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DEPARTMENT OF FISHERIES AND OCEANS
(PACIFIC & YUKON REGION)

SUBMISSIONS
TO THE
ALASKA HIGHWAY GAS PIPELINE HEARINGS

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Submissions to the Alaska
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PREFACE

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This document contains the briefs presented by the Department of Fisheries and Oceans to the Environmental Assessment and Review Panel during public hearings held in Whitehorse, April 23 - 28, 1979 on the Alaska Gas Pipeline proposal. These briefs were presented to the Panel as part of the document entitled "Department of Environment/Department of Fisheries and Oceans Submissions to the Yukon Public Hearings Panel". The information contained herein represents the major concerns of the Department of Fisheries and Oceans. Other concerns relating to the fisheries resource have been incorporated in briefs prepared by the Task Force and presented by the Department of Environment. This has been done in cases where both Departments have a common interest in order to avoid duplication of information presented to the Panel.



Department of Fisheries and Oceans
BRIEF NO. I(B)

INTRODUCTION TO THE
DEPARTMENT OF FISHERIES AND OCEANS' SUBMISSIONS

Submitted to:
Yukon Public Hearings Panel
April 23 - 28

Vancouver, B.C.

Good evening Mr. Chairman. The Department of Fisheries and Oceans is appearing at this hearing because of the statutory requirement under the Canada Fisheries Act, which provides for the protection of fish and fish habitat. As you may be aware, that Act gives our Minister broad powers to examine, correct and/or prevent activities which, in his judgment, are or would be deleterious to Canada's fisheries. For this project, it is our job, through our representation in the NPA process, to see that conditions which will ensure adequate protection to Yukon fisheries and supporting habitat are satisfactorily observed. We trust that via the present hearings and subsequent direct contact with the Northern Pipeline Agency, these conditions will be achieved efficiently and harmoniously. I will represent our delegation during the presentation of these introductory remarks, and during the resource use segment of the hearings. I would like to introduce my colleague, Mr. Bob Robertson, Chief of the Land Use Division of our Habitat Protection Group, who will serve as spokesman for the balance of the program. I would also like to present to you Mr. Obert Sweitzer, our District Supervisor here in the Yukon, and Mr. Rick Higgins and Ms. Mary Harrison, who will support us in their respective biological and economic areas of expertise. As pointed out by Mr. Romaine, some of the briefs to be presented during this hearing represent a combined DFO/DOE concern. Both agencies have participated in the preparation and review of all briefs of mutual concern.

During the 1977 hearings of the Alaska Highway GAs Pipeline Environmental Assessment and Review Panel, this Department presented the limited information available on fishery resources and use in the Yukon, suggested construction and operating procedures whereby damage to fisheries could be reduced, and requested that the construction schedule for the pipeline be put back and an intensive effort made to redress the substantial and potentially significant information shortfalls that existed with respect to species distribution and abundance, critical habitat locations, and how identifiable stocks are utilized for sustenance, sport and commerce.

As you are aware, scheduling has gone forward - and we find ourselves, today, about to enter the design-review phase of the

project. Further, in examining the more recent (1979) E.I.S. prepared by Foothills Pipe Line Ltd., and assessing the results of such modest further work as our Department has been able to do in the interim, it is clear that a major lack of information with respect to species identification, abundance, timing, critical habitat location, and type and extent of use still exists.

It is not our intention to debate the decision to proceed with the project. It is our intention, however, to point out that by proceeding in the face of such uncertainty, fishery values are put at risk, and will, from time to time, be unavoidably damaged.

Second, proceeding in the face of such incomplete information will require fishery personnel to make judgments - both at this hearing and during the process of design review and construction - that are outside tolerances of precision usually demanded by science.

Under such circumstances, we believe it appropriate that not only the responsibility for mitigation and payment of damages - but also the onus of proof where uncertain estimates conflict - must rest squarely with the beneficiary of the adopted pipeline construction schedule - Foothills Pipe Line Ltd. This will be a theme of our testimony.

In these hearings, we will be discussing deficiencies in the E.I.S. and providing advice on methods of mitigating potential fisheries problems, particularly through construction scheduling. We will also be discussing the need for fair and adequate compensation where fishery stocks and resource users are damaged. The details of our advice will be presented in the appropriate sections to follow.

Thank you.

Department of Fisheries and Oceans
BRIEF NO. IV(A)

MITIGATION FOR FISH HABITAT
DAMAGE BY MEANS OF DETAILED
DESIGN AND SCHEDULING

Submitted to:
Yukon Public Hearings Panel
April 23 - 28

Vancouver, B.C.

I. INTRODUCTION

The activities associated with construction of a pipeline may affect fish populations, and the aquatic habitat on which they depend. Construction activities that may degrade this resource, and which are of particular concern to the Department of Fisheries and Oceans include right-of-way clearing and grading; removal of streamside cover; trenching and backfilling at the stream crossings; installation and maintenance of access roads; equipment transport across streams; removal of gravel from streams; water withdrawal from waterbodies; disposal of waste products associated with construction camps and pipeline testing; and accidental spillage of fuels and other toxic materials. Departmental concerns relating to the operating phase include sedimentation of streams as a result of streambank and right-of-way erosion; exposure of the pipeline through riverbed scour; alteration of groundwater flow; thaw settlement and frost heave; and the construction activities associated with pipeline repairs.

The January, 1979 Environmental Impact Statement provides a general description of the project, the attendant consequences to fish resources, and the procedures for mitigating possible adverse effects to such resources. However, we find that very little additional fisheries data has been brought forward since the 1977 hearings and as a result, our knowledge of the fisheries resource along the pipeline route is still very limited. Insufficient information is provided on stream crossing scheduling, alternative route alignments, required aggregate volumes and borrow sites, parasite transfer during hydrostatic testing, and methanol disposal. Several contradictions on construction schedules, and critical life stages of fish stocks are also evident throughout the report.

It would not be particularly constructive to dwell on all the deficiencies which we have identified in the EIS. However, for those who are interested we have included our detailed comments on the EIS in Appendix 1 of this brief.

II. CONCERNS RELATING TO SCHEDULING

While many of the fisheries impacts associated with pipeline construction activities can be avoided or minimized through the incorporation of special design features and construction practices, it is virtually impossible to prevent the downstream siltation of streams during construction of the pipeline crossing. This siltation can be particularly damaging to fish stocks and their supporting habitat during certain critical life stages and avoidance of these critical periods should be a key element in the selection of construction schedules for river crossings. With this in mind, we have reviewed the Environmental Impact Statement to identify potential scheduling conflicts. We have found that the recommended scheduling period will provide adequate protection for fish populations in several of the streams along the pipeline route. However, there are many instances where scheduling is in direct conflict with one or more species of fish and in these cases we will be recommending changes. There are also instances where data is not adequate to allow valid scheduling decisions to be made, and in such cases, we will be recommending additional studies.

The EIS does not provide site specific data on the timing of critical life stages of fish for all the streams along the pipeline route. Therefore, it is necessary to use estimates of this timing based on limited knowledge of northern fish populations in combination with the information in the scientific literature. On this basis, we consider that for the eight fish species of commercial, subsistence, or recreational value in the Yukon Territory, the critical periods which should be avoided during pipeline crossings are as follows:

- chinook salmon - late July to late May
- chum salmon - late August to early June
- Arctic grayling - mid April to late June
- late trout - mid September to mid May
- lake whitefish - mid September to late May
- Dolly Varden - mid September to mid May
- Northern Pike - mid April to late June
- Burbot - early January to mid May

These periods include the adult migration, spawning and incubation stages of the life cycle, which must be avoided to ensure adequate protection of the resource. It

is recognized that juvenile fish could reside in many of the streams at other times, but are considered to be less susceptible to damage from pipeline-related activities due to their mobility. However, in some cases we will recommend special scheduling to avoid overwintering areas and known critical chinook salmon rearing areas.

Our detailed review of the EIS in terms of construction scheduling at each of the identified stream crossings in the Yukon Territory, plus one or two others which were not included in the EIS, is contained in Appendix 2 of this brief. The appendix identifies the fish species present at each crossing site, as determined by the proponent and other researchers, the proposed crossing schedule, and our comments on potential conflicts and acceptability of the proposed schedule. Following are general comments which apply to construction sections 1 to 7 inclusive:

- Section 1. Since winter construction is proposed and most of the streams in this section contain no water during late winter, we have no objection to the proposed schedule. A groundwater source has been identified near the proposed crossing site in Snag Creek, and we would recommend additional studies to determine the presence or absence of overwintering fish and subsequent minor realignment of the pipeline route if necessary.
- Section 2. To avoid conflict with reported chum salmon spawning in the White River we recommend that this crossing be completed prior to August 31. Construction should be undertaken in the Koidern River complex, including the three Koidern River crossings, and the Long and Wolf Creek Crossings, between July and August 31 to avoid spring spawning species and chum spawning. If this is impossible then additional studies must be undertaken to completely document chum salmon spawning areas, with subsequent adjustment of the schedule to accommodate spawning and incubation where these areas occur downstream of the proposed crossings.
- Section 3. Construction on the Donjek River should be completed prior to August 31 to avoid impact on downstream chum spawning and incubation.

Section 4. Construction on the Duke River should be completed prior to August 31 to avoid impact on downstream chum spawning and incubation. Additional fisheries studies are required in Inlet and Christmas Creeks on the east side of Kluane Lake to determine potential conflicts. At Bear, Pine and Marshall Creeks and Aishihik River, we recommend a delay in construction until after July 1 to avoid spring spawning species. The Bear Creek crossing should be completed before August 31 to avoid Dolly Varden spawning and incubation.

Section 5. Mainline summer construction has been designated for all stream crossings in this section except the Yukon River. Most streams in this section contain a wide diversity of fish species and, as a result, it is difficult to assess potential conflicts without more precise scheduling information for each of the crossings. We therefore request that scheduling be better defined so that potential problem areas can be determined and necessary future studies identified. The Department is particularly concerned with the potential impact on chinook salmon populations in this area. Accordingly, wherever chinook spawning areas are located downstream of the pipeline crossing, instream activity should be completed during the period May 30 to July 21. In some cases additional restrictions may also be necessary to accommodate other species.

Crossing of the Yukon River is scheduled for the period May 1 to July 31. The preferred crossing site is located a short distance downstream from the outlet of Marsh Lake, in a suspected chinook spawning area. We therefore recommend a slight change in the schedule for instream construction to the period May 30 to July 21, on the basis of available data for juvenile and adult migrations at the Whitehorse Rapids powerplant.

Section 6. Chinook salmon spawning will require that instream construction be completed prior to July 21 in Teslin, Morley and Smart Rivers and in Log Jam Creek. Additional surveys should be undertaken to determine the presence or absence of chinook spawning in Deadman Creek.

Section 7. Several species of resident fish are present in the Swift and Rancheria Rivers and Albert Creek. Construction in these streams should therefore be limited to the period July 1 to August 31.

The above comments on each of the construction sections pertain to information available at or in close proximity to the filed pipeline route. Alternative alignments will in some cases require additional field studies of the fisheries resource to determine acceptable scheduling.

III. SUMMARY AND RECOMMENDATIONS

With the above information in mind we wish to present the following recommendations:

- 1) During the early design stages of this project, the proponent should be required to produce a detailed scheduling plan for all stream crossings on the proposed pipeline route. The plan should indicate the expected timing and duration of all instream construction activities associated with right-of-way preparation, access roads, and pipeline installation.
- 2) The Department of Fisheries and Oceans must be given the opportunity to review this schedule for the purpose of identifying potential conflicts.
- 3) Where potential conflicts arise, the proponent must be prepared to undertake additional field studies as necessary to identify fish utilization areas near the proposed pipeline at the time of year in which instream construction is to occur. These studies should allow this Department, in cooperation with the Northern Pipeline Agency, to determine appropriate mitigative measures.

IV(A)7.

APPENDIX 1

Comments on Fisheries Related Information
Included in the Environmental
Impact Statement

Part A: General Concerns

Part B: Comments Related to the EIS

IV(A)8.

APPENDIX 1

Part A: General Comments

Foothills Pipe Lines (Yukon) Ltd. has proposed the construction of approximately 509 miles of pipeline within the Yukon Territory generally paralleling the Alaska Highway. Alternative routes have also been suggested. There are several general fisheries-related concerns in the EIS prepared by Foothills Pipe Lines Ltd.

1) Comments on the Data Base

1976-1977 Fall - Annex 01 Volume 1, Page 11.

"Beak's approach to this study was initial examination of the watercourses in question, on a seasonal basis, and documentation of aquatic habitats and life history stages of important fish species in these habitats during periods of open water.

"The field programs commenced September 22, 1976 and terminated November 10, 1977, and involved five separate components."

	<u>No. of Days</u>
(i) Fall, 1976	
September 22 to October 1, 1976	10
October 22 to October 27, 1976	6
(ii) Winter, 1977	
March 15 to March 21, 1977	6
(iii) Spring, 1977	
April 23 to June 3, 1977	42
(iv) Summer, 1977	
July 4 to August 8, 1977	35
(v) Fall, 1977	
August 20 to November 10, 1977	
(report preparation)	<u>82</u>
1976-1977 Total	<u>181</u>

IV(A)9.

1978 - Spring and Summer

(See "Proposal for 1978 Investigations, Alaska Highway Pipeline Route", page IV(A)12.)

Six watercourses were selected for detailed study in 1978. There was a 12-day turnaround period (each stream was investigated every 12 days) and some additional data were collected in deficient areas. The actual man/days of effort in field data collection in 1978 were as follows:

	<u>Dates</u>	<u>Men</u>	<u>Man/Days</u>
April 1978	1-30	2	60
May 1978	1-31	4	124
June 1978	1-30	4	120
July 1978	1-31	2	62
August 1978	1-31	2	62
September 1978	1-30	2	60
Winter: March 1978	5 days	2	10
March 1979	5 days	2	10
	Total man/days 1978		<u>508</u>

By way of comparison, fisheries studies conducted in preparation for the Berger Commission hearings in northern Yukon were extended over a period from 1971-1975 with much more detail and intensity by both the public sector and by Gas Arctic.

Foothills (page 3 of proposal #4), in the interests of cost effectiveness, stated that "neither the larger rivers nor lakes are included in the surveillance program" (in 1978).

The total effort expended in the collection of fisheries information for inclusion in the EIS in the period 1976-1978 was 689 days.

IV(A)10.

2) In general, the schedule of preferred stream crossings as presented by the proponent does not seem to be related to the biology of fish present in those streams.

3) Much of the information presented in the EIS relative to the spawning periods of fish present in streams along the proposed route has been extracted from the literature and may not be strictly applicable to specific streams in the study area. The construction schedule has apparently been developed from these generalities and not in all cases from specific data collected by the proponent's fisheries representatives.

4) The EIS fails to address potential concerns and possible impacts identified at the public hearings conducted in 1977 during the Lysyk Inquiry. Some of the more important of these concerns include (1) impacts on rare or endangered species of fish, (2) areas critical to fish stocks as identified in the submission by Mr. J. McNally, and (3) areas critical to fish stocks on a seasonal basis. (See N.N.R.S. reports, 1977.)

5) All streams should be prioritized in a list of their subjective relative importance.

6)

7) The fisheries position as presented in the EIS relies only on data collected prior to 1978, and can therefore be expected to be incomplete.

8) The fisheries presentation does not clearly identify critical areas by type, e.g. species or life stage or function.

9) Overwintering capacity is indicated by the potential to support fish life. However, no sampling was conducted during the winter, so the scheduling of stream crossings of the Donjek, Duke and White Rivers for winter construction is not based on data collected in the field.

IV(A)11.

The potential for overwintering may also be identified by aufeis areas which are tabled in the EIS. All of the areas where aufeis is documented are not identified in the EIS as potential overwintering areas. It is recommended that studies be conducted to determine the effect of pipeline trenching on these aquifers.

10) Potential downstream impacts on the fisheries resource (i.e. the watershed concept) is poorly addressed in the EIS.

11) Foothills Pipe Lines representatives at the Lysyk Inquiry expressed a willingness to do additional studies and/or to consult with Fisheries Service personnel to develop programs in critical areas. Were these discussions held?

IV(A)12.

"Proposal for 1978 Investigations, Alaska Highway Pipeline Route, Fisheries

"INTRODUCTION

This proposal for investigations represents BEAK's second year of investigations in watercourses within the influence of the proposed Alaska Highway pipeline during the spring and summer seasons. The emphasis of this BEAK proposal is twofold:

1. The development of a surveillance program on six watercourses, and
2. Simultaneous investigation of areas in which data were deficient during previous studies, as well as confirm the results of previous investigations.

The surveillance program proposed by BEAK is designed to study fishery utilization, the biology of the fish populations, and to gather baseline data on benthic invertebrate communities and water quality during the pre-construction phase of the proposed development. It is anticipated that these surveillance programs will be carried out during the construction and post-construction phases, in order to monitor the effects of the development on these and similar systems.

"RECOMMENDED WATERCOURSES FOR SURVEILLANCE

In general, watercourses were chosen for surveillance by BEAK on the basis of:

1. Fishery populations present,
2. Accessibility,
3. Suitability for fishery, benthic and water quality investigations,
4. Cost effectiveness of results. (It is for this reason that neither the larger rivers nor lakes are included in the surveillance program. A surveillance program on the Yukon or Teslin River would require at least one full-time crew, and results may not be definitive.)

IV(A)13.

Specifically, the following watercourses are recommended for the reasons cited:

1. Beaver Creek: Intermittent, productive watercourse, in which movements and growth of fauna may be documented.
2. Koidern River: Identified as a sensitive area, and provides opportunity to study life history characteristics of Arctic grayling, lake whitefish, round whitefish and to a minor degree chum salmon.
3. Bear Creek: One of the very few watercourses in which Dolly Varden populations may be investigated. (If this proposed crossing proves to be too inaccessible for surveillance, it may be substituted.)
4. Wolf Creek: Arctic grayling, longnose sucker spawning. Utilization by chinook salmon parr, in a watercourse which does not support chinook salmon spawning.
5. Morley River: Chinook salmon emergence, parr utilization. Arctic grayling spawning and movements.
6. Rancheria River: Arctic grayling life history information, and possibly information on mountain whitefish and Dolly Varden life histories.

These watercourses are representative of most systems encountered along the proposed route, with the exception of muskeg, large river and lake biomes.

BEAK proposes that studies on other aquatic systems be carried out simultaneously with the monitoring program. These studies are designed to clarify contentions in previous programs, such as 'likely' or 'possible' utilization. Most of these contentions resulted from spring spawning investigations, and as a result maximum effort will be expended during this season.

"METHODS

"1. FISHERY INVESTIGATIONS:

- (i) In terms of the monitoring program, BEAK proposes a minimum of biweekly visits to each of the six watercourses involved.

Sampling will be standardized, such that catch per unit effort

IV(A)14.

may be established (indication of relative abundance), and changes in fishery utilization may be monitored. Representative samples of endemic fauna will be taken and analyzed for length-weight-age relationships, in order to define growth and recruitment in the populations.

(ii) BEAK will also carry out seasonal, site-specific investigations, in order to determine the emergence times of chinook and chum salmon fry and whitefish fry. Chinook salmon smolt movements will be monitored in the Teslin River.

(iii) Visits will be made to watercourses where site-specific deficiencies exist. An attempt will also be made to confirm the results of investigations carried out in the previous year, although time constraints may not enable 100 percent coverage of all watercourses in this aspect. Emphasis will be placed on systems where results of previous studies were not definitive.

"2. BENTHIC INVERTEBRATE INVESTIGATIONS

BEAK proposes the definition and quantification of benthic invertebrate populations in the systems under surveillance be carried out once in each of the three seasons of investigation, spring, summer and fall. To this end, four stations will be established on each stream under surveillance. The locations of the stations will be:

1. Above the proposed pipeline crossing (control);
2. Immediately below the proposed crossing (point of maximum impact on benthic invertebrates);
3. Downstream of the proposed crossing (where the impact will be minimal); and,
4. A station far enough downstream to be beyond the anticipated realm of influence of pipeline activity.

Six replicate samples will be taken, by Surber sampler or dredge, from each station. This will result in a total of 36 samples/stream/season, which BEAK believes will provide an adequate documentation of pre-construction characteristics in these watercourses.

"3. WATER QUALITY

Documentation of water quality during the pre-construction phase is an integral component of the monitoring program. BEAK proposes that water samples be collected at bi-weekly intervals from each system under surveillance. This program would commence May 1, 1978, and extend to September 30, 1978, during the most active period in these lentic systems. During the winter season, water samples will be collected twice, once just after freeze-up, and once towards the end of the winter season. This last sample may be taken prior to break-up this spring (March, 1978). These samples will be analyzed for parameters identified by BEAK as those characteristics which may be altered through construction activity or associated practices, or altered drainage. These parameters are:

1. Total dissolved solids (filterable residue)
2. Suspended solids (non-filterable residue)
3. Total organic carbon
4. Total Kjeldahl nitrogen
5. Total phosphate phosphorous
6. Alkalinity
7. Total hardness
8. True colour
9. Turbidity
10. Oils and greases
11. Iron
12. Specific conductance
13. pH
14. Dissolved oxygen.

"SCHEDULE OF ACTIVITIES, 1978

April 1-30: One 2-man crew. Establish monitoring program and sampling stations. Salmon, whitefish and Dolly Varden emergence will be monitored in the six systems under surveillance. Other biotic factors to be investigated are:

IV(A)16.

1. Chum salmon emergence in Kluane River;
2. Chinook salmon emergence in Michie Creek (providing ground access is possible);
3. Whitefish emergence in Squanga Creek;
4. Arctic grayling movements in general; and,
5. Attempt to delineate overwintering areas on the basis of fauna present at break-up.

May 1-31: Two 2-man crews. Continue monitoring program.

1. Surveillance of Arctic grayling migrations and spawning behaviour; and,
2. Investigate the development of young-of-the-year chinook salmon, whitefish and Dolly Varden.

June 1-30: Two 2-man crews. Continue monitoring program.

1. Investigate chinook salmon smolt migrations in Teslin River; and,
2. Investigate Arctic grayling emergence.

July 1-31: One 2-man crew. Continue monitoring program.

1. Investigate summer utilization of waterbodies.

August 1-31: One 2-man crew. Continue monitoring program.

1. Investigate summer utilization of waterbodies.

September
1-30: One 2-man crew. Continue monitoring program.

1. Investigate fall utilization and movements of fauna.

Winter

Season: One 2-man crew. Two water quality trips, five days each trip. (It is desirable to make one trip in March of 1978 to enable presentation of one year of data before March 1979.)

IV(A)17.

"PROJECT COMPLETION DATE

If the project is approved with sufficient lead time to enable the collection of water samples in March of 1978, all field work will be terminated by December 1, 1978. Based on this schedule, a report documenting the results of this investigation will be prepared by February 28, 1979.

Should it be necessary to carry out a water sampling trip in February or March of 1979, an alternate approach to report preparation is proposed. In such a case, a report documenting the results of fishery, benthic invertebrate and water quality investigations during the sampling period April 1 to September 30, 1978 would be prepared. This report would be submitted to Foothills before January 31, 1979. The results of the winter water quality analyses would be prepared as a supplement to this report, and presented to Foothills by April 1, 1979."

Part B. Evaluation of the Fisheries-Related Information
Included in the Environmental Impact Statement
for the Alaska Highway Gas Pipeline Project

Appendix 1 Part B introduces comments drawn from a review of sections of the Environmental Impact Statement. The sections selected for review included:

Section 2.0	Overview Summary.
Section 4.0	
4.1.3	Stream Crossings - Location and Scheduling (4.1.c).
Section 6.5	Fisheries Resources.
Section 8.0	Description and Assessment of Environmental Impacts.
Section 9.0	Mitigation.
Section 10.0	Residual Impacts.

The preliminary review consisted of an initial reading of the EIS and supporting documents to gain familiarity with the report, to obtain an understanding of the proposed project, and to identify the extent of the data base and the potential environmental impacts of the proposed development on fisheries resources in the pipeline corridor. A more specific appraisal of the material was then conducted to identify areas of agreement and areas of concern in sections of the report selected for more detailed review. This review was not specifically designed to question the study objectives, the field methods, or interpretation of the results. In general, the comments are designed to question the logical relationship between the data and the conclusions drawn from them. Are the conclusions supported by, and logically related to, the data? In areas of agreement quotations by representatives of Foothills

Pipe Lines (South Yukon) Ltd. outlining procedures or methodology which would (if implemented) reduce impacts on the fisheries resource are extracted and included in this review.

Options suggested by Foothills Pipe Lines could be introduced as terms and conditions if pipeline construction proceeds. Recommendations to this effect are presented by D.F.E. if it is felt that their inclusion in the terms and conditions would reduce or minimize the impact on the fisheries resource. In some instances, recommendations to modify the statements in the EIS to reduce potential impacts associated with pipeline construction are outlined in the review. In areas of concern or disagreement, questions are posed. The answers should provide insight into the necessity of altering construction, requesting additional information, recommending further studies and implementing special and/or additional terms and conditions for pipeline construction. The material reviewed is identified by the appropriate page number of the EIS.

This review is not intended as a comprehensive critical editorial discussion of the quality of the EIS. We have selected for discussion only those fisheries-related concerns for which data are obviously deficient or for which disagreement exists between the proponent's view and that of the reviewer. Many of our comments should be considered for inclusion in terms and conditions to be developed relative to pipeline construction.

Section 2.0 Overview Summary

Page

2-4 Section 2.4.2 "Clearing and grading operations have been scheduled on a year round basis but will be curtailed during colder winter months."

Question: How is it proposed to reduce potential impacts from clearing and grading on the fisheries resource?

Page

In the EIS the clearing and grading schedule for construction spreads is provided on pages 4-5, Figure 4.1-1(a). This schedule for stream crossings should be the same as the mainline construction schedule provided in Appendix 2 Part B.

2-5 Section 2.4.3 Testing

"Water will be drawn from available sources and discharged to the nearest available suitable watercourse."

Recommend-
ation:

- That the "suitable watercourse" designation be clarified with the regulatory agency prior to disposal. Disposal into critical areas and sensitive fish habitat must be prohibited.

2-10 Section 2.6.5 Fish Resources

2-11 (a) Chinook salmon

"Spawning grounds located within the influence of proposed pipeline watercourse crossings... Table 6.5-4."

Comment:

The information in the table is incomplete. Spawning documented and/or reported in other areas includes:

- Takhini River - documented upstream and downstream of pipeline crossing.
- Yukon River - highly probable that chinook spawn downstream of the Lewes Dam in the vicinity of the pipeline crossing.

IV(A)21.

Page

- Teslin River - documented spawning upstream and downstream of pipeline crossing.
- Deadmans Creek - reported spawning in the vicinity of crossing.
- Smart River - documented spawning downstream and upstream of pipeline crossing.

Recommend-
ation:

- That construction scheduling of clearing, grading and instream activities be implemented to minimize impacts on all chinook salmon populations.
- That additional studies may be necessary to better assess the population sizes being impacted.
- That erosional control mechanisms must be implemented and maintained on a regular basis for the life of the pipeline.

2-11 (b) Chum Salmon

"Spawning locations...in Table 6.5-5."

Comment:

The information in the table is incomplete. Spawning documented and/or reported in other areas includes:

- Duke River - documented in the vicinity of crossing.
- White River - reported upstream of crossing.
- Takhini River - reported in the vicinity of the crossing in past years.

Recommend-
ations:

- As above for chinook salmon.

Page

- 2-11 (c) Arctic grayling
- 2-11 (d) Lake trout
- 2-11 (e) Lake whitefish
- 2-11 (f) Dolly Varden

Question: Applies to the six designated important fish species. Has the 1978 field program identified additional spawning, rearing and overwintering areas and additional migration routes for important fish populations in particular streams? When will this information be incorporated into the construction scheduling?

2-18 Section 2.8.1

(b) Concerns related to water crossings

2-19 Fish spawning

"These investigations resulted in the identification of potential or actual spawning locations in the vicinity of 25 proposed pipeline crossing locations out of approximately 60 streams capable of supporting fish."

Comment: Information on fish spawning is available in the EIS (Section 6.0), summary of fish utilization by important fish species (includes potential pipeline related impacts and sensitive time periods) (Table 1, page 2, summary. Annex Report to EIS No. 01 Volume 1) and can be inferred from the presence of fry (Appendix 2 Part A, Table 1 and Table 6.5-6 of the EIS on pages 6-154).

Page

Recommend-
ation: All of this information should be reviewed on a continuing basis and updated as new data become available, to ensure that pipeline construction scheduling does not impose unacceptable impacts on the integrity and quality of the aquatic habitat. This can be accomplished by direct interaction between the consultants of Foothills, the government agency in charge of the fisheries resource, and the design engineering group of Foothills Pipe Lines. Refinement in timing of construction, avoidance of and/or restricted construction scheduling is essential if the impacts to the fishery resource are to be minimized, mitigated and/or compensated for losses resulting from construction.

2-19 Fish migrations

2-19 Overwintering fish

Comment: See recommendation for fish spawning.

2-21 (e) Pipeline integrity

"Water-contaminated methanol will not be disposed of in watercourses and thus will not threaten aquatic organisms."

Recommend-
ation: - That the above statement be included as a term and condition of pipeline construction.

2-29 (9) "No wastes or known toxic materials will be permitted to enter aquatic systems in quantities harmful to fish resources or humans."

Recommend-
ation: Delete "known toxic materials" from the above statement. Toxic materials should be destroyed or removed and not allowed to enter aquatic systems.

Page

2-30 (3) "Pipeline facilities will be located so as to avoid conflict with recognized areas of mining potential."

Recommendation: Realignment away from the Quill Creek settling pond is essential.

2-31 (24) "Construction practices will comply with all laws and regulations that are related to fisheries matters and the protection of aquatic environments."

Comment: Updating of the fisheries information including additional site specific studies through the design stages until construction is essential if the impacts on the fisheries resource are to be minimized. Some flexibility in construction scheduling may be necessary in light of new information which may become available.

2-32 (11) "If hydrostatic test solutions, which use a freezing point depressant such as methanol, are used, these solutions will be distilled or diluted before release. The distillate will be incinerated or re-used. The use of such depressants in test solutions is not presently planned."

Comment: Water has been suggested by the proponent as the test solution. If a freezing point depressant is used, the solution should be distilled and the residue incinerated. Dilution of the test solution or methanol used as a drying agent is not an acceptable method of disposal if released into watercourses.

Note: (pages 2-39, 10-3) "Methanol will be used in relatively large quantities to assist in

Page

drying the pipeline after hydrostatic testing. This methanol will not be released into aquatic environments where it might cause harm."

Recommendation:

That dilution of methanol solutions is an unacceptable method of disposal. Incorporate the statement on page 2-22 offered by Foothills Pipe Lines, "Water-contaminated methanol will not be disposed of in watercourses and thus will not threaten aquatic organisms" as a term and condition of pipeline construction. No impacts to the fisheries resource are envisaged if this recommendation is implemented.

- 2-33 (18) "Wastes or known toxic materials will not be permitted to enter aquatic systems in quantities harmful to fish populations."

Recommendation:

The terms and conditions for disposal must be stringent. Disposal sites must not include critical and sensitive fisheries habitat. This topic, and the methanol question (see previous comment), must be clearly defined (also see comment page 2-33, Number (22)).

- 2-33 (27) "All activities, facilities and structures related to pipeline development will be planned in a manner that will impart minimal adverse impact on the fisheries resource. This will include the avoidance of areas critical to the maintenance, perpetuation and utilization of the regional fisheries resource."

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Question: Where have these areas been designated in the EIS? What are the types of critical areas defined to date? If the present alignment approaches a critical area, would an overhead pipeline crossing be seriously considered as a means of reducing the environmental impact of pipeline construction on the fishery resource?

2-37 Section 2.10.2 Water Crossings

"Present construction scheduling along the preferred alignment may result in direct interference of significance to fish spawning at two locations...Bear Creek (Dolly Varden)... M'Clintock River (lake whitefish)... Other potential effects on fish spawning due to crossing activities are judged to be relatively insignificant due to either the size of the spawning populations involved or the nature of the regional fisheries resource."

Comment: The above statement appears to totally disregard the fisheries data collected to date. As yet the scheduling at specific crossings is undecided.

Recommendation: The agency responsible for the fisheries resource must have an input to scheduling developed in the final design stage of the project. The design stage should accommodate the scheduling information present in Appendix 2 Part B of this brief. Additional alterations to scheduling and/or special crossing crews may be requested as new fisheries information becomes available.

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2-41 Section 2.11 Associated Projects

"On December 8, 1978, Northwest Energy Company of the...U.S.A....filed...to construct and operate the Alaska Highway Oil Pipeline..."

Comment: From a fisheries point of view, the concept of a shared corridor for river crossing locations and river crossing methods for an oil pipeline must be considered separately from the gas pipeline being considered in this brief.

Section 4.0

4.1.3 Stream Crossings - Location and Scheduling (4.1.c)

4-4 "Determination of which streams will be crossed by the mainline crew and which will require a special crew...will be collected during the design process."

Question: Does this mean that the fisheries investigations will be continuing through the design stages up to the time of construction?

4-5,
4-6 Figure 4.1-1(a) Construction Plan A Schedule

Recommendation: The timing of mainline construction and some river crossings are identified in the figure. In some instances direct conflicts with spawning migrations and spawning are evident. The construction schedule developed for final design should accommodate the schedule outlined in Appendix 2 Part B of this brief.

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During summer construction periods, instream activities of pipeline mobilization and clearing in sensitive streams or near critical habitat should be scheduled a year earlier than the time period of pipeline trenching in the rivers.

A more accurate construction schedule for all instream activities would be beneficial in assessing impacts on the fisheries resource. It may be necessary to identify areas where special crossing methods and techniques should be employed once this information becomes available.

	Section 6.5	Fish Resource
6-146	Table 6.5-1	Fish species present in the major drainage systems of the southern Yukon Territory.
	Comment:	Table incomplete with regard to species found in waterbodies within the influence of the proposed Alaska Highway pipeline development. Should also include: <ul style="list-style-type: none"> - Arctic lamprey - rainbow trout - mountain whitefish.
6-147	Table 6.5-2	The relative abundance of chinook salmon parr ...within the influence of Alaska Highway pipeline.
	Comment:	Table incomplete. Should also include: <ul style="list-style-type: none"> - Mendenhall River - Cowley Creek

Page

- Yukon River
- Greyling Creek
- Unnamed tributaries to Marsh Lake
- M'Clintock River
- Teslin River.

Question: Are the inadequacies of the tabled information a reflection of the sampling times, the areas sampled, and/or an indication of an inadequate data base? In the case of chinook salmon juveniles, some streams may be seasonally critical for rearing. It appears that the construction schedule and the EIS does not take this into consideration even though it was discussed at the hearing in 1977.

The table identifies 13 chinook rearing areas. At least 7 additional areas have been included in this review. The question to ask is, how many important spawning, overwintering and rearing areas in streams have not been identified for the other species within the influence of pipeline development? Stress the importance of continuing additions to the data base.

6-149 Table 6.5-4 Chinook salmon spawning areas within the influence of the Alaska Highway pipeline.

Comment: Table incomplete. See Overview Summary - Comments on (a) Chinook Salmon.

Chinook salmon spawning documented or reported in other areas includes:

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- Takhini River
- Yukon River
- Teslin River ("In 1972, 10 chinook salmon were enumerated in the upper Teslin River close to the lake outlet" - source: N.N.R.S., July, 1977)
- Deadmans Creek
- Smart River.

The following was extracted from Annex 01 Volume 1, page 145, by Foothills Pipe Lines (January, 1979) re: Takhini River.

"Aerial surveys by the Alaska Department of Fish and Game (fixed-wing) and Northern Natural Resource Services Ltd. (helicopter) resulted in population estimates of 88 and 72 chinook salmon, respectively (Northern Natural Resource Services Ltd., 1977b).

"The region of the proposed pipeline crossing on the Takhini River was a major chinook salmon migration route, and was also heavily utilized as a nursery and rearing area by chinook salmon parr. This region was utilized as a minor nursery area by Arctic grayling, round whitefish and longnose sucker. The endemic species also utilized this area for rearing, adult summer habitat and probably for overwintering. No spawning activity was observed at this locale."

The following information about the Takhini River was extracted from the N.N.R.S. report referred to in the above statement (Annex 01, page 145) and published in September, 1977.

"On August 22 and September 2 the river was surveyed to enumerate the chinook salmon populations. On August 22, Alaska Department of Fish and Game personnel estimated the population to be 88 chinook salmon. The survey was conducted from a fixed-

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wing aircraft under poor survey conditions. Personnel of N.N.R.S. estimated that 72 chinook salmon were spawning in the system on September 2 (helicopter survey). Two fish were observed 'finning' approximately 1 mile downstream of the confluence with the Ibex River. This location is approximately 8 miles downstream of the proposed Alaska Highway pipeline crossing site. The turbidity of the river prevents an accurate assessment of the numbers of fish spawning downstream of the proposed crossing. It is of interest to note that on August 26, chinook salmon fry of year were still present in the river. In view of this, further assessment will be required to develop a construction window for the pipeline crossing of the Takhini River to ensure a minimized impact on the chinook salmon population."

Comment: It is of interest to note that Foothills Pipe Lines Ltd. references the N.N.R.S. report of 1977 (Annex 01, page 145), however fails to include the presence of chinook salmon spawning downstream of the pipeline crossing in the EIS.

The following information was extracted from Annex 01, page 145:

"A helicopter survey was conducted by BEAK on August 24 and repeated on August 25, 1977 in order to determine the relative number of chinook salmon utilizing this watercourse ((Takhini River)). Conditions for a visual reconnaissance were considered excellent on both dates. Two adult chinook salmon were observed during each of these aerial surveys."

It is of interest to note that on August 22 the Alaska Department of Fish and Game estimated the population to be 88 chinook salmon. On September 2, N.N.R.S. personnel estimated that 72 chinook were spawning in the system. There is a drastic contrast between the number observed by Beak and

Page

the number observed before and after their survey. This observation on chinook salmon is an excellent example of the inadequacy of the present data base on which pipeline decisions are being formulated. The same inadequate data base exists for chum salmon.

6-149 Table 6.5-5 Chum salmon spawning areas within the influence of the Alaska Highway pipeline.

Comment: Table incomplete. From Annex Report Number 01, Volume 2, chum salmon are reported in:

- White River - mile 44.3 (reported)
- Koidern River - mile 48.9 (spawning adults)
- Koidern River - mile 63.0 (parr)
- Koidern River - Lake Creek to bridge, km 1853 (adult)
- Duke River near crossing (page 6-152 of EIS).

Other reports of chum salmon occur in:

- Takhini River (reported upstream of crossing)
- Teslin River (documented downstream of crossing).

The information provided by the proponent in the EIS does not incorporate all the information from the reference sources utilized in preparation of the EIS.

6-152 Section 6.5.3.5

The following information concerning the Duke River was extracted from the EIS on page 6-152.

Page

"Chum salmon begin arriving at spawning areas during late September, with the peak of spawning activity generally occurring during the third week of October. Studies completed during 1977 indicate that spawning is virtually complete by early November (Foothills Pipe Lines (Yukon) Ltd., 1977c).

"Spawning locations within the influence of the proposed pipeline and the degree of utilization (minimal, moderate, extensive) are presented in Table 6.5-5. This information was summarized from data published by Foothills Pipe Lines (Yukon) Ltd. (1978).

"Although a single chum salmon carcass was observed in the Duke River in the vicinity of the proposed pipeline crossing during 1976 field studies, no upstream movement of chum salmon in the Duke River was observed during extensive studies completed the following year."

Comment:

- The reference at the end of the first paragraph is incorrect.
- Last paragraph: "no upstream movement of chum salmon in the Duke River was observed during extensive studies completed the following year" (refers to 1977).

The extensive surveys in the fall of 1977 are reported in Annex 01, Volume 2, Waterbody: Duke River. Mile 111.0. The effort during the chum

Page

salmon spawning period consisted of 2 helicopter surveys and 8 ground inspections. Only 5 seine hauls were completed and gillnetting effort for 24 hours is reported in the data summary sheet.

Question: Does the effort expended represent "extensive studies completed the following year"?

6-154 Table 6.5-6 and Table 8.1-1 (page 8-5)

Table 6.5-6 represents summer utilization of fry, juvenile and adult Arctic grayling in waterbodies within the influence of pipeline development. The table states the abundance of fry in the vicinity of the proposed crossing. The presence of fry usually indicates that spawning has occurred close by.

Question: Why, if there is an abundance of fry in Swede Johnson Creek, in Table 6.5-6 is there not spawning identified in Table 8.1-1? In the Aishihik River, grayling fry are rare within the influence of pipeline development, however in Table 8.1-1 Arctic grayling spawning is reported at the proposed crossing. Other conflicts which are evident exist for the Takhini River, Teslin River, Fox Creek, Smart River, Little Rancheria River, and Albert Creek, to mention some examples.

6-159 Kluane Lake

Comment: The EIS notes that spent lake trout were collected near the mouth of Slims River, Halfbreed Creek, and reports spawning near the mouth of Congdon.

Page

Creek. Reports of lake trout spawning near the outlet of Teslin Lake are also given on page 6-159. It appears that the information provided in Section 6 of the EIS is not all incorporated in Table 8.1-1 on page 8-5. Omissions for lake trout spawning include: mouth of Slims River, mouth of Congdon Creek, and outlet of Teslin Lake.

Question: How much other information for all fish species is available that to date has not been included in the EIS? The construction schedule must consider all the available information if the impacts are to be minimized.

Section 8.0 Description and Assessment of Environmental Impacts

8-5 Table 8.1-1 Duration of fish spawning behaviour and proposed construction activities along the Alaska Highway Gas Pipeline Route.

Comment: The table notes the location of spawning areas at, upstream and downstream of, the proposed pipeline crossings. The information provided in the table is incomplete (see previous comments - review of Section 2.0, Section 6.5).

Question: How were the number of Arctic grayling spawners included in Table 8.1-1 determined? The inclusion of the numbers of spawners misrepresents the information provided in the support documents (Annex Report 01, Volumes 1 and 2), since the

Page

numbers of fish captured or observed are supposed to be recorded in the data summary sheets (Volume 2).

8-6 Table 8.1-2 Fish migrations and proposed construction activities along the Alaska Highway Pipeline Route.

Comment: The data included on fish migrations in the table is incomplete.

The Takhini, Teslin and Morley rivers all contain spawning chinook salmon populations. The timing of instream construction activities in the Takhini and Teslin rivers directly conflicts with documented spawning areas upstream and downstream of the proposed crossings. In addition, the instream construction duration for the Takhini River appears to be one week, for the Teslin River, two weeks, and for the Morley River, one week. The duration of instream construction activities differs significantly from those presented in the Construction Schedule Plan A. Is it possible to cross the Teslin River in a two-week period? How were the numbers of fish determined?

8-7 Table 8.1-3 Overwintering fish and scheduled pipeline construction activity along the Alaska Highway Gas Pipeline Route.

Comment: The Koidern River also supports the progeny of overwintering chum salmon. Snag Creek has not been previously noted as an overwintering area in the EIS for Arctic grayling. On page 8-8, it states "Snag Creek...is not of concern due to the absence of fish."

Page

8-9 Section 8.1.2.4 Assessment of the deleterious effects of siltation on fish due to crossing activities.

The following information was extracted from the EIS on page 8-10:

"Only two streams where spawning is located near and downstream of crossings were identified in the discussion noted above. These were Dolly Varden spawning areas in Bear Creek and potential whitefish spawning areas downstream from the M'Clintock River crossing."

Explain the relationship between this statement and the information identified in Table 8.1-1 where it is indicated that spawning of fish species at or downstream of the proposed crossing in summer construction areas occurs in at least 12 different locations. In addition, it has been previously stated in the review that this list is probably incomplete.

8-27 Section 8.2.1.4

The following was extracted from page 8-27 of the EIS:

"The methanol used in drying the pipe following hydrostatic testing will not be discharged in aquatic systems."

Recommendation:

Incorporation of this voluntarily offered statement as a term and condition of pipeline construction activities.

Page

9.0 Mitigation

Section 9.1.3 Erosion control

9.1.3.1 Action taken on scheduled erosion control

9-4

Number (18) "Stabilization, by appropriate means, of all river banks, with frequent post-construction inspection and maintenance if necessary."

Comment:

The implementation of this mitigative measure is essential to prevent the short term and long term degradation of important fish habitat. Some mechanism must be incorporated into the terms and conditions of pipeline construction that ensures that monitoring, stabilization and remedial measures can be accommodated by the proponent for the life of the project. Requests by government agencies to perform remedial measures must be accomplished within a reasonable time frame if the fisheries resource is to be adequately protected from sedimentation from the right-of-way when the pipeline is in operation.

9-6

(11) "If hydrostatic test solutions, which use a freezing point depressant such as methanol..."

Comment:

Previously discussed in the review of Section 2.0, Overview Summary.

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Section 10. Residual impacts

10.5 Pipeline integrity

10-3

"Plans for disposal of test water have not been completed but numerous locations and/or methods of disposal are available which avoid any risk to fish resources or aquatic habitats. As special care to avoid harmful effects to aquatic habitats will be taken when disposing of test fluids, no significant harmful effects can be anticipated.

"Methanol will be used in relatively large quantities to assist in drying the pipeline after hydrostatic testing. This methanol will not be released into aquatic environments where it might cause harm."

Recommend-
ation:

It is recommended that in the last paragraph quoted the phrase "where it might cause harm" be deleted. The methanol solutions thus will not directly enter into watercourses which support fish species. The use of lagoons or lakes devoid of fish stocks may be an alternate disposal site for toxic wastes.

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APPENDIX 2

Part A. Summary of Fish Species and Life Stages
Present in Streams on the
Proposed Pipeline.

Part B. Comments on Proposed Scheduling of
Stream Crossings.

APPENDIX 2Parts A and B.

Part A, Table 1 is a summary of species present and life stages identified (F = fry; J = juvenile; A = adult) in streams crossed by the proposed Alaska Highway Natural Gas Pipeline. The format follows the mileage along the pipeline route in a west-to-east direction. The stream crossings are identified by name and a number designating the alignment sheet number (1-42) separated by a hyphen and followed by a number designating a particular stream crossing on each alignment sheet (1-10) (from west to east). The fisheries information was compiled from data provided by Foothills Pipe Lines (South Yukon) Ltd. and Northern Natural Resource Services Ltd. The reference sources are given at the end of Table 1. The table includes environmental fisheries concerns reported in Section 6.2 of Annex Report Number 11 to the Environmental Impact Statement. The table also includes the proponent's construction schedule (dates of construction) developed from the construction plan "A" schedule included in the EIS (Section 4, Figure 4.1-1(a), page 4-5).

Part B of Appendix 2 provides comments on the proposed scheduling of stream crossings on the proposed Alaska Highway Natural Gas Pipeline as presented in the Environmental Impact Statement. Using the fisheries information presented in Part A, Table 1, an assessment of the scheduling as presented by Foothills Pipe Lines is evaluated in relation to the fisheries data base and the biology of the fisheries resource subject to impact. Requests for alterations of the construction schedule, and for additional study are essential if the fisheries resource is to receive protection from trenching activities of pipeline construction. Sedimentation from the right-of-way and slope approaches after the trenching operation must be prevented immediately and continually maintained, if the impact is to be of short duration. The scheduling of construction to minimize impacts becomes a pointless exercise if degradation of fisheries habitat continues after instream activities are completed.

Appendix 2. Part A.

Table 1. Species present and life stages identified (F, fry; J, juvenile; A, adult) in streams crossed by the proposed Alaska Highway Natural Gas Pipeline. Data drawn from all available sources.

River or Creek Name	Crossing Number	Effort - visits to Fall 1977	Environmental Fisheries Concern	Proponent's Construction Schedule	Chinook Salmon	Chum Salmon	Arctic Grayling	Dolly Varden	Lake Trout	Lake Whitefish	Broad Whitefish	Round Whitefish	Mountain Whitefish	Least Cisco	Inconnu	Northern Pike	Burbot	Longnose Sucker	Lake Chub	Slimy Sculpin	Rainbow Trout	Unidentified Fish	Fish Captures	Reference Source
<u>Section 1</u>																								
Unnamed	1-1		N11	Jan.15-Mar.31 1982																			?	(1)
Unnamed	1-2		N11	Jan.15-Mar.31 1982																			?	(1)
Snag Creek	1-3	11	N11	Jan.15-Mar.31 1982			J					A							X J				Yes Yes	(1) (2)
Beaver Creek	2-1	12	N11	Jan.15-Mar.31 1982			FJA J					J F							X X				Yes Yes	(1) (2)
Enger Creek	2-2	7	N11	Jan.15-Mar.31 1982																			No	(1)
Enger Creek	2-3	9	N11	Jan.15-Mar.31 1982			F												X				Yes	(1)
Enger Creek (Lake)	2-4	9	N11	Jan.15-Mar.31 1982			X												X				No Yes	(1) (2)
Unnamed	2-5		N11	Jan.15-Mar.31 1982																			?	(1)
Unnamed	3-1		N111	Jan.15-Mar.31 1982																			?	(1)
<u>Section 2</u>																								
Drv Creek	3-2	9	N11	Jan.15-Mar.31 1983			J															F	No Yes	(1) (2)

River or Creek Name	Cross- ing Number	Effort - visits to Fall 1977	Environmental Fisheries Concern	Proponent's Construction Schedule	Chinook Salmon	Chum Salmon	Arctic Grayling	Dolly Varden	Lake Trout	Lake Whitefish	Broad Whitefish	Round Whitefish	Mountain Whitefish	Least Cisco	Inconnu	Northern Pike	Burbot	Longnose Sucker	Lake Chub	Slimy Sculpin	Rainbow Trout	Unidentified Fish	Fish Captures	Reference Source
Dry Creek	3-3	8	Nil	Jan.15-Mar.31 1983																			No	(1)
Unnamed	3-4		Nil	Jan.15-Mar.31 1983																			?	(1)
Sanpete Creek (Lake)	3-5	9	Nil	Jan.15-Mar.31 1983			JA																No Yes	(1) (2)
Unnamed	3-6	9	Nil	Jan.15-Mar.31 1983			JA																Yes	(1)
White River	4-1	24	High-Winter Moderate- Summer	*Jul.15-Sep.30 1982	R	R	FJA J		A			JA					J A	JA X		X J			Yes Yes	(1) (1)
Koidern R. #1	4-2	35	High-Winter Moderate- Summer	Jan.15-Mar.31 1983		A R	FJA A		A			JA A				JA	JA X	FJA A		X J			Yes Yes	(1) (2)
Unnamed	5-1		Nil	Jan.15-Mar.31 1983																			?	(1)
Long Creek	5-2		Nil	Jan.15-Mar.31 1983			X																?	(1) (2)
*Wolf Creek, Long Creek	5-3	23	Nil	Jan.15-Mar.31 1983			A		F A			A						F		X			Yes	(1)
Koidern R. #2	5-4	30	High-Winter Moderate- Summer	*Jul.31-Aug.31 1982			F A		A			A				A		F A		X			Yes	(1)
Lake Creek to Km 1853		15				A	JA		A			A					J	F		X			Yes	(1)

River or Creek Name	Cross- ing Number	Effort - visits to Fall 1977	Environmental Fisheries Concern	Proponent's Construction Schedule	Chinook Salmon	Chum Salmon	Arctic Grayling	Dolly Varden	Lake Trout	Lake Whitefish	Broad Whitefish	Round Whitefish	Mountain Whitefish	Least Cisco	Inconnu	Northern Pike	Burbot	Longnose Sucker	Lake Chub	Slimy Sculpin	Rainbow Trout	Unidentified Fish	Fish Captures	Reference Source *
Unnamed	6-1		Nil	Jan. 15-Mar. 31 1983																			?	(1)
Unnamed	6-2	15	Nil	Jan. 15-Mar. 31 1983																			?	(1)
Koidern #3 (Edith Cr.)	6-3	16	Nil	Jan. 15-Mar. 31 1983			A			A		A						A		X			Yes	(1)
Lake Creek (Lake)	6-4	13	Nil	Jan. 15-Mar. 31 1983			F A A			A						A		F A A					Yes Yes	(1) (2)
Pickhandle Lake Complex			Nil	Jan. 15-Mar. 31 1983			A			JA		A				J		A					Yes	(2)
Section 3																								
Unnamed	6-5		Nil	Jan. 15-Mar. 31 1982																			?	(1)
Unnamed	6-6		Nil	Jan. 15-Mar. 31 1982																			?	(1)
Unnamed	6-7		Nil	Jan. 15-Mar. 31 1982																			?	(1)
Unnamed	6-8		Nil	Jan. 15-Mar. 31 1982																			?	(1)
Unnamed	6-9		Nil	Jan. 15-Mar. 31 1982																			?	(1)
Unnamed	6-10		Nil	Jan. 15-Mar. 31 1982																			?	(1)
Unnamed	7-1		Nil	Jan. 15-Mar. 31 1982																			?	(1)
Donjek River	7-2	22	High-Winter	*Jun. 15-Sep. 15 1982			F J A X					A					X		A J	X J			Yes Yes	(1) (2)

River or Creek Name	Cross- ing Number	Effort - visits to Fall 1977	Environmental Fisheries Concern	Proponent's Construction Schedule	Chinook Salmon	Chum Salmon	Arctic Grayling	Dolly Varden	Lake Trout	Lake Whitefish	Broad Whitefish	Round Whitefish	Mountain Whitefish	Least Cisco	Inconnu	Northern Pike	Burbot	Longnose Sucker	Lake Chub	Slimy Sculpin	Rainbow Trout	Unidentified Fish	Fish Captures	Reference Source
Unnamed	7-3		Nil	Jan.15-Mar.31 1982																			?	(1)
Unnamed	7-4		Nil	Jan.15-Mar.31 1982																			?	(1)
Unnamed	7-5		Nil	Jan.15-Mar.31 1982																			?	(1)
Swede Johnson Creek	8-1	16	High-Spring and Fall	Jan.15-Mar.31 1982		R	FJA JA					A						A		X			Yes Yes	(1) (2)
Unnamed	8-2		Nil	Jan.15-Mar.31 1982																			?	(1)
Quill Creek	8-3	9	High-Spring and Fall	Jan.15-Mar.31 1982			JA																	
Unnamed	9-1		Nil	Jan.15-Mar.31 1982																			?	(1)
Unnamed	9-2		Nil	Jan.15-Mar.31 1982																			?	(1)
Burwash Creek	9-3	10	Nil	Jan.15-Mar.31 1982			J J																Yes Yes	(1) (2)
Unnamed	9-4		Nil	Jan.15-Mar.31 1982																			?	(1)
Section 4																								
Duke River	9-5	20	High-Mid Sep. to late June	*Jun.15- Sep.15 1982		A A	JA X					X								A			Yes Yes	(1) (2)
Halfbreed Creek	10-1	9	Moderate- Summer	Mar.1-Sep.30 1982			J																	
Halfbreed Creek	10-2		Nil	Mar.1-Sep.30 1982																			No No	(1) (2)

River or Creek Name	Cross- ing Number	Effort - visits to Fall 1977	Environmental Fisheries Concern	Proponent's Construction Schedule	Chinook Salmon	Chum Salmon	Arctic Grayling	Dolly Varden	Lake Trout	Lake Whitefish	Broad Whitefish	Round Whitefish	Mountain Whitefish	Least Cisco	Inconnu	Northern Pike	Burbot	Longnose Sucker	Lake Chub	Slimy Sculpin	Rainbow Trout	Unidentified Fish	Fish Captures	Reference Source
Lewis Creek		2		Mar.1-Sep.30 1982																			No No No	(1) (2) (3)
Unnamed	10-3		Nil	Mar.1-Sep.30 1982																			?	(1)
Bock's Creek	11-1	4	Nil	Mar.1-Sep.30 1982																			No No	(1) (2)
Mines Creek	11-2	3	Nil																				No	(1)
Nines Creek	11-3	2		Mar.1-Sep.30 1982																			No No No	(2) (3)
Unnamed	11-4		Nil	Mar.1-Sep.30 1982																			?	(1)
Congdon Creek	11-5	2	Nil	Mar.1-Sep.30 1982																			No No No	(1) (2) (3)
Unnamed	12-1		Nil	Mar.1-Sep.30 1982																			?	(1)
Williscroft Creek	12-2		Nil	Mar.1-Sep.30 1982																			? No	(1) (2)
Unnamed	12-3		Nil	Mar.1-Sep.30 1982																			?	(1)
Slims River	12-4	9	Moderate- Summer	Mar.1-Sep.30 1982							JA	A							A	X X			Yes Yes	(1) (2)
Kluane Lake Alternative Kluane Lake		21	Nil	Mar.1-Aug.31 1982		A R	FJA R		FJA R	FJ R		JA				R	R	A		X			Yes	(1) (2)
Unnamed	13-1		Nil	Mar.1-Sep.30 1982																			?	(1)
Unnamed	13-2		Nil	Mar.1-Sep.30 1982																			?	(1)

River or Creek Name	Cross- ing Number	Effort - visits to Fall 1977	Environmental Fisheries Concern	Proponent's Construction Schedule	Chinook Salmon	Chum Salmon	Arctic Grayling	Dolly Varden	Lake Trout	Lake Whitefish	Broad Whitefish	Round Whitefish	Mountain Whitefish	Least Cisco	Inconnu	Northern Pike	Burbot	Longnose Sucker	Lake Chub	Slimy Sculpin	Rainbow Trout	Unidentified Fish	Fish Captures	Reference Source
Topham Creek	13-3		Nil	Mar. 1-Sep. 30 1982																			?	(1)
Unnamed	13-4		Nil	Mar. 1-Sep. 30 1982																			?	(1)
Unnamed	13-5		Nil	Mar. 1-Sep. 30 1982																			?	(1)
Silver Creek	13-6	9	Nil	Mar. 1-Sep. 30 1982																			No No No	(1) (2) (3)
Boutellier Cr.	14-1	10		Mar. 1-Sep. 30 1982		R	J FJA			J											X FJA		Yes Yes	(1) (2)
Inlet Creek			Nil	Mar. 1.-Aug. 31 1982																			?	(1)
Christmas Cr.		7		Mar. 1-Sep. 30 1982		A	FJA FJA		F												X FJA		Yes Yes	(1) (2)
Sulphur Creek (Lake)	14-2	7	Moderate- Summer	Mar. 1-Sep. 30 1982			F									A					X		Yes Yes	(1) (2)
Jarvis River	14-3	8	Moderate- Summer	*Jul. 1-Aug. 31 1982			FJA FJA					A X						A			X X		Yes Yes	(1) (2)
Kloo Lake							A		R	A		A				A					F		Yes	(2)
Unnamed	15-1		Nil	Mar. 1-Sep. 30 1982																			?	(1)
Bear Creek	15-2	14	Moderate- Summer	Mar. 1-Sep. 30 1982			A FJA X	FJA X	J												X J	F	Yes Yes	(1) (2)
Unnamed	15-3		Nil	Mar. 1-Sep. 30 1982																			?	(1)
Pine Creek	16-1	6		Mar. 1-Sep. 30 1982			A R		R	R		A				FJ A	A R				F		Yes Yes	(1) (2)

River or Creek Name	Cross- ing Number	Effort - visits to Fall 1977	Environmental Fisheries Concern	Proponent's Construction Schedule	Chinook Salmon	Chum Salmon	Arctic Grayling	Dolly Varden	Lake Trout	Lake Whitefish	Broad Whitefish	Round Whitefish	Mountain Whitefish	Least Cisco	Inconnu	Northern Pike	Burbot	Longnose Sucker	Lake Chub	Slimy Sculpin	Rainbow Trout	Unidentified Fish	Fish Captures	Reference Source
Marshall Creek	16-2	6	Moderate-Summer	Mar. 1-Sep. 30 1982			JA X J	J												X X F			Yes Yes Yes	(1) (2) (3)
Aishihik River	17-1	10	Moderate-Summer	Mar. 1-Sep. 30 1982			FJA FJ FJ		R	F A R		J F				R	R	JA A FJA		X FJ FJA	R		Yes Yes Yes	(1) (2) (3)
Unnamed	17-2		N11	Mar. 1-Sep. 30 1982																			?	(1)
Unnamed	17-3		N11	Mar. 1-Sep. 30 1982																			?	(1) (3)
Cracker Creek	17-4	7	N11	Mar. 1-Sep. 30 1982			JA FJA					JA					JA			X X JA			Yes Yes Yes	(1) (2) (3)
Unnamed.	18-1		N11	Mar. 1-Sep. 30 1982																			?	(1)
<u>Section 5</u>																								
Unnamed	18-2		N11	Mar. 1-Sep. 30 1983																			?	(1)
Unnamed	18-3		N11	Mar. 1-Sep. 30 1983																			?	(1)
Mendenhall R.	19-1	10	Low	Mar. 1-Sep. 30 1983	F		JA J A			A		J						J FJA JA	FJ	FJ			Yes Yes Yes	(1) (2) (3)
Unnamed	20-1		N11	Mar. 1-Sep. 30 1983																			?	(1)
Stony Creek	20-2	1		Mar. 1-Sep. 30 1983	R		J													X			Yes Yes Yes	(1) (2) (3)

River or Creek Name	Cross- ing Number	Effort - visits to Fall 1977	Environmental Fisheries Concern	Proponent's Construction Schedule	Chinook Salmon	Chum Salmon	Arctic Grayling	Dolly Varden	Lake Trout	Lake Whitefish	Broad Whitefish	Round Whitefish	Mountain Whitefish	Least Cisco	Inconnu	Northern Pike	Burbot	Longnose Sucker	Lake Chub	Slimy Sculpin	Rainbow Trout	Unidentified Fish	Fish Captures	Reference Source
Takhini River	20-3	13	Moderate- Summer	*Jul.15-Aug.15 1982	PA FJ F	R	F F A A		J A	JA A		FJA J A				A		FJA J A	X	X JA A			Yes Yes Yes	(1) (2) (3)
Unnamed	20-4			Mar.1-Sep.30 1983																			?	(1)
Arnell Creek	21-1		Moderate- Summer	Mar.1-Sep.30 1983																			No	(2)
Ibex River	21-2	9		Mar.1-Sep.30 1983	PA		FJA					F									X		Yes No	(1) (2)
Ibex River	21-3	8	Nil	Mar.1-Sep.30 1983	P		JA														X		Yes	(1)
Ibex River	21-4	9	Nil	Mar.1-Sep.30 1983																	(X)		Yes	(1)
Fish Creek (Jackson L.)	22-1	6	Moderate- Summer	Mar.1-Sep.30 1983			F A FJA		JA JA			A JA									FJ	JA	Yes Yes	(1) (2)
Wolf Creek	23-1	32		Mar.1-Sep.30 1983	P R		JA JA JA											A			X JA		Yes Yes Yes	(1) (2) (3)
Cowley Creek	23-2	18		Mar.1-Sep.30 1983	P F		A											A	JA	X JA			Yes Yes	(1) (3)
Yukon River	24-1	11	Moderate- Summer	*May 1-Jul.31 1983	FA		A A F		F	A X	R	A X F		FJA		JA JA A	R	JA J J		X FJA JA	R		Yes Yes Yes	(1) (2) (3)
Unnamed	24-2			Mar.1-Sep.30 1983																			?	(1)
Unnamed	24-3			Mar.1-Sep.30 1983																			?	(1)

River or Creek Name	Cross- ing Number	Effort - visits to Fall 1977	Environmental Fisheries Concern	Proponent's Construction Schedule	Chinook Salmon	Chum Salmon	Arctic Grayling	Dolly Varden	Lake Trout	Lake Whitefish	Broad Whitefish	Round Whitefish	Mountain Whitefish	Least Cisco	Inconnu	Northern Pike	Burbot	Longnose Sucker	Lake Chub	Slimy Sculpin	Rainbow Trout	Unidentified Fish	Fish Captures	Reference Source
Unnamed	24-4			Mar.1-Sep.30 1983																			?	(1)
M'Clintock R.	24-5	15	Moderate- Summer	*Mar.1-Apr.30 1983	FJA		FJA F A F A			F A X F A	A	F A		F A		JA A JA	J	F A FJA JA	R	X FJA JA			Yes Yes Yes	(1) (2) (3)
Unnamed	24-6			Mar.1-Sep.30 1983													J			JA			?	(1) (3)
Greyling Cr.	25-1	4	Moderate- Summer	Mar.1-Sep.30 1983	F		FJ FJ J													A			Yes Yes Yes	(1) (2) (3)
Unnamed	25-2		Moderate- Summer	Mar.1-Sep.30 1983	F															JA			?	(1) (3)
Unnamed	26-1		N11	Mar.1-Sep.30 1983																			?	(1)
Unnamed	26-2		N11	Mar.1-Sep.30 1983																			?	(1)
Unnamed	26-3		N11	Mar.1-Sep.30 1983																			?	(1)
Unnamed	26-4		N11	Mar.1-Sep.30 1983			J												JA	JA			?	(1) (3)
Judas Creek	26-5	1	Moderate- Summer	Mar.1-Sep.30 1983			FJ													FJA			No Yes	(1) (3)
Unnamed	26-6		N11	Mar.1-Sep.30 1983																			?	(1)
Section 6																								
Squanga Lake Inlet	27-1	5	Moderate- Summer	Apr.1-Sep.15 1982			FJA				A					A							Yes	(1)

River or Creek Name	Cross- ing Number	Effort - visits to Fall 1977	Environmental Fisheries Concern	Proponent's Construction Schedule	Chinook Salmon	Chum Salmon	Arctic Grayling	Dolly Varden	Lake Trout	Lake Whitefish	Broad Whitefish	Round Whitefish	Mountain Whitefish	Least Cisco	Inconnu	Northern Pike	Burbot	Longnose Sucker	Lake Chub	Slimy Sculpin	Rainbow Trout	Unidentified Fish	Fish Captures	Reference Source
Hall Creek	27-2		N11	Apr. 1-Sep. 15 1982																			?	(1)
Unnamed	27-3		N11	Apr. 1-Sep. 15 1982																			?	(1)
Unnamed	27-4		N11	Apr. 1-Sep. 15 1982																			?	(1)
Squanga Cr.	27-5	9	Moderate- Summer	Apr. 1-Sep. 15 1982			JA X			A JA				X		A X J				X F			Yes Yes Yes	(1) (2) (3)
Seaforth Cr.				Apr. 1-Sep. 15 1982																				
Unnamed	27-6		N11	Apr. 1-Sep. 15 1982																			?	(1)
Teslin River	28-1	19	Moderate- Summer	*Jul. 15-Aug. 15 1982	A R	F	FJA A F A		A	FJA A	J R	FJA A JA		JA A F	X	F A A FJ	A A J	F A X		X X JA			Yes Yes Yes	(1) (2) (3)
Unnamed	28-2		N11	Apr. 1-Sep. 15 1982																			?	(1) (2)
Unnamed	28-3		N11	Apr. 1-Sep. 15 1982																			?	(1) (3)
Brook's Brook	28-4	17	N11	Apr. 1-Sep. 15 1982	P		FJA X JA			F						F	J			X			Yes Yes Yes	(1) (2) (3)
Unnamed	29-1		N11	Apr. 1-Sep. 15 1982																			?	(1) (2)
Unnamed	29-2		N11	Apr. 1-Sep. 15 1982																			?	(1) (2)
Unnamed	29-3		N11	Apr. 1-Sep. 15 1982																			?	(1) (2)

River or Creek Name	Cross- ing Number	Effort - visits to Fall 1977	Environmental Fisheries Concern	Proponent's Construction Schedule	Chinook Salmon	Chum Salmon	Arctic Grayling	Dolly Varden	Lake Trout	Lake Whitefish	Broad Whitefish	Round Whitefish	Mountain Whitefish	Least Cisco	Inconnu	Northern Pike	Burbot	Longnose Sucker	Lake Chub	Slimy Sculpin	Rainbow Trout	Unidentified Fish	Fish Captures	Reference Source
Deadmans Cr.	29-4	18	N11	Apr.1-Sep.15 1982	R		FJA X FJ			J A		JA F		A	J		J J			X JA	X		Yes Yes Yes	(1) (2) (3)
Lonetree Cr.	29-5	18	N11	Apr.1-Sep.15 1982	P		JA FJ													X			Yes Yes	(1) (3)
Unnamed	29-6		N11	Apr.1-Sep.15 1982																			? No	(1) (3)
Ten Mile Cr.	30-1	18	N11	Apr.1-Sep.15 1982	P		J J J										A			X X			Yes Yes Yes	(1) (2) (3)
Unnamed	30-2		N11	Apr.1-Sep.15 1982																			? No	(1) (3)
Fox Creek	30-3	15	Moderate- Summer	Apr.1-Sep.15 1982	P J		FJA F J			A		JA J				JA	A			X JA			Yes Yes Yes	(1) (2) (3)
Nisutlin Bay	30-4	18	N11	*Jun.15-Sep.30 1982	R		F R		R	FJA JA	JA	FJA A		JA JA	A	JA A JA	A R	FJA JA J		JA			Yes Yes Yes	(1) (2) (3)
Unnamed	31-1		N11	Apr.1-Sep.15 1982																			? No	(1) (3)
Unnamed	31-2		N11	Apr.1-Sep.15 1982																			? No	(1) (3)
Unnamed	31-3		N11	Apr.1-Sep.15 1982																			? No	(1) (3)
Unnamed	31-4		N11	Apr.1-Sep.15 1982																			? No	(1) (3)

River or Creek Name	Cross- ing Number	Effort - visits to Fall 1977	Environmental Fisheries Concern	Proponent's Construction Schedule	Chinook Salmon	Chum Salmon	Arctic Grayling	Dolly Varden	Lake Trout	Lake Whitefish	Broad Whitefish	Round Whitefish	Mountain Whitefish	Least Cisco	Inconnu	Northern Pike	Burbot	Longnose Sucker	Lake Chub	Slimy Sculpin	Rainbow Trout	Unidentified Fish	Fish Captures	Reference Source	
Hays Creek	31-5	14	Moderate-Summer	*Apr.1-Jun.30 1982	P		A JA													X			Yes Yes Yes	(1) (2) (3)	
Strawberry Creek	32-1	14	Moderate-Summer	*Apr.1-Jun.30 1982	P FJ		JA A F														X			Yes Yes Yes	(1) (2) (3)
Unnamed	32-2		N11	Apr.1-Sep.30 1982																			? No	(1) (3)	
Morley R.	32-3	24	High-Summer	*Aug.1-Aug.31 1982	PA R FJ		FJA JA FJ		JA	JA JA J		A JA J				F A	A A	A A FJ			X FJA			Yes Yes Yes	(1) (2) (3)
Unnamed	33-1		N11	Apr.1-Sep.15 1982			J														JA		? Yes	(1) (3)	
L. Hazel Cr.	33-2	8	N11	Apr.1-Sep.15 1982			X							J		A J	J	X			X J JA			Yes Yes Yes	(1) (2) (3)
U. Hazel Cr.	33-3	8	N11	Apr.1-Sep.15 1982																			No No	(1) (3)	
Coconino Cr.	33-4		N11	Apr.1-Sep.15 1982																			? No	(1) (3)	
Unnamed	34-1		N11	Apr.1-Sep.15 1982																			? No	(1) (3)	
Smart River	34-2	22	Moderate-Summer	Apr.1-Sep.15 1982	PA A		FJA FJA J	JA JA J		JA A A		JA A S					J	A JA		X JA JA			Yes Yes Yes	(1) (2) (3)	
Unnamed	34-3		N11	Apr.1-Sep.15 1982																			? No	(1) (3)	

River or Creek Name	Cross- ing Number	Effort - visits to Fall 1977	Environmental Fisheries Concern	Proponent's Construction Schedule	Chinook Salmon	Chum Salmon	Arctic Grayling	Dolly Varden	Lake Trout	Lake Whitefish	Broad Whitefish	Round Whitefish	Mountain Whitefish	Least Cisco	Inconnu	Northern Pike	Burbot	Longnose Sucker	Lake Chub	Slimy Sculpin	Rainbow Trout	Unidentified Fish	Fish Captures	Reference Source
Log Jam Cr.	34-4	16	Moderate- Summer	Apr. 1-Sep. 15 1982	P F		FJA													X A			Yes Yes	(1) (3)
<u>Section 7</u>																								
Unnamed	35-1		N11	Apr. 1-Aug. 31 1983																			?	(1) (3)
Unnamed	35-2		N11	Apr. 1-Aug. 31 1983																			?	(1) (3)
Screw Cr.	35-3	14	N11	Apr. 1-Aug. 31 1983																X			Yes No No	(1) (2) (3)
Partridge Cr.	35-4	10	N11	Apr. 1-Aug. 31 1983																(X)			Yes No	(1) (2)
Seagull Cr.			N11	Apr. 1-Aug. 31 1983																			No No	(2) (3)
Swift River #1	36-1	14		Apr. 1-Aug. 31 1983			JA																Yes	(1)
Swift River #2	36-2	8	Moderate- Summer	Apr. 1-Aug. 31 1983			FJA FJA F A	J JA J	J	F A	A	A JA F A					J	J		X JA FJA			Yes Yes Yes	(1) (2) (3)
Unnamed	36-3		N11	Apr. 1-Aug. 31 1983																			?	(1)
Swift River #3	36-4	25	N11	Apr. 1-Aug. 31 1983			FJA F A	J	J	F A		A A						J		X FJA			Yes Yes	(1) (3)
Carlick Cr.	37-1	10	N11	Apr. 1-Aug. 31 1983																			No No	(1) (3)
Allen Creek				Apr. 1-Aug. 31 1983																			?	(1)

River or Creek Name	Cross- ing Number	Effort - visits to Fall 1977	Environmental Fisheries Concern	Proponent's Construction Schedule	Chinook Salmon	Chum Salmon	Arctic Grayling	Dolly Varden	Lake Trout	Lake Whitefish	Broad Whitefish	Round Whitefish	Mountain Whitefish	Least Cisco	Inconnu	Northern Pike	Burbot	Longnose Sucker	Lake Chub	Slimy Sculpin	Rainbow Trout	Unidentified Fish	Fish Captures	Reference Source	
Freer Creek				Apr. 1-Aug. 31 1983																			?	(1)	
Unnamed				Apr. 1-Aug. 31 1983																				?	(1)
Tootsee R.				Apr. 1-Aug. 31 1983																				?	(1)
Rancheria R.	38-1	13	Moderate- Summer	Apr. 1-Aug. 31 1983			FJA FJA	A				F A	FJA				J			X FJA			Yes Yes	(1) (3)	
Unnamed	38-2		Nil	Apr. 1-Aug. 31 1983																				?	(1)
Unnamed	38-3		Nil	Apr. 1-Aug. 31 1983																				?	(1)
Boulder Cr.	38-4	10	Moderate- Summer	Apr. 1-Aug. 31 1983			F A	JA					F A										Yes NF No	(1) (2) (3)	
Spencer Cr.	39-1	10	Moderate- Summer	Apr. 1-Aug. 31 1983																				No No No	(1) (2) (3)
Unnamed	39-2		Nil	Apr. 1-Aug. 31 1983																				?	(1)
Burnt Creek	39-3		Nil	Apr. 1-Aug. 31 1983																				?	(1)
Rancheria R.	39-4	12	Moderate- Summer	Apr. 1-Aug. 31 1983			JA FJA F A	JA A JA					A A F A			A	J J	A		X JA FJA			Yes Yes Yes	(1) (2) (3)	
Big Creek	40-1	13	Nil	Apr. 1-Aug. 31 1983			FJA JA FJA	JA JA					A A				A			X FJA			Yes Yes Yes	(1) (2) (3)	

River or Creek Name	Cross- ing Number	Effort - Visits to Fall 1977	Environmental Fisheries Concern	Proponent's Construction Schedule	Chinook Salmon	Chum Salmon	Arctic Grayling	Dolly Varden	Lake Trout	Lake Whitefish	Broad Whitefish	Round Whitefish	Mountain Whitefish	Least Cisco	Inconnu	Northern Pike	Burbot	Longnose Sucker	Lake Chub	Slimy Sculpin	Rainbow Trout	Unidentified Fish	Fish Captures	Reference Source
Little Rancheria R.	41-1	11	Moderate- Summer	Apr.1-Aug.31 1983			JA FJA FJA	JA				F	J A F A					X A		X A F			Yes Yes Yes	(1) (2) (3)
Unnamed	42-1		N11	Apr.1-Aug.31 1983																			?	(1)
Albert Creek	42-2	10	Moderate- Summer	Apr.1-Aug.31 1983			FJA F A F A			J			A			FJA A	J	JA FJ		X JA F A			Yes Yes Yes	(1) (2) (3)

(See legend on following page.)

Table 1 (continued)

F = presence of fry

J = presence of juveniles

A = presence of adults

X = a species presence, life stage not identified

P = parr of a species

R = reported species presence

? = no fisheries data available

*Special construction schedule noted in Construction Plan A schedule of E.I.S.

(Figure 4.1-1(a), Pages 4-5). *Denotes construction timing removed from mainline schedule.

- (1) Reference: Foothills Pipe Lines (South Yukon) Ltd. January 1979. A summary of fishery investigations in waterbodies within the influence of the proposed Alaska Highway Pipeline in Yukon Territory, 1976-1977. Annex to E.I.S. Number 01, Volumes 1 and 2.
- (2) Reference: Northern Natural Resource Services Ltd. July 1977. Collection of fisheries information from waterbodies along the proposed Alaska Highway Gas Pipeline Route to July 15, 1977. Submitted to Department of Fisheries and Environment, Vancouver, B. C.
- (3) Northern Natural Resource Services LTD. October 1978. A compilation of fisheries data from waterbodies adjacent to the Alaska Highway from kilometer 1008 to kilometer 1635. Submitted to Department of Fisheries and Environment, Vancouver, B. C.

Appendix 2

Part B: Comments on proposed scheduling of stream crossings on the proposed Alaska Highway Natural Gas Pipeline as developed from Appendix 2, Part A. *Denotes special fisheries concern for these streams.

Section 1

Unnamed (1-1) Jan. 15-Mar. 31, 1982

No sampling conducted. Probably no overwintering capacity. Construction schedule is probably acceptable.

Unnamed (1-2) Jan. 15-Mar. 31, 1982

No sampling conducted. Probably no overwintering capacity. Construction schedule is probably acceptable.

Snag Creek (1-3) Jan. 15-Mar. 31, 1982

Fall spawning round whitefish are present. There is a documented capacity for overwintering. Alignment is in proximity to a groundwater source. The data base is inadequate. The construction schedule may be unacceptable on the present alignment. The importance of the groundwater source should be investigated. Additional documentation should be requested.

Beaver Creek (2-1) Jan. 15-Mar. 31, 1982

No overwintering capacity. Construction schedule probably acceptable.

Enger Creek (2-2) Jan. 15-Mar. 31, 1982

Sampled but no fish collected. Probably no overwintering capacity. Construction schedule probably acceptable.

Enger Creek (2-3) Jan. 15-Mar. 31, 1982

Arctic grayling are present in summer. Probably no overwintering capacity. Construction schedule is probably acceptable.

Enger Creek (2-4) Jan. 15-Mar. 31, 1982

Sampled but no fish collected. Probably no overwintering capacity. Construction schedule probably acceptable.

Unnamed (2-5) Jan. 15-Mar. 31, 1982

No sampling conducted. Probably no overwintering capacity. Construction schedule is probably acceptable.

Unnamed (3-1) Jan. 15-Mar. 31, 1982

No sampling conducted. Probably no overwintering capacity. Construction schedule is probably acceptable.

Section 2

Dry Creek (3-2) Jan. 15-Mar. 31, 1983

Arctic grayling and unidentified fry are present in summer. Probably no overwintering capacity. Construction schedule is probably acceptable.

Dry Creek (3-3) Jan. 15-Mar. 31, 1983

Sampled but no fish collected. Probably no overwintering capacity. Construction schedule is probably acceptable.

Unnamed (3-4) Jan. 15-Mar. 31, 1983

No sampling conducted. Probably no overwintering capacity. Construction schedule is probably acceptable.

Sanpete Creek (3-5) Jan. 15-Mar. 31, 1983

Sampled, but no fish collected. No overwintering capacity. Construction schedule is probably acceptable.

Unnamed (3-6) Jan. 15-Mar. 31, 1983

Arctic grayling are present in the stream in summer and also in a headwater lake. Probably no overwintering capacity. Construction schedule is probably acceptable.

*White River (4-1) July 15-Sept. 30, 1982

Chum salmon have been reported upstream of the crossing. The construction schedule poses potential conflict with the migration and spawning of chum salmon. To avoid conflict with chum salmon it is suggested that construction should be completed by August 31.

*Koidern River #1 (4-2) Jan. 15-Mar. 31, 1983

Chum salmon have been documented in the system. The construction schedule is probably unacceptable because of the overwintering capacity for Arctic grayling, humpback whitefish and chum salmon eggs and alevins. Re-alignment to a corridor south of the Pickhandle Lakes complex would be preferable from a fisheries point of view to minimize all risks to the resource. If the preferred route is adopted, construction should proceed in the summer (July 1-August 31). An alternate minor re-alignment closer to the existing highway from Km 79-80 is recommended. Additional study is suggested for all remaining streams in Section 2.

Unnamed (5-1) Jan. 15-Mar. 31, 1983

No sampling conducted. Probably no overwintering capacity. Construction schedule is probably acceptable (see Koidern #1).

Long Creek (5-2) Jan. 15-Mar. 31, 1983

Arctic grayling are present in summer. Limited overwintering capacity but no fish were captured. The alignment is in proximity to a groundwater source. Summer construction should be considered. Additional study is recommended (see Koidern #1).

Wolf Creek, Long Creek (5-3) Jan. 15-Mar. 31, 1983

Support five species of fish. Limited overwintering capacity but no fish were captured. The proportional contribution to Koidern River overwintering capacity is unknown. Summer construction should be considered. Additional study is recommended (see Koidern #1).

Koidern River #2 (5-4) July 1-Aug. 31, 1982

Chum salmon spawn upstream of the crossing. Construction schedule is probably acceptable. Additional study is recommended (see Koidern #1).

Unnamed (6-1) Jan. 15-Mar. 31, 1983

No sampling conducted. Probably no overwintering capacity. Construction schedule is probably acceptable.

Unnamed (6-2) Jan. 15-Mar. 31, 1983

No sampling conducted. Probably no overwintering capacity.

Construction schedule is probably acceptable.

*Koidern River #3 (6-3) - also referred to as Edith Creek

Jan. 15-Mar. 31, 1983

Arctic grayling spawn in the vicinity of the crossing. Probably no overwintering capacity upstream of the confluence with Lake Creek. Overwintering capacity is probably at the crossing.

Construction schedule is probably acceptable and should be revised to July 1-August 31, 1982, as at other Koidern River crossings.

Additional study is recommended.

Lake Creek (6-4) Jan. 15-Mar. 31, 1983

Not crossed by the present alignment.

Section 3

Unnamed (6-5)

} Jan. 15-Mar. 31, 1982

Unnamed (6-6)

} No sampling conducted. Probably no overwintering

Unnamed (6-7)

} capacity in the streams, but the importance of

Unnamed (6-8)

} interconnected lakes is undetermined. Construc-

Unnamed (6-9)

} tion schedule is probably acceptable. Present

Unnamed (6-10)

} alignment represents a possible source of

Unnamed (7-1)

} erosional impact between Km. 115 to 120 because

of position of alignment on the downslope side of the highway.

*Donjek River (7-2) June 15-Sept. 15, 1982

Supports five fish species. The presence of chum salmon in the system warrants abbreviation of the schedule to August 31.

Unnamed (7-3) Jan. 15-Mar. 31, 1982

No sampling conducted. Probably no overwintering capacity. Construction schedule probably acceptable.

Unnamed (7-4) Jan. 15-Mar. 31, 1982

No sampling conducted. Probably no overwintering capacity. Construction schedule probably acceptable.

Unnamed (7-5) Jan. 15-Mar. 31, 1982

No sampling conducted. Probably no overwintering capacity.

Construction schedule is probably acceptable.

Swede Johnson Creek (8-1) Jan. 15-Mar. 31, 1982

Supports four fish species. No overwintering capacity. Construction schedule is acceptable. Prevention of degradation of chum salmon spawning habitat at the mouth is mandatory.

Unnamed (8-2) Jan. 15-Mar. 31, 1982

No sampling conducted. Probably no overwintering capacity.

Construction schedule is probably acceptable.

*Quill Creek (8-3) Jan. 15-Mar. 31, 1982

Arctic grayling are present in summer. No overwintering capacity. Construction schedule is probably acceptable. Re-alignment should be considered because of proximity to a mine-tailings pond and consequent possible source of contamination into Quill Creek and/or the Kluane River.

Unnamed (9-1) Jan. 15-Mar. 31, 1982

No sampling conducted. Probably no overwintering capacity.

Construction schedule is probably acceptable.

Unnamed (9-2) Jan. 15-Mar. 31, 1982

No sampling conducted. Probably no overwintering capacity. Construction schedule is probably acceptable.

Burwash Creek (9-3) Jan. 15-Mar. 31, 1982

Arctic grayling are present in summer. No overwintering capacity exists. Construction schedule is probably acceptable.

Unnamed (9-4) Jan. 15-Mar. 31, 1982

No sampling conducted. Probably no overwintering capacity.

Construction schedule is probably acceptable.

Section 4

Duke River (9-5) June 15-Sept. 15, 1982

Supports four species including chum salmon and Arctic grayling.

The presence of chum salmon warrants abbreviation of the schedule

to August 31. There is a possibility of downstream erosional impact resulting in degradation of chum salmon spawning habitat in the Duke and/or Kluane rivers.

Halfbreed Creek (10-1) Mar. 1-Sept. 30, 1982

Arctic grayling are present in summer. There is no overwintering capacity. Winter construction would be preferable, but summer construction is allowable if completion can be achieved by August 31 to avoid potential degradation of lake trout and possible chum salmon spawning habitat on lake shoals and/or in the estuarine environments of Kluane Lake.

Halfbreed Creek (10-2) Mar. 1-Sept. 30, 1982

Sampled but no fish collected. (See comments above for Halfbreed Creek 10-1.)

Lewis Creek Mar. 1-Sept. 30, 1982

Sampled but no fish collected. (See comments above for Halfbreed Creek 10-1.)

Unnamed (10-3) Mar. 1-Sept. 30, 1982

No sampling conducted. (See comments for Halfbreed Creek 10-1.)

Bock's Creek (11-1) Mar. 1-Sept. 30, 1982

Sampled but no fish collected. (See comments for Halfbreed Creek 10-1.)

Mines Creek (11-2), Nines Creek (11-3) Mar. 1-Sept. 30, 1982

Sampled but no fish collected. (See comments for Halfbreed Creek 10-1.)

Unnamed (11-4) Mar. 1-Sept. 30, 1982

No sampling conducted. (See comments for Halfbreed Creek 10-1.)

Congdon Creek (11-5) Mar. 1-Sept. 30, 1982

Sampled but no fish collected. (See comments for Halfbreed Creek 10-1.)

Unnamed (12-1) Mar. 1-Sept. 30, 1982

No sampling conducted. (See comments for Halfbreed Creek 10-1.)

Williscroft Creek (12-2) Mar. 1-Sept. 30, 1982

Sampled but no fish collected. (See comments for Halfbreed Creek 10-1.)

Unnamed (12-3) Mar. 1-Sept. 30, 1982

No sampling conducted. (See comment for Halfbreed Creek 10-1.)

Slims River (12-4) Mar. 1-Sept. 30, 1982

Supports four fish species. No overwintering capacity. Construction schedule is probably acceptable.

Kluane Lake Alternate Mar. 1-Aug. 31, 1982

Supports multiple fish species. Documented chum salmon and lake trout spawning on lake shores. Additional study is required.

Unnamed (13-1) Mar. 1-Sept. 30, 1982

No sampling conducted. Probably no overwintering capacity. Preferred alteration of schedule from January 15 to March 31.

Unnamed (13-2) Mar. 1-Sept. 30, 1982

No sampling conducted. Probably no overwintering capacity. Schedule should be adjusted in the period January 15-March 31.

Topham Creek (13-3) Mar. 1-Sept. 30, 1982

No sampling conducted. Probably no overwintering capacity. Schedule should be adjusted in the period January 15-March 31.

Unnamed (13-4) Mar. 1-Sept. 30, 1982

No sampling conducted. Probably no overwintering capacity. Schedule should be adjusted in the period January 15-March 31.

Unnamed (13-5) Mar. 1-Sept. 30, 1982

No sampling conducted. Probably no overwintering capacity. Preferred construction in the period January 15-March 31.

Silver Creek (13-6) Mar. 1-Sept. 30, 1982

Sampled but no fish collected. No overwintering capacity. Preferred construction in the period January 15-March 31.

Boutellier Creek (14-1) Mar. 1-Sept. 30, 1982

No sampling conducted. Probably no overwintering capacity. Winter construction preferred.

Inlet Creek (on Kluane Lake Alternate) Mar. 1-Sept. 30, 1982

No sampling conducted.

Christmas Creek (on Kluane Lake Alternate) Mar. 1-Sept. 30, 1982

Supports chum salmon, Arctic grayling, and lake trout fry. Over-

wintering capacity unknown. Construction schedule should be abbreviated to August 31 to avoid any impact on chum salmon.

Sulphur Creek (14-2) Mar. 1-Sept. 30, 1982

The present alignment should have no impact on Sulphur Creek. The construction schedule is acceptable.

Jarvis River (14-3) July 1-Aug. 31, 1982

Supports six fish species including Arctic grayling and lake whitefish. There is no overwintering capacity. The construction schedule is acceptable.

Unnamed (15-1) Mar. 1-Sept. 30, 1982

No sampling conducted. The location of this stream requires clarification.

*Bear Creek (15-2) Mar. 1-Sept. 30, 1982

Supports five fish species including Arctic grayling and Dolly Varden char. Dolly Varden spawn at and downstream of the crossing. Overwintering is probable. Construction schedule should be abbreviated in the period July 1-Aug. 31 to avoid potential conflict with grayling and char.

Unnamed (15-3) Mar. 1-Sept. 30, 1982

No sampling conducted. Construction schedule is probably acceptable.

Pine Creek (16-1) Mar. 1-Sept. 30, 1982

Supports five fish species including Arctic grayling and pike. Overwintering capacity is possible. Construction schedule may interfere with spring spawning species and with recreational use.

Marshall Creek (16-2) Mar. 1-Sept. 30, 1982

Arctic grayling spawning is documented at and downstream of the crossing. Overwintering capacity is possible. The construction schedule should be accommodated in the period July 1-August 31 to avoid potential conflict with grayling and Dolly Varden.

Aishihik River (17-1) Mar. 1-Sept. 30, 1982

Supports five fish species including Arctic grayling and lake whitefish. Construction schedule conflicts with grayling spawning times and should not be initiated until July 1.

Unnamed (17-2) Mar. 1-Sept. 30, 1982

No sampling conducted. No overwintering potential. Construction schedule is probably acceptable.

Unnamed (17-3) Mar. 1-Sept. 30, 1982

No sampling conducted. Construction schedule is probably acceptable.

Cracker Creek (17-4) Mar. 1-Sept. 30, 1982

No overwintering potential. Construction schedule is probably acceptable.

Unnamed (18-1) Mar. 1-Sept. 30, 1982

No sampling conducted. Probably no overwintering capacity. Construction schedule is probably acceptable.

Section 5

Comment 1 applies to streams in Section 5.

Comment 1: Mainline summer construction has been designated for all stream crossings in this section except the Yukon River. Most streams in this section contain a wide diversity of fish species and, as a result, it is difficult to assess potential conflicts without more precise scheduling information for each of the crossings. We therefore request that scheduling be better defined so that potential problem areas can be identified and the necessity of additional studies determined.

Unnamed (18-2) Mar. 1-Sept. 30, 1983

No sampling conducted. Probably no overwintering capacity. Construction schedule is probably acceptable.

Unnamed (18-3) Mar. 1-Sept. 30, 1983

No sampling conducted. Probably no overwintering capacity. Construction schedule is probably acceptable.

*Mendenhall River (19-1) Mar. 1-Sept. 30, 1983

Supports seven fish species including chinook salmon, Arctic grayling and lake whitefish. Overwintering capacity is possible. This stream provides important rearing habitat for several species. Winter construction should be considered. Construction schedule would ideally be accommodated after emergence of chinook salmon in the Takhini River and prior to July 21 (upstream migrational period for chinook salmon).

Unnamed (20-1) Mar. 1-Sept. 30, 1983

No sampling conducted. Probably no overwintering capacity. Construction schedule is probably acceptable.

Stony Creek (20-2) Mar. 1-Sept. 30, 1983

No overwintering capacity. Construction schedule is probably acceptable.

*Takhini River (20-3) July 15-Aug. 15, 1983

Supports nine species of fish including chinook salmon, Arctic grayling, lake trout and lake whitefish. Overwintering capacity exists. Chinook salmon spawn both upstream and downstream of the crossing. Suggest change of schedule to the period June 21-July 21 to allow one month to minimize interference with chinook salmon spawning and migration, and most of the grayling spawning and emergence.

Unnamed (20-4) Mar. 1-Sept. 30, 1983

No sampling conducted. No known overwintering capacity. Could provide rearing habitat for juvenile chinook salmon. Construction schedule is probably acceptable.

Arkell Creek (21-1) Mar. 1-Sept. 30, 1983

Sampled but no fish collected. May provide rearing habitat for chinook salmon. Construction schedule should be accommodated in the period June 21-July 21 to avoid potential conflict with chinook salmon spawning migration and emergence.

Ibex River (21-2) Mar. 1-Sept. 30, 1983

The river is not crossed. Construction schedule is probably acceptable.

Ibex River (21-3) Mar. 1-Sept. 30, 1983

Supports chinook salmon and Arctic grayling. Alignment does not cross stream. Construction schedule is probably acceptable.

Ibex River (21-4) Mar. 1-Sept. 30, 1983

Sampled but no fish collected. Construction schedule is probably acceptable.

Fish Creek (22-1) Mar. 1-Sept. 30, 1983

Supports five species including lake trout and rainbow trout. Because of the small size of the stream and probable short duration of instream trenching, we do not consider it appropriate to designate this a special crossing and remove it from the mainline schedule. However, to accommodate spring spawners it would be preferable to schedule the crossing during the period July 1 to August 31, if mainline construction allows.

Wolf Creek (23-1) Mar. 1-Sept. 30, 1983

Supports chinook salmon and Arctic grayling spawning at or below the crossing. There is no overwintering capacity (see Fish Creek comment).

Cowley Creek (23-2) Mar. 1-Sept. 30, 1983

Supports four fish species including chinook salmon juveniles and Arctic grayling. Culvert barriers at Alaska Highway represent existing blockage to upstream salmon migration. The construction schedule is probably acceptable.

Yukon River (24-1) May 1-July 31, 1983

Supports multiple species. Excellent overwintering capacity exists. The construction schedule represents a direct conflict with chinook salmon migration and possible spawning in the vicinity of the crossing. It is suggested that the construction schedule be accommodated in the period May 1-July 21. Re-alignment to a point east (upstream) of the present highway crossing should be considered.

Unnamed (24-2) Mar. 1-Sept. 30, 1983

No sampling conducted. Probably no overwintering capacity. Construction schedule is probably acceptable.

Unnamed (24-3) Mar. 1-Sept. 30, 1983

No sampling conducted. Probably no overwintering capacity.
Construction schedule is probably acceptable.

Unnamed (24-4) Mar. 1-Sept. 30, 1983

No sampling conducted. Probably no overwintering capacity.
Construction schedule is probably acceptable.

*M'Clintock River (24-5) Mar. 1-April 30, 1983

Supports multiple species including chinook salmon, lake whitefish, and Arctic grayling. Excellent overwintering capacity exists. The construction schedule should be changed to May 21-July 21 to avoid conflict with adult chinook salmon migrations.

Unnamed (24-6) Mar. 1-Sept. 30, 1983

No sampling conducted. There is probably no overwintering capacity and the construction schedule is probably acceptable.

Greyling Creek (25-1) Mar. 1-Sept. 30, 1983

Arctic grayling spawning is indicated at the proposed crossing. The stream provides rearing habitat for juvenile chinook salmon. Barriers to the upstream migration of fish exist at the Alaska Highway crossing. The latter part of the indicated construction schedule is probably acceptable.

Unnamed (25-2)

Unnamed (26-1) } Mar. 1-Sept. 30, 1983

Unnamed (26-2) } No sampling conducted during pipeline investigations. Some of these streams support chinook

Unnamed (26-3) } salmon juveniles (see Comment 1).

Unnamed (26-4) }

Judas Creek (26-5) Mar. 1-Sept. 30, 1983

The data base is inadequate. There is probably no overwintering capacity and the construction schedule is probably acceptable.

(Note: Arctic grayling are present along the Alaska Highway alternate route.)

Unnamed (26-6) Mar. 1-Sept. 30, 1983

No sampling conducted. Probably no overwintering capacity. The construction schedule is probably acceptable.

Section 6

- Squanga Lake Inlet (27-1) April 1-Sept. 15, 1982
Hall Creek (27-2) }
Unnamed (27-3) } These streams are on the filed route,
Unnamed (27-4) } not on the preferred altered alignment.
Squanga Creek (27-5) }
- Seaforth Creek April 1-Sept. 15, 1982
 Supports five species including Arctic grayling and lake whitefish.
 Overwintering capacity probably exists. The construction schedule
 should be confined to the period July 1-Sept. 15.
- Unnamed (27-6) April 1-Sept. 15, 1982
 No sampling conducted. No overwintering capacity exists and the
 construction schedule is probably acceptable.
- *Teslin River (28-1) July 15-Aug. 15, 1982
 Supports multiple species including chinook salmon, lake trout,
 Arctic grayling. Possesses excellent overwintering capacity and
 is important for several biological activities. Construction
 should be confined to the period June 21-July 21.
- Unnamed (28-2) April 1-Sept. 15, 1982
 No sampling conducted. Probably no overwintering capacity. Con-
 struction schedule is probably acceptable.
- Unnamed (28-3) April 1-Sept. 15, 1982
 No sampling conducted. Probably no overwintering capacity.
 Construction schedule is probably acceptable.
- Brook's Brook (28-4) April 1-Sept. 15, 1982
 Supports six species of fish including chinook salmon, Arctic
 grayling, and lake whitefish. Overwintering capacity exists. The
 construction schedule is probably acceptable (see Comment 1).
- Unnamed (29-1) April 1-Sept. 15, 1982
 No sampling conducted. Probably no overwintering capacity. Con-
 struction schedule is probably acceptable.

Unnamed (29-2) April 1-Sept. 15, 1982

No sampling conducted. Probably no overwintering capacity. Construction schedule is probably acceptable.

Unnamed (29-3) April 1-Sept. 15, 1982

No sampling conducted. Probably no overwintering capacity. Construction schedule is probably acceptable.

Deadmans Creek (29-4) April 1-Sept. 15, 1982

Supports six species including grayling and lake whitefish. Overwintering capacity exists. Local reports indicate the possibility of chinook salmon spawning. Additional studies to confirm chinook salmon spawning are warranted. An abbreviation of the construction schedule may be necessary.

Lonetree Creek (29-5) April 1-Sept. 15, 1982

Supports Arctic grayling. Overwintering capacity is possible but the construction schedule is probably acceptable.

Unnamed (29-6) April 1-Sept. 15, 1982

No sampling conducted. Probably no overwintering capacity, and the construction schedule is probably acceptable.

Tenmile Creek (30-1) April 1-Sept. 15, 1982

Supports four fish species including chinook salmon juveniles and grayling. Overwintering capacity exists but the construction schedule is probably acceptable (see Comment 1).

Unnamed (30-2) April 1-Sept. 15, 1982

No sampling conducted. Probably no overwintering capacity, and the construction schedule is probably acceptable.

*Fox Creek (30-3) April 1-Sept. 15, 1982

Fox Creek supports seven fish species including chinook salmon, grayling and lake whitefish. Overwintering capacity exists (see Comment 1).

*Nisutlin Bay (30-4) June 15-Sept. 30, 1982

Supports multiple species including a migration of chinook salmon. Overwintering capacity exists and is documented. The construction schedule is probably acceptable.

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- Unnamed (31-1) } April 1-Sept. 15, 1982
Unnamed (31-2) } No sampling conducted, and probably no overwinter-
Unnamed (31-3) } ing capacity exists. The construction schedule is
Unnamed (31-4) } probably acceptable.
- Hays Creek (31-5) April 1-June 30, 1982
Supports chinook salmon and Arctic grayling. Overwintering capacity exists. The construction schedule is probably acceptable.
- Strawberry Creek (32-1) April 1-June 30, 1982
The construction schedule is probably acceptable, since the Alaska Highway presently represents a barrier to the upstream migration of fish.
- Unnamed (32-2) April 1-Sept. 15, 1982
No sampling conducted. Probably no overwintering capacity, and the construction schedule is probably acceptable.
- **Morley River (32-3) Aug. 1-Aug. 31, 1982
Supports multiple species including chinook salmon, grayling, lake trout and lake whitefish. Documented overwintering capacity. The construction schedule conflicts directly with the migration and spawning of chinook salmon. An abbreviated schedule (June 21-July 21) is suggested. Further study is recommended.
- Unnamed (33-1) April 1-Sept. 15, 1982
Supports grayling. Overwintering capacity is probable. The construction schedule is probably acceptable.
- Lower Hazel Creek (33-2) April 1-Sept. 15, 1982
Pike and sculpins have been collected. Overwintering capacity exists. The construction schedule is probably acceptable.
- Upper Hazel Creek (33-3) April 1-Sept. 15, 1982
Sampled, but no fish were collected. Overwintering capacity exists. Construction schedule is probably acceptable.
- Coconino Creek (33-4) April 1-Sept. 15, 1982
Sampling was not conducted. Probably no overwintering capacity, and construction schedule is probably acceptable.

Unnamed (34-1) April 1-Sept. 15, 1982

Sampling was not conducted. Probably no overwintering capacity, and construction schedule is probably acceptable.

*Smart River (34-2) April 1-Sept. 15, 1982

Supports multiple species including chinook salmon, grayling, Dolly Varden, lake whitefish and four others. Overwintering capacity exists. Chinook salmon spawn in the vicinity of the crossing. The construction schedule should be accommodated in the period June 21-July 21.

Unnamed (34-3) April 1-Sept. 15, 1982

No sampling conducted. Probably no overwintering capacity. The construction schedule is probably acceptable.

Logjam Creek (34-4) April 1-Sept. 15, 1982

Supports chinook salmon juveniles and Arctic grayling. Overwintering capacity exists. The construction schedule should be completed by July 21 to avoid downstream effects on chinook salmon spawning in the lower Swift River.

Section 7

Unnamed (35-1) April 1-Aug. 31, 1983

No sampling conducted. No overwintering capacity exists. The construction schedule is probably acceptable.

Unnamed (35-2) April 1-Aug. 31, 1983

No sampling conducted. No overwintering capacity exists. The construction schedule is probably acceptable.

Screw Creek (35-3) and Partridge Creek (35-4) April 1-Aug. 31, 1983

Sampled but no fish collected. Overwintering capacity exists. Construction schedule is probably acceptable.

Seagull Creek April 1-Aug. 31, 1983

The construction schedule is probably acceptable.

Swift River #1 (36-1) April 1-Aug. 31, 1983

Supports multiple species. Grayling spawn downstream of the

crossing. Construction should be accommodated in the period
July 1-August 31.

Swift River #2 (36-2)

Unnamed (36-3)

Swift River #3 (36-4)

} As above for Swift River #1.

Carlick Creek (37-1) April 1-Aug. 31, 1983

Sampled but no fish collected. Construction schedule is probably
acceptable.

Allen Creek

Freer Creek

Unnamed

Tootsee River

} April 1-Aug. 31, 1983

} No information is available. The collection of

} appropriate information is recommended.

Boulder Creek (38-4) April 1-Aug. 31, 1983

Construction schedule is probably acceptable.

Spencer Creek (39-1) April 1-Aug. 31, 1983

Construction schedule is probably acceptable.

Unnamed (39-2) April 1-Aug. 31, 1983

Construction schedule is probably acceptable.

Burnt Creek (39-3) April 1-Aug. 31, 1983

Construction schedule is probably acceptable.

Rancheria River (39-4) April 1-Aug. 31, 1983

Multiple species including grayling and Dolly Varden. Overwinter-
ing capacity exists. Compression of the construction schedule from
July 1-August 31 is advised to avoid interference with the
emergence of spring spawning species.

Big Creek (40-1) April 1-Aug. 31, 1983

Supports five species including grayling and Dolly Varden char.

The construction schedule is probably acceptable.

Little Rancheria River (41-1) April 1-Aug. 31, 1983

Supports five species including grayling and Dolly Varden char.

The construction schedule is probably acceptable.

Unnamed (42-1) April 1-Aug. 31, 1983

No sampling conducted. Probably no overwintering capacity. The construction schedule is probably acceptable.

Albert Creek (42-2) April 1-Aug. 31, 1983

Multiple species including grayling and lake whitefish. Overwintering capacity exists. Compression of the construction schedule from July 1-August 31 is advised to avoid interference with emergence of spring spawning species.

Department of Fisheries and Oceans

BRIEF NO. II(A)

COMPENSATION FOR FISHERIES DAMAGE

Submitted to:

Yukon Public Hearings Panel

April 23 - 28

Vancouver, B.C.

A. INTRODUCTION

The fisheries of the Yukon are of considerable significance for residents and tourists alike. The exact magnitude of importance is unknown, for reasons we will go into more fully in a moment. It is known, however, that most residents sport fish, that they spend in excess of \$3 million annually on fishing and other related pursuits, and that sport fishing represents an important component of the limited (relative to more southerly areas) amenity base for the Yukon. It is also known that the fisheries of the Yukon are an important part of the traditional resource base of Indian peoples, and that they play a significant subsistence role for many Indian and non-Indian residents. Finally, they support substantial business activity in outfitting and tourism, with the potential for even greater revenue returns upon successful conclusion of international negotiations concerning reciprocal fishing treaties.

Thus, fisheries are not a trivial resource for the Yukon - and it is against this backdrop that the potential impact of gas pipeline construction and operation must be evaluated.

A good deal of the E.I.S. information concerning recreational, commercial and subsistence fisheries has been taken from a report done for our Department by P. Eby and Associates Limited, and presented to the Environmental Assessment Panel Hearing in 1977. In that report, Mr. Eby stated:

"Owing to the brief time available and the paucity of site-specific data, this report is in no way definitive. An adequate assessment of potential impacts on utilization of fish resources would require detailed information on the following topics:

1. Engineering and construction plans, including stream crossings, manpower requirements, access road specifications, etc. Since alignment has not been finalized and construction details are vague, much of this needed information is currently lacking.
2. Biological and habitat characteristics and potential impact of pipeline activities, including site specific information on species composition and abundance, harvestable surplus and seasonal habitat use. No quantitative site-specific data has been provided by the Applicant on biological parameters or potential impacts.

3. Fishery resource use and impacts, including site specific effort and harvests, economic and socio-cultural values, and potential pipeline impacts. Even given the general lack of site specific information, the Applicant has treated this topic superficially.
4. Mitigation measures, both on general and site specific basis. The Applicant has stated an intention to mitigate adverse impacts, but provides little information on what mitigation measures will be required and their probable success."

Construction plans have advanced since that date, but biological and socio-economic information is little changed. Provisions for mitigation and compensation remain non-specific.

B. The Specifics of the E.I.S.

1. With respect to the recreational fishery

On page 2-11, it is stated that "...all other fish species (i.e., other than chinook salmon, chum salmon, Artic grayling, lake trout, lake Whitefish and Dolly Varden)...found in southern Yukon Territory drainages are considered of minor importance since they do not contribute significantly to regional economics and are judged to have limited ecological, scientific and aesthetic value."

On what information basis were the species mentioned above selected? Rainbow trout according to Eby's report (1977,12) are caught in the sport fishery by resident and tourist anglers, in slightly greater amounts than Dolly Varden. Dolly Varden are listed as an important species; but rainbow trout are not. Burbot, one of the four major species caught in the subsistence fishery (Eby 1977,21) are also not considered important in the E.I.S. Additionally northern pike are considered to be important by our Department.

On page 2-22, the additional fishing pressure from the increased work force is estimated at about 600-700 people. It is not clear whether this number takes into account the families of the additional work force and whether the additional pressure would be spread along the whole corridor, or concentrated at one or more sites during a specific time period? These questions could make a very significant difference to pressure on fishery resources.

On page 2-30, it is suggested: "Increased pressure may reduce catch per unit by recreational fisherman in some waters that are already heavily fished, but the effects are not expected to be long term or permanent. Changes in

commercial returns are not anticipated." Is there an informational basis for these statements? In particular, is there any information on the resiliency of these stocks if depleted by overfishing? It seems entirely possible that damage could be longer term, requiring more specific levels of replacement or compensation. Proper verification of the suggestion that recreational effects of the pipeline will not be long term, and that no commercial impacts are anticipated, is required.

With respect to the Table on page 6-169, it should be pointed out that distribution of recreational effort by major river system is only generally known. Each system involves a number of lakes, rivers and streams, so that information on site-specific effort is even less accurate. It is this information that is critical to assessing potential impact and recommending pipeline location and construction scheduling.

On page 6-170, the E.I.S. notes, "A 1972 telephone survey of Whitehorse residents indicated that 43 percent of the population fishes on occasion." The source document (Eby) notes that this figure is believed to be conservative for the Yukon as a whole, however. Generally, participation in outdoor recreational activities is higher in small rural communities than in large urban areas because of closeness of opportunities, and relative lack of alternative opportunities. Thus a conclusion closer to the 70 percent participation estimate (Burton) seems appropriate.

2. With respect to the Commercial Fishery

On page 6-166, it is observed that "Yukon River salmon contribute an undetermined share of the \$5.2 million Alaskan Yukon River salmon fishery." It should be further pointed out that the Canadian contribution to this fishery is likely substantial, and that Canada-U.S. negotiations with respect to a reciprocal agreement for compensation of country-of-origin for salmon harvesting by the other's commercial fishery are in progress. These negotiations are directed at returning value for fish taken, to country of origin, and would return substantial value to Canada from this fishery upon completion.

The statement on page 7-26 and concerning the commercial fishery of the Yukon River again notes no reference to the potentially reclaimable values downstream in Alaska.

With reference to Table 6.5-13 (pg. 6-168) "The Quantity and Value of Lake Trout and Whitefish Landed in Commercial and Domestic Fisheries within the Yukon Territories", the source is listed as Eby (1977,27). However, the following qualifying statement has been omitted.

"These figures are known to substantially understate freshwater harvests. While all commercial fishermen are supposed to report their catches, few do so."

3. With respect to the Subsistence Fishery

Again on page 6-170, and in discussing the Subsistence Fishery, no information is provided on native families or individuals who receive fish, but who do not fish themselves. Studies have shown that an important aspect of subsistence fishing is the sharing of catch among band members. (M. Bennet, Synergy West). Further, no information is provided on the use or dependency of non-status Indians on the fishery resource.

Harvests are also underestimated. Native people wishing to fish are required to obtain a free permit and report their catch. However, few do so, and in 1975 only 13 permits were issued in the Yukon (Eby, 1977,13).

It is also known that the list of Native fishing sites is incomplete (Eby, 1977,24).

Indian fisheries are again alluded to on page 7-24. Will the report done for the Council for Yukon Indians concerning hunting, fishing and traditional use areas be made available to Foothills? It would appear important that it be considered in planning, scheduling and designing the pipeline.

In summary, no proper methodological approach has been developed to value the subsistence fishery. In particular, the Native concept of resource banking has not been considered, and in fact could not have been considered in the time available for investigation.

4. Summary - Specific Concerns with the E.I.S.

In summary, we find the state of knowledge with respect to fishery resources and their use in the Yukon little changed from two years previous - and substantially incomplete. A decision to proceed as scheduled under such conditions; places substantial fishery resources in the Yukon at risk - and will inevitably result in some fishery losses. Such conditions of risk render the terms and conditions under which the pipeline is to be constructed,

and by which fishery resources and their users are to be protected, vitally important to the decisions before the panel. In this final section, we will therefore provide recommendations on how the pipeline process might proceed, given the substantial informational deficiencies displayed by the E.I.S.

C. Future Requirements and Recommendations

We applaud the inclusion in the Socio-Economic Terms and Conditions of the requirement "to replace or restore sites utilized for resource harvesting, or habitat critical to the resource utilized, where damage to such sites cannot be avoided", and the requirement to compensate where damage unavoidably occurs. As the interests of fishery users and of this department would be affected if losses occur, procedures to avoid, prevent, measure and compensate for loss must be dealt with effectively, and we will make recommendations in this regard.

It should be emphasized at the outset that avoidance of critical habitat areas and stock concentrations is a preferred fisheries strategy for construction activity. Further where stocks or critical habitat cannot be avoided, mitigative design and construction practices will be required. My colleagues will advise you in these matters as the Hearings progress.

As noted, however, in the face of grossly inadequate information on species location, abundance, timing and use - fishery losses will occur. A fair and operable process for determining compensation is therefore required.

In this section a process will be presented whereby an equitable method of compensation for damages might be achieved, where fisheries are lost to pipeline activities. Compensation may be "in kind" at site, (a preferred strategy where feasible), in the form of monies to produce "equally valued" fishery opportunities elsewhere in the Yukon, or in the form of a terminal cash payment.

There are, in essence, four interrelated problems associated with compensating payment for damage to fisheries. They are:

- 1) Determining the magnitude of fisheries losses
- 2) Establishing the dollar value of the fishery losses
- 3) Determining the rate of, and time needed for, recovery (if appropriate) from fisheries damage
- 4) Establishing even-handed adjudication in case of disputes regarding the previous three tasks.

These topics will be treated in the sections to follow.

1. Determining the Magnitude of Fishery Losses

a. Measuring Losses

In theory, it would seem a simple matter to observe the impact of pipeline construction, determine if fish are killed, and then assess damage. In practice, it is anything but. Mortality may affect juvenile fishes as well as adults. Damage may be incremental, and not identifiable - in part, or in whole - at site. And, in fact, damage to habitat, or populations of juveniles may not impact upon users until as much as seven years hence, when particular species would have reached adulthood. Finally, in an environment possessing many, often only partially understood, natural interrelationships - and impacted on by any number of man-related activities - definitive assessment of precise cause and effect relationships between pipeline construction impacts and fisheries mortalities will be difficult, and often impossible. This problem is intensified in the present case by the absence of even rudimentary data at a large number of site-specific locations. It follows that assessment of damage will, at best, be a combination of assessment of the partial data base available concerning stock levels, seasonal and cyclical abundance and location, together with a scientific judgement of "most likely" result of environmental damage, based on general understanding of fisheries' habitat dependencies and tolerances. As noted earlier, these types of judgements put extreme pressure on fishery scientists, and pose unknown risks for the fishery. In such cases, and where the only other alternative is to stand mute and observe a steady erosion of fishery values - uncorrected and uncompensated for - a judgemental "range of estimate" assessment technique has been developed.* This method assesses a lowest possible, a highest possible, and

*See P.A. Meyer and R.R. Dolphin. "A System for Determining Economic Loss Associated with Estuary Degradation", Coastal Zone Management Journal, Vol. 3, No. 4, 1977, pp. 385-404.

a most likely estimate of impact, and uses curvilinear probability estimates to develop a "most likely" impact statement. The Department of Fisheries and Oceans submits that such a process should be developed for specific application to situations of possible pipeline damage to fisheries, and is prepared to assist in same.

b. The Burden of Proof

The decision to proceed with pipeline construction in the face of inadequate knowledge concerning abundance and location of Yukon fisheries and their human users, by season and by year, is no longer an issue. Such a decision accepts a significant degree of risk, however - and it is clear that the burden of such risk should fall on the beneficiary of the decision to proceed - the proponent. In practical terms there are two implications of this concern.

First, it is desirable to build an extra measure of safety into damage estimates calculated in the face of high uncertainty. A process to integrate such an "environmental factor of safety" into damage calculations has been developed** - again based upon established engineering and business principles. It is recommended that such a safety factor be incorporated into the damage estimation technique presented above. Our Department is again prepared to assist in this process.

Second, because damage estimates will be based upon scanty or incomplete knowledge, and will often be probabalistic in nature, it is possible that estimates of "most likely" level of damage may, from time to time, vary. Again, it is this Department's belief that in such cases of difference, the "onus of proof" to explain lower bound estimates must lie with the proponent. This recommendation is based upon the recognition that the proponent is the potential beneficiary of both an early (relative to time required for adequate environmental inventory) pipeline start, and of any lower damage estimate that is put forth.

2. Establishing the Dollar Value of Fishery Losses

Where values exist in private markets, and the impact estimating problems discussed in the previous section can be overcome, dollar loss assessments are straight forward. Thus, a private commercial fisherman, a sport fishing

**See previous citation.

guide, or a resort owner who loses money due to pipeline construction damage is in a position to identify such loss, and claim compensation. By far the greatest proportion of fishery related user values do not fall within private and/or Territorial markets however.

First, there is the multi-million dollar Alaska salmon fishery based upon Yukon River stocks. Successful completion of the international negotiations presently underway - and based upon the principle of compensation to country of origin - would return significant revenues to Canada. Damage to these stocks from pipeline activities would therefore likely require the Department of Fisheries and Oceans to play a role in compensatory proceedings.

Of perhaps equal importance will be the very large values that Yukon residents place upon fishery related subsistence and recreation activities in the Yukon that are not (in part or in whole) captured by private market transactions. In such a case, traditional economic theory seeks a close proxy to market value. This proxy is usually obtained by direct inquiry of potentially affected residents. Where vested fishery opportunities are damaged, eliminated, or expropriated, the closest enquiry approximating private market conditions is of the form: "What amount of money would you have to receive to leave you as well off as if the damage to your fishery opportunities had not occurred?"

Where damage is very localized, fishing alternatives exist close by, and these alternative opportunities are not fully utilized, responses to such a question can be expected to be relatively moderate. Where damage ranges further, where alternative local fishery opportunities are limited, or where they are already fully utilized, experience from similar surveys elsewhere*** suggests that compensatory claims can be very high - and that many respondents will give "not for sale" types of responses. This "not for sale" response was a relevant consideration before the decision to build the pipeline was made. Having reached that decision, however, it becomes a difficulty for compensatory evaluations - as the respondent supplies no numerical response to the "what would you sell for" question - and thus effectively disenfranchises himself or herself from the compensatory dialogue. Such a result is unacceptable, as it is precisely those who deem themselves "most affected" that usually give non-numerical answers.

***For a contemporary discussion see: P.A. Meyer, "Publically Vested Values for Fish and Wildlife - Criteria in Economic Welfare and the Law". Land Economics (forthcoming), May, 1979.

In considering the difficulty discussed in the previous paragraph, the Department of Fisheries and Oceans has developed an alternative to valuation.**** This approach takes cognizance of the fact that trade-off decisions may occur between development and environment, and relates fishery value questions to general public priorities for services. It has been utilized in both British Columbia and subsequently, California - and could be employed, with appropriate site-specific focus, to develop baseline values in the pipeline corridor against which any subsequent damage could be assessed. It should be emphasized, however, that while this approach captures numerical values for most respondents - and yields generally consistent results - it is susceptible to respondent emotion if applied after damage has taken place. It is recommended that such fishery value baselines be established in the pipeline corridor as soon as is possible.

Finally, this methodology has not been applied where significant native Indian values are at stake. Advice from Indian peoples as to its appropriateness for them should be sought prior to a decision to include them or not.

In sum, dollar estimates of fishery loss will depend upon "uncertain" estimates of damaging impact, will often involve public as well as private damages, and will require estimation of public values at risk. In such circumstances, the most certain and effective form of compensation will likely be "in kind" - the provision of new fishery opportunities at a level similar to those damaged - and in the same location. Where this is not possible, a value estimating methodology, similar to that described above, will be required. That methodology will be most effective in resolving claims issues to the extent that satisfactory procedures, processes and requisite data are established prior to damage occurring - so that extreme postures associated with "negotiating" losses are less apparent.

3. Determining Recovery

Where gas pipeline construction is concerned, it is unlikely that damage to fisheries will be irreversible. Consequently, while the procedures of the previous two sections may provide a present estimate of dollar value lost - that

****For a recent application of this approach, see: P.A. Meyer, Updated Estimates for Recreation and Preservation Values Associated with the Salmon and Steelhead of the Fraser River. Fisheries and Environment Canada, Vancouver, 1978.

loss is unlikely to proceed into the future indefinitely. It is therefore recommended that a program of post facto monitoring be applied to damaged fishery resources, and that compensatory payments only be extended forward to the extent that recovery is not achieved. Again, such monitoring would often be judgemental, and would involve some of the types of processes described in Section (1).

4. Adjudication Procedures and Process

Notwithstanding the availability of methodologies to provide judgemental estimate of the value of fishery losses due to pipeline related activities, experience in other areas involving negotiation and/or expropriation suggest that disagreements will sometimes occur, and that they may not always be resolved voluntarily. Thus, estimates of damage, of values lost, and of rate of recovery could diverge - especially where data is sparse. In such cases, an adjudicating procedure may be necessary. It is recognized that the Department of Fisheries and Oceans may be required to play an advisory role in all three of these areas - and provision should be made to this end in both this process' administrative procedures and funding. Final resolution of disputes, however, should be by a body, whether judicial or administrative, without other responsibilities, either direct or indirect, to the pipeline project. Only in this way, experience suggests, will both project proponent and plaintiff for damages receive a balanced hearing from the adjudicatory process.

It is also recognized that processes of negotiation and adjudication are sometimes time consuming and expensive - and often become unequal contests between parties possessing grossly unequal financial resources and access to expertise. Consistent with placing the onus of proof on the pipeline proponent, individuals or groups who wish to present compensatory claims, and who, in the view of an independent screening officer, may have reasonable cause, should have their claims assessed in a manner similar to that outlined here (encompassing a damage estimate, a dollar loss estimate, and a recovery monitoring procedure) at project expense, and under the direction of the independent adjudicator or his staff.

Finally, because the extent of damage may not be fully evident, in the case of salmon, for instance, for several years - and because recovery may take a further period of time, it is possible that the special agencies and procedures

set up to build the pipeline and protect the environment may be terminated prior to full recovery of all damaged species. In that case, it is recommended that supervisory responsibility for continued recovery monitoring and over the fulfillment of any still outstanding compensatory obligations, be returned - in the case of fisheries - to the Department of Fisheries and Oceans.

D. Potential Electrification of the Gas Pipeline

In closing, I should like to return briefly to Section 11-3 of the E.I.S., and concerning possible electrification of the pipeline. At the hearings conducted in 1977, this Department made it clear that it considered the question of hydro-electric generation in the Yukon a decision separate from the decision to build a gas pipeline. Construction of hydro-electric facilities often involves significant or even massive risk for fishery resources - beyond those posed by the pipeline itself.

For these reasons, we welcome the statement in the E.I.S. that public hearings would be held prior to any contract negotiations on electrification. This Department would expect to play an active role in any such hearings.

E. Recommendations

It is recommended that an equitable method of compensation be developed for fishery losses which occur during pipeline construction. Compensation may be "in kind" at site, (a preferred strategy where feasible), in the form of monies to produce "equally valued" fishery opportunities elsewhere in the Yukon, or in the form of a terminal cash payment. This document has outlined a methodological approach, and has discussed the major problems associated with compensation payment for damages to fisheries. The Department of Fisheries and Oceans stands ready to assist in this regard.

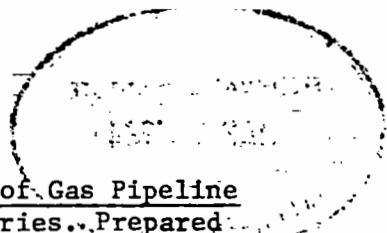
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