ANNUAL REPORT

April 1, 1993 - March 30, 1994

NECHAKO FISHERIES CONSERVATION PROGRAM

(A joint Program of the Government of Canada,
Alcan, and the Province of British Columbia)

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CONTENTS

INTRODUCTION

In 1980, Alcan Aluminum Limited proposed to use the remaining portion of its water rights to divert water from the Nechako River and produce power for a second smelter in the Kitimat region of British Columbia. To establish appropriate, fisheries conservation measures and stock habitat monitoring projects, several years of scientific and engineering studies were undertaken by the federal government and Alcan.

In 1987, to ensure conservation of the Nechako River chinook and protection of migrating sockeye salmon populations in the Nechako River, a Settlement Agreement was signed by Alcan Aluminum Limited, the Government of Canada and the Province of British Columbia. This agreement set in place the Nechako Fisheries Conservation Program (NFCP). Under this program, conservation strategies are developed, tested and carried out. Specific water releases from the Nechako Reservoir required for fisheries conservation, the monitoring of fish stock and habitat performance, testing and implementing instream and/or side channel remedial measures and conducting applied research studies have been carried out since the beginning of the NFCP.

Implicit in the Agreement is the development of a cold water release facility at Kenney Dam to provide control over flow and water temperature in the Nechako River to protect salmon. Until this facility is constructed, Alcan will release the appropriate amount of water through the Skins Lake Spillway, as set out in the Settlement Agreement.

The NFCP began in 1987-1988 with the development of operating procedures and a program framework. Field projects for the first year of an initial five-year period began in 1988. Annual reports are available for each of the program years.

During the uncertainty on the status of the Nechako River Settlement Agreement, created by the Federal Court decision of May 14, 1991, the federal and provincial governments and Alcan authorized certain actions so as not to jeopardize monitoring, remedial measures and applied research programs already underway.

As a consequence of the Federal Court of Appeal, May 1992 and the Supreme Court Decision of February 1993, the legal validity of the 1987 Settlement Agreement was confirmed. Any restrictions on the formal function of the Nechako Fisheries Conservation Program Technical Committee were removed.

On March 11, 1994, the Technical Committee submitted a document to the B.C. Utilities Commission outlining the mandate of the NFCP and the progress to date of the program.

This report for 1993/94 covers Year 6 of the Nechako Fisheries Conservation Progam. It provides the rationale and review of field projects carried out, providing detail on the remedial measures, monitoring of stock and habitat performance, and applied research projects undertaken in 1993/94. It also includes approved projects for Year 7 of the program. A summary chart presents a review of all projects carried out since 1987.

PROGRAM OPERATIONS

TheTechnical Committee is responsible for planning, designing, recommending, and carrying out annual and long-term projects to achieve the NFCP Conservation Goal. This Committee consists of a representative from each of the signatory parties to the Agreement and one independent representative.

The Steering Committee is responsible for overall program direction and budget approval. This Committee consists of senior members of the three signatory parties.

The program is subject to approval by the Steering Committee and is based on the deliberations of the Strangway Working Group; technical specialists from Fisheries and Oceans, Alcan and the Province of British Columbia. This group identified a program of measures and a plan of implementation which would provide an acceptable level of certainty for the conservation of chinook salmon and protection of sockeye salmon in the Nechako River.

PROGRAM DEVELOPMENT

As set out in the Settlement Agreement the NFCP will exist until sustained achievement of the Conservation Goal can be demonstrated. In order to establish this, long-term monitoring of chinook stocks will be undertaken to continuously assess stock status.

In 1987/88, the Technical Committee developed an initial pre-construction plan under which project activities for the entire life of the NFCP would be carried out. The time frame was initially identified as the time available until the expected change from short-term to long-term flows. Due to delays of the Kemano Completion Project (KCP), the pre-construction plan was modified, using the additional time to continue remedial measures pilot tests, refine monitoring programs and continue baseline data acquisition.

The Technical Committee is involved in the ongoing development of the Evaluation Framework. This document will become an integral component of the long-term plan of achieving the fisheries objectives of the Settlement Agreement.

There are three components to the NFCP:

Remedial Measures
Designing and testing of site specific remedial measures such as in-stream habitat improvements, side channel development, stream fertilization techniques, and measures to control sediment in the river. All of these programs are undertaken to achieve the conservation of chinook salmon populations;

Monitoring
Developing and implementing monitoring programs on stock and habitat performance which have the capability to detect changes in physical and biological parameters, measuring the efficiency of remedial measures and collecting baseline data;

Applied Research
Identifying and implementing applied research programs that would add to the overall understanding of Nechako River chinook life history.

Strategic Framework

A strategic framework is used by the Technical Committee to direct the overall plan. This framework focuses on specific and measureable elements of habitat and chinook ecology rather than an evaluation of all stages of salmonid life history. It provides guidelines for testing and carrying out remedial measures, the monitoring of stock and habitat performance and research into the ecology and life cycle of Nechako River chinook salmon.

Flow Charts

Under the strategic framework, the Technical Committee designed three flow charts to assist the understanding of how committee activities are to be directed. These include:

The Decision Chart used in the evaluation of selection, implementation and evaluation of Remedial Measures (Appendix A.1).

The 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).

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).

Evaluation Framework

The Evaluation Framework initiated in 1992/93 by the Technical Committee is intended to facilitate interpretation of results from all projects for cause and effect linkages between physical and biological programs. The framework 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 important component of the long-term planning and evaluation processes.

The results from each monitoring program will be interpreted in conjunction with data collected on physical parameters and other biological programs on the Nechako River.

Comparison on both annual cycle and five year stock cycle changes in the values being measured will be possible through the use of the evaluation framework; for example, fry emergence success, juvenile outmigration and the number of adults returning to the system. Changes in these values, when compared to the baseline data, may suggest that tertiary monitoring programs targeted at specific areas should be undertaken. Such areas include the dissolved oxygen levels in the intergravel environment and any life history phase of Nechako chinook salmon. Changes detected may also initiate additional remedial measures.

Native Participation

The majority of Native participation in the NFCP has been on monitoring programs, including carcass recovery on the Nechako and Stuart rivers, marking of juvenile chinook at the Necoslie Hatchery, juvenile outmigration, fry emergence, and habitat complexing.

Native participation in 1993/94 was less than in previous years due to a reduction in persondays of work associated with the 1993/94 operating period and the availability of native technicians. Continued dialogue with native people will provide opportunities for this cooperative effort to expand.

Interactions with the Kemano Completion Project Team

As part of the Technical Committee's responsibility to ensure conservation of Nechako River chinook salmon and protection of sockeye salmon, it must assess design and operational procedures of the proposed Kenney Dam Release Facility and the Cheslatta Fan Channel. During the life of the program a number of meetings with the Kemano Completion Project (KCP) team have taken place.

On July 26, 1993, the Technical Committee approved the non-erodible design option of the Cheslatta Fan Channel and requested that the feasibility of a "regime" channel concept be assessed by KCP.

Meetings and Reports

The Technical Committee provides information on the Nechako Fisheries Conservation Program through an annual report and technical reports on all of the projects conducted.

As a result of the two appeal court decisions (May 1992 and February 1993), any restrictions on the formal function of the Technical Committee have been removed, and all reports, correspondence and proceedings prepared or performed within the mandate of the Committee could be finalized, approved and ratified.

The Technical Committee convened 23 meetings in Year 6 (April 1, 1993 to March 31, 1994) of the NFCP.

Annual reports for 1988/89, 1989/90, 1990/91, and 1992/93 are available. These provide an overall look at the program components, a rationale and summary of each of the field projects including the test results of remedial measures, stock and habitat monitoring and applied science activities. A survey report on 1991/92 programs is also available.

PROGRAM COMPONENTS

Remedial Measures

All remedial measures are biologically sound, professionally engineered, durable, consistent with other effective techniques and cost effective. The Remedial Measures Program in the Settlement Agreement is in compliance with the Department of Fisheries and Oceans habitat policy. Projects to test and evaluate appropriate measures to be taken in order to protect against any change in the chinook salmon habitat following implementation of the long-term flow regime have been a focus of the first six years of NFCP work.

There are three stages of remedial measures. These were identified in the Settlement Agreement and have been developed in accordance with the Department of Fisheries and Oceans policy for the management of fish habitat.

Several first-stage (Level A) measures will be put in place in preparation for the long-term flow regime. The first stage represents a set of measures that, if properly applied, should be sufficient to ensure conservation of the chinook stock. First-stage measures to ensure maintenance of the target population fall under three main categories: flow design changes, instream habitat modifications and off-channel modifications.

The second stage (Level B) represents a set of additional measures that could be implemented in the event that the first stage measures prove inadequate. These could include additional habitat alterations and access to new habitat.

The third stage (Level C) represents the ultimate fall-back position in the event that implementation of first and second stage measures proves inadequate. These measures could include anything from a spawning channel to incubation of Nechako chinook eggs at an existing hatchery, a hatchery on the Nechako River, compensation for lost production by implementing appropriate measures in other systems, or maintainance of Nechako stock gene pool at some other hatchery.

Several types of habitat complexes have been tested, assessed, modified and reassessed for structural integrity and juvenile chinook utilization to help define the characteristics of the most suitable complexes required to meet the needs of Nechako River chinook. Rail debris catchers are proving the most durable of the instream habitat complex types.

Results from biological sampling indicate that handmade habitat complexes are well utilized by emergent fry during May and June. There is also continued evidence that the complexes are utilized as overwintering habitat by chinook.

A stream bank revegetation pilot project initiated in 1991, at two test sites along the Nechako River, has had mixed results. One of the sites is no longer available due to changes in the river's course. Monitoring of the remaining site (located at km 30) will continue to determine the effectiveness of the revegetation treatments.

The summer temperature monitoring program continues to manage water temperatures in the Nechako River above the confluence of the Stuart River to protect migrating sockeye salmon.

The annual water allocation is managed by the NFCP to achieve the most beneficial flows for fish.

Habitat and Stock Monitoring

To assess the overall success of the NFCP, studies on habitat and salmon stock performance were identified. To date, efforts have been directed at establishing monitoring projects for use throughout the program to expand the existing database. Monitoring studies were targeted at three life history phases of Nechako River chinook salmon.

The primary monitoring measure for chinook salmon is the number of adult chinook returning to the Nechako River to spawn. To help assess whether the Conservation Goal is being achieved, adult spawning enumeration is undertaken to determine the number of adults returning to the Nechako River. In support of this, various population parameters such as: age structure; sex ratio; post orbital hypural length ; and egg retention in females are also measured. For sockeye salmon, the primary monitoring measure is the water temperature of the Nechako River above the confluence with the Stuart River.

There is a four to five-year time delay before adults return to spawn. Thus, monitoring of juveniles is important because data collected can provide an early indication of life cycle stresses. Secondary measures include juvenile outmigration monitoring to provide an early warning of any productivity changes in the system, and annual monitoring of fry emergence to develop an index of egg / alevin survival.

Tertiary measures to monitor parameters that may affect habitat quality include physical monitoring of gravel quality, ice conditions and water temperatures.

Preparation of a strategic framework was initiated to allow a synthesis and trend analysis of the data acquired over the first five years of the NFCP.

Applied Research

Applied research involves studies which will increase current knowledge and provide a basis for decision-making regarding the factors in the biological cycle of Nechako River chinook and the examination of cause / effect relationships.

Research on overwintering juvenile chinook populations examined winter abundance and distribution within the Nechako River. Knowledge of the habitat needs of the overwintering chinook is necessary in order to best manage the Nechako River chinook stock.

Research into predator / prey relationships was conducted to identify predators, define the potential risks posed to chinook populations, and determine what, if any, action may be required.

Studies on temperature effects on invertebrate production and fish growth were initiated in 1993 / 94.

The development of a limiting factors model to assess chinook production is the final area of focus for applied research.

Year 7 - Project Summary
Year 8 - Approved Projects

This report provides a description of all projects carried out in Year 7 (1993/94) and of all projects approved for Year 8 (1994/95) of the Nechako Fisheries Conservation Program.

Each project is presented with the rationale for the activity, accompanied by a brief review of 1993/94 work and the proposed project activity for the next year.

YEAR 7: PROJECT SUMMARY (1993/94)

REMEDIAL MEASURES

FLOW MANAGEMENT
- Cheslatta-Murray Hydrologic Data Collection
- Allocation of Flows
- Summer Water Temperature Management

IN-STREAM HABITAT COMPLEXES
- Physical Assessment of In-Stream Habitat Complexes
- Biological Assessment of Habitat Complexes

RIPARIAN RE-VEGETATION

HABITAT AND STOCK MONITORING

ADULT PROGRAMS
- Adult Spawner Enumeration
- Adult Carcass Recovery

INCUBATION ENVIRONMENT
- Gravel Quality and Dissolved Oxygen Monitoring
- Fry Emergence
- Winter Physical Conditions

JUVENILE OUTMIGRATION

TEMPERATURE MONITORING / PHYSICAL DATA COLLECTION

EVALUATION FRAMEWORK / TREND ANALYSIS

APPLIED RESEARCH

JUVENILE CHINOOK OVERWINTERING BEHAVIOUR

PREDATION AND COMPETITION

TEMPERATURE EFFECTS

YEAR 8: APPROVED PROJECTS (1994/95)

REMEDIAL MEASURES

FLOW MANAGEMENT
- Cheslatta-Murray Hydrologic Data Collection
- Allocation of Flows
- Summer Water Temperature Management

IN-STREAM HABITAT COMPLEXES
- Physical Assessment of In-Stream Habitat Complexes
- Biological Assessment of Habitat Complexes

RIPARIAN RE-VEGETATION

HABITAT AND STOCK MONITORING

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- Adult Carcass Recovery

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FLOW MANAGEMENT

Cheslatta-Murray Hydrologic Data Collection

RATIONALE

To make the best use of the annual water allocation from the Nechako Reservoir, it is necessary for the NFCP to know the magnitude and timing of inflows from the Cheslatta-Murray lakes watershed.

PROJECT SUMMARY 1993/94

In 1993/94, data collected since 1990 was analyzed to evaluate the timing and magnitude of flows from the Bird Creek sub-basin. Since sufficient data had been collected for the analyses, data collection in the Cheslatta-Murray Lakes watershed was discontinued following the 1993 freshet. All instruments were removed and stored at Skins Lake Spillway.

Allocation of Flows

RATIONALE

In 1993/94, flow allocation to the Nechako River was managed by the NFCP to best utilize available water to benefit fish in the river and to achieve the fisheries Conservation Goals of the Settlement Agreement. To meet objectives for flow control in the Nechako River, necessary adjustments must be made regarding Skins Lake Spillway releases.

PROJECT SUMMARY 1993/94

The annual water allocation was again managed by the NFCP Technical Committee to achieve the most beneficial flows for fish.

Reservoir releases from Skins Lake Spillway into the Nechako River were scheduled. The spring and summer mean monthly flows were monitored by recording mean daily releases from Skins Lake Spillway and mean daily flows at the gauging station on the Nechako River below Cheslatta Falls. Reservoir releases from Skins Lake Spillway and flow in the Nechako River are shown in Figures 1 and 2.

The release from Skins Lake Spillway was increased to approximately 49.0 m^3/s in late April 1993 and maintained until early July 1993 when the release was further increased for the summer cooling flows. On August 18, 1993, the spillway release was reduced to 14.2 m^3/s to achieve the fall spawning flows in early September. The spillway release was then increased to 32.2 m^3/s on September 3, 1993 and maintained to achieve the annual water allocation for 1993/94. No forced spill occurred at Skins Lake Spillway during 1993.

APPROVED PROJECT 1994/95

In 1994/95, flow allocation will again be managed by the NFCP to best utilize available water. Preliminary snowpack information indicates that it is unlikely that a forced spill will be necessary in 1994/95.

Figure 1

COMPARISON OF ACTUAL AND SETTLEMENT AGREEMENT - SKINS LAKE SPILLWAY RELEASES
(January to December 1993)

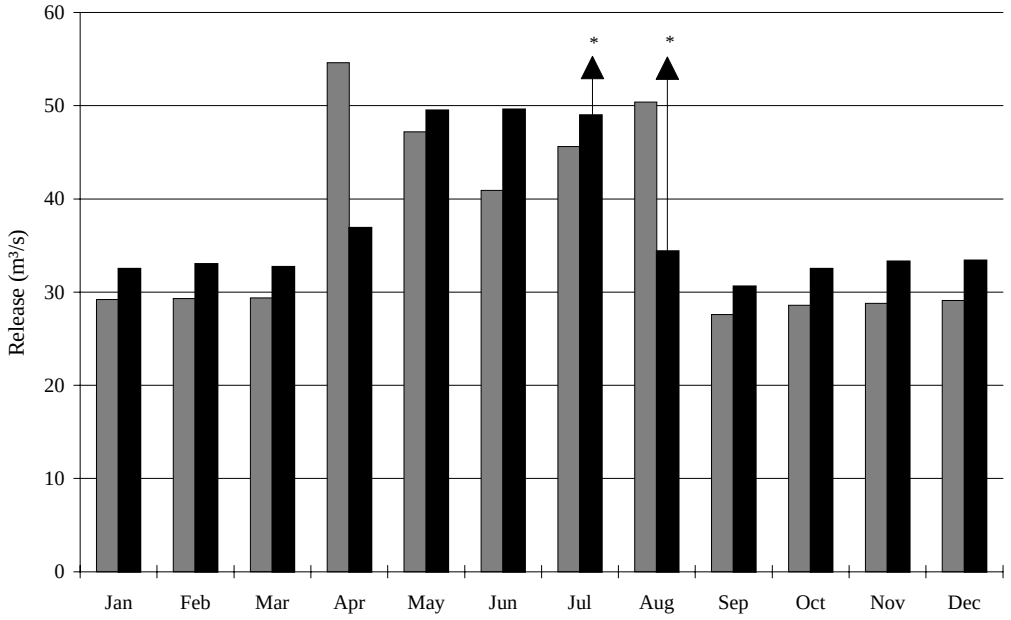
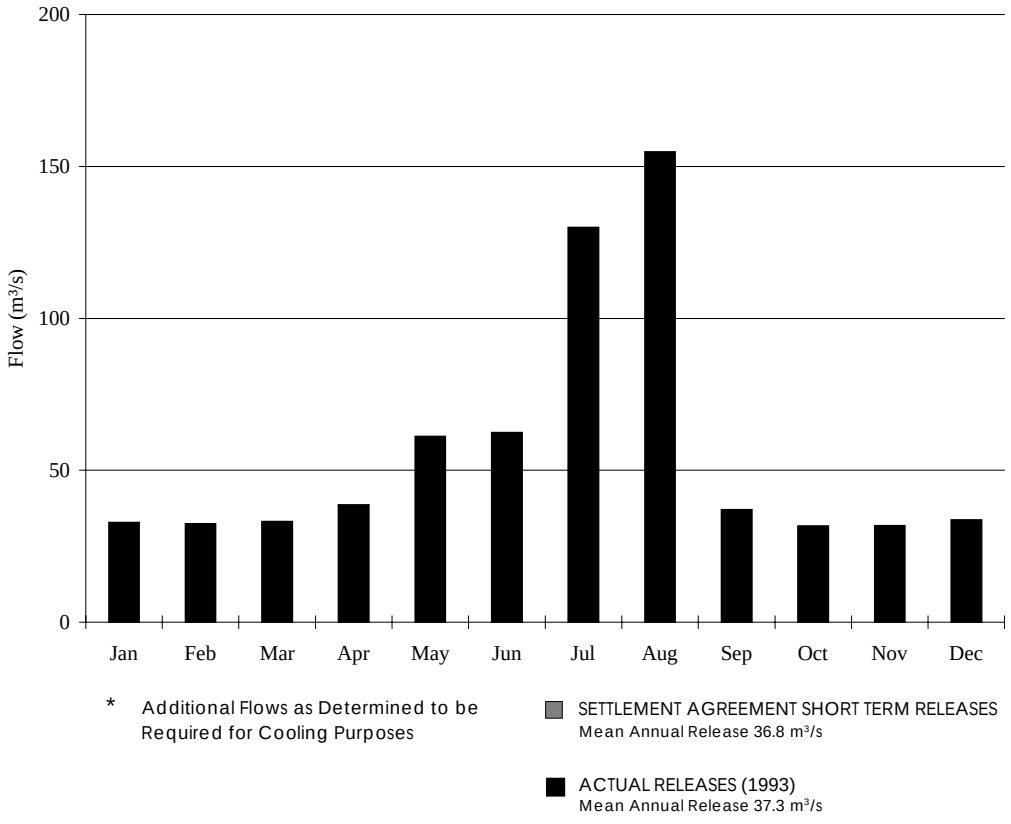


Figure 2

actual flows in nechako river below cheslatta falls
(January to December 1993)



Summer Water Temperature Management

RATIONALE

To protect sockeye salmon during their migration within the lower Nechako River, it is necessary to manage river water temperatures.

Nechako River flows and water temperatures are managed through releases from the Skins Lake Spillway. This is done in an attempt to maintain mean daily water temperatures at or below 20°C in the Nechako River upstream of the Stuart River confluence at Finmoore. Management of flows and water temperatures is carried out through a computer-based program defined in the Settlement Agreement. To schedule releases from the Skins Lake Spillway, the program protocol uses a trend analysis developed from five-day meteorological forecasts to schedule releases from the Skins Lake Spillway.

PROJECT SUMMARY 1993/94

The Water Temperature Management Program was again followed in 1993/94.

The program was successful in maintaining the majority of mean daily water temperatures at or below 20.0°C. Mean daily water temperatures exceeded 20.0°C on August 5, reaching a maximum of 20.1°C. During this time, flow in the Nechako River below Cheslatta Falls was at the maximum allowable level of 283 m^3/s, and thus no further action could be taken.

Flows in the Nechako River below Cheslatta Falls were maintained at approximately 170 m^3/s for the majority of the water temperature control period, with a single increase from Skins Lake Spillway in August which resulted in flows at Cheslatta Falls of approximately 283 m^3/s August 5 and August 6. Mean daily water temperatures at Finmoore averaged 19.4°C (range 16.0°C to 20.1°C).

APPROVED PROJECT 1994/95

The 1994/95 Summer Temperature Management Project will follow the same protocol and will be conducted in a manner consistent with previous projects.

IN-STREAM HABITAT COMPLEXES

Physical Assessment of In-Stream Habitat Complexes

RATIONALE	PROJECT SUMMARY 1993/94	APPROVED PROJECT 1994/95
Cover habitat provides refuge for fish from fast-flowing water and predators, yet still allows them access to food in the river. Installation of habitat complexes will manage the risk to chinook stocks associated with changes in the amount of instream cover habitat after the shift to the long term flow regime. *The physical assessment of different habitat complexes pilot tested in the Nechako River aids in the identification of the types of structures most suitable for the rearing requirements of juvenile chinook.*	In 1993/94, physical assessment and photographic/video documentation of the habitat complexes was conducted to provide a chronological record of the effects from winter conditions and summer cooling flows. In general, rail debris catchers continue to be durable although some debris loss is taking place in Reach 4. Debris bundle complexes are less durable than debris catchers. Continued monitoring will help to define the best debris bundle complex design.	In 1994/95 further design work and limited pilot testing will be carried out to develop overhead cover structures that will withstand the ice and hydraulic conditions which exist in Reach 4. In addition, physical assessment and photographic/video documentation of the habitat complexes will continue to provide a chronological record of the effects from winter conditions and summer cooling flows.

Biological Assessment of Habitat Complexes

RATIONALE	PROJECT SUMMARY 1993/94	APPROVED PROJECT 1994/95
Assessment of fish usage of the man-made habitat complexes will identify the most beneficial types of habitat complexes. These complexes must provide habitat for all life history phases of Nechako River juvenile chinook but not contribute advantageous rearing conditions to coarse fish.	Results from 1993/94 assessments continue to indicate good usage of the habitat complexes. Initial assessments suggest that up to 73 % of the chinook enumerated during May and June within Reach 2 and 81% in Reach 4 were associated with the habitat complexes. Furthermore, there is continued evidence that suggests that the complexes were utilized as overwintering habitat.	Assessment will continue in 1994/95. This year's project will include assessments in May and June, reflecting those periods of maximum utilization observed during summer rearing flows. In addition, assessments will occur in November to investigate potential overwintering utilization. Controls and complexes constructed in previous years will be assessed. The 1994/95 data will demonstrate the level of utilization of complexes in a year of low recruitment as a result of low spawner numbers in 1993.

RIPARIAN RE-VEGETATION

RATIONALE

Riparian stabilization or revegetation of stream banks in North America is increasingly used to protect against bank failure and cattle grazing. Trees and shrubs not only provide protection against erosion, but also create refuge for fish and provide food in the form of terrestrial insects and leaf litter which drop from the canopy.

Several failing banks have been identified on the Nechako River. It may be desirable to stabilize these banks using simple riparian revegetative techniques. Reduced levels of erosion contribute to the protection of spawning, incubating and rearing habitat for chinook salmon.

PROJECT SUMMARY 1993/94

Monitoring of the revegetation test banks continued in 1993/94. Flood conditions in Greer Creek caused the channel to shift away from the revegetated bank thus terminating the pilot test at this site. The Nechako River mainstem bank is demonstrating mixed results for the different planting techniques. While some applications continue to grow, much of the revegetated area is no longer growing.

APPROVED PROJECT 1994/95

In 1994/95 the Nechako River mainstem bank will continue to be monitored intermittently by personnel involved in other projects on the Nechako River. Video and photographic documentation will be taken for future analysis.

ADULT PROGRAMS

Adult Spawner Enumeration

RATIONALE

The number of adult chinook salmon returning to spawn in the Nechako River is the primary indicator regarding the overall strength of the Nechako River chinook salmon stock and signifies achievement of the Conservation Goal.

PROJECT SUMMARY 1993/94

In 1993, seven aerial counts taken between August 20 and October 1, in conjunction with a female residence time study, provided an escapement estimate of 664 spawners.

The mark / recapture experiment on the Stuart River was repeated. Crews applied tags throughout the spawning period in an attempt to distribute them throughout the run, and recovery was conducted throughout the complete die-off period.

The limited Stuart River chinook carcass recovery project documented 1300 returning spawners. The decline in spawner numbers in the Stuart, as well as the Nechako River, appears to be due to influences downstream of the spawning areas of these two systems.

APPROVED PROJECT 1994/95

The 1994 / 95 project on the Nechako River will employ similar methods to those of previous years.

The tagging and carcass recovery project on the Stuart River will be overseen by DFO personnel to ensure the application of a reproducible methodology in 1994.

During 1994 an analysis of the 1993 returns to the upper Fraser River, conducted by DFO, will become available to provide insight on the 1993 data.

Adult Carcass Recovery

RATIONALE

The analysis of data from adult carcasses collected near the spawning grounds provides life history information on both the freshwater and marine components of Nechako River chinook salmon. This information aids in interpreting enumeration results and in indicating which brood years have contributed to the spawning population. It also aids in the determination of the success of juvenile rearing strategies, the quality of spawning habitat and the condition of spawning fish. Age at return and egg deposition are important data for interpreting results of other monitoring projects.

PROJECT SUMMARY 1993/94

Adult chinook carcasses recovered from the Nechako and Stuart rivers provided biological data on size, sex, age, life history and egg retention of chinook. The dominant age class in 1993 / 94 was five-year-old chinook with one complete year of fresh water residency.

APPROVED PROJECT 1993/94

In 1994 / 95 the carcass recovery project will continue to collect biological data on size, sex, age, life history, and egg retention in prespawn mortalities.

INCUBATION ENVIRONMENT

The incubation environment refers to the habitat and conditions within the river where salmon spawn and eggs subsequently incubate. This environment is used during the winter months, from October to March, when the eggs and alevins are within the gravel.

Fry emergence is an indicator of the quality of the gravel and the effects of winter conditions on the gravel environment. Studies are being conducted in each of these areas.

Gravel Quality and Dissolved Oxygen Monitoring

RATIONALE	PROJECT SUMMARY 1993/94	APPROVED PROJECT 1993/94
The substrate of the Nechako River provides habitat for spawning, incubating and rearing, and food production for chinook salmon. The oxygen concentration in the interstitial gravel is directly related to emergent success of juvenile chinook salmon. One method to determine the quality of the incubation environment is through the measurement of intergravel dissolved oxygen. *To ensure an adequate database of the intergravel environment, monitoring projects were designed to collect continuous data on dissolved oxygen in the intergravel environment. In addition, to compile a database on the gravel quality of the Nechako River, a comprehensive analysis of the substrate will be performed prior to the implementation of long-term flows.*	In 1993 / 94, the complete dissolved oxygen monitoring station was installed and operated on the Nechako River. Problems were encountered with the recovery of data.	In 1994 / 95, investigations will continue into modifications to the data retrieval system.

Fry Emergence

RATIONALE	PROJECT SUMMARY 1993/94	APPROVED PROJECT 1994/95
The quality and quantity of salmon fry emerging from the gravel is a key indicator of the condition of the incubation environment. A monitoring project designed to assess emergent success serves as an early warning indicator of any changes in the incubation environment.	In 1993 / 94, four inclined plane traps were installed at a major spawning area near Bert Irvine's at km 19. These were used to collect data on numbers of emerging chinook. Emergence success was estimated at 44%.	The 1994 / 95 project will repeat the program conducted in the previous four years. The results of the fry emergence project continue to be important for interpreting results of other monitoring projects. Low spawner numbers in 1993 will provide a further opportunity to test the sensitivity of the trapping project to determine changes in numbers of emerging chinook.

Winter Physical Conditions

RATIONALE	PROJECT SUMMARY 1993/94	APPROVED PROJECT 1994/95
The understanding of winter physical conditions (winter river water temperatures and ice conditions) and their effect on chinook incubation and overwintering in the Nechako River is important for successful management of the fisheries resource. Baseline data collected during the short-term flow regime will contribute to the existing database and will provide the basis for design and application of remedial measures.	In 1993/94, air, water temperature and ice condition data collected on the Nechako River was added to the database.	In 1994/95, data will continue to be collected and analyzed. A report documenting the results of the project will be completed.

JUVENILE OUTMIGRATION

RATIONALE	PROJECT SUMMARY 1993/94	APPROVED PROJECT 1993/94
The number and condition of juvenile chinook migrating down the Nechako River is an early indicator of the productivity of the river's spawning, incubation and rearing areas, and thus any change in chinook survival. *Monitoring the timing and abundance of migrating juveniles on an annual basis will indicate changes and provide management information four to five years prior to the return of adult spawners. As outlined in the Strategic Framework, indications of changes in numbers of juvenile chinook leaving the system will determine subsequent monitoring and remedial action.*	In 1993/94, three rotary screw traps were again deployed at Diamond Island. The peak catches of chinook fry at Diamond Island occurred during the late spring, while low numbers of chinook emigrated from the system throughout the fall period.	In 1994/95 the three rotary traps will again be deployed at Diamond Island and run in conjunction with index sampling. The traps will be fished from April 1 to the start of the summer water temperature cooling period on July 20, which is the period of greatest chinook outmigration. Index sampling will be conducted in the fall. The low numbers of chinook recruits in 1994, as a result of low spawner numbers in 1993, will provide a test for the sensitivity of the trapping methodology.

TEMPERATURE MONITORING/PHYSICAL DATA COLLECTION

RATIONALE

The timing of emergence, growth rates and life history dynamics of chinook salmon are closely related to the temperature of their environment. Reliable collection of river temperature information forms part of the ongoing database of observed physical conditions in the Nechako River. The data is important in the designing of other monitoring projects and assessing the timing of juvenile chinook life history events.

PROJECT SUMMARY 1993/94

In 1993/94 the collection of physical data included air temperature, water temperature, and discharge data was continued as in previous years.

The data was applied to the fry emergence, juvenile outmigration, chinook enumeration and winter physical conditions projects.

APPROVED PROJECT 1994/95

In 1994/95, collection of baseline data will be continued to provide physical data to the other program components.

EVALUATION FRAMEWORK/TREND ANALYSIS

RATIONALE

The projects conducted by the NFCP consist of numerous physical and biological components. The need was identified for the Technical Committee to systematically analyze cause and effect relationships to best manage the overall program. In addition, the ability to detect statistically significant changes in the fish population and habitat availability will be evaluated.

As a precursor to the utilization of the NFCP Early Warning Monitoring Program, an initial synthesis and trend analysis of the data acquired over the first five program years of the NFCP is planned. This analysis, undertaken within the context of the Conservation Goal outlined in the Settlement Agreement, will help define the adaptive management program that will be followed after the change to the long term flow regime. It will also help define the duration and effort required by monitoring and remedial measures projects to ensure that the chinook conservation goal will be met.

PROJECT SUMMARY 1993/94

In 1993/94 work continued on a framework to evaluate the projects of the NFCP. This will provide insight for development of planning for the next program year. The framework will form the basis for the adaptive management approach to be followed by the NFCP Technical Committee and will be the decision pathway used to evaluate the results from monitoring projects. Decision points for action will be identified.

APPROVED PROJECT 1993/94

In 1994/95 work will continue on this document.

JUVENILE CHINOOK OVERWINTERING BEHAVIOUR

RATIONALE

More information is needed to understand the overwintering behavioural patterns of juvenile chinook in northern river systems. Knowing how winter habitat is used will enable estimation of juvenile chinook abundance overwintering in the Nechako River. Understanding winter habitat requirements will also aid in deciding whether, and to what extent, remedial measures may be required.

PROJECT SUMMARY 1993/94

An analysis of the existing database on overwintering chinook salmon was initiated in 1992/93, and a draft primary publication was prepared.

APPROVED PROJECT 1994/95

In 1994/95 the primary publication and all contractor reports will be finalized.

PREDATION AND COMPETITION

RATIONALE

It is necessary to understand the impact of predator and competitor populations on juvenile chinook populations to determine if effort is required to control these populations. The relationships between juvenile chinook life history and predator abundance, distribution and impact, must be investigated.

SUMMARY PROJECT 1993/94

In 1993/94 the data from the 1991/92 sampling surveys were analyzed.

APPROVED PROJECT 1994/95

In 1994/95 reports on fish and bird predation and chinook availability will be finalized and published.

TEMPERATURE EFFECTS

RATIONALE

Cooler water released from the Kenney Dam Release Facility into the Nechako River during the period of sockeye migration may affect invertebrate production. Invertebrates are the primary food supply for juvenile chinook.

An understanding of the effects of temperature on invertebrate production and fish growth has been identified as an area requiring further research.

PROJECT SUMMARY 1993/94

In 1993/94 an experiment using stream troughs was carried out at Hill Larsons, to determine the effects of decreased water temperatures on invertebrate production.

APPROVED PROJECT 1994/95

In 1994/95, at the PBS, 1993/94 data will be analyzed and tests will be conducted on Nechako River chinook to determine growth rates under various temperatures. Design modifications for trough tests adjacent to the Nechako River will be developed for the 1995/96 program year.

Summaries of the 1993/94 budget and the proposed 1994/95 budget are provided in figures 3 & 4. Increases of expenditures in monitoring reflect the development of additional programs.

Figure 3
COMPARISON OF YEAR 7 & YEAR 8 MANPOWER BUDGETS *

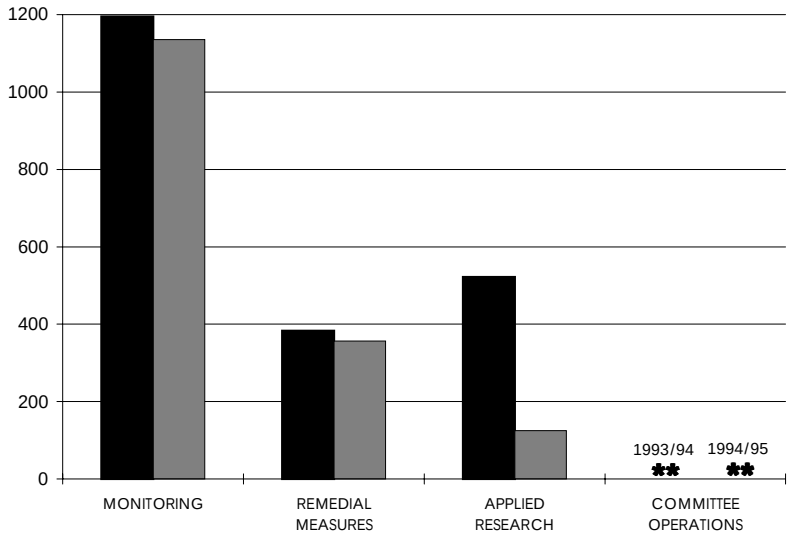
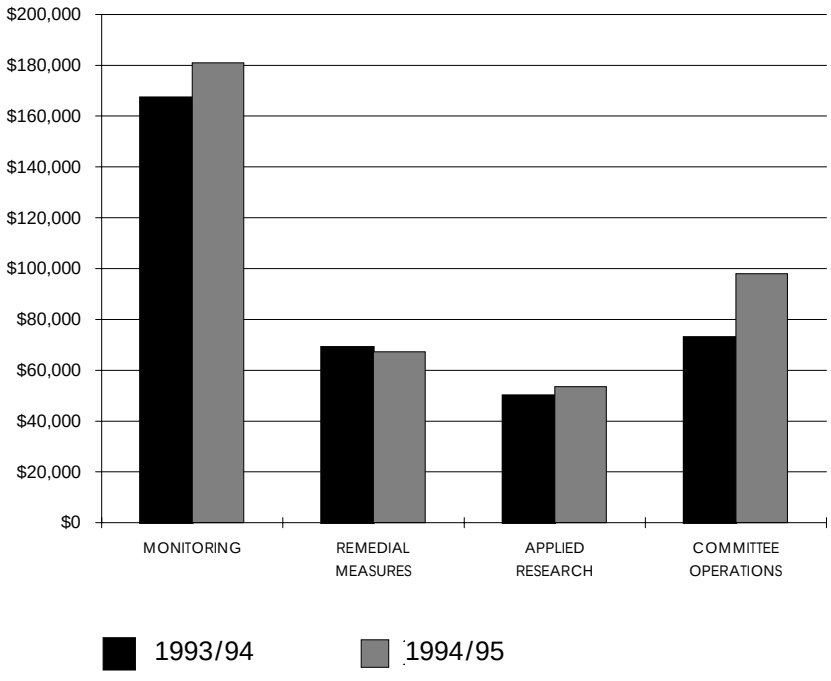


FIGURE 4
COMPARISON OF YEAR 7 & YEAR 8 DISBURSEMENT BUDGETS *

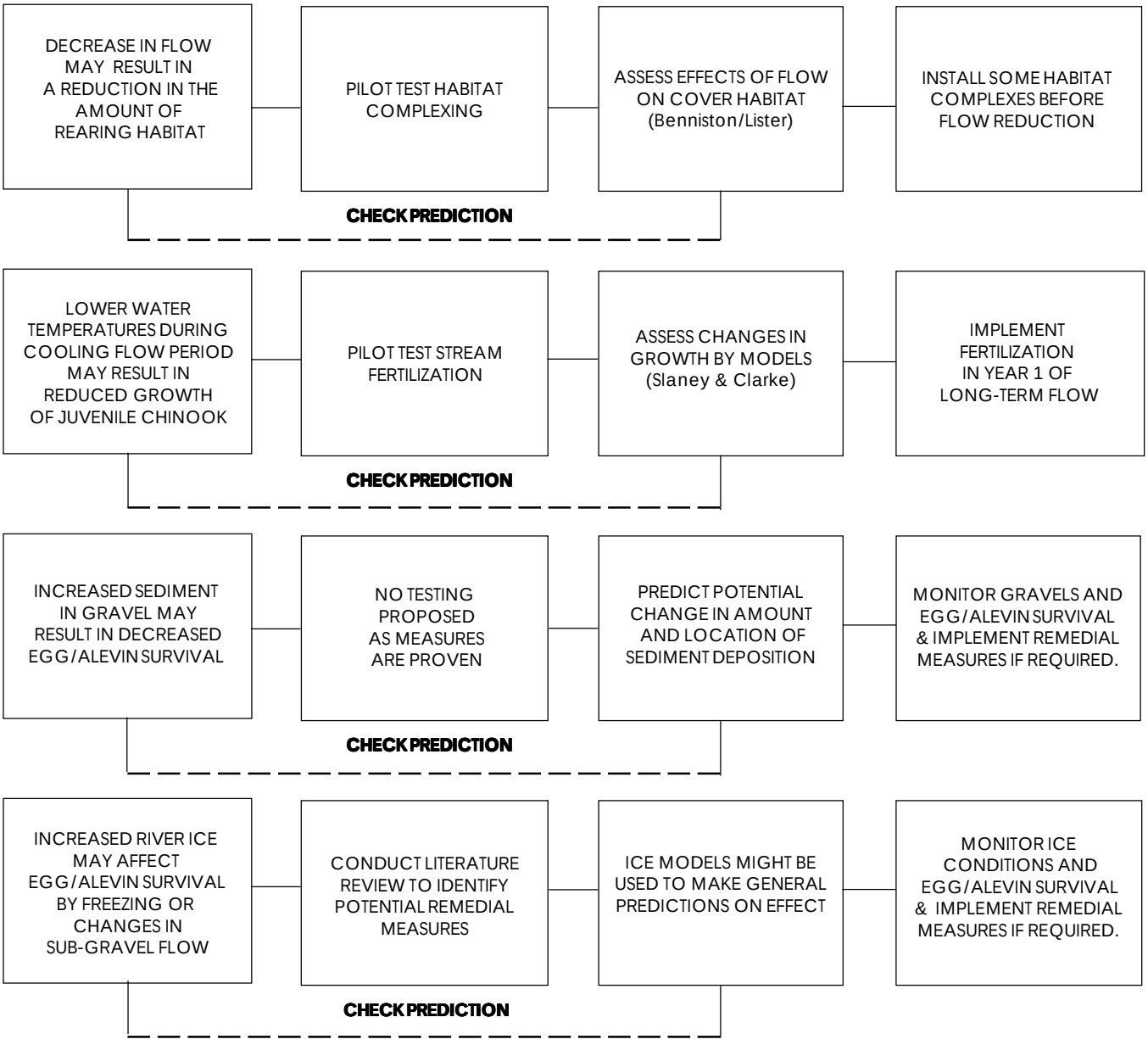


* Cost of manpower budgets are over and above the cost of disbursement budgets.

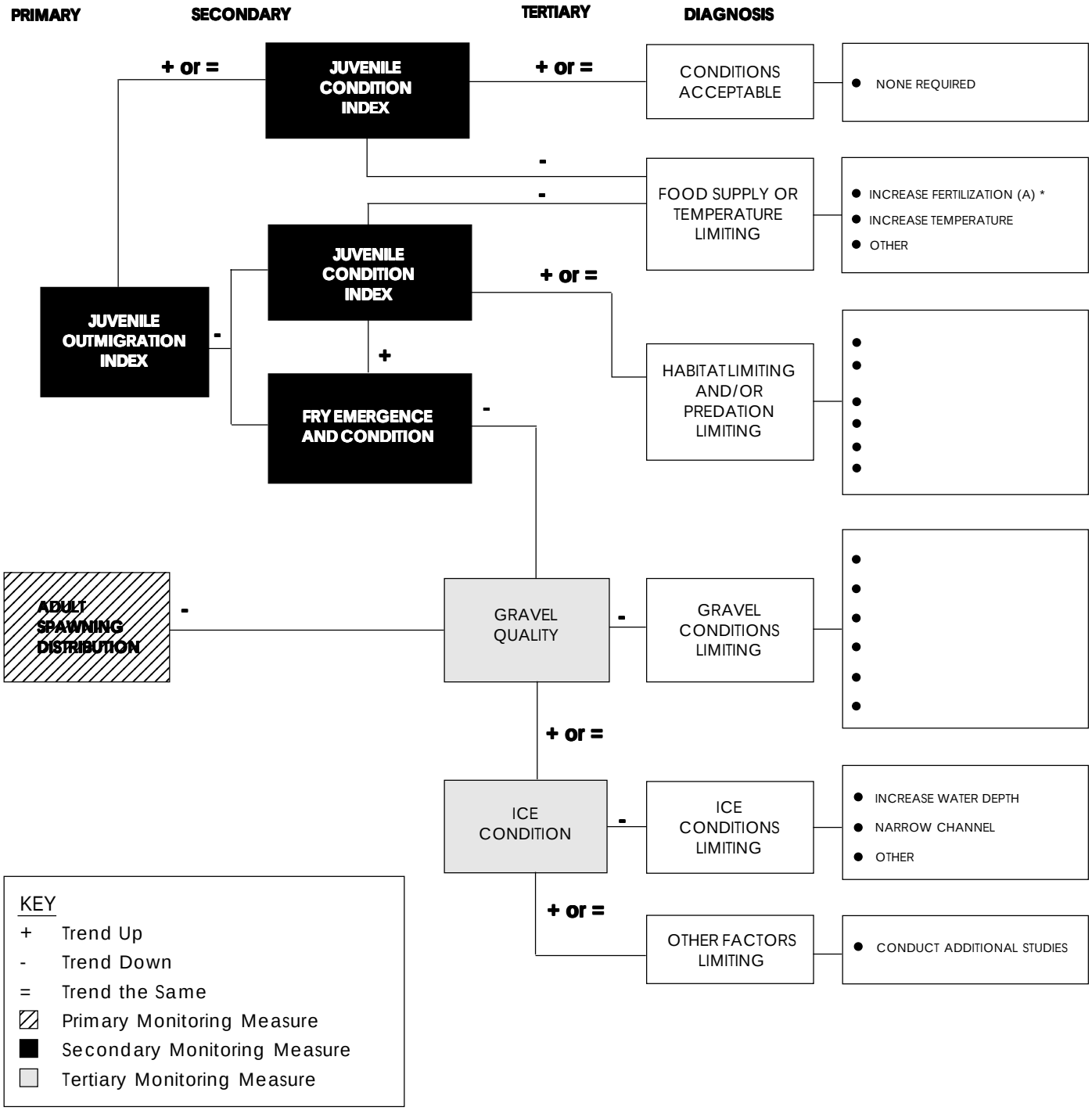
* * As required for each party.

APPENDICES

DECISION CHART FOR REMEDIAL MEASURES PROGRAM

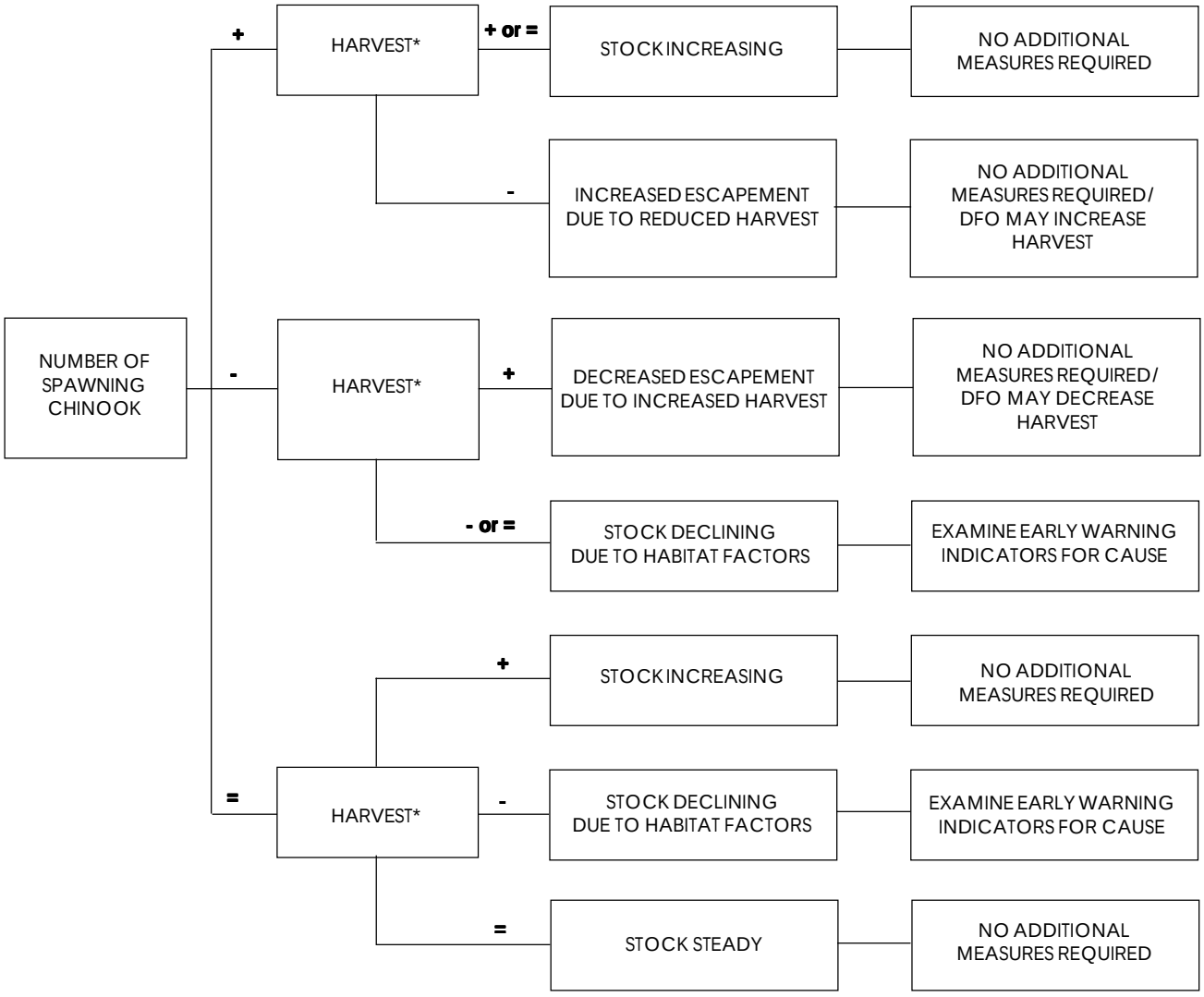


N.F.C.P. EARLY WARNING MONITORING PROGRAM



*** Stage of Remedial Measures**

ASSESSMENT OF CONSERVATION GOAL



* Harvest analysis includes: comparison of trends in index stream, coastwide trends in chinook stocks and ocean survival.

LISTS OF REPORTS

REPORT NO.	TITLE	AUTHOR
RM93-1	Cheslatta/Murray Hydrological Data Collection	Triton Environmental Consultants Ltd.
RM93-2	Nechako River 1993 Summer Water Temperature Management Program	Triton Environmental Consultants Ltd.
RM93-3	Instream Modifications and Habitat Complexing	Triton Environmental Consultants Ltd.
RM93-4	Biological Assessmentof Habitat Complexing	Triton Environmental Consultants Ltd.
RM93-5	Riparian Bank Stabilization	Triton Environmental Consultants Ltd.
RM93-6	Nechako River Flow Control	Triton Environmental Consultants Ltd.
M93-1	Nechako and Stuart Rivers Chinook Spawner Enumeration	DFO
M93-2	Nechako and Stuart Rivers Chinook Carcass Recovery	DFO
M93-3	Juvenile Outmigration	Triton Environmental Consultants Ltd.
M93-4	Winter Physical Conditions	DFO
M93-5	Nechako River Physical Data Summary	DFO
M93-6	Nechako River Fry Emergence Program	Triton Environmental Consultants Ltd.
M93-7	Dissolved Oxygen Monitoring	DFO
M93-8	Evaluation Framework and Trend Analysis	DFO Triton Environmental Consultants Ltd.
AR93	Nechako Chinook Overwintering Study Temperature Effects Predator-Prey Interaction Monitoring	DFO

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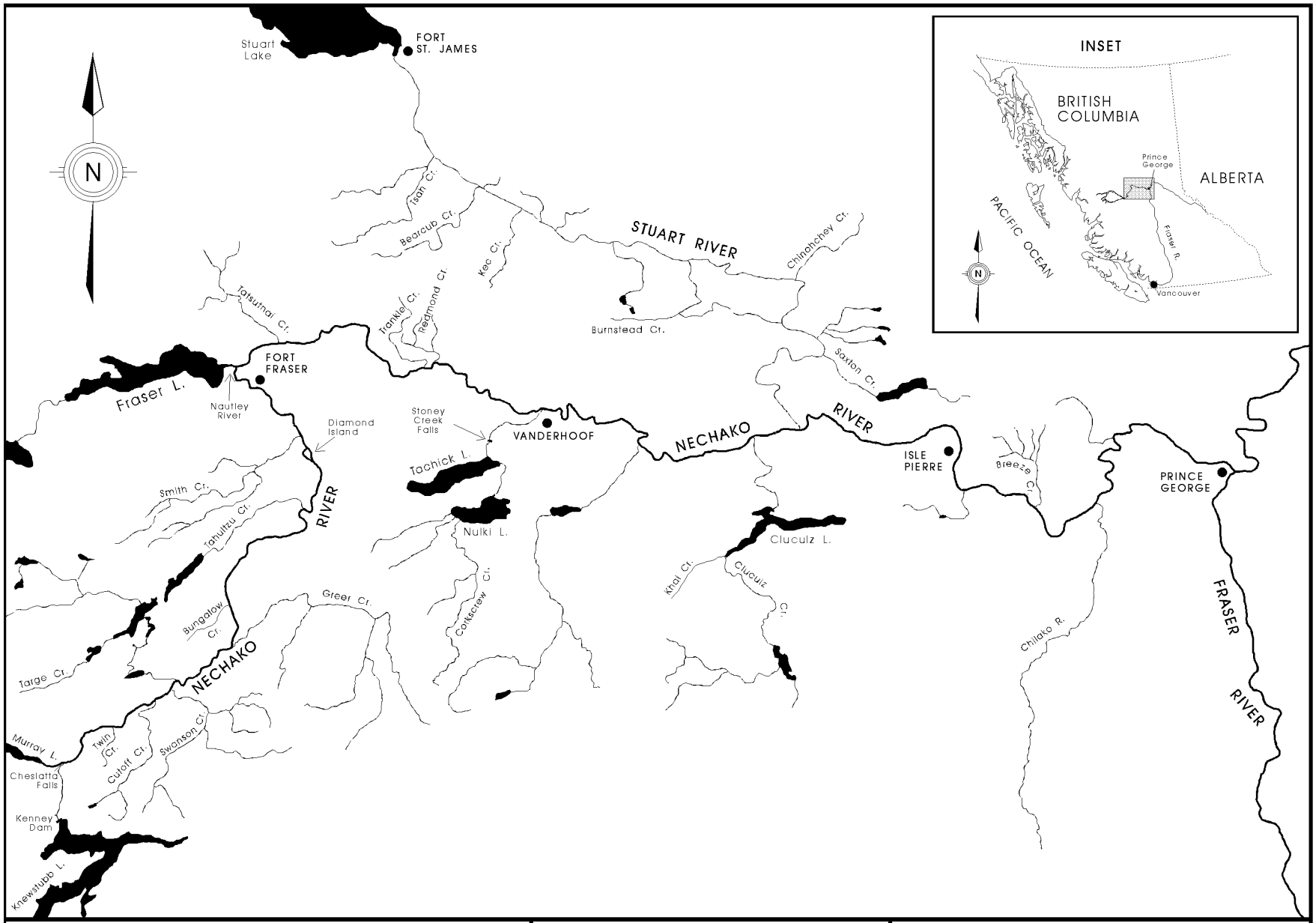
DECISION RECORDS
FROM THE TECHNICAL COMMITTEE



Nechako Fisheries Conservation Program

Map # AREP94-95

NECHAKO RIVER DRAINAGE

APPENDIX E