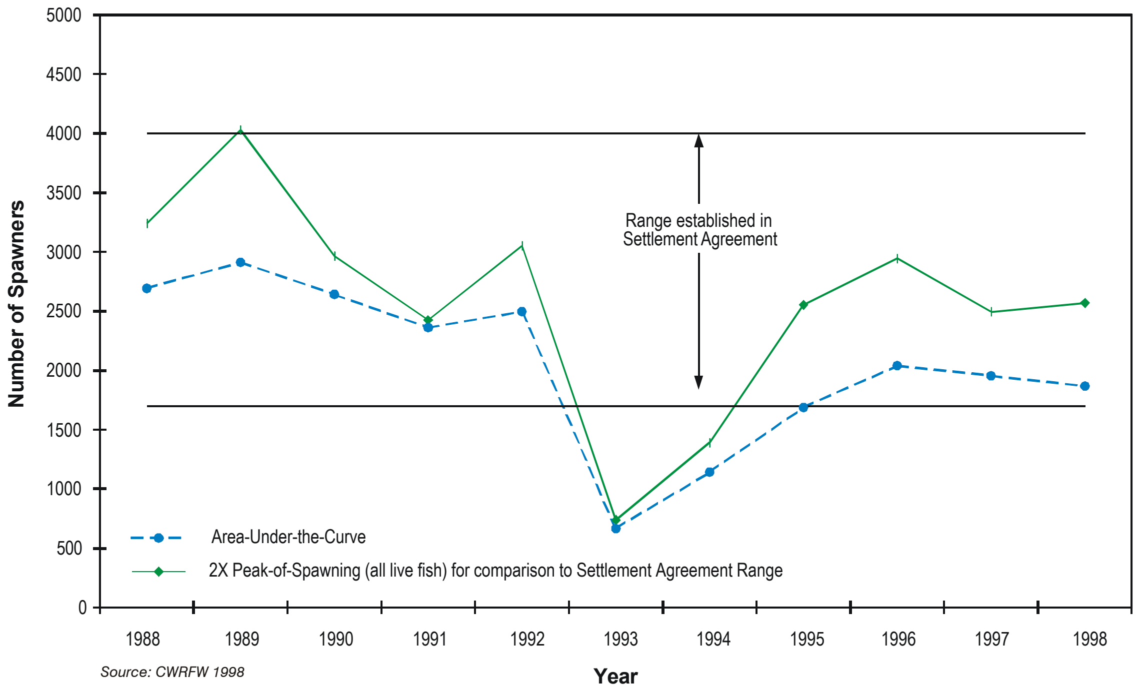
White sturgeon have been the subject of a five-year study on both the Nechako and Fraser rivers. As a result of this study concerns have been raised about white sturgeon reproduction on the Nechako River. This is the subject of ongoing work which will lead to an increased understanding of the status and health of white sturgeon in the Nechako and Fraser systems. Rainbow trout are the species of most interest to resident and non-resident anglers, but productivity is limited in some reaches by the availability of tributary rearing habitat. Angling is currently affected in some locations by the high releases of water during the summer cooling period.

5.6 Water Management

Since the beginning, the fundamental issue for the Nechako River and its watershed has been related to establishing an acceptable balance between the various competing interests for use of the river's flow to meet the needs of nature and those of mankind. To date this balance has not yet been achieved in the view of many. The following is a brief review of the more important water management issues that have been identified by various interested parties before the BCUC and other recent forums.

5.6.1 Alcan's Water License

There has been ongoing debate over Alcan's Water License that grants Alcan the right (in perpetuity) to 170 cubic metres per second (m^3/s). This is more water than Alcan typically uses (average use ranges between 125 and 135 m^3/s) and more than the maximum flow that the existing tunnel and can handle (140 m^3/s).



Source: CWRFW 1998

Figure 5-11: Nechako River Chinook Spawner Counts 1988-1998

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Recent preliminary studies by Alcan have confirmed that in most recent years the long-term average inflows have been greater than the current long-term average powerhouse requirements and the amount of water that they believe is required for fisheries protection and conservation needs (Alcan 1998). In addition, if a cold water release facility was constructed, Alcan has indicated that in most years they would need to release more water into the Nechako River than the flows specified under the 1987 and/or the 1997 Agreements. While there are significant constraints on the timing of these releases, Alcan has indicated their willingness to work with the Nechako Watershed Council (and others) to determine how best to redistribute these anticipated excess flows, if there are opportunities to do so. Any proposed changes to the future flows released into the Nechako River would be subject to the final approval of the Water Comptroller and the NFCP (Alcan 1998).

5.6.2 Agricultural Water Use

Agriculture is an important economic activity in the Nechako Valley. There is a beef and dairy industry in the region and farms produce local large crops such as hay and alfalfa. The growing season in the Nechako Valley typically extends from May to late August and the short frost-free period is the major constraint on agricultural production (BCUC 1994).

The most significant issue to farmers in the Nechako Valley relates to the availability of water for existing irrigation and for probable future expansion of agriculture. The ability to use the rivers as an effective containment barrier for cattle movement during periods of low flow is a second issue of concern.

The allocation and regulation of surface water in British Columbia is governed by the Water Act. The Ministry of Environment Lands and Parks (MELP) is responsible for issuing licenses and has divided the Nechako River into three reaches (increasing from 1-3 downstream).

Reach 1: Nechako River from Cheslatta Falls to the confluence with the Nautley River.

Reach 2: Nechako River from the Nautley River to the confluence with the Stuart River.

Reach 3: Nechako River from the Stuart River to the confluence with the Fraser River.

For a number of years dating back to the early 1990s the province was reluctant to issue new water withdrawal licenses because of concerns expressed by the Steering Committee of the NFCP and DFO that additional withdrawals could cause adverse effects on resident chinook and migrating sockeye salmon.

Based on the advice received, to this date MELP is still not accepting applications for major withdrawals in Reach 1. Until very recently, applications for water withdrawals in Reach 2 were being accepted, but the issuance of licenses was being held in abeyance. However, on June 4, 1999, the Ministry announced that applications in Reach 2 (the middle reach) were now under active review; there were five outstanding applications at that time. Further downstream in Reach 3, applications are accepted and generally result in licenses. In addition, MELP has initiated a review of water utilization under existing water licences to determine actual use in the area at this time.

At this time, a total of 40 licenses have been issued authorizing irrigation of about 5,040 hectares of farmland in the Nechako Valley upstream of the Stuart River. This corresponds to a mean annual flow of about 0.5 m^3/s, which represents almost all of the current authorized use of water from the Nechako and its tributaries, aside from power production and fisheries (MELP 1998).

It is anticipated that Alcan's recent commitment to work with the Nechako Watershed Council and others to determine how best to redistribute excess flows from the Nechako Reservoir (Alcan 1998) should help to address the concerns of the agricultural and ranching community.

5.6.3 Municipal and Domestic Water Use

The communities of Fort Fraser, Vanderhoof and Prince George currently withdraw water for domestic purposes from groundwater.

Fort Fraser withdrew water for domestic consumption directly from the Nechako River prior to 1998 but in that year a new groundwater well was installed which has resolved most, if not all, of their water quality and quantity concerns (MEM 1999).

Vanderhoof has a license to withdraw water from the river, but to date has not exercised its rights under the license. Currently, all of Vanderhoof's water needs are supplied by groundwater. In addition to the communities of Fort Fraser and Vanderhoof, a number of private individuals withdraw water from the Nechako, its tributaries and private wells. Prince George and the surrounding area draw water from a major surficial aquifer below the city.

In general, the licensed amount for domestic and municipal purposes that may be withdrawn from the Nechako and its tributaries is less than 0.1 m^3/s on a mean annual basis. This amount includes the currently unused license held by Vanderhoof (BCUC 1994).

The present water licensing system has made allowances for and accommodated current domestic water uses in the Nechako Valley. Nevertheless, residents continue to want assurances that there will be sufficient water for them now and in the future.

5.6.4 Water Quality

The setting of water quality objectives in priority basins in British Columbia began in 1982. By the end of 1995, the provincial Environment Ministry had set water quality objectives in 43 bodies of water, both fresh and marine, throughout the Province (B.C. Environment 1995).

The Nechako River was one of the waterbodies selected for this purpose and annual monitoring to check the attainment of objectives began in 1987. The major potential sources of water quality contamination along the Nechako River include the sewage treatment plants at Vanderhoof and Fort Fraser, and runoff from agriculture and forestry practices. The key water quality objectives established for the Nechako River include fecal coliforms, ammonia, nitrate, the growth of algae (chlorophyll a) dissolved oxygen, temperature, total gas pressure and pH.

The available data for the period 1987 to 1994 indicate that the only objectives that have not been met on occasion are fecal coliforms (<100/100 mL) and temperature (15°C below Cheslatta Falls). In addition, ammonia concentrations near Vanderhoof have at times approached the objective (<1.87 mg/L av.).

In 1994, the most recent year for which data are available, the fecal coliform objective was met at all stations in the Nechako River, except immediately downstream from Vanderhoof, as has been the case in the past (B.C. Environment 1995). Overall, water quality in the Nechako River was rated in 1994 as "fair" due to the elevated fecal coliform levels found downstream of Vanderhoof and water temperatures above the 15°C objective set for this parameter by the Province.

Proposed nutrient removal and improved disinfection as planned are expected to improve fecal coliform levels in the Nechako River in the future.

5.6.5 Waste Water Dilution

Fort Fraser, Vanderhoof and Prince George are the three main sources of sewage on the Nechako River. Although all three communities treat their sewage, the level of treatment at the Vanderhoof and Prince George sewage treatment plants are considered to be inadequate and require upgrading (BCUC 1994).

The current discharges continue to pose four main concerns related to: nutrient impacts, fecal coliform, enterococci and ammonia levels. The treated discharges have caused elevated levels of nutrients downstream with resultant effects on primary producers (algae, weeds). Fecal coliform, enterococci and ammonia have triggered health concerns, affecting contact recreational activities such as swimming and the quality of drinking water (BCUC 1994; BC Environment 1995). The implementation of proposed improvements in sewage effluent treatment, including nutrient removal, improved disinfection and/or land based disposal, would likely assist in alleviating current fecal coliform contamination in the Nechako River.

5.6.6 Aquatic Weeds

For many years some residents of the Nechako Basin (Christensen 1995) have expressed concern about the beds of aquatic weeds that now grow in the shallow areas of many parts of the Nechako River. The plants prefer sites where the current is relatively slow and where the substrate allows them to become established. Aquatic weeds are a common nuisance in the Province but wherever they occur, they are usually considered more of a curse than a blessing (BCUC 1994)

Weeds may provide cover for fish, but the fish may be a coarse fish rather than a game species. They provide cover for fish food organisms, but some of these organisms may be vectors of swimmer’s itch. Weeds may produce oxygen by day but consume it at night during the summer and contribute to oxygen depletion when they decompose in the winter. They may acts as filters in the water by trapping fine particles, but in so doing enhance conditions for their own growth. They may take up nutrients and toxins, but can block water intakes and obstruct flows. Moreover, aquatic weeds are not generally considered to be aesthetically pleasing, and may impair recreational pursuits such as swimming and boating, and leaving exposed shorelines both unsightly and unpleasant (BCUC 1994).

The reduced summer flows resulting from the Kemano I project, combined with elevated levels of nutrients resulting from sewage plant discharges and agricultural run-off have contributed to increased aquatic weed growth in some areas such as below the sewage discharge points at Fort Fraser and Vanderhoof. Sewage treatment upgrades at these major point sources and the opportunity to redistribute excess flows from the Nechako Reservoir during the summer period could assist in addressing this concern by contributing to reduced weed growth in some of the problem areas.

5.6.7 Water-Based Transportation and Recreation

During the summer and fall, portions of the Nechako River are used by members of the general public for canoeing, kayaking and jet boating. In addition, the broad, slow moving waters and relatively even river bottom at Vanderhoof offers one of the few float plane landing and take-off sites on the Nechako River. However, under present conditions, navigation and float plane use of the river during the summer and fall low flow periods can at times be difficult (BCUC 1994; Christensen 1995).

Alcan's commitment to work with the Nechako Watershed Council and others to determine how best to redistribute excess flows from the reservoir provides a timely opportunity to address some of these concerns.

5.6.8 Flood Control

Prior to the creation of the Nechako Reservoir in the 1950s, freshet flows from the Nechako River caused widespread flooding in the valley of the Nechako and contributed to flooding of the Fraser River (BCUC 1994). The Nechako Reservoir is now the largest regulated storage facility in the Fraser River system and the Comptroller of Water Rights requires that reservoir releases do not contribute unnecessarily to peak flood flows in the Fraser River.

During some years in the 1960s and 1970s, large discharges from the Skins Lake Spillway in the spring and summer caused flooding in the Cheslatta River Valley and at low lying properties on the Nechako River. As well, in the early 1980s, some flooding of these lands occurred during the release of summer cooling flows. The current limit on Nechako River flows at Cheslatta Falls was implemented to prevent recurrence of flooding in and around Fort Fraser and Vanderhoof.

In recent years Alcan, the NFCP Technical Committee and the Comptroller of Water Rights have generally collaborated effectively to manage water levels in the Nechako Reservoir and the downstream Nechako River.

The critically important role the Nechako Reservoir fulfills in helping to prevent or control flooding in the Nechako Valley and the downstream Fraser system was highlighted in recent years by a late season flooding event that occurred in 1996 (BriMar, 1996). Leading up to that year, major fall spillages from the Nechako reservoir had not been observed since 1976, the year of maximum reservoir inflows. However, 1996 turned out to be a considerably wetter year than most that had been recently experienced. Total inflows to the Nechako Reservoir for the January to November 1996 period, which averaged 244 m^3/s, had exceeded the estimated long-term (1930 to 1995) average by about 22%.

Largely due to these inflows, and not withstanding significant releases that were made earlier (mostly in July) in conjunction with the Summer Temperature Management Program, the reservoir level on September 15, 1996 reached 853.3 metres, just below the normal maximum level of 853.4 metres. This represented the highest reservoir elevation that Alcan had experienced for that time of the year (BriMar, 1996).

Concern about the availability of reservoir storage for the 1997 spring freshet led to the decision to spill increasing volumes of water through the Skins Lake Spillway from September 20, 1996, through early November. The largest releases, at 226 m^3/s, occurred between October 8, 1996, and November 15, 1996, when releases were reduced to approximately 61 m^3/s.

Given the normal travel time of water from the Skins Lake Spillway to Vanderhoof, it takes about one week for the reduction in observed flow volumes at Vanderhoof to match one-half of the reduction in Skins Lake Spillway releases, and about another three days for a similar impact to be observed at Prince George, where the Nechako River flow volume is also significantly influenced by inflows from the Stuart River.

However, in 1996 a deep cold snap commenced on November 15, and lasted for approximately ten days. Average mean temperatures at Prince George Airport for this period fell to approximately -17°C. These abnormally low temperatures led to rapid ice formation on the Nechako River, and ice jams were observed to be forming in the vicinity of Vanderhoof by November 20, 1996, and near Prince George by November 23, 1996. These ice jams led to some flooding in both communities, and flooding of riparian lands and beaver lodges along other reaches of the Nechako River (BriMar 1996).

The BriMar Report (1996) commissioned by the Province of British Columbia on this incident concluded that while Alcan, the Nechako Fisheries Conservation Program and the provincial Comptroller of Water Rights all "took a prudent course" of action with water flow releases from the Nechako Reservoir during the summer and fall of 1996, more care should have been paid to the potential weather-related risk of high water releases during the first half of November in that year (B.C. 1996).

The BriMar report highlighted the need for all parties to learn from that experience. Nevertheless, the ability of the Kenney Dam to provide a degree of flood protection to downstream communities that would not be available without the existence of the reservoir and the dam was reaffirmed (BriMar 1996).

6. FUTURE ENHANCEMENT OF THE NECHAKO WATERSHED

6. FUTURE ENHANCEMENT OF THE NECHAKO WATERSHED

Throughout the long history of the Kemano Project, the Government of Canada, the Province of British Columbia, industry (led by Alcan), and the general public, including First Nations and other interests, have been concerned with trying to find ways to return the Nechako River to a "healthier" state.

After the proposed Kemano Completion Project was rejected, the Province of B.C. and Alcan signed the 1997 Settlement Agreement to address outstanding legal matters and established the Nechako Environmental Enhancement Fund (NEEF) and its Management Committee. The primary responsibility of this committee is to review, assess and report on options that may be available for the downstream enhancement of the Nechako Watershed area.

Soon after this, a number of other organizations with interests in the Nechako River were created, including the Nechako Watershed Council and the Nechako River Alliance. While all of these developments were unfolding, the four First Nations with a particular interest in the Nechako Watershed, namely the Carrier-Sekani Tribal Council, the Cheslatta Nation, Stoney Creek First Nation (Saik'uz) and the Lheidli T'enneh, have continued to express concerns about the health of the river, decisions that have been made and decision-making processes in general.

The current NEEF-sponsored multi-interest involvement process providing a timely opportunity for all interested parties to assist in identifying, exploring and evaluating possible options for achieving suitable enhancement objectives for the Nechako Watershed area.

During the preparation of this report; it became apparent that a number of issues remain to be addressed during the development of options for enhancing the downstream environment of the Nechako River and its watershed.

In particular, it seems clear that an important first step should be to achieve a satisfactory consensus on an overall vision for the future state of health of the Nechako River system.

It is hoped that participants at the October 1999 NEEF - sponsored workshop will use this opportunity to make a meaningful contribution to the development and eventual implementation of cost-effective and suitable enhancement options for the Nechako River watershed.

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APPENDIX A
NFCP ACTIVITY FLOW CHARTS

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NFCP ACTIVITY FLOW CHARTS

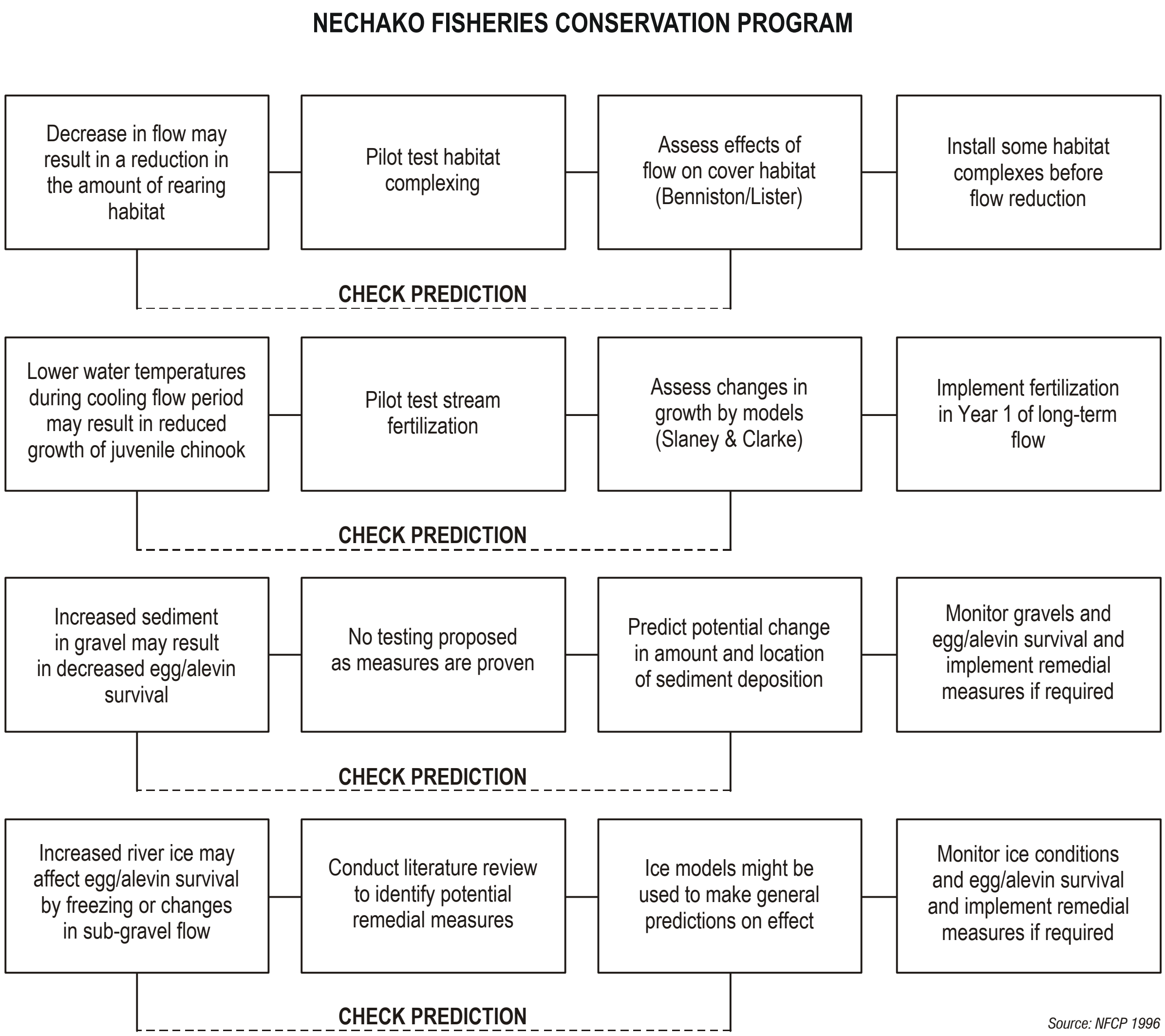

Figure A.1: Decision Chart for Remedial Measures Program

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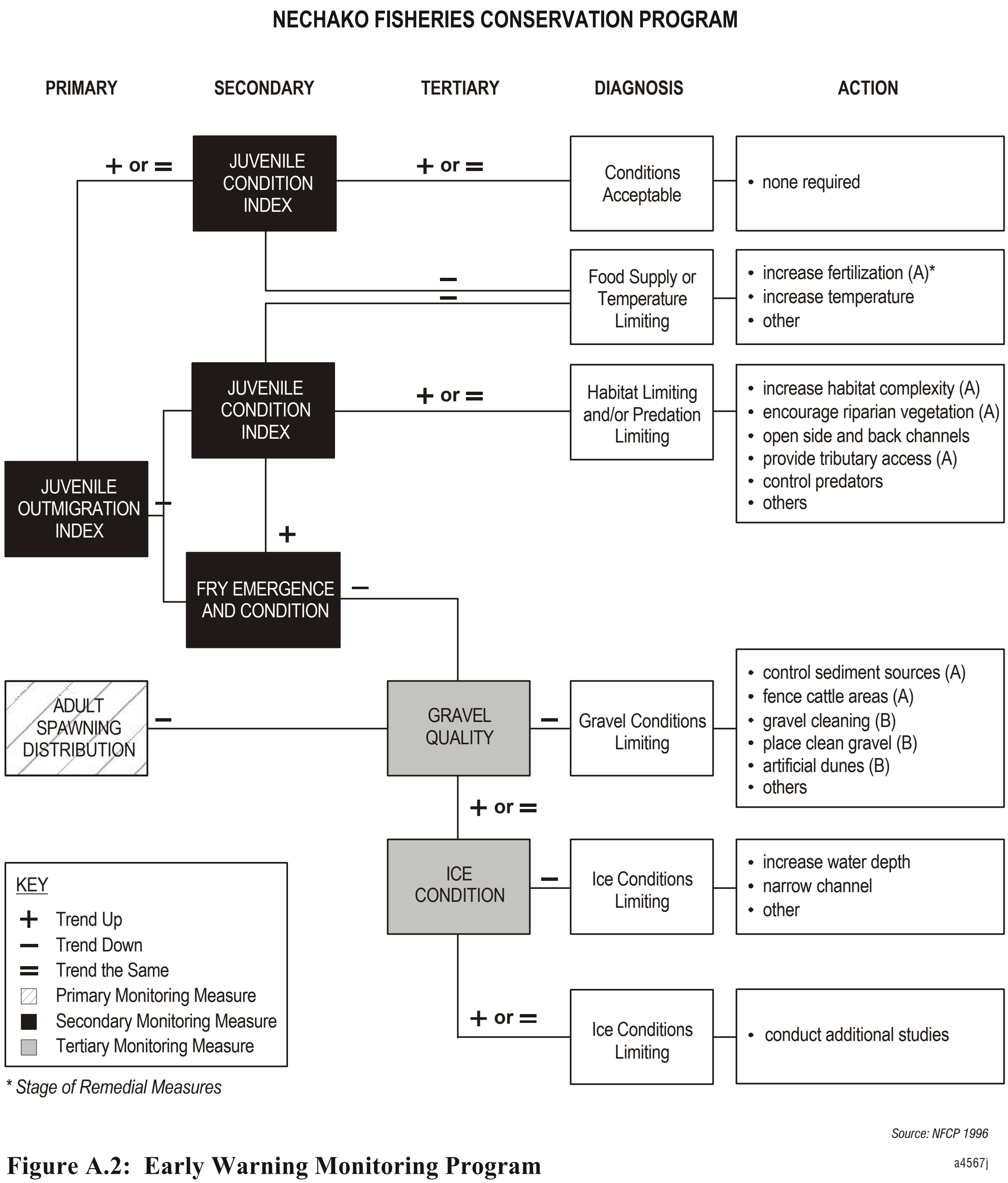

Figure A.2: Early Warning Monitoring Program

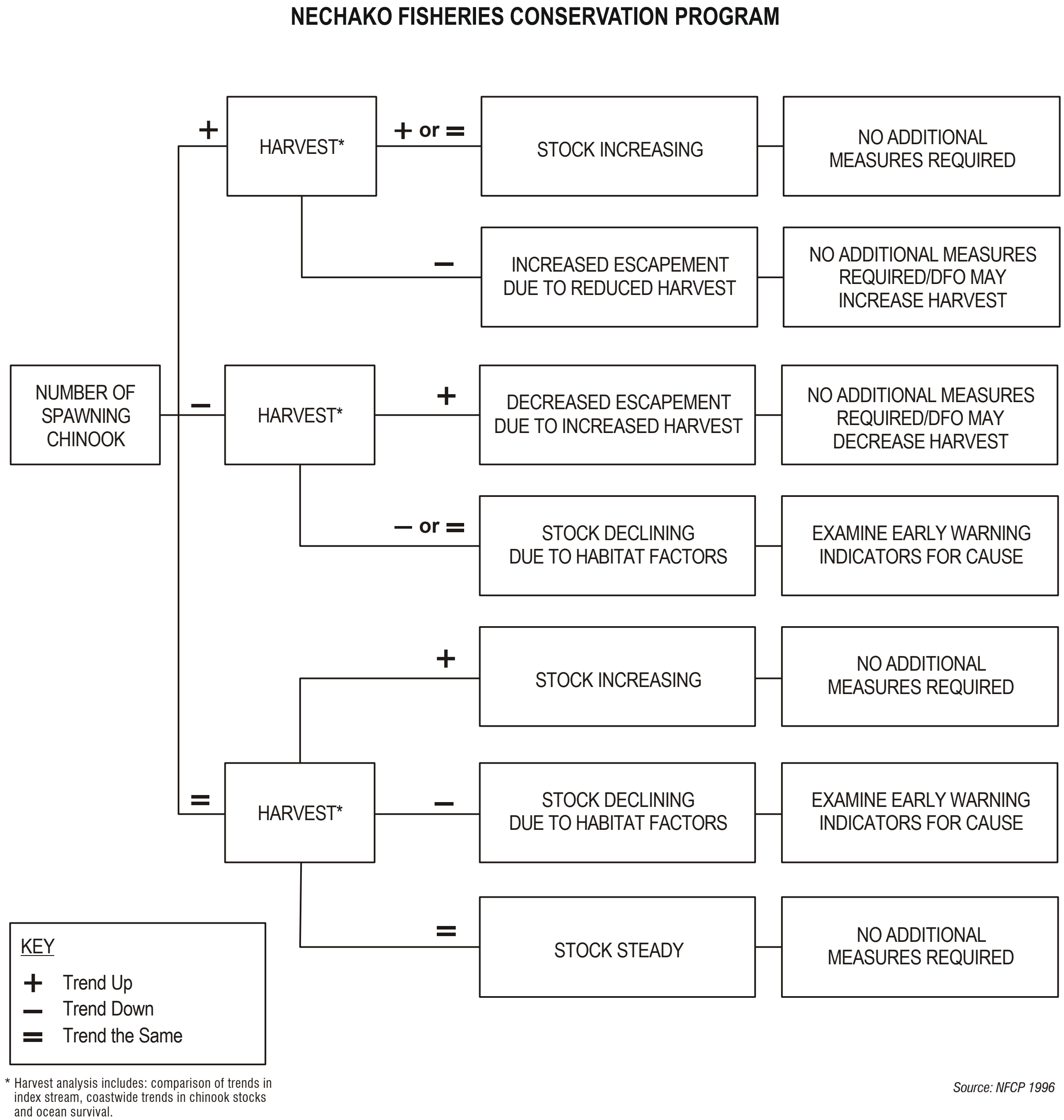

Figure A.3: Process for Assessment of Conservation Goal

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APPENDIX B
LIST 1998 - 1999 NECHAKO FISHERIES CONSERVATION PROGRAM REPORTS

APPENDIX B - LIST 1988 - 1999 NECHAKO FISHERIES CONSERVATION PROGRAM REPORTS

("na" indicates report not applicable to this project)
Updated September 14, 1999

Year of Project	Report Number	Title	Prepared By	Report Status
1988	M88-1	Nechako River Physical Data Summary 1986	DFO	Published
1988	M88-2	Nechako River Physical Data Summary 1987	DFO	Published
1988	M88-3	Nechako and Stuart Rivers Chinook Spawner Enumeration 1988	DFO	Published
1988	M88-4	Nechako and Stuart Rivers Chinook Carcass Recovery 1988	DFO	Published
1988	M88-6	Winter Conditions 87/88 (DFO)	DFO	Published
1988	M88-7	Nechako River Physical Data Summary 1988	DFO	Published
1988	M88-8	Winter Conditions 88/89	DFO	Published
1988	M88-9	Incubation Environment: Testing of Redd Capping	TRITON	Published
1988	RM88-1	Nechako River Secondary Channel Geomorphology Studies Phase II	ROOD	Published
1988	RM88-2	Investigations into the Use of Instream Cover Structures by Juvenile Chinook Salmon	TRITON	Published
1988	RM88-3	Pilot Fertilization of the Nechako River: A Test of Nutrient Deficiency and Periphyton Response to Nutrient Addition	PERRIN	Published
1988	RM88-4	In-stream Habitat Complexing 1989 - 1990 Pilot Testing Consolidated in RM90-3	na	na
1988	RM88-5	The 1988 Summer Water Temperature and Flow Management Project	TRITON	Published
1988	RM88-6	Nechako River Flow Control Report 1988/1989	TRITON	Published
1989	M89-1	Nechako and Stuart Rivers Chinook Spawner Enumeration 1989	DFO	Published
1989	M89-2	Nechako and Stuart Rivers Carcass Recovery 1989	DFO	Published
1989	M89-3	Juvenile Outmigration Nechako River 1989	TRITON	Published
1989	M89-4	1) Review of River Ice Modeling, Nechako River (included in M97-7)	DFO	Published
1989	M89-5	Nechako River Physical Data Summary 1989	DFO	Published
1989	M89-6	1990 Fry Emergence	TRITON	Published
1989	M89-7	Nechako River Substrate Quality and Composition	ROOD	Published
1989	M89-8	Nechako River Chinook Residence Time, 1989	DFO	Published
1989	RM89-1	Cheslatta/Murray Data Collection Summary Report 1989 - 1993 Consolidated in RM93-1	na	na
1989	RM89-2	The 1989 Summer Water Temperature and Flow Management Project	TRITON	Published
1989	RM89-3	In-stream Habitat Complexing 1989 - 1990 Pilot Testing Consolidated in RM90-3	na	na
1989	RM89-4	Pilot Fertilization of the Nechako River II: Nitrogen-Limited Periphyton Production and Water Quality Studies during Treatment of the Upper River	PERRIN	Published
1989	RM89-5	Biological Assessment of Habitat Complexing and Stream Fertilization	TRITON	Published
1989	RM89-6	Preliminary Inventory of Habitat Cover/Cover Opportunities Nechako River 1989	LISTER	final review
1989	RM89-7	Identification and Ranking of Sources Contributing Sediment to the Upper Nechako River	ROOD	final review
1989	RM89-8	Nechako River Flow Control 1989/1990	TRITON	Published
1990	M90-1	Nechako and Stuart Rivers Chinook Spawner Enumeration 1990 Data Report	DFO	Published
1990	M90-2	Nechako and Stuart Rivers Chinook Carcass Recovery 1990	DFO	Published
1990	M90-3	Juvenile Outmigration, 1990	TRITON	Published
1990	M90-4	Winter Physical Conditions	DFO	Published
1990	M90-5	Nechako River Physical Data Summary 1990	DFO	Published
1990	M90-6	1991 Fry Emergence	TRITON	Published
1990	M90-7	Gravel Quality - Consolidated in M97-7	DFO	na
1990	RM90-1	Consolidated in RM93-1	na	na
1990	RM90-10	Winter Remedial Measures	TRITON	final review
1990	RM90-2	The 1990 Summer Water Temperature and Flow Management Project	TRITON	Published
1990	RM90-3	In-Stream Habitat Complexing 1989-1990 Pilot Testing	TRITON	Published
1990	RM90-3.1	A Literature Review of Riparian Revegetation Techniques	TRITON	Published
1990	RM90-3.2	Cattle Ranching Activities in Riparian Zones along the Upper Nechako River and Its Tributaries. Identifying Erosion at Potential Problem Areas	TRITON	Published
1990	RM90-4	Pilot Fertilization of the Nechako River III: Factors Determining Production of Fish Food Organisms	PERRIN	Published
1990	RM90-5	Pre-Fertilization Assessment: Baseline Fisheries Studies of Reach 1 of the Upper Nechako River, 1990	TRITON	Published
1990	RM90-6	Biological Assessment of Habitat Complexing, Nechako River 1990	TRITON	Published
1990	RM90-7	Inferred Changes in Chinook Cover Habitat Suitability in Nechako River (Reaches 5-7) due to Flow Reduction	LISTER	final review
1990	RM90-8	River Bed Survey/HEC-2 Numerical Model of Nechako River: Volume I and II	HAY & CO	Published
1990	RM90-8.1	Nechako River Sand Mapping	ROOD	Published

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Year of Project	Report Number	Title	Prepared By	Report Status
1990	RM90-9	7	TRITON	Published
1991	M91-1	Nechako and Stuart Rivers Chinook Spawner Enumeration 1991	DFO	Published
1991	M91-2	Nechako and Stuart Rivers Chinook Carcass Recovery 1991	DFO	Published
1991	M91-3	Juvenile Outmigration, 1991	TRITON	Published
1991	M91-4	Winter Physical Conditions	DFO	Published
1991	M91-5	Nechako River Physical Data Summary 1991	DFO	Published
1991	M91-6	1992 Fry Emergence	TRITON	Published
1991	M91-7	Substrate Quality - Consolidated in M97-7	DFO	na
1991	M91-8	Dissolved Oxygen Monitoring - Consolidated in M97-7	DFO	na
1991	RM91-1	Cheslatta/Murray Data Collection Summary Report 1989 - 1993 Consolidated in RM93-1	na	na
1991	RM91-2	The 1991 Summer Water Temperature and Flow Management Project	TRITON	Published
1991	RM91-3	Instream Habitat Complexing Pilot Testing	TRITON	Published
1991	RM91-4	Pilot Fertilization of the Nechako River IV: Monitoring to Improve Precision	PERRIN	Published
1991	RM91-5	Pre-Fertilization Assessment: Baseline Fisheries Studies of Reach 1 of the Upper Nechako River, 1991	TRITON	Published
1991	RM91-6	Biological Assessment of Habitat Complexing in the Nechako River 1991	TRITON	Published
1991	RM91-7	Riparian Vegetation Pilot Testing	TRITON	Published
1991	RM91-8	Nechako River Flow Control 1991/1992	TRITON	Published
1992	M92-1	Nechako and Stuart Rivers Chinook Spawner Enumeration 1992	DFO	Published
1992	M92-2	Nechako and Stuart Rivers Chinook Carcass Recovery 1992	DFO	Published
1992	M92-3	Juvenile Outmigration 1992	TRITON	Published
1992	M92-4	Winter Physical Conditions	DFO	Published
1992	M92-5	Nechako River Physical Data Summary - Database	DFO	Published
1992	M92-6	1993 Fry Emergence	TRITON	Published
1992	M92-7	Dissolved Oxygen Monitoring - Consolidated in M97-7	DFO	na
1992	M92-8	Evaluation Framework and Trend Analysis	TRITON/DF	na
1992	RM92-1	Cheslatta/Murray Data Collection Summary Report 1989 - 1993 Consolidated in RM93-1	na	na
1992	RM92-2	The 1992 Summer Water Temperature and Flow Management Project	TRITON	Published
1992	RM92-3	1992 Instream Habitat Complexing Pilot Testing	TRITON	Published
1992	RM92-4	na	na	na
1992	RM92-5	Assessment of Fertilization	TRITON	Published
1992	RM92-6	Biological Assessment of Habitat Complexing in the Nechako River 1992	TRITON	Published
1992	RM92-7	Riparian Vegetation Pilot Testing	TRITON	Published
1992	RM92-8	Nechako River Flow Control 1992/1993	TRITON	Published
1993	M93-1	Nechako and Stuart Rivers Chinook Spawner Enumeration 1993	DFO	Published
1993	M93-2	Nechako and Stuart Rivers Chinook Carcass Recovery 1993	DFO	Published
1993	M93-3	Juvenile Outmigration 1993	TRITON	Published
1993	M93-4	Winter Physical Conditions	DFO	In Prep.
1993	M93-5	Nechako River Physical Data Summary - Database	DFO	Published
1993	M93-6	1994 Fry Emergence	TRITON	Published
1993	M93-7	Dissolved Oxygen Monitoring - consolidated in M97-7	DFO	na
1993	M93-8	Evaluation Framework and Trend Analysis	TRITON/DF	na
1993	RM93-1	Cheslatta/Murray Data Collection Summary Report 1989-1993	TRITON	In Prep.
1993	RM93-2	The 1993 Summer Water Temperature and Flow Management Project	TRITON	Published
1993	RM93-3	1993 Instream Habitat Complexing Pilot Testing (merged RM95-3)	TRITON	na
1993	RM93-4	Biological Assessment of Habitat Complexing in the Nechako River 1993	TRITON	Published
1993	RM93-5	Riparian Bank Stabilization	TRITON	In Prep.
1993	RM93-6	Nechako River Flow Control 1993/1994	TRITON	Published
1993	RM93-7	1993 Riparian Vegetation Monitoring Program	TRITON	Draft
1994	M94-1	Nechako and Stuart Rivers Chinook Spawner Enumeration 1994	DFO	Published
1994	M94-2	Nechako and Stuart Rivers Chinook Carcass Recovery 1994	DFO	Published

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Year of Project	Report Number	Title	Prepared By	Report Status
1994	M94-3	Size, Distribution and Abundance of Juvenile Chinook Salmon of the Nechako River 1994	TRITON	Published
1994	M94-4	Winter Physical Conditions	DFO	In Prep.
1994	M94-5	Nechako River Physical Data Summary - Database	DFO	Published
1994	M94-6	1995 Fry Emergence	TRITON	Draft
1994	M94-7	Dissolved Oxygen Monitoring - consolidated in M97-7	DFO	na
1994	M94-8	Evaluation Framework	TRITON/DF	na
1994	RM94-1	The 1994 Summer Water Temperature and Flow Management Project	TRITON	Published
1994	RM94-2	1994 Habitat Complexing Pilot Testing (merged RM95-3)	TRITON	na
1994	RM94-3	Biological Assessment of Habitat Complexing in the Nechako River, 1994	TRITON	Published
1994	RM94-4	Nechako River Flow Control 1994/1995	TRITON	Published
1995	M95-1	Nechako and Stuart Rivers Chinook Spawner Enumeration 1995	DFO	Draft
1995	M95-2	Nechako and Stuart Rivers Chinook Carcass Recovery 1995	DFO	Draft
1995	M95-3	Juvenile Outmigration 1995	TRITON	Draft
1995	M95-4	Winter Physical Conditions	DFO	In Prep.
1995	M95-5	Nechako River Physical Data Summary - Database	DFO	Published
1995	M95-6	1996 Fry Emergence	TRITON	Final
1995	M95-7	Dissolved Oxygen Monitoring - consolidated in M97-7	DFO	na
1995	M95-8	Evaluation Framework and Trend Analysis	TRITON/DF	na
1995	RM95-1	Cheslatta-Murray Data Collection	TRITON	Draft
1995	RM95-2	1995 Summer Water Temperature and Flow Management Project	TRITON	Draft
1995	RM95-3	Instream habitat complexing 1993 - 1995	TRITON	Draft
1995	RM95-4	Biological Assessment of Habitat Complexing in the Nechako River, 1995	TRITON	Published
1995	RM95-5	Nechako River Flow Control 1995/1996	TRITON	Published
1996	1995/96	1995/96 Annual Report	TRITON	Draft
1996	M96-1	Nechako and Stuart Rivers Chinook Spawner Enumeration 1996	DFO	In Prep.
1996	M96-2	Nechako and Stuart Rivers Chinook Carcass Recovery 1996	DFO	In Prep.
1996	M96-3	Juvenile Outmigration 1996	TRITON	Draft
1996	M96-4	Winter Physical Conditions	DFO	In Prep.
1996	M96-5	Nechako River Physical Data Summary - Database	DFO	Published
1996	M96-6	1997 Fry Emergence	TRITON	Draft
1996	M96-7	Dissolved Oxygen Monitoring	DFO	na
1996	M96-8	Evaluation Framework and Trend Analysis	TRITON/DF	na
1996	RM96-1	1996 Summer Water Temperature and Flow Management Project	TRITON	Draft
1996	RM96-2	1996 Instream habitat complexing	TRITON	Draft
1996	RM96-3	Biological Assessment of Habitat Complexing in the Nechako River, 1996	TRITON	Published
1996	RM96-4	Nechako River Flow Control 1996/1997	TRITON	Final
1997	1996/97	1996/97 Annual Report	TRITON	Draft
1997	M97-1	Nechako and Stuart Rivers Chinook Spawner Enumeration 1997	DFO	In Prep.
1997	M97-2	Nechako and Stuart Rivers Chinook Carcass Recovery 1997	DFO	In Prep.
1997	M97-3	Juvenile Outmigration 1997	TRITON	Draft
1997	M97-4	Winter Physical Conditions	DFO	In Prep.
1997	M97-5	Nechako River Physical Data Summary - Database	DFO	Published
1997	M97-6	1998 Fry Emergence	TRITON	Draft
1997	M97-7	Dissolved Oxygen Monitoring	DFO	Draft
1997	M97-8	Evaluation Framework and Trend Analysis	TRITON/DF	na
1997	RM97-1	1997 Summer Water Temperature and Flow Management Project	TRITON	Draft
1997	RM97-2	1997 Instream habitat complexing	TRITON	Draft
1997	RM97-3	Biological Assessment of Habitat Complexing in the Nechako River, 1997	TRITON	Draft
1997	RM97-4	Nechako River Flow Control 1997/1998	TRITON	In Prep.
1998	1997/98	1997/98 Annual Report	TRITON	In Prep.

APPENDIX B - LIST 1988 - 1999 NECHAKO FISHERIES CONSERVATION PROGRAM REPORTS

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Updated September 14, 1999

Year of Project	Report Number	Title	Prepared By	Report Status
1998	M98-1	Nechako and Stuart Rivers Chinook Spawner Enumeration 1998	DFO	In Prep.
1998	M98-2	Nechako and Stuart Rivers Chinook Carcass Recovery 1998	DFO	In Prep.
1998	M98-3	Juvenile Outmigration 1998	TRITON	Draft
1998	M98-5	Nechako River Physical Data Summary - Database	DFO	In Prep.
1998	M98-6	1999 Fry Emergence	TRITON	In Prep.
1998	M98-8	Evaluation Framework and Trend Analysis	TRITON/DF	na
1998	RM98-1	1998 Summer Water Temperature and Flow Management Project	TRITON	Draft
1998	RM98-2	1998 Instream habitat complexing	TRITON	Draft
1998	RM98-4	Nechako River Flow Control 1997/1998	TRITON	In Prep.
1998	Ten Year	NFCP 10 Year Report	TRITON	In Prep.
1999	1998/99	1998/99 Annual Report	TRITON	In Prep.
1999	M99-1	Nechako and Stuart Rivers Chinook Spawner Enumeration 1999	DFO	na
1999	M99-2	Nechako and Stuart Rivers Chinook Carcass Recovery 1999	DFO	na
1999	M99-3	Juvenile Outmigration 1999	TRITON	In Prep.
1999	M99-4	Nechako River Physical Data Summary - Database	DFO	In Prep.
1999	M99-5	2000 Fry Emergence	TRITON	na
1999	M99-8	Evaluation Framework and Trend Analysis	TRITON/DF	In Prep.
1999	RM99-1	1999 Summer Water Temperature and Flow Management Project	TRITON	In Prep.
1999	RM99-2	1999 Instream habitat complexing	TRITON	na
1999	RM99-3	Nechako River Flow Control 1998/1999	TRITON	In Prep.
1999	Ten Year	NFCP 10 Year Report	TRITON	In Prep.