BEFORE THE
FEDERAL ENERGY REGULATORY COMMISSION

APPLICATION FOR LICENSE FOR MAJOR PROJECT

SUSITNA HYDROELECTRIC PROJECT

VOLUME 10B

EXHIBIT E
Chapter 11

FEBRUARY 1983

Prepared by:

ACRES

ALASKA POWER AUTHORITY

SUSITNA HYDROELECTRIC PROJECT

VOLUME 10B

EXHIBIT E CHAPTER 11

APPENDICES I THROUGH J

AGENCY CONSULTATION

APPENDIX E11I

CORRESPONDENCE RELATING TO DRAFT LICENSE REVIEW

APPENDIX 11.I

DRAFT LICENSE REVIEW

On November 15, 1982, a Draft Exhibit E of the license application was distributed to appropriate federal, state, and local agencies. Following the workshop (see Appendix 11.H) and the 60-day review period, comments were received from the resource agencies. This appendix contains copies of all agency correspondence received related to review of Draft Exhibit E.

Responses to all these comments are contained in Volume ___ of this chapter. Comments relating to any mitigation measures or facilities recommended by the agencies are addressed specifically at the end of the appropriate chapters of Exhibit E.

ACRES

November 15, 1982

Dear

Susitna Hydroelectric Project
Document Transmittal

On behalf of the Alaska Power Authority I am pleased to provide herewith a draft of Exhibit E of the license application for the Susitna Hydroelectric Project. Your earliest possible review and comment would be very much appreciated.

Approximately a month ago, Acres American Incorporated informed you that today's distribution would be made, and advised you of our plans to hold a workshop during the week of November 29 through December 3, 1982. I am convinced that, with your cooperation, the workshop sessions will be extremely valuable to us as a partial basis for refining and improving the enclosed document.

Earlier this year, your agency received copies of the draft feasibility report for the Susitna Hydroelectric Project. With a few exceptions generally noted in the attached document, Volume 1 (Engineering and Economic Aspects) of the draft feasibility report remains valid. (Particularly important project changes since March, 1982 include a new access plan and a major modification to the post-project flow regime.) Volume 2 (Environmental Report) of the draft feasibility report is superseded by the attached draft Exhibit E.

Simultaneously with your receipt of this draft Exhibit, we are delivering copies of the draft license application to the Federal Energy Regulatory Commission (FERC). FERC's critical review along with your input to us will greatly influence the content of the final application now planned for submission on February 15, 1983.

It is my sincere desire that we can together achieve interactive, face-to-face consultation on the various aspects of the project. The workshop noted above will be valuable in that regard. Insofar as written comments are concerned, I would very much appreciate it if we could receive them -- even in draft form if necessary -- by the end of December. The final deadline for receipt of written comments is 60 days after your receipt of the enclosed document.

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The Liberty Bank Building, Main at Court
Buffalo, New York 14202
Telephone 716-853-7525 Telex 91-6423 ACRES BUF
Other Offices: Columbia, MD; Pittsburgh, PA; Raleigh, NC; Washington, DC

Please be assured that after the official application is submitted to FERC, you will have continuing opportunity for review as an essential part in the licensing process.

Thanking you in advance for your diligent efforts on this important matter, I am

Sincerely,

C. A. Debelius
Project Manager

Encl: a/s

Letter on Preceding Page and
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UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
P.O. Box 1668
Juneau, Alaska 99802

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ALASKA POWER AUTHORITY
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November 29, 1982

Mr. Eric Yould
Executive Director, Alaska Power Authority
334 West 5th. Ave.
Anchorage, Alaska 99510

Dear Mr. Yould:

We have received a letter from Acres American dated November 15, 1982, accompanying the Draft FERC license application Exhibit E for the Susitna Hydroelectric Project. In that letter our comments are requested, and a deadline for receipt of written comments established as 60 days after receipt of the document. As you know, the FERC guidelines require consultation between the applicant and the National Marine Fisheries Service (NMFS) regarding project impact to the environment. Specifically, Subpart E, section 4.41 (f) requires an environmental report (License Exhibit E) to be prepared after consultation with NMFS and that NMFS shall be afforded a minimum of sixty (60) days for consultation and documentation of concerns. The FERC has clarified this process in its April 1982 publication <u>Application Procedures for Hydropower Licenses, Exemptions and Preliminary Permits</u>. Appendix A of this document concerns the Consultation Process, and describes a three-level process; <u>initial agency contact</u> after which an application is prepared; <u>formal consultation</u> requested by the applicant who at this stage provides NMFS with a copy of the application, a detailed description of the project and the results of any studies performed, then must allow a minimum of 60 days for agency comment; and finally <u>documentation</u> of the consultation process, wherein the applicant presents in the application its response to comments and recommendations received during the agency review period.

As we enter the second stage of this process, our agency recognizes the concerns over permitting and licensing delays and wishes to provide as timely a response as possible. However, the 60 day review constitutes the <u>minimum</u> period prescribed by FERC for all projects larger than 5 MW. Considering the magnitude of the Susitna proposal and the environmental values which must be addressed, we believe a more liberal response period is certainly appropriate.

Also, as suggested by the FERC 1982 Application Procedures, our review would be facilitated by receiving the complete application and we request that such be provided.

Sincerely,

for James W. Brooks

Robert W. McVey
Director, Alaska Region

DEC 08 1982

ALASKA POWER AUTHORITY

34 WEST 5th AVENUE - ANCHORAGE, ALASKA 99501

Phone: (907) 277-7641
(907) 276-0001

ALASKA POWER AUTHORITY
SUSITNA
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Susitna File 78.2.7
Task 7.1
December 6, 1982

Mr. Robert W. McVey
Director, Alaska Region
National Marine Fisheries Service
P.O. Box 1668
Juneau, Alaska 99802

Subject: Review of Draft Exhibit E, Susitna Hydroelectric Project

Dear Mr. McVey:

The Alaska Power Authority appreciates the burden that our request for a sixty-day review and comment on the Draft Exhibit E makes upon your staff. To assist them in their review, we presented extensive material to agency personnel during the review workshop from November 29, 1982, through December 2, 1982. Our intention was to facilitate the sixty-day review and comment period which we feel must be maintained if the Power Authority is to remain on its submission schedule.

The letter transmitting a copy of Draft Exhibit E pointed out that the description of facilities remained unchanged from that found in the Feasibility Report (with the exception of access and transmission routes). As your agency is already in receipt of the Feasibility Report, we did not send you copies of the engineering draft exhibits. Until submission of the formal application, we are trying to minimize distribution of transitory documents to reduce the burden of review upon agencies. We suggest it may be appropriate to wait for the application document in February, but, if you wish to review these documents as well, we will attempt to make a set available.

Sincerely,

FOR THE EXECUTIVE DIRECTOR

Richard S. Fleming
Deputy Project Manager, Environment
Susitna Hydroelectric Project

RSF:cb

cc: John Hayden, Acres American, Anchorage
Gary Lawley, Envirosphere, Anchorage

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
701 C St. Box 43
Anchorage, Alaska 99513

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ALASKA POWER AUTHORITY SUSITNA			
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January 12, 1983

Mr. Eric Yould
Executive Director
Alaska Power Authority
334 W. 5th. Ave.
Anchorage, Alaska 99501

Dear Mr. Yould:

The National Marine Fisheries Service is currently reviewing the draft license application Exhibit E for the Susitna Hydroelectric project. Due to staffing constraints and the magnitude of the Susitna project, we will require a review period exceeding the 60 day minimum specified in the FERC regulations. We anticipate our official response will be completed and available to you by January 28 of this year.

Sincerely,

Ronald J. Morris
Western Alaska Office Supervisor
Environmental Assessment Division

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
P.O. Box 1668
Juneau, Alaska 99802

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Mr. Eric Yould
Executive Director, Alaska Power Authority
334 W. 5th Avenue
Anchorage, Alaska 99501

Dear Mr. Yould:

The National Marine Fisheries Service (NMFS) is entrusted with Federal jurisdiction over marine, estuarine, and anadromous fishery resources. Under Reorganization Plan No. 4 of 1970, 3 C.F.R. Section 203 (1970 compilation), reprinted in 5 U.S.C. Appendix II at 64 (1970), NMFS was established to exercise those functions previously carried out by the Bureau of Commercial Fisheries. By virtue of this delegation of authority, NMFS is responsible for oversight and evaluation of activities which may affect marine, estuarine, and anadromous fishery resources. Under the Fish and Wildlife Act of 1956, 16 U.S.C. Section 661-666 (c) requires that NMFS be consulted "whenever the waters of any stream or other body of water are proposed or authorized to be impounded... for any purpose whatever... by any public or private agency under Federal permit or license." NMFS interests in the protection of marine, estuarine, and anadromous fishery resources also derives from the Anadromous Fish Conservation Act, the Magnuson Fishery Conservation and Management Act, and the National Environmental Policy Act. The FERC rules and regulations require consultation with NMFS whenever a project may affect anadromous, estuarine, or marine fishery resources.

The National Marine Fisheries Service has reviewed draft Exhibit E of the license application for the Susitna Hydroelectric Project. We are submitting comments on this document which satisfy, in part, the agency coordination mechanism established by the Federal Energy Regulatory Commission (FERC). The formal position of NMFS in regards to the Susitna Project has been requested and provided to the Alaska Power Authority (APA) in several previous instances. Specifically, we refer to the following NMFS correspondence which should be considered, along with the Exhibit E comments, as formal coordination.

✓1. Letter to Eric Yould from Robert McVey, Director, Alaska Region NMFS, November 29, 1982.

✓2. Statement of Robert McVey before the Alaska Power Authority Board of Directors, April 16, 1982.

3. Letter to Eric Yould from Robert McVey, October 15, 1982.

APR 11 1983
Harza-Ebasco

Because of the nature and magnitude of this project, and certain unresolved issues concerning resources for which NMFS bears responsibility, we do not feel the formal consultation process is complete at this stage. NMFS will continue to assist your agency throughout the planning and licensing process.

General Comments

Our review found this license exhibit to be very informative and generally well developed. It represents a considerable improvement over the 1981 Feasibility Report, particularly in its consideration of filling concerns and in discussing project effects from a Watana alone and Watana/Devil Canyon combined perspective.

We have not commented extensively on chapters 5, Socioeconomic impacts or 10, Alternatives. However we believe it is important to recognize certain recent developments which will influence the feasibility of this project. World oil prices have failed to escalate as projected in earlier economic studies. Natural gas alternatives have been influenced by recent pricing agreements and a proposal to construct a gas pipeline capable of supplying much of the Southcentral population. We have recently reviewed the Battelle Railbelt Electric Power Authority Study Newsletter #4, December, 1982. This newsletter presents an updated electrical demand forecast which, for the year 2010, is 44 percent lower than the 1980 ISER forecast. Load forecasts will dictate facility design and operations which, in turn, will determine the amount of water required for power production and available for downstream fisheries flow. In an ACRES report of October 1982, Energy Simulation Studies to Select Project Drawdown and Mitigation Flows, energy simulations were made which assumed a medium load forecast for the year 2010 of 7791 GWH, a figure significantly in excess of the recent Battelle forecast of 3844 and 4986 for medium and low 2010 demand. It appears that many of the basic economic premises upon which this project was planned have now changed. We believe the license application should fully consider the impact of these events and discuss their effect or impact on overall project feasibility, the need for Watana to be operational by 1993, and the economics associated with providing sufficient downstream flows to minimize fishery impacts.

The data gathered from the environmental field studies, begun in June 1981, and presented in the Exhibit, show the Susitna River system to support large, valuable runs of pacific salmon, other anadromous fish, and several freshwater resident fish species. The proposed project would impact these resources, particularly in that reach of the Susitna River between Devil Canyon and Talkeetna. The primary interests and concerns of NMFS in the Susitna feasibility studies have been to assure that (1) the fishery resources are identified and quantified, (2) specific impacts are identified, (3) impacts are avoided whenever possible, and (4) specific and effective mitigative measures are developed for all unavoidable adverse impacts.

The results of these studies and other materials presented within license Exhibit E indicate that project construction and operation will significantly affect fishery resources through changes in streamflow, water quality, temperatures, ice conditions, vegetation, and slough habitat. Studies to identify and assess these changes and to describe the fishery resources of the project area were initiated in 1981. At this time two field seasons of data have been gathered. However, the draft Exhibit E does not include most of the 1982 data nor the results or analysis of that data. The document clearly suffers by this omission, and we recommend that Exhibit E of the license application include a presentation and analysis of the 1982 data.

Throughout Exhibit E references are made to ongoing or proposed studies which will address issues we consider critical to the feasibility of this project. Yet it is not clear what these studies will entail, who will conduct them or when they will occur. We recommend that the license application detail ongoing and proposed studies.

The information presented in Exhibit E regarding reservoir operations does not sufficiently convey the range of impacts presented by the project. We recommend the license application be expanded to include a more precise description of impacts and present the following design/operating concerns:

- Flow releases - based upon weekly rather than monthly averages.
- Quantification of "normal" spillages, below the 1 in 50 year event, passed through the outlet/cone valve facility.
- Potential peaking operations at Watana without the Devil Canyon Dam. ACRES has identified this as a possibility. What circumstances would dictate such operation? What daily and hourly fluctuations would result? How would such fluctuations be attenuated by tributary input and the river distance between Watana and Devil Canyon?
- Compensation flow pumps at the Devil Canyon facility. What flows will they provide? How were these flows established? Are these pumps still planned for this facility?

We continue to be concerned about development of a release schedule which would mitigate impacts to fisheries. The draft Exhibit E states that reduced flows could impair fish migration, de-water spawning and rearing habitat, prevent access to slough and side channel habitats, and lower or eliminate inter-gravel flows to slough and side channel spawning grounds. The minimum flows proposed in Exhibit E, however, were not developed using any recognized in-stream flow predictive methodologies, and may not constitute the preferred flow regime for minimizing such effects. The license exhibits do not explain how the 12,000 cubic feet per second (cfs) minimum operational flows for August and September were determined. We note that these flows have been reduced from those recommended minimum flows presented in the 1982 Final Draft Feasibility Report, Volume 2. Similarly, no rationale is provided which supports "minimum" winter flows ten times that of existing natural winter flows. We believe that maximum winter flow limits should be required as well, particularly in light of potential staging should ice cover develop below Devil Canyon.

Exhibit E suggests that it may be desirable to spike spring flows to accommodate out-migrants and facilitate flushing of sloughs and side channels. It also states that the project release schedule will need to incorporate both volume and temperature considerations. However, neither of these concerns is reflected in the proposed flow regime. The release schedule presented is not supported by biological data, nor does it reflect concerns for fish passage. We recommend that the license application contain a specific, detailed flow release schedule, developed through a quantifiable in-stream flow analysis and coordinated with NMFS, US Fish and Wildlife Service and the Alaska Department of Fish and Game (ADFG), which would minimize impacts and/or enhance conditions for spawning, feeding, passage, out-migration, and overwintering in the Susitna River.

The Watana and Devil Canyon dams will cause changes to the existing water temperature regime of the Susitna River, generally releasing cooler water during summer months and warmer water in winter. Temperature variations affect the ability of fish to migrate, spawn, feed, and develop in the Susitna system. Ice formation will be delayed or possibly not occur. Exhibit E discusses this matter at length but does not present an accurate description of post-project temperature alterations. A model was developed to project temperatures, yet it has been operated with only one year of data (1981). Further, this model was run only for the months of June through October. Temperature modeling is not presented for the Devil Canyon Reservoir, yet Exhibit E states that the location of ice formation above Talkeetna will depend on the outflow temperatures from Devil Canyon Dam.

Realizing the importance of an accurate understanding of the thermal structure within the reservoirs and of outflow temperatures, we believe additional information is warranted. We recommend that modeling be done for both reservoirs throughout the year, and the resultant data be incorporated into the riverine temperature model calibrated with at least two seasons data.

Of the various fish habitats below Devil Canyon Dam, the sloughs between Talkeetna and Portage Creek are the most likely to be adversely affected by the proposed work. Approximately thirty-five sloughs exist in this reach. Adult salmon have been observed in at least twenty-six of these. Post project flows and water temperatures will present several significant impacts to these habitats. These are discussed in some detail in Exhibit E. However, on only one of these, slough 9, has detailed investigation been conducted which included groundwater flow, upwelling, and temperature studies. These sloughs are the most important spawning areas influenced by the mainstem Susitna River. They are also identified as potential sites for mitigating fishery resource losses through physical modification. We feel it is important therefore, that Exhibit E present an informed opinion based on site specific data as to the effects of project operation on slough habitat. In a draft report prepared for Acres American, Inc. [1], the author notes that until the 1982 field data are analyzed, any statements regarding streamflows necessary for chum salmon access to the side sloughs are provisional. Within Exhibit E, there are vague and seemingly contradictory statements concerning slough impacts. Statements are made within this Exhibit that data on the areal extent of upwelling within the sloughs at low flows are not presently available, that ground water upwelling is driven by mainstem river stage, that spawning areas of the sloughs may be affected by reduced upwelling, and that flows of 16,000 to 18,000 cfs are required for easy access to the sloughs. The document also contains statements that 12,000 cfs will provide access to most sloughs, that a 12,000 cfs release will assist in maintaining groundwater flow and upwelling within sloughs, and that changes in streamflow during the open water season predicted under operation of Devil Canyon are not expected to affect slough habitats. Clearly, post-project impacts to these important and sensitive habitats are poorly understood. NMFS recommends that the final license application contain the results and analysis of the 1982 field data being gathered by the Alaska Department of Fish and Game, et al, and results of an expanded study of sloughs in the Devil Canyon to Talkeetna reach which would provide a larger and more representative sample than currently available.

Exhibit E discusses the impact of project construction and operations on river ice formation. Apparently, post-project ice formation will be delayed due to higher release temperatures from Devil Canyon. Currently, ice originating from the upper Susitna contributes 75 to 85 percent of the ice load to the lower River. With this input reduced or delayed by the project, ice formation on the lower River will be affected. This impact is not adequately discussed in the Exhibit.

Ice formation above Talkeetna will also be delayed by the project. The location of the ice front in this reach has important implications to fisheries habitat within the mainstem, side channels, and sloughs. In areas with ice cover, staging is expected to occur which would increase water surface elevations, possibly increasing upwelling, overtopping the upstream berms of sloughs, and causing high velocities and scour to occur.

In those areas where ice formation does not occur, water elevations would drop below natuarally occurring levels, leading to potential de-watering of spawning gravels and reductions in upwelling areas. Exhibit E predicts that the ice front should occur at some location between Talkeetna, RM 100 and Sherman, RM 130 and will depend upon the upstream temperature, i.e. the Devil Canyon outflow. As no model was completed for winter riverine or reservoir temperatures, the full scope and measure of these effects cannot be assessed.

1. Preliminary Assessment of access by Spawning Salmon to Side Slough Habitat above Talkeetna. Draft Report. ACRES American, Inc. November, 1982.

Measures to mitigate unavoidable impacts to fisheries resources are presented in the Exhibit. Many of those measures designed to mitigate construction impacts effectively address this concern. Development of a flow regime that minimizes loss of habitat and maintains normal timing of flow related biological stimuli is also proposed. We recommend that such a release schedule be included in the final license application. The Exhibit proposes to mitigate fishery losses by physical modification of side sloughs and creation of mainstem and side channel spawning areas. This vague commitment to an approach that is only a paper concept dependent upon the results of ongoing or proposed studies does not allow us to fully evaluate the feasibility of the proposed project nor to assess the effectiveness with which project impacts can be mitigated.

We support the concept of retaining the habitat value of side sloughs through physical alteration. Further, we recommend that Exhibit E incorporate a slough mitigation plan which identifies the sloughs to be modified, the design criteria, and the operational plan and target fish species specific to each slough. Details for the mitigation goals and operational monitoring efforts for this plan should be included. The applicant should note, however, that we feel the release schedule proposed in Exhibit E should be refined based upon an accepted instream flow predictive methodology and the specific requirements of the selected species. We believe this is essential to serious consideration of a slough modification program.

Exhibit E states that if alternative mitigation schemes prove infeasible, a hatchery could be developed. While we regard such artificial methods to be the least desirable form of addressing fishery losses, we realize that slough modification is largely untried in Alaska and that these mitigative efforts may indeed fail. Therefore, we recommend that Exhibit E should advance this discussion beyond the statement that "a hatchery could be developed." Information should be included within license Exhibit E which describes the number of hatcheries needed, locations, sizes, what the production target for each species would be, and cost estimates.

Finally, none of the mitigative measures presented comply with FERC rules and regulations under Section 4.41 (F)(3)(iii); i.e., costs for these features are not presented, nor are design plans for mitigation features included.

Specific Comments

Exhibit E

Chapter One - No comment.

Chapter Two

page 15, para. 4. Breakup
The section should describe when breakup normally occurs, specifically the dates of the earliest, mean, and latest recorded events.

page 38, para. 3
This section should consider that at least eight sloughs exist above Gold Creek, several of which support large numbers of spawning salmon, e.g., slough 21. While Gold Creek may be a logical point at which to gauge flow, it does not necessarily guarantee that upstream flow will be sufficient to maintain habitat value in these sloughs. Exhibit E should discuss this concern and recommend necessary measures to guarantee adequate flow to these sloughs.

page 47. Section (v) Impacts on Sloughs
The section notes that data to confirm the areal extent of upwelling at low flows are unavailable at this time. Currently only one slough has been investigated sufficiently to predict project influences on groundwater and upwelling. This slough is not representative of all such sloughs in the Devil Canyon to Talkeetna reach.
Under existing winter flows, ice formation causes staging equivalent to an open water flow elevation exceeding 20,000 cfs. Filling flows of 1,000 cfs, for which ice formation may be delayed or fail to occur, could significantly impact sloughs through de-watering gravel spawning areas and overwintering habitat.

page 49, para 2
As the temperature of groundwater is considered a function of the average annual temperature of the mainstem Susitna; what will be the impacts of the second filling year release temperatures to the groundwater? How long would any change persist? No data are presented to support the statement that groundwater temperatures will not change.

page 51, para 3. Monthly Energy Simulations
The referenced program utilized load forecasts developed by ISER, Woodward-Clyde, and Battelle. These forecasts are now seriously questioned in light of recent developments (see General Comments). We recommend these simulation studies be updated and run with the most recent load forecasts available.

page 58, para. 1. Reservoir and Outlet Water Temperatures
This suggests that winter outflow temperatures between 1° and 4°C can be selectively withdrawn through a multiple intake structure. This control would be dependent upon the thermal profile of the reservoir during winter, a set of conditions which has not been modeled. Therefore, we question the validity of the statement which suggests one degree water temperatures would be available on request. Information presented by ACRES during the Nov. 29 - Dec. 3 workshop showed winter temperatures in Eklutna Lake to be between 0 and 3.6° in the upper 2 meters, while isothermal conditions exist below this level.

page 59, para. 2. Ice
It is not clear what impact will occur to the lower River from reduction of ice flow from the upper Susitna. How far downriver would ice formation occur? When does freeze-up normally occur?

page 91, para. 2. Mitigation of Watana Impoundment Impacts
This section states that a proposed 12,000 cfs flow at Gold Creek would provide salmon access to most of the sloughs and would assist in maintaining adequate ground water levels and upwelling rates. There are no studies which would support these conclusions, as only one of approximately thirty-six sloughs has receive detailed study. Similarly, current information does not permit the development of mitigation measures within the sloughs, as stated in the last paragraph on this page.

page 93, para. 2. Nitrogen Supersaturation
While we support the concept of installing cone valves at the outlet works of both dams, the subject requires further discussion. These valves will only operate (and afford gas supersaturation benefits) during spillages below the 1 in 50 year high flow event. According to the discussion presented on pages 79 through 81, such spillages would be a relatively uncommon event (for the 32 year period simulated, there were 4 years during which spillages occurred). The discussion on these valves should present data on their frequency of use and explain the criteria by which they are planned and installed. This should include the following:

1. Potential temperature impacts resulting from withdrawal from these outlet structures.
2. Potential impacts to river ice formation attributed to operation of these valves during winter.

page 95, para. 1. Temperature
The discussion of Devil Canyon post-project temperature mitigation is inadequate. What advantages are gained by the multiple release structure? Will Devil Canyon reservoir stratify during summer and winter?

Chapter Three

page 8, para. 2
"Since the greatest changes in physical habitats are expected in the reach between Talkeetna and Devil Canyon, fishery resources using that portion of the river were considered to be the most sensitive to project effects." Transforming the mainstem Susitna River into a reservoir is also a considerable change. Later in this paragraph is the statement "The mitigations proposed to maintain chum salmon should allow sockeye and pink salmon to be maintained as well." We are unable to locate specific mitigation plans for chum salmon. Those conceptual plans presented for slough modification and mainstem

spawning bed construction deal principally with one life history stage. The statements made here that improved mainstem conditions will replace loss of slough rearing habitat and that juvenile overwintering areas are not expected to be adversely affected by the project are not supported. In fact, preliminary data presented elsewhere in the Exhibit indicate that overwintering habitat will be impacted and that sloughs may provide important rearing habitat.

page 12. Species Biology and Habitat Utilization in the Susitna River Drainage

Estimates of adult salmon presented in this section depict only escapement. A more meaningful estimate should be made using catch to escapement ratios, as done in chapter five. For instance, in 1982 77,000 pink salmon migrated above Talkeetna. However only one fish in every 3.8 escaped the commercial fishery. Using the 3.8 to 1 ratio, this reach of the Susitna accounted for over 350,000 pink salmon of which over 277,000 were available to the commercial fishery. Escapement estimates alone fail to indicate the high values associated with anadromous fishery resources.

page 76. Slough Habitat

This section does not describe impacts associated with lowered winter river stage during filling. Should upwelling and backwater effects during winter prove critical to developing eggs or juvenile salmonids, any reduction in these areas could create significant damage.

We question the figure presented as the number of sloughs in which salmon spawn within the Chulitna to Devil Canyon reach. Using information supplied by the ADFG and from Exhibit E, adult salmon have been observed in 26 of these sloughs. Exhibit E should clearly present the total numbers of sloughs in this reach and the 1981 and 1982 data on spawning adults.

page 77

The discussion presented on impacts to slough habitat is not clear. As Exhibit E states that groundwater upwelling in the sloughs is probably driven by the mainstem stage, which would cause a decreased flow in the sloughs (post-project), why does this section state that under post-project conditions only the backwater areas (of the sloughs) would be affected?

The second paragraph of this page states, "With mainstem flows above 14,000 cfs, a backwater forms at the mouth of the slough." How is this known? Which slough is being discussed? Is this true for each slough? The same paragraph explains that, during the 1982 field season, flows in the 12,000 to 14,000 cfs range occurred and afforded opportunity to observe fish passage at flows below normal August levels. These flows appeared to hamper or restrict fish passage into sloughs. Backwater effects were not seen at flows of approximately 12,000 cfs., yet project low flow limits for August have been established at 12,000 cfs. This section underscores the problems associated with such proposed flows. It is apparent that some significant changes occur to the slough habitat within a relatively narrow range of flows; changes which may have important biological implications.

page 87, para. 5
While the described floods may transport sediment and scour the River bed~~, re~~duction or elimination through flow regulation may not necessarily be beneficial. The Exhibit presents no data to support the comment that high mainstem velocities limit fish usage (page 87, para. 2). Further, such high flow events may be critical to maintaining side channel and slough habitat through flushing and replenishment of gravels and by removing vegetation and beaver dams which may reduce habitat value. This point is not discussed in the following sections on slough or side channel habitats.

page 103, paragraph 3. <u>Slough Habitat</u>
We disagree that changes in streamflow during the open-water season are not expected to affect slough habitats.

page 116. <u>Aquatic Studies Program</u>
We believe this discussion suffers from omission of the majority of the 1982 field study results. We strongly believe that two years of study are the minimum required as a basis to discuss the impact of hydroelectric development on the Susitna River.

page 130. <u>Measures to Minimize Impacts</u>
It is stated that "A flow release schedule will be used that minimizes the loss of downstream habitat and maintains normal timing of flow-related biological stimuli." The flow schedule presented in Exhibit E, chapter 2 does not minimize habitat loss, nor does it maintain normal flow related biological stimuli. This section should also discuss installation of compensation flow pumps at Devil Canyon which would provide flow between the dam and tailrace channel.

page 130, para. 2. <u>Measures to Minimize Impacts</u>
The section states that "Instream flow requirements are being determined for each species/life stage/time unit combination." Who is performing these studies? How will they be determined? Again, it is impossible to understand what flow regime, if any, is actually being suggested within Exhibit E. Is the release schedule presented in Table 2.17 just a "first cut?" This is apparently the case. Considering that the final release schedule is to be based on future studies as suggested here and may be modified to accommodate outmigration (page 3-132, para. 1) and will need to consider temperature and volume (page 3-143, para. 1); why is a flow regime proposed in the absence of such information?

page 131, para. 1
This states, in effect, that slough habitat will either be enhanced or degraded by the project, and that actual impacts to habitat are the subject of ongoing studies. These ongoing studies should be described. What will be investigated? Which sloughs will be studied?

page 132, para. 4
This states that flows of 12,000 cfs are sufficient to undertake rectifying impacts by modifying habitat. How is this known? The paragraph should discuss the studies upon which this is based or qualify any such conclusions as preliminary and subject to further study.

page 133, para. 1. Winter Flows
The statement is made that "Since minimal impacts are expected during both filling and operational winter flow, rectifying measures are not needed." This is not supported. On page 131, para. 1, we learn slough habitat may be degraded by winter flows and that these impacts are the subject of ongoing studies. Page 94 presents a lengthy discussion of impacts attributed to altered winter flows.

page 133, para. 5. Reduction of Impacts Over Time
"Post-operational monitoring will be conducted to evaluate the effectiveness of mitigation measures (see Section 2.6)." The license application should detail what monitoring will occur and how the effectiveness of mitigation efforts will be evaluated.

page 136, para. 3
The discussion of hatchery development is inadequate. In the event that other mitigation alternatives fail, it will be important to present a clear picture of what measures would be taken to compensate for fisheries losses.

page 137, para. 3
We believe that the water temperatures of 5° to 6°C during the second filling year will present significant adverse impacts to salmon. Addition of a low level portal could apparently avoid much of these effects. We recommend such a device be incorporated into the final design.

page 143, para. 1
"Continuing reservoir thermal modeling will allow an evaluation of available water temperatures throughout the year so that a detailed release plan can be developed. The release plan will need to consider both water temperatures and volume in order to minimize impacts." We strongly agree with this, and recommend that the license application contain just such a release plan which would most effectively minimize impact.

Chapters 4-9 - No Comment.

Chapter 10

page 28, para. 6. Diversional Emergency Release Facilities
The release levels referred to do not avoid adverse effects on the salmon fishery downstream.

page 30, para. 3

Figure E.2.90 indicates that three, rather than four portals would be constructed at Watana. We question which is correct and how the numbers and position of the portals were considered in minimizing impact. Also we cannot concur that temperatures will be controlled within acceptable limits.

page 30, para. 4

We are not aware of studies which have occurred to mitigate project impacts through provision of streamflow at Gold Creek. These should be described.

page 31, para. 5

According to presentation by ACRES American at an APA-sponsored workshop in Anchorage during the week November 29 to December 3, 1982, no temperature model has been run for Devil Canyon reservoir. How, then, can the utility of a multi-level draw-off at Devil Canyon be known? This again underscores the present lack of understanding of project temperature impacts.

The following statements of concern were presented by NMFS before the APA Board of Directors on April 16, 1982.

"One area of limited information in the Feasibility Report deals with the effects of post project flows on the fishery resources..." "These sloughs therefore represent an area requiring consideration of potential mitigation and/or enhancement measures. To date, less than one eighth of the side channels and slough areas have been surveyed. Further, the impacts of various flow regimes on the habitat are unknown because the hydrological and ecological relationships between the mainstem Susitna and these areas have not been adequately studied..." "The results of a comprehensive In-Stream Flow Study would allow a balancing of fish habitat losses against power generation..." "Currently, we do not believe a high level of confidence exists in the projected post project temperature within the two reservoirs, the Susitna mainstem, and the side channels and sloughs..." "...specific studies must occur which will develop mitigation options..." "It is not reasonable to assume that (one field season of fisheries data) is adequate for proper characterization of the resources."

"We are concerned that the (license) application will reflect the serious deficiencies we have mentioned. If our review shows this to be the case, we feel our agency will have no alternative but to request the FERC to reject the application or direct that the deficiencies be corrected."

Our review of the material presented in draft license Exhibit E indicates that these deficiencies still exist. It is regrettable that we have reached the draft license application stage while these issues remain unresolved. We feel that these issues and data must be incorporated into Exhibit E and that without them the license application will be found deficient. We believe that Exhibit E should be sufficiently developed so as to form the basis for specific license conditions which would protect anadromous fish and their habitat. As written, Exhibit E only leads to further studies. The FERC guidelines specify that information within Exhibit E be developed to a level commensurate with the scope of the project. The Susitna project will be the most costly and complex hydroelectric facility ever considered by the FERC[2/], and this complexity and depth should be reflected in license Exhibit E.

We appreciate this opportunity to comment on the draft Exhibit E.

Sincerely,

Robert W. McVey
Director, Alaska Region

2/ Susitna Project Status Report - Preliminary Draft. Federal Energy Regulatory Commission - Data for Decisions. December 1, 1982.

STATE OF ALASKA

BILL SHEFFIELD, GOVERNOR

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March 16, 1983

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MAR 17 1983

ALASKA POWER AUTHORITY

Mr. Eric Yould, Executive Director
Alaska Power Authority
334 West 5th Avenue
Anchorage, Alaska 99501

Dear Mr. Yould:

We have received a copy of the Susitna Hydroelectric Project FERC License Application, Exhibit E, and have focused our review primarily to chapters on socioeconomic and land use issues, Chapters 5 and 9, respectively. In proposed major resource development projects such as the Susitna project, the Department is concerned that: 1) proposed development activities be sensitive to Statewide, regional, and local interests and limitations; and 2) the capability of local/regional governments be strengthened in order to meet demands placed on them by major development activities. In the review of Exhibit E, we found many of the Department concerns raised earlier in our review of the Susitna Hydroelectric Project Feasibility Report remain in effect. We have, however, re-emphasized Department concerns as they apply to the information contained in Exhibit E. A number of page specific comments are also provided toward the end of this letter.

The major issues of concern to the Department in review of the Susitna Hydroelectric Project FERC License Application - Exhibit E are:

1) the assumptions underlying the socioeconomic analysis imply significant and yet uncommitted policy positions on the part of the State. For example, Exhibit E contains assumptions regarding the origins of the labor force, housing opportunities for that labor force, and mobility of the work force during construction. Implicit in these assumptions are policies addressing local hire and job training, worker residence at the project site, mode(s) of access to and from the construction site, and the use of construction camps as opposed to transporting workers. Should any of these implicit policies fail to materialize as presumed, the nature of the impacts described in Exhibit E could change drastically.

In order to clarify the relationship between assumptions of the socioeconomic impact model and State policy, the Department's recommendation is that the Alaska Power Authority provide a process for key State agencies to become actively involved in the methodology and use of the model. This would, in our opinion, serve two useful purposes. One, it would enable the State to constructively critique the assumptions of the model, particularly in light of existing State policies. Secondly, a better understanding and practical use of the model by State agencies could help form the basis for establishment of new State policies for the project. In the same manner, involvement of the Matanuska-Susitna Borough in the critique and application of the model should be provided for, should the Borough choose to participate.

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Susitna File Copy

2) It is the Department's opinion that the socioeconomic impacts identified in Exhibit E as resulting from the Susitna project are significantly understated.

As was described in the Department's review comments for the Susitna Project Feasibility Study, we feel that the proposed impacts from the Susitna project will far exceed those expressed in Exhibit E. We base our predictions on the impacts historically caused from other large construction projects in Alaska, most notably the Trans-Alaska Pipeline project (TAPS).

In order to account for a larger impact than described in Exhibit E, the Department recommends that an alternate socioeconomic impact model scenario(s) be established to represent, as closely as possible, appropriate factors of the TAPS experience for the Susitna project. At a minimum, this alternative analysis should assess those impacts due to induced population growth and increased numbers of people seeking employment. For example, Exhibit E (on page E-5-20) describes that within the period 1983-1991, the latter date representing the peak year of the Watana construction phase, the population of the Matanuska-Susitna Borough is proposed to increase by approximately 22,355 persons. Of this total, only 4,700 persons are proposed to be connected to the project, including direct and indirect/induced workers and their dependents. This estimate appears to be low, particularly in light of the experience gained from the TAPS project, when a far larger than anticipated influx of people was attracted to the area. As a result, this in-migrant population competed with local residents for both direct and indirect/induced jobs and greatly strained the capabilities of public services and facilities. The Department feels that the types of impacts found with the TAPS project could likely reoccur with the Susitna project. We recommend, therefore, that a model scenario be developed which utilizes information gained from the TAPS experience in calculating population influx and resultant impacts. Even with the difficulty in predicting precise numbers of secondary or induced workers and families, the model can at least be used to generate likely or alternative scenairos to guide deicsion makers in assessing potential impacts and preparing mitigation measures.

3) Responsibilities for provision of services and facilities within the local project area (Matanuska-Susitna Borough) should be more clearly defined for the State, Borough and the contractor.

Exhibit E does present a discussion regarding projected public service and facility needs for the Matanuska-Susitna Borough (and selected cities within) both in base-case and project-induced scenarios. More specific data, however, could have been provided regarding the costs and revenues anticipated for the State, Borough and contractor for specific services and facilities required under both scenarios. Such information, for example, would clearly illustrate the levels of State support anticipated both with and without the Susitna project.

4) Legal responsibilities for access to the project site both during and after construction need to be clearly defined.

Exhibit E (Chapter 9) briefly discusses the location of the proposed access road and its potential future use. It is also discussed that during the construction phase, only project personnel will be allowed passage on the road. Land management planning for the access road area is proposed to also take place during the construction phase.

The Department recommends that legal responsibilities should be clearly identified prior to opening of the road for any purpose. This action would clarify, for example, maintenance responsibilities and liable parties in the event of unauthorized use of the road. Secondly, the Department recommends that land use planning take place before the original road is constructed in order to incorporate future land use considerations within the original road design and layout. Similar considerations, as described above, should be given to the proposed rail access route to the Devil Canyon site.

5) The possibility of dam failure should be taken into consideration for the Susitna project, particularly for areas downstream of the dam. This is a critical issue given the size of the dam and impoundments and the proven seismicity of the project area. The Department has stressed in our previous comments that the downstream flood hazard due to catastrophic dam failure should be mapped and appropriate stipulations should be placed on downstream development in order to prevent potential loss of life and property.

Exhibit E (Chapter 6) gives attention to seismicity, however, it is simply stated on Page E-6-36 that the main structures (dams) have been analyzed to accommodate the ground motions induced by the maximum credible earthquake. The Department stresses, however, that our above concerns be addressed within the land use planning for the project area.

6) More information needs to be provided about the proposed permanent townsite.

Exhibit E presents in various chapters the concept of a permanent townsite to be established at Watana. Chapter 8 (Aesthetic Resources), for example, presents a conceptual layout of the proposed townsite. The Department is concerned that if a permanent townsite is to be established near the project, much more information needs to be provided regarding: physical site suitability, livability factors, community expansion areas, government, and opportunities for economic diversification. Additionally, the costs and providers (State, Matanuska-Susitna Borough, community) of facilities and services for the community should be specifically identified.

The Department has a number of more specific comments on Exhibit E as follows.

Chapter 5. Socioeconomic Impacts

1) It would be helpful to summarize in one section of Chapter 5 all the assumptions, standards, and input variables that were used within the impact model. Data sources of each should be cited.

2) Chapter 5 does not identify if and when sensitivity analysis will be done for key variables used in the socioeconomic impact model.

3) It would be useful in Chapter 5 to portray in graphic format the data regarding baseline and project-induced costs vs revenues. The percentage of costs and revenues per contractor, State, and Matanuska-Susitna Borough should also be shown in graphic format. Additionally, if various scenarios are to be eventually portrayed by the model, graphic representations of costs vs revenues per scenario would be useful.

4) On page E-5-23, reference is made to the absence of impact on the Matanuska-Susitna Borough School District because a contractor provided school at the construction site will serve the residents. As specified in previous Department comments, under Alaska Statutes, the Matanuska-Susitna Borough is mandated to exercise areawide education powers. The District would therefore be responsible, by law, for the provision of educational facilities and services to all residents of the Borough. This does not prohibit the project contractor and the School District from formally agreeing to share costs or take other steps to lessen impacts; however, any educational facilities, programs, and faculty will have to comply with School District standards and guidelines. Therefore, there will be an impact on the School District.

5) Page E-5-47: The 1981 vacancy rate for housing (outside of incorporated communities) within the Matanuska-Susitna Borough is given as 25%. Does this figure include secondary homes?

6) Page E-5-137; Table E.5.35: A more detailed breakout of costs and revenues for each service or facility per year would be useful to include somewhere in Chapter 5 as back-up data to Table E.5.35.

Chapter 9. Land Use

1) Pages E-9-20 through E-9-22, Section 23 - Description of Existing Land Use Management Plans for the Project Area: Among management plans listed in this section, the Denali Scenic Highway Study [pursuant to the Alaska National Interest Lands Conservation Act, Section 1311(b)] should also be included.

2) Page E-9-59; Figure E.9.8: The biophysical coastal boundary for the Matanuska-Susitna Borough Coastal Management Program has been amended from that shown on Fig. E.9.8.

Thank you for the opportunity to comment.

Sincerely,

Mark Lewis
Commissioner

cc: Lawrence H. Kimball, Jr., Director
Division of Community Planning

Al Carson, Chairman
Susitna Hydroelectric Steering Committee

Gary Thurlow, Manager
Matanuska-Susitna Borough

Claudio Arenas, Director
Matanuska-Susitna Borough
Planning Department

Lennie Corin
U.S. Fish and Wildlife Service

ATTACHMENT II
Task - 7.4

United States Department of the Interior

NATIONAL PARK SERVICE
Alaska Regional Office
540 West Fifth Avenue
Anchorage, Alaska 99501

IN REPLY REFER TO:

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DEC 7 1982

ALASKA POWER AUTHORITY

Mr. Eric Yould, Executive Director
Attention: Richard Fleming
Alaska Power Authority
344 W. 5th Avenue, Suite 501
Anchorage, Alaska 99501

Dear Mr. Yould:

I appreciate the opportunity to have participated in the recent Susitna Hydroelectric Project FERC License Application Exhibit E Presentation and Discussion and to discuss issues related to cultural resource management with Dr. Fleming, and Don Follows of Acres American, Inc., both of whom have done an outstanding job in my opinion.

The point that I made there, and wish to repeat here, is that the comments of the Advisory Council on Historic Preservation should be solicited without delay in the interest of expeditious development of a plan for future survey and inventory, and for mitigation of potential impact on sites already inventoried and evaluated. It is not necessary to wait until the inventory is complete to solicit Advisory Council comments since the Council can accommodate actions at this early stage. Council's comments now could negate the need for the compressed, one-year, program of mitigation that was proposed as a probable necessity if Council comments are delayed until the survey is completed. In my opinion more lead time is necessary for development and implementation of a mitigation plan for a project of this magnitude.

Again, I appreciate the hospitality of the Alaska Power Authority, and the opportunity to comment.

Sincerely,

Floyd W. Sharrock

Floyd W. Sharrock
Archeologist

cc:
Don Follows, Acres American, Inc.

STATE OF ALASKA

DEPARTMENT OF NATURAL RESOURCES

DIVISION OF PARKS

JAY S. HAMMOND, GOVERNOR

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DEC 9 1982
ALASKA POWER AUTHORITY

December 3, 1982

Re: 1130-13

Mr. Eric Yould, Executive Director
ATTN: Dr. Richard Fleming
Alaska Power Authority
334 W. 5th Avenue
Anchorage, Alaska 99501

Dear Mr. Yould:

This letter is to reaffirm our views on two important points discussed in the Cultural Resource Section of the Susitna Hydropower meetings on November 30th.

First, we feel the Advisory Council on Historic Preservation should be involved in the cultural resources mitigation program at the earliest possible time. While FERC regulations do not specifically require Advisory Council consultation during the preparation of Exhibit E, the prudent course is to have them well-informed as soon as possible. The Advisory Council must be consulted under 36 CFR 800 when the time comes for determinations of eligibility and effect, and they would be a signatory party to any Memorandum of Agreement on mitigation of adverse effects to cultural resources.

Second, concerning the remaining fieldwork, we feel that two field seasons are preferable to one. An estimated 70 archaeologists will be required to do the necessary work in a single season. We have reservations about the availability of 70 people with appropriate experience and the limited time left for logistics planning.

Further, few, if any, institutions have the space required to properly process the mass of raw data and artifacts generated by so many field workers. This problem would be greatly ameliorated if the work is spread over two seasons.

In general, we feel that the quality of the work would suffer and can see no compelling reasons to force the remaining work into a single season.

Once again, we congratulate Dr. Dixon and Mr. Smith of the University of Alaska Museum on the fine work that they have done to date. We trust that work of this quality will continue.

Please call or write if we can be of additional assistance.

Sincerely,

Judith E. Marquez
Director

By: Ty L. Dilliplane
State Historic Preservation Officer

cc: Mr. Dan Follows
Dr. E. J. Dixon
Dr. E. Slater

TAS:clk

STATE OF ALASKA

DEPARTMENT OF NATURAL RESOURCES

DIVISION OF PARKS

JAY S. HAMMOND, GOVERNOR

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PHONE: 274-4676

December 15, 1982

File No. 1130-3

Mr. Al Carson
DPDP
Pouch 7-005
Anchorage, Alaska 99501

Dear Mr. Carson

Thank you for the review copy of the draft Exhibit E. We are pleased to comment on Chapter 4 - Report on Historic and Archaeological Resources.

The report is well done and addresses all the pertinent questions about mitigation. Table E.4.2 is particularly informative and is a good synthesis of the available information to date. We concur with the mitigation plan as it stands in this draft document. We would also like to add our recommendations to the proposed education program recommended on page E.4.114. We consider such a program to be a necessary part of any large construction project. It seemed to be quite effective during construction of the Alyeska Pipeline. If project personnel are adequately trained and sites are clearly marked, avoidance should be a viable mitigative measure in a fair number of the indirect and potential impact cases.

We look forward to continuing to work with all concerned parties on this project.

Sincerely,

Judith E. Marquez
Director

Tom Smith, DEPUTY
By: Ty L. Dilliplane
State Historic Preservation Officer

cc: Leila Wise, Division of Natural Resources Coordinator
Dr. Edward Slatter, FERC Archaeologist
Mr. Lou Wall, Advisory Council on Historic Preservation
Dr. E. James Dixon, Lead Archeologist, Susitna Hydro Project
Dr. Glenn Bacon, Lead Archeologist, Alaska Heritage Research Group

DR:ces

STATE OF ALASKA

DEPARTMENT OF FISH AND GAME

OFFICE OF THE COMMISSIONER

Bill Sheffield, Governor

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Juneau, AK 99802
Phone: 465-4100

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JAN 1 4 1983

ALASKA POWER AUTHORITY

January 13, 1983

Alaska Power Authority
334 West Fifth Avenue
Anchorage, Alaska 99501

Attention: Eric Yould, Executive Director

Gentlemen:

Re: Review Comments - Draft Exhibit E - Susitna Hydroelectric Project

The Alaska Department of Fish and Game (ADF&G) has reviewed the Draft Exhibit E, dated November 15, 1982, that was prepared for inclusion in the license application for the Susitna Hydroelectric Project that the Alaska Power Authority (APA) intends to submit to the Federal Energy Regulatory Commission (FERC).

The Department's review of the Draft is based on the adequacy with which the fish and wildlife resources affected by the project, the impacts to those resources attributable to the project, and specific mitigation proposals to offset impacts are identified and quantified.

The types of information required for an adequate assessment of feasibility, with respect to fish and wildlife resources were originally identified for the APA in November 1979 through correspondence relative to the Plan of Study and were most recently identified in Commissioner Ronald Skoog's statement to the APA Board of Directors on 16 April, 1982.

Our review comments on the following chapters are appended to this letter:

Appendix A - Chapter 2 - Water Use and Quality;

Appendix B - Chapter 3 - Fish, Wildlife and Botanical Resources;

Appendix C - Chapter 5 - Socioeconomic Impacts;

Appendix D - Chapter 7 - Recreational Resources; and

Appendix E - Chapter 9 - Land Use.

The time afforded the ADF&G to review the Draft Exhibit E has not been sufficient to allow a detailed review of all the chapters, nor has it enabled us to present our comments in as thorough and refined a manner as we would have liked. We do, however, expect to take advantage of future review opportunities to further address these issues.

The appended reviews (Appendices A-E) contain general statements regarding the overall adequacy of each chapter. Following these are specific comments addressing the technical content of the report. In the specific comment section, we have on occasion clarified the Department's policies and positions with respect to the proposed Susitna Hydroelectric project.

Throughout the chapters of the Draft Exhibit E that we reviewed, both the information presented and the assessment of impacts are generally insufficient for the kind of a planning and source document needed for preparation of an EIS. We are concerned that the benefits and cost aspects of the project have not been presented completely and clearly. The general problems with the Draft Exhibit E chapters that were reviewed by the ADF&G are as follows:

1. Data and information contained in the Exhibit E are, in many cases, incomplete or not properly interpreted.

2. Many potential impacts and issues attributed to the Susitna Hydroelectric Project are not addressed. Impacts to fish and wildlife resources and users that are addressed are not adequately quantified and proposals to mitigate impacts are not sufficiently developed.

3. Not all source materials, other Draft Exhibit E chapters, or the results of other study disciplines that are pertinent to the project are referenced.

4. Throughout the document there is a failure to discriminate between fact and speculation.

Our comments, recommendations, and suggestions to strengthen the material contained in Draft Exhibit E in relation to the problem areas identified above are as follows:

1. The APA should examine the specific comments appended to this letter and clarify or expand sections in the Draft Exhibit E chapters where inadequate treatment of the data or information is suggested. The suggestion here is that while some interpretations by the authors are not necessarily inaccurate, they are incomplete. This type of problem in the Draft Exhibit E may be either editorial or a function of the short time frame allotted to assemble, assess and analyze the information available. The Draft Exhibit E chapters should utilize currently available and relevant information and data sources.

2. The Draft Exhibit E chapters should accurately reflect the current state of resource knowledge and information on impacts which are understood and those which are still undetermined. Consequently, the mitigation plans cannot be considered adequate unless the information and analysis of impacts is current and comprehensive. The mitigation plans should clearly indicate how impacts are considered in the design of the project; what measures will be taken to avoid, minimize or rectify impacts; and how effective these measures will be in mitigating losses.

3. Source material in the Draft Exhibit E is not adequately referenced. Furthermore, data and information reported in chapters of the document should be consistent with other chapters. The lack of coordination between the resource groups and the engineering and construction groups is evident; conflicts have not been clearly identified between uses and disciplines. To remedy this deficiency all conflicts between engineering and economic factors and environmental alternatives should be identified and the consequences of altering those factors should be listed. The environmental concerns should be weighed equally with engineering and economic constraints.

4. Throughout the document, there is not always adequate discrimination between fact and speculation about resource values, concerns, issues, impacts and mitigation alternatives.

In some cases adequate referencing and reporting of data in the chapters may resolve this. Where baseline data collection is required to remove speculation it should be done, or if relevant data and information are available elsewhere they should be collected and evaluated.

The Department of Fish and Game recognizes the general character of the above recommendations. These recommendations are made based on an overview of the ADF&G comments for the chapters we have examined. We invite further consultation by the APA with our agency to discuss the specifics of the chapters we reviewed and our general recommendations.

The fish and wildlife resources of the Susitna River Basin are of high value. Construction and operation of the proposed Susitna Hydroelectric Project can have wide ranging implications for these resources and their users. It is the objective of this Department to help Governor Sheffield insure that fish and wildlife resources are considered along with other project features during all stages of project planning, construction and operation.

Based on the above overview of the Draft Exhibit E and the chapter-specific comments contained in the enclosed Appendices, the ADF&G does not believe that this planning document is sufficiently complete. Furthermore, we believe that the APA can best insure expeditious review and approval by FERC if it does as much as possible to resolve agency concerns or establishes the mechanism to resolve those concerns.

We hope our review assists the APA in addressing the concerns expressed herein and consider that this review represents only part of the process needed to reach the objective we wish to attain. It is highly important from our perspective that the FERC License Application scheduled for submission in February and the process of consideration of the Exhibit E will positively contribute to the equitable consideration of fish and wildlife concerns.

Thank you for the opportunity to review and comment on this document. We would appreciate your providing an explanation of how you eventually respond to the comments we have made.

Sincerely,

Don W. Collinsworth

Don W. Collinsworth
Acting Commissioner

Enclosures

cc w/enclosures: Lennie Boston, Special Assistant to the Governor
APA Board Members:
John Schaeffer
Charles Conway
Robert Weeden
Daniel A. Casey, Commissioner,
Department of Transportation and Public Facilities
Richard A. Lyon, Commissioner,
Department of Commerce and Economic Development
Richard A. Neve, Commissioner,
Department of Environmental Conservation
Peter McDowell, Office of Management and Budget
John Hayden, Acres American
Mark Robinson, FERC, Washington D.C.

APPENDIX A

Susitna Hydroelectric Project, Draft Exhibit E

Volume 1, Chapter 2

Water use and quality

GENERAL COMMENTS

This document generally fails to cite supporting evidence for the statements made or for potential impacts considered to be of major importance to this agency. An example can be found in the discussion of ice processes in the lower river. The ice formation processes are simply stated as causing staging of 4 feet at Talkeetna to 3 feet at Sherman (E-2-59). The method used to determine this estimate has not been defined. Also, no references have been provided that evaluate whether ice processes are or are not a problem below other hydro projects. If this is a purely speculative scenario, it should be so noted. Otherwise, a scenario assuming that the staging would be 6 to 8 feet at Talkeetna during the winter months and annual floods would occur is just as supportable as the statements provided.

The failure to provide a separation of the speculative comments from the segments of the text supported by documentation creates severe problems in assessing the overall credibility of the report.

This document also needs a preface on how the flow scenario and access route were selected for the license submittal and a discussion of other available options. The Exhibit A document referenced on page E-2-86 on access routes was not provided for our review.

SPECIFIC COMMENTS

The following comments are addressed to page specific areas and paragraphs and primarily address general deficiencies rather than grammatical errors.

Page/Paragraph

E-2-3/4

The source of the 40 percent stream flow statistic should be identified.

E-2-3/5

State that all the flows listed other than upper Susitna River are also mean annual flows.

E-2-4/1-4

References are needed to support the flood information discussed.

E-2-5/1

References are needed to support the statement that the shape of the listed duration curves is indicative of flow from northern glacial rivers.

E-2-5/3

Reference(s) are required to support the discussion regarding Susitna River morphology.

E-2-10/1

The description of sloughs as having a steeper gradient than the mainstem is misleading. The gradient within the sloughs is generally variable, with a steep upper section and a lesser slope in the lower end. In upland sloughs, those without scour channels, the gradient appears to be even less. Overall, the sloughs have a steeper gradient, but the variability of their gradient is important to their fisheries production.

E-2-11/2

There is a need to cite specific references in the water quality text even though a general reference section was provided in the preface for the water quality section.

E-2-12/3 & 4

The months that are included in the "winter, spring and summer" time frames need to be identified.

E-2-12/5

Clarification needs to be provided as to whether the Gold Creek temperature data presented in Fig. E-2-30 were correct. The location of this station was determined to be influenced by Gold Creek flows in 1981 and the station location was changed in 1982 to the northwest bank as a consequence.

E-2-14/1

A reference is needed for the Portage Creek temperature data.

E-2-14/3

It should be noted here that under natural conditions, staging during freezeup reportedly causes flooding of portions of the town of Talkeetna near the downtown airport. There is a need to reference the material presented in this paragraph.

E-2-14/5 & 6

The term frazil ice should be defined for the readers. Also it cannot be overstated that ice jams could have severe consequences to portions of the community of Talkeetna.

E-2-17/5

In order to properly assess the effects of the project on the downstream fisheries and fisheries potentials of the impoundments, a relationship of suspended sediment and associated particle size to vertical illumination is desirable. This does not appear to have been done, in that no quantitative measurements of vertical illumination have been obtained.

E-2-20/5

The dissolved gas concentrations above the Devil Creek rapids were not supersaturated and were recorded as approximately 100 percent. The 105 percent value was recorded above the Devil Canyon dam site.

E-2-24/2

These sloughs also contain important anadromous and resident fish rearing habitat.

E-2-25/5

Power generation could be considered an instream flow use under only unusual circumstances. In the case of reservoirs which store water for later power generation, the storage of water is definitely an out of stream use. Using the terminology of "in-stream flow" in the context presented here for power generation is inappropriate and inaccurate.

E-2-26/3

Fry emergence occurs at different times within and among species. Emergence is most closely correlated with accumulated thermal units and has little to do with the hydrograph. Also burbot and Dolly Varden should be added to the list of important resident species.

E-2-28/6 & E-2-29/1

Seasonal salinity measurements should be collected and correlated to a wide range of flow levels and tide conditions instead of to a few selected flow levels.

E-2-29/2

The location of the sampling site and a definition of the mouth of the Susitna River should be provided to give credence to this statement. Saltwater intrusion would be expected to be dependent upon tidal action so this must also be taken into account when describing saltwater mixing and intrusion.

E-2-29/4-5

The use of regression equations to calculate the peak and low flows without data on actual discharge of the tributary streams to be crossed by the access road is inappropriate and should not be used as a substitute for collection of discharge information. This is particularly important to the design of bridges or culverts for engineering integrity or for fish passage. The sizes of many drainage structures placed in the North Slope haul road and pipeline workpad were underestimated when these methods were applied. This resulted in hydraulic erosion and structure failures that were unnecessary.

E-2-29/6

It is stated that "The line between the dam and the intertie has yet to designed, sited or constructed." The Exhibit E should include information on the siting (corridors) of the transmission lines, baseline information on resources which may be impacted, an assessment of the impacts, and the methods proposed to offset impacts.

E-2-30/1-5

Discharge measurements should be collected at any stream crossings associated with the transmission lines if road access is to be developed. These measurements should be used in determining the size of bridges or culverts for fish passage and engineering integrity. If any other transmission line routes were considered they should be listed.

E-2-31/General Comment on Section 3, PROJECT IMPACT ON WATER QUALITY AND QUANTITY.

It is essential to present a discussion of the rationale and process for selecting the operational schemes on which the impact discussions were based. In other words, it needs to be made clear why this specific operational scheme was selected above other alternatives, what the engineering rationale is and how considerations of environmental values, concerns or needs were incorporated into the judgement that this is a satisfactory operational scheme.

E-2-32/1

The statement that dewatering a 1-mile section of the Susitna River will not result in any serious impacts is incorrect. This area is used by grayling for wintering, and dewatering will result in a permanent barrier to migrating fish in the system. Data collected by the ADF&G in 1981 on intrasystem movements of grayling between Deadman and Tsusena Creek indicated migration between these systems.

E-2-33/4

The statement does not address the large amount of spoil that will be generated and the large amount of grading and washing that will be necessary to obtain proper sized materials for the construction of the dam. This will generate an enormous water quality and spoil disposal problem that has not been addressed. Spoil disposal sites should be located in a manner to preclude introduction of sediments into the Susitna River and fish-bearing tributaries.

E-2-34/4

Petroleum and petroleum product spills in the smaller grayling streams can have significant impacts on these fisheries. An oil spill contingency plan is essential to provide proper direction to prevent or mitigate spill events.

E-2-34/5

The description of the treatment of the waste water is totally inadequate. The discussion of waste water treatment should describe the volume of the waste water, the nature of the contaminant, a documented system for appropriate water treatment, the anticipated quality and the volume of the effluent, and an analysis of the instream concentrations of the effluent.

E-2-35/1

Groundwater can be impacted by polluted surface water drained into a well.

E-2-35/2

The term minor impacts, to describe the effects of excavation of borrow material, appears to be a mis-statement. If borrow material is taken from streams or lakes in the impoundment area, the impacts could have serious consequences on these fish populations. The types and volume of borrow materials to be removed, and the availability of materials need to be identified. An inventory of the fisheries in these areas needs to be made and baseline water quality conditions need to be documented. An analysis of the effects of borrow removal and mitigative actions to reduce the impacts by altering site locations or construction and operation techniques should be presented. This is a major oversight in this document.

E-2-35/5

Structural measures to prevent downstream movement of fishes through the tunnels is a necessary mitigative action that is not addressed. Downstream movement of fish without passage upstream essentially means these fish are lost to the population.

E-2-35/6

Upstream migration of fishes will be completely blocked by the velocity barrier in the diversion gates.

E-2-36/5

As with earlier comments (E-2-29/4-5), the regression analysis of peak and minimum discharges should not be substituted for the collection of discharge information.

E-2-37/3

The level of analysis presented here and detail of mitigation of the effluent should be provided for all effluents related to the project, not just sewage.

E-2-38/6

Reference to this information as a personal communication is inappropriate. The outmigration of salmon in the spring is as likely related to photoperiod and development as the other factors listed. Very low flows in the spring could cause many of the juveniles to remain trapped in backwater pools that are normally flooded by the mainstem under pre-project conditions.

E-2-39/2

The proposed flows of 12,000 cfs have not been demonstrated to maintain the character of sloughs and provide the flushing flows needed to clean fines out of the gravel. Also the cycle of vegetation succession will be altered if flows do not wash away old vegetative growth. Consequently, what is now aquatic habitat may become terrestrial habitat over time.

E-2-39/3

Minimum flows for the winter period should be established according to fishery resource requirements. This is a critical period for the populations of overwintering fish and even minor dewatering may have significant deleterious effects.

E-2-39/5 & E-2-40

There needs to be an analysis of longer filling periods and associated consequences. The short filling period evaluated (3 years) may produce unacceptable consequences to fisheries resources. An extended schedule for filling may provide for a higher and more preferable mitigation option for fisheries through the 3-year schedule.

E-2-42/5

The potential negative impacts to slough areas downstream from Talkeetna resulting from decreasing the recurrence intervals of what are now mean annual bank full floods is not addressed.

E-2-43/2-5

The timing and the consequences of the thermal regimes created within the reservoir during filling to downstream water temperatures must be better defined.

E-2-43/5

The water temperatures downstream from Watana need to be defined more accurately. The cause of these low temperatures should be identified.

E-2-44/4

What are the predicted depths at which photosynthesis will occur and how will the quality of water discharged downstream compare with the preproject conditions with regard to photosynthetic processes? Data or discussion regarding this question should be presented.

E-2-45/3

The method used to estimate the 30-50 NTU values should be defined and better described. The reasons why winter turbidity levels are neither quantifiable nor subject to estimation should be clarified.

E-2-47/6

The section regarding impacts to slough habitats is not adequately presented. Basically, the relationship of mainstem discharge to slough discharge should be illustrated graphically. The response of the ground water wells to changes in the mainstem at the various locations (for those wells that were not silted in) should be plotted; a gradient profile of the groundwater, rather than just the thalweg of the slough, should be illustrated; and a map of the locations of upwelling in the sloughs should be presented. The text as written does not present data and many speculative comments are provided without appropriate qualifications.

E-2-49/2

The statements suggesting that there will be no changes in the temperature of upwelling groundwater and consequently, no impacts to incubating salmon eggs are not supported by data or citation. The reduction of flows through these sloughs is not quantitatively defined and could easily be major as well as minor. The loss of scouring flows that remove sediment in these sloughs as well as beaver dams, and removal of spring ice buildups could easily cause a senesence process to begin which may ultimately destroy the sloughs is not addressed.

E-2-49/4-5

There are no citations, references or data to support these statements.

E-2-50/1

There is no reference to the commercial boat launch at Sunshine located immediately below the Parks Highway bridge on the east bank nor is there acknowledgement of the boat launch at the Talkeetna Village airstrip which is becoming more heavily used due to bank degradation and channel erosion at the "new" Talkeetna boat landing. If the mainstream of the Chulitna River moves west from its present position as defined in the Draft Exhibit E (E-2-42/4), access to the Chulitna River and Susitna River north of Talkeetna River confluence could be considerably more difficult than at present. The source of the data, analysis or other documentation to support the comment that minor restriction on upstream access to Alexander Slough may occur during years of low stream flow needs to be provided.

E-2-51/1

Downstream flow requirements have not yet been determined or agreed upon.

E-2-51/2

The criteria used to develop the 5,000 cfs minimum flow as well as any of the other "target" flows should be presented. There must be some documentation of the rationale, review or selection process by which these "target flows" were developed and justified.

E-2-52/1

Optimally operated reservoir scenarios should be examined for other target flows downstream using the new synthesized flows.

E-2-52/3

A scenario wherein Devil Canyon Dam is not constructed in the projected time frame should be presented.

E-2-56/2

A detailed discussion on ice processes should be presented.

E-2-57/5

To evaluate the effectiveness of the multiple level intake structures, their efficiency at removal of a layer of water at a particular depth must be analyzed hydraulically. The velocity at the port of the intake structure must be low enough to prevent upwelling at the face of the dam. This is a common occurrence that effectively eliminates the functionality of these types of structures.

E-2-58/1

The strata modelled for the reservoirs during the winter under alternative operational scenarios must be presented. The ability of the structures to control temperature during the winter needs further documentation.

E-2-59/2

The process by which staging elevations were estimated should be documented. Under preproject conditions with lesser flows, staging is often much higher than these levels. Local flooding in November reportedly affects the town of Talkeetna.

E-2-61/1

There should be an explanation why turbidity in the top 100 feet of the reservoir is the main interest.

E-2-63/5

Other potential sources of waste water need to be listed.

E-2-64/3

We recognize that this section refers to the operational phases; however, there is no explanation how the valves will be operated during the initial filling and startup procedure. An explanation of the thermal effects of using these valves is also needed, since the valves will facilitate discharge of waters from the hypoliminion.

E-2-66/1-3

Data to support this presentation should be provided.

E-2-66/5-6

We disagree that navigation and transportation will not be significantly impacted. These are somewhat contradictory to the statements in E-2-66/5-6. Information to substantiate this conclusion should be presented.

In the continuation of paragraph 6 on the next page it is stated that "...caution will be required in navigating various reaches." Also E-2-67/2 refers to the winter season and the fact that winter travel by snowmachine and dog sled will be impeded.

E-2-67/1

Reduction of floating debris will not benefit navigation significantly in our opinion. Low water flows are expected to be the most significant hazard in the downstream reach. The source or data to support statements in this paragraph should be provided.

E-2-69/2

This paragraph conflicts with Page E-3-137, second paragraph, wherein it states the dam construction will adversely impact temperature from a fisheries perspective.

E-2-70/3

See earlier review comments for E-2-34/5 concerning the analysis needed to determine the water quality hazard from the discharge of concrete wastewater.

E-2-76/4

Documentation of the statement that, "As Devil Canyon reservior is filled, additional fishery habitat will become available in the reservoir." should be provided.

E-2-87/1

Accurate discharge information on the creeks is needed to insure proper culvert sizing and fish passage. This information is needed to insure proper mitigation of potential impacts.

E-2-90/2

The minimum flow to maintain fisheries should be refined because 12,000 cfs may not be adequate.

E-2-90/3

The seasonal timing of the construction has not been addressed. This is an important factor in addressing fish and wildlife impacts.

E-2-91/2

Twelve thousand cfs for a flow at Gold Creek will not afford adequate access to 50 percent of available slough spawning habitat. A higher flow is required to maintain adequate access. This flow must be determined by an analytical process. Also, other life phases of fish in the downstream reaches below Devil Canyon are not addressed. All of the statements regarding the effects of 12,000 cfs flows are purely speculative and are not supported by data or measurements yet available. The release of water through the valves may present downstream thermal problems by releasing cold water in mid-summer.

E-2-91/4

Changes in downstream river morphology have not been fully assessed. To state that no mitigation is necessary to maintain slough habitats is premature. The lack of ice scour and flood flows may cause an aggradation of sediment in sloughs and may reduce natural cleaning processes necessary to maintain productive spawning substrate and rearing areas.

E-2-91/5 Line 8

Mitigation should be required and should be borne by the project developer as a standard project cost.

E-2-92/1

Data to support statements in this paragraph should be provided.

E-2-92/3

Thermal control by withdrawing water close to the surface can result in vortices causing air entrainment and supersaturation which is detrimental to fisheries. This subject should be addressed with supporting analysis to ensure that surface withdrawal of water can occur without detrimental impacts to fisheries.

E-2-92/4

The report cited did not demonstrate supersaturation because of faulty analytical techniques. The sample of water was not pressurized before gas chromatographic analysis as is required by standard methods. Therefore, any supersaturation would have probably dissipated before the sample was analyzed. The study did show, however, that the thermal conditions will not be affected by the valve and that the temperature downstream will essentially be the same as the temperature at the withdrawal layer in the dam.

Tables

E-2-1 through E-2-20 References to data sources for tabular material should be made where they are missing.

Figures

E-2-1 through E-2-39 Reference to data sources for figures should be made where they are missing.

Appendix B

Susitna Hydroelectric Project, Draft Exhibit E

Volume 2, Chapter 3

Fish, Wildlife and Botanical Resources

GENERAL COMMENTS - FISH

This report lacks sufficient data to support most of the statements on project impacts, whether adverse or beneficial. It does not reference or use the literature or experience obtained from other hydro projects. Many of the statements regarding populations of fishes do not adequately reflect consideration of the instream flow requirements necessary to sustain those populations. It does not separate opinion from statements supported by correlative data regarding responses of the fishery to river regulation and impoundment. It also does not refer to or cite in the text the economic consequences of the flow regime presented. The document does not provide information relative to Alaska or other locations as to the success or failure of proposed mitigation measures. In short, the data base presented is insufficient to support most statements of impacts or the quantitative effects that the project will have on downstream fisheries.

Additional difficulties in reading the report are encountered due to lack of literature references, processes by which conclusions or assumptions were developed, and an absence of lists of technical documents and their locations. Sources of tabular or figure material often are not cited. In general, mistakes are common, many errors are apparent, and the report is neither well organized nor edited.

GENERAL COMMENTS - WILDLIFE AND BOTANICAL RESOURCES

There are numerous typographical errors, incomplete sentences, and inconsistent or contradictory statements. The format is frequently violated with impacts of one project feature incorporated into the discussion under the heading of another feature. Terminology is at times inconsistent or vague. The level of detail varies greatly from one subsection to another with "minor" impacts often treated more comprehensively than "major" impacts. There are numerous examples of incompletely thought out ideas, some of which will not stand up to close scrutiny. These are all indications that the terrestrial portions of Draft Exhibit E, especially the impact sections, were written too quickly before information was organized and had received very little proofing. The draft is in such poor shape that a meaningful, detailed review is very difficult if not impossible. However, some major problem areas that require extensive modification of the impact and mitigation sections can be identified and specific examples of types of deficiencies can be cited.

1. Quantification of impacts - Magnitude of impacts are rarely indicated except in terms such as "minimal" or "moderate." Even those terms are rarely supported by a rationale. Most judgments of the significance of impacts appear to be subjective. While studies are incomplete, and some data (such as available vegetation maps) are of marginal value, it should be possible to place outer limits on many impacts, at least indicating the order of magnitude. Indication of the general proportion of a population's range subjected to a particular impact would be useful as a crude indicator of magnitude that could be refined at a later date. As written, the reader does not know if a species will lose 10 percent or 90 percent of its habitat.

2. Impacts based on current populations - Current populations are almost always used as the basis for impact assessment. Impacts are judged under current management plans and management strategies. This approach is not adequate for assessing many of the impacts of the Susitna Hydroelectric Project. Impacts should be assessed in terms of the range of population levels that could reasonably be expected to occur during the life of the impact. Current populations might be adequate for short-term impacts, as the population would not change greatly during that period. However for long-term impacts, such as those resulting from inundation of habitat, a full range of population levels that could be supported by the habitat (carrying capacity) and the range of management objectives that could be supported by those population levels should be presented.

It should be recognized that carrying capacity as well as population levels may vary over time. Consequently, likely changes in carrying capacity during the life of an impact should be considered. Any action that maintains carrying capacity at a generally higher or lower level than expected in the absence of the project would have a positive or negative impact respectively.

Carrying capacity cannot always be measured. Where current populations are near carrying capacity, they are an appropriate measure even for long-term impacts. Where current populations are believed to be below carrying capacity, some estimate of carrying capacity is required. In some cases, historical population data may suffice. In other cases, measures of habitat quality may be used as direct or indirect indicators of carrying capacity.

There are numerous examples where the Draft Exhibit E completely ignores these concepts. Prime examples are caribou and wolf. Both populations are currently at levels below carrying capacity, caribou because of current management goals and wolves because of high harvest, much of which is illegal. Exhibit E concludes that project impacts would be minimal under current harvest levels and avoids discussing impacts that would occur if these goals and actions were altered and the populations were allowed to increase. Wildlife populations, user demand, and management goals have changed dramatically over the last 50 years and can be expected to continue to change over the life of the Susitna project. For example, increased hunter demand is likely to result in an upward adjustment of the caribou population and harvest goals, perhaps even before construction begins. If the Susitna project precludes attainment of goals that could have been attained without the project, there will be a negative impact that has not been adequately addressed by the Draft Exhibit E.

3. Failure to discuss cumulative impacts - Impacts are usually discussed one at a time, with little discussion of the potential cumulative effects on the population. Often each impact is sufficiently isolated that its effect on the population is judged "minimal." However the cumulative effect of all habitat alteration and all mortality factors may significantly affect the population's ability to sustain major impacts such as habitat loss. For example, inundation of moose winter range may reduce carrying capacity, increasing the impact of severe winters on the population. Project induced mortality could slow or even prevent recovery during subsequent years of milder winters. At the very least, there would be an impact on the amount of hunter use the population could sustain.

4. Ranking of impacts - When impacts are ranked, the most significant impact listed is often one that is easily mitigated. For example, increased hunter harvest resulting from improved access is often suggested to overwhelm all other impacts. In such cases, the discussion of other impacts is often cursory. However, hunting can be regulated and it is certain that the Board of Game will take measures to minimize adverse effects of hunting on wildlife populations, usually shifting the impact to the users. This treatment is inconsistent with that of

other easily mitigated impacts such as borrow pits where the impact after rectification (revegetation) is discussed.

By suggesting that the greatest impact will be unregulated hunting, a distorted view of total impacts is created. Less easily mitigated impacts such as loss of critical foods tend to be obscured and are discussed only superficially.

5. Incomplete and inconsistent treatment of impacts of improved access - Some of the greatest and longest term impacts of the Susitna project will be secondary effects of improved access and attraction of people to the area. This will likely precipitate development and increased recreational use of the area that might not occur for decades without the project. Impacts of improved access through hunting, including direct mortality, disturbance, and ORV use, are discussed repeatedly, often to the exclusion of less controllable impacts. But impacts of improved access through individuals other than the hunters are almost completely ignored. This is inconsistent and ignores a significant source of impacts.

6. Inadequate treatment of habitat alteration - Habitat alteration is consistently treated superficially. As noted above, this is sometimes done through failure to even roughly quantify the impact or consider cumulative effects. There are other examples where alteration is dismissed without adequate rationale. The most serious example is downstream impacts to moose habitat.

It is concluded that habitat may be enhanced between Devil Canyon and Talkeetna during the license period. However it fails to consider that areas of current early successional stages may become mature more rapidly than new areas will become vegetated, resulting in an immediate loss of habitat quality.

Changes in frequency of flooding are dismissed because bank full floods will still occur every 5 to 10 years. However this could reduce the rate of cutting and filling to 20 percent of current levels with a corresponding reduction in habitat created by that mechanism. Effects of peak floods and ice scouring below Talkeetna are dismissed even though changes in stage will exceed 4 feet in some areas.

This is an example where conclusions were presented without supporting rationale. Close scrutiny of the problem shows that the underlying rationale was either faulty or that alternative conclusions are possible.

The problems listed above, singly or in combination, work to systematically minimize potential impacts that might require mitigation. This appears to stem from a tendency to seek a rationale that nullifies the need to fully discuss impacts. However, if an underlying assumption is rejected (e.g., downstream effects on moose habitat), the entire section of the impact assessment becomes inadequate. Virtually every section of the wildlife impact assessment suffers from at least one of the problems listed.

Mitigation Plan

The wildlife mitigation plan is too incomplete to warrant detailed comments. Measures to avoid, minimize, or rectify impacts are scattered. Some are included in the vegetation section but there is little indication of how effective these measures will be for wildlife. It also is not clear which measures have been incorporated into the project design and which are merely recommendations from environmental consultants. The mitigation plan should clearly indicate how wildlife impacts are considered in the design of the project; what measures will be taken to avoid, minimize, or rectify impacts; and how effective these measures will be in mitigating losses. This is necessary to demonstrate that the option analysis the Susitna Hydroelectric Project Fish and Wildlife Mitigation Policy has been followed and so that residual impacts can be estimated for compensation planning.

The inadequacies of the impact assessment are evident in the mitigation plan. There is no mention of compensation for impacts to species other than moose. It is suggested that mitigation measures for moose will partially mitigate for losses to bears and wolves, but that will depend on what actions are taken and where. No mention of options for out-of-kind compensation is made.

SPECIFIC COMMENTS - FISH

Page/Paragraph

E-3-2/5

In this paragraph it is stated, "...criteria for assessing the relative importance of biological impact issues have been provided by....(2) comments and testimony by the Alaska Department of Fish and Game (Skoog, 1982; ...)." We have reviewed the text of Skoog, 1982 and, we do not believe this statement can be construed as establishing "...criteria for assessing relative importance of biological impact issues...." The context of the comments by ADF&G were specific to three alternative access plans, numbers 13, 16, and 17, and provided qualitative assessment of impacts for each of those plans. It was clearly noted in several areas of the letter that ADF&G's assessment was subjective and qualitative. We would like to state that the criteria by which project impacts are judged should lead to a quantifiable determination of impacts. These criteria for project access routes to our knowledge have not been established. Programs which will collect quantifiable information to insure equal consideration of fish and wildlife and their habitats and mitigation of those impacts in access corridors have not been performed.

A reference to Commissioner Skoog's April 1982 testimony to the APA Board of Directors would be appropriate. Also, references to comments and testimony provided by Schneider (1979, 1982 a.b.c.) are not cited in the bibliography.

E-3-3/1

The ADF&G disagrees that its policy implies "...that project impacts on fish and game species will be of greater concern than changes in the distribution and abundance of non-game wildlife and invertebrate species." First, the terms "fish and game" and "fish and wildlife" are used interchangeably throughout our policy document, and secondly, the ADF&G's greatest concern is fish and wildlife habitat and its ability to maintain productive populations. As stated in ADF&G policy, "The overall mitigative goal of the Department of Fish and Game is to maintain or establish an ecosystem with the project in place that is as nearly desirable as the ecosystem that would have been there in the absence of that project." We are primarily interested in maintaining the quality, quantity and diversity of the habitat for fish and wildlife with the project that is similar to that existing without the project.

E-3-3/2

The general tone of statements in this paragraph indicates a process of rationalization rather than of a clear sense of direction and logic. It is stated in this paragraph, "Where there is a high degree of confidence that an impact will actually occur, it has been ranked above impacts predicted with less certainty." For this thesis to have any validity one must also specify the vulnerability of the resource to be evaluated. The same applies to assessing the process for evaluating the probability that an impact will occur. It is equally important, if not more so, to specify the magnitude of the impact that will occur.

E-3-3/3-4

The priority sequence for ADF&G mitigation policy is not only for mitigation option analysis in a planning sense but also for mitigation option implementation. We have five potential options for implementation as listed, and require an assessment which quantifies project impacts, and determines the parameters under which the project must operate to implement each option. The highest priority mitigation option which is feasible is the one which this Department will require for direct implementation. Quantifiable information sufficient to determine whether an option is feasible must be available to enable the ADF&G and others to select the appropriate mitigation option. As stated in the ADF&G mitigation policy, "The burden of proof to justify lower estimates of damage to fish and wildlife habitat lies with the developer."

E-3-5/3

We suggest that management strategies will require the concurrence of resource management boards and agencies.

E-3-7/2

Chinook, pink, chum and coho salmon mill at the entrance to Devil Canyon. Chinook salmon spawn in Devil Canyon in Cheechako Creek (RM 152.5) and Chinook Creek (RM 156.8). The lower limit of Devil Canyon is defined as RM 152. It would therefore be correct to state that "The Susitna River is a migrational corridor, spawning area and juvenile rearing area for five species of salmon from its point of discharge into Cook Inlet to <u>upstream</u> <u>within</u> Devil Canyon."

E-3-8/1

Impacts to less sensitive species with similar habitat requirements would be mitigated, however, species with a lower evaluation priority may be highly sensitive to change and may not be mitigated. For example, species that are adapted to turbid waters may be adversely affected if a project creates substantial decreases in turbidity. Burbot are an example of a species which may be so affected.

E-3-8/3

Chinook and coho do not have a greater commercial value than chums, although they do have a greater sport fishing value.

The projected change in conditions in the mainstem are not necessarily beneficial to rearing juveniles as suggested in this paragraph. The conditions (parameters) referred to should be identified. Further, mainstem habitat will not necessarily be improved in winter months, higher turbidity is an example. Juveniles are also consistently present in sloughs. There are no data or literature cited to support the last two statements in this paragraph.

E-3-8/4

Arctic grayling also utilize mainstem habitats not only clearwater tributaries as implied.

E-3-9/1

What are the resident evaluation species below Talkeetna? None are indicated in the listing.

Rainbow and burbot should be included in the list of evaluation species because of their importance to the sport fishery and because of their abundance and adaptation to the turbid conditions. There may be a particular sensitivity to possible changes in the case of burbot.

E-3-10/3

Table E.3.3 does not reflect the 1.2 million figure discussed in text.

E-3-10/4

Table E.3.4. reflects different figures than the text with regard to chum salmon escapement. The chum salmon escapement was 20,800 and 49,100 in 1981 and 1982 respectively.

E-3-11/1

Value (ex-vessel) on coho salmon is not presented.

E-3-11/5

If Mills (1980) data are to be used to indicate significance of recreational use, the 1981 information should be included.

E-3-12/1

The harvest figures reported here reflect primarily Susitna River harvest. Additional harvest occurs on some of the anadromous species (chinook for example) outside the Susitna drainage, i.e., in Lower Cook Inlet saltwater fisheries. The statement that the sport fishing harvest is from an area larger than that which may be impacted is incorrect.

E-3-12/3

The Tyonek Village subsistence fishery is principally supported by Susitna River chinook salmon stocks, not "at least in part" as stated in the text. The Department not only recognizes the subsistence harvest of fish by Tyonek, but is responsible to insure the continuation of this stock of fish.

E-3-13/1

Throughout the discussion, the escapement year is unidentified.

E-3-13/4

Types of individuals or species of fish should be identified.

E-3-16/1

The statement that, "Out-migration in the reach from Talkeetna to Devil Canyon peaks prior to early June and terminates by the end of July throughout the drainage." requires documentation.

E-3-18/2

There are lakes with sockeye in the upper Susitna River (Talkeetna to Devil Canyon reach). The potential for sockeye enhancement in the upper Susitna Basin should also be mentioned.

E-3-19/3-4

Based on the 1982 evaluation of sonar versus tag/recapture Petersen estimates, the latter has been determined to be more representative of escapements than sonar estimates. Therefore, it is recommended that Petersen population estimates be used where available.

E-3-22/1-5

We suggest Petersen population estimates would be more meaningful in lieu of sonar counts for the stations at Sunshine, Talkeetna and Curry. The 1982 evaluation of sonar versus tag/recapture Petersen estimates indicates that the latter are more reliable. Therefore escapement should be defined on Petersen estimates when available.

E-3-24/1-7

The year the data represent is not stated in the text.

E-3-26/4

Eulachon are known to extend as far upstream as RM 58 based on 1981 observations by Su Hydro Aquatic Studies staff. The RM 48 figure provided by Trent (1982) was for 1982 observations.

E-3-28/2

Principal study areas were located in the first mile of the tributaries upstream of their confluence with the Susitna. The reference to upper stream reaches in the fourth sentence should be removed.

E-3-29/1, Subsections 1 and 2

These statements are speculative and cannot be supported by existing data.

E-3-29/2

A much larger number of grayling depend upon the area to be inundated over and above those included in this estimate.

E-3-29/3

Grayling fry were captured at Watana Creek area in 1981, indicating spawning in the immediate vicinity.

The final sentence concludes that if other unidentified conditions are suitable, spawning habitat will not be a limiting factor for grayling. This needs proper referencing and evaluation.

E-3-30/1

Burbot also inhabit Susitna River tributaries, not just the mainstem.

E-3-30/2

Areas downstream from Talkeetna of importance to burbot were identified specifically. The four mainstem sites upstream from Talkeetna should also be specifically identified.

E-3-31/3

The discussion of whitefish occurrence in the impoundment is not clear.

E-3-32/4

The juvenile longnose sucker collection effort was not sufficiently uniform to conclude changes in distribution from the catch per unit effort data.

E-3-37/3

Chinook salmon extend to RM 156.8 (Chinook Creek) not RM 158.2.

E-3-37/4

Resident species of sculpin also occur in the Susitna mainstem. The text should therefore report seven species.

E-3-40/1

Timing for respective salmon use based on 1981 data would be more accurate if changed to:

Coho - 30 July through mid-September,

Pink - 27 July through 20 August.

E-3-41/1

The Arctic lamprey also occurs in the Susitna River above the Chulitna confluence.

E-3-41/5

Based on set net and electrofishing catches in 1982, pink salmon mill in the Susitna mainstem immediately below Devil Canyon.

E-3-43/1

Not all sloughs are overtopped by flows of 20,000 to 24,000 cfs. Examples are Sloughs 10, 11, 14, and 15.

E-3-44/4

Holding areas at the mouth of sloughs are not considered a critical factor any more than "holding areas" at the confluence of many of the chum salmon producing streams. The fact that there are holding areas does not necessarily make the sloughs more productive.

E-3-44/8

In the last sentence, are the authors speaking of a tributary mouth or tributary? In either case, importance of the habitat type for rearing cannot be measured simply by number of fish captured at a site. This is particularly true for tributary mouths because they are part of the downstream and out-migratory pathway where fish may be seasonally concentrated.

E-3-46/4

These are not static populations. The populations of individuals becomes redistributed to favorable rearing habitat locations, including tributary mouths.

E-3-46/7

Chum salmon preference to slough habitat over tributary streams is unsupported. Only index surveys were conducted on tributaries whereas sloughs have been surveyed in total. The 1974 investigations and 1982 ADF&G surveys indicate that tributaries may be equally as important to overall chum salmon spawning in the Talkeetna to Devil Canyon reach as slough habitats.

E-3-47/1

Indian River is a major chum salmon spawning stream. Based on 1974, 1981, and 1982 escapement surveys, this stream supported higher numbers of chum salmon than chinook and coho salmon.

E-3-49/4

Eulachon were found upstream to RM 58 in 1981, and to RM 48 in 1982.

E-3-51/7

Based on 1981 and 1982 ADF&G spawning surveys, sloughs do serve as chum, sockeye and pink spawning habitat.

E-3-52/3

Yes, all species of salmon were recorded in tributaries in 1981 but sockeye were not found in notable numbers. We do know that the Chase Creek system supports a "small" sockeye run. ADF&G surveys are conducted in the half mile reach of tributaries upstream from the confluence with the Susitna River. The balance of the tributaries are not surveyed. If the report is to reflect that all species utilized tributaries, then it would be appropriate to modify Page E-3-46, paragraph 2 which presently excludes sockeye as being present in tributaries.

E-3-55/3

Fish Creek in the Big Lake drainage supports a significant rainbow trout population and also pink salmon.

E-3-62/4

Cheechako Creek is a chinook salmon spawning stream. Chinook salmon spawn both in the creek and the mixing area at its confluence with the Susitna River.

Gravel removal/dam construction will destroy this production area, which is a long term impact. The Cheechako Creek plume area is a spawning site. Will project impacts be mitigated here at least until Devil Canyon is built?

If Tsusena Creek will have the long-term and degree of impacts stated it seems contradictory and optimistic to say it will or can be rehabilitated.

E-3-65/4

Investigations should be conducted to determine the presence or absence of fish in the referenced lake.

E-3-67/3

This is a mid-summer estimate of only those grayling inhabiting the impoundment area and is not an accurate reflection upon the number of grayling that depend upon that same area for spawning, rearing, or wintering.

E-3-68/3

Data are required to support the suggestion that the reservoir may provide additional wintering habitat.

E-3-71/3

The ADF&G studies document juvenile salmon occurrence in mainstem habitats all summer. Catch rates were relatively low, however, and large numbers of fish could be present in low densities over a large area at any time.

E-3-73/4

Water temperatures of 5° to 6°C at Talkeetna during open water period may have major impact on returning adults. If higher flows will reduce temperature, it may be better to reduce flows or find ways to tap warmer layers of water for discharge.

E-3-74/2

The statements in this paragraph are speculative and reflect the need for further study and analysis.

E-3-75/2

Same comment as E-3-74, paragraph 2.

E-3-78/1

The statements here are speculative and not supported by data or references.

E-3-78/3

Beaver dams in Sloughs 9B and 19 did not inhibit use by adult salmon in August of 1982. Slough 9B had a peak survey count in 1982 of five chum and one sockeye salmon on 19 September. Low water condition in mid-August generally precluded adult salmon access to Slough 9 which is the access corridor for salmon using Slough 9B. Slough 19 was essentially void of adult salmon spawning in 1982. Only one pink salmon was observed in this slough and this fish was recorded on 4 August 1982. No beaver dams were present in Slough 19 which would have precluded fish access.

E-3-79/4

Deadhorse Creek (RM 121.0) is not an established anadromous fish stream. Occasionally, one or two adults enter this stream, usually pink salmon. However, no successful spawning has been documented.

Annually, Deadhorse Creek flows go below the surface in the lower one-third mile during the late fall and winter period.

It is questionable whether successful salmon production occurs in Sherman Creek. About 25 pink salmon entered Sherman Creek on or about 12 August 1982, presumably for spawning, it has not been established that the eggs will successfully incubate. The creek flows subsurface in the winter and eggs may be frozen.

Skull Creek (RM 124.7) is another stream which probably will be perched with flow changes in the Susitna mainstem. This creek supports a small chum salmon population.

E-3-80/1

Devil Creek (RM 161.0) would be equally accessible to salmon as Tsusena or Fog creeks. Devil Creek appears to have potential chinook salmon spawning habitat.

E-3-80/2

Data regarding flow characteristics are insufficient to substantiate minimal impacts into Susitna River reaches downstream from Talkeetna. A greater proportion of the Susitna River fishery resources utilize this downstream reach. A small change may affect a proportionately larger resource base.

E-3-80/3

See comments for E-3-80/2.

E-3-80/4

In addition to salmon utilization, the Susitna River reach from approximately RM 4.5 to RM 29 is almost entirely eulachon spawning habitat, sustaining a spawning adult population ranging in the millions of fish.

E-3-81/1

All resident species occupy mainstem habitats during ice free months, not "may" occupy.

E-3-82/1

Eulachon spawning limits extend from approximately RM 4.5 to RM 58.

E-3-82/3

Eulachon do not spawn in backwater or semi-placid areas. Principle spawning areas are adjacent to cut banks where the substrate included deposits of unconsolidated sands and gravels, and riffle zones or bars with relatively moderate velocity and unconsolidated sands and gravels.

E-3-88/4

The statement on sediment in this paragraph contradicts the statement on page E-3-90, paragraph 2, sentence 3.

E-3-90/1

These statements are not supported by data.

E-3-90/3

Ice cover would probably form at RM 114 not RM 14 as presented.

E-3-90/4

The impacts to fish habitat due to backwater and staging processes caused by increased post-project winter flows are not defined.

E-3-90/5

These statements are not supported by data and are speculative.

E-3-95/6

Eulachon do not spawn in backwaters. See comment on E-3-82, paragraph 3.

E-3-98/6

Other species are known to be present. A relatively small population of Dolly Varden inhabits the subject areas along with at least one sculpin species.

E-3-100/3

Additionally, Jack Long Creek supports adult coho salmon. Portage Creek also has spawning populations of chum and pink salmon.

E-3-103/3

Changes in streamflow during open-water seasons will affect slough habitats depending on the flow released. The potential for destroying these aquatic habitats appears high.

E-3-122/5

Does restricting unauthorized traffic mean that project personnel will be allowed to fish and the general public will not be allowed access to the fisheries? This may not be an acceptable form of mitigation during a construction phase that may span 20 years. The Board of Fisheries management decisions will also supercede the stated policy of APA on catch and release fisheries by project personnel. It does not seem likely that the public will be barred from the area while project personnel have exclusive access and use of the fisheries.

E-3-126/4

The lakes for water withdrawal should be identified and their resources inventoried.

E-3-127/2

Individual fish will not necessarily be lost by filling of the reservoir. Fish do not have to be moved through the diversion tunnel. Structural protection from passage through the tunnel is a potential mitigative measure.

E-3-130/3

A 10 percent reduction of flows during a critical and stressful period for fish does not constitute a minor reduction. The potential effect of reducing the November flow have on the recharge of groundwater reserves which will be needed throughout winter should be evaluated. Icing may take place much sooner with reduced flows and be much more severe.

E-3-130/4

There are no data presented to support the statements regarding fisheries impacts at the referenced flows.

E-3-131/5

Pink salmon fry moved out primarily during the ice breakup period. Chums out-migrated primarily following the early run-off period.

E-3-134/2

There are no assurances that responses, i.e., releases of water, will happen quickly enough to keep from losing one year class of fish. By the time the problem appears to be sufficiently severe to warrant correction, it is most probably too late to act. This problem needs to be further examined.

E-3-134/4

We are not aware of testing of this procedure in this area of Alaska, or that the technique is feasible. Additional research needs to be conducted to evaluate the feasibility of the concept of introducing spawning substrate.

E-3-135/4

Data have not been presented to suggest this procedure will work for chinook salmon. It is as likely that suitably sized gravels placed in side channels, given maintenance flow, may attract chum salmon.

E-3-136/3

There is no definition of species to be produced, nor a management scenario. In addition a suitable location for the proposed hatchery facility has not been identified. To be considered a feasible mitigation alternative, these considerations must be included.

E-3-138/3

There are no data or references presented to document the feasibility of this mitigation approach. Altered thermal regimes in the mainstem and side-channels would cause potential pre-emergence of salmon fry in these areas. However, early emergence of salmon fry spawned in sloughs may not result as a consequence of higher mainstem temperatures. Therefore, the proposed feeding and rearing of pre-emergent salmon fry would not be resolved by the proposed spawning channel and rearing ponds (E-3-143-and 144) as mainstem fish would have no access to them.

E-3-138/4

A much larger number of grayling than included in this estimate depend upon the area to be inundated. Also, this is <u>not</u> a wintering population estimate.

Additional Comments on Mitigation

On a more general basis, the attitude implicit in the mitigation plan is that losses are inevitable but unquantifiable, and that some mitigation measures will be implemented but may not work. It is also implied that if monitoring demonstrates inadequacy of a mitigation measure other steps will be taken.

How and by whom will the effectiveness of mitigation measures be determined? Under natural conditions small sub-populations of salmon undergo extreme variations in survival. This will confound evaluation of the mitigation measures and could be a source of continuing conflict between the operators and the resource agencies. The frequent references to alternatives and operations which could be implemented if a mitigation measure proves inadequate puts the burden on the wrong parties. The mitigation aspects of this document are too tentative and too speculative. Substantially more detail and information is required before ADF&G can make a reasonable decision on mitigation methods.

Other additional comments specific to the mitigation section are as follows:

E-3-136 and E-3-140/1

Reference the following statement from the Exhibit E document:
"Since the effective mitigation measures to avoid, minimize, rectify or reduce impacts to the grayling population in the impoundment area are

not available, it will be necessary to compensate for the loss of these grayling. Compensation is proposed to be in the form of hatchery propagation of grayling... Sufficient grayling will be planted such the number [sic] of catchable grayling will be similar to the number lost."

The FRED Division of ADF&G has been experimenting with grayling culture for several years, first at Fire Lake, then Ft. Richardson, and now at Clear Hatchery. We are continuing to work with grayling and intend to develop techniques that <u>someday</u> will support a grayling production program. At this time and for the forseeable future, grayling production in Alaska must be considered <u>experimental</u>. In brief, several factors impact hatchery grayling production:

1. It is difficult to find egg sources that are sufficient in number. Whereas salmon egg takes in the tens of millions are common, a one million grayling egg take is a major undertaking.

2. The eggs and fry are extremely small and from a culturist's standpoint, very difficult to work with. Grayling fry hatch at 30,000 per pound as compared with salmon which are ten times that size at emergence. Marking and therefore evaluation of survival after stocking are not possible with existing technology.

3. Survival from green egg to fry have generally been low - 50 percent as compared to 80 to 95 percent for salmon production.

4. Attempts to rear fry in hatcheries have been largely unsuccessful. The obvious survival advantage that could be gained by releasing larger fish cannot be obtained until techniques are developed which will permit holding and feeding of fry. Grayling have been successfully reared in the lower 48. However, those fish hatch at a larger size (20,000 per pound) and behave differently in raceways.

We intend to overcome these problems as we learn more about the performance of grayling in our hatcheries. However, the idea that an irrevocable loss of grayling due to habitat inundation can be compensated by hatchery propagation must be judged speculative at this point.

The development and operation of spawning channels and the modifications of sloughs, that has been proposed as mitigation warrants further discussion.

Reference the following seven excerpts from Chapter 3, of the Draft Exhibit E document:

1. "The slough habitat for the incubating salmon embryos may be enhanced through increased intergravel flow associated with larger flows, or it may be degraded if the higher flows substantially alter the intergravel temperature regime or ice conditions." [E-3-131]

2. "The [proposed] flows are of sufficient magnitude, however, to undertake to rectifying (SIC) impacts to salmon spawning activity by modifying existing spawning habitat to maintain natural spawning by salmon." [E-3-132]

3. "If further impact reduction is required to maintain existing fish populations, additional mitigation measures will be incorporated. Certain target mitigation issues will receive priority in the monitoring program." [E-3-133]

4. "The outmigration of salmon fry will be monitored to evaluate if proper timing of outmigration is achieved. The basis for such an evaluation will be the baseline outmigration studies and within year comparison to adjacent unregulated systems." [E-3-134]

5. "Success of a multi-level intake depends on the thermal structure of the reservoir, the existence of sufficient water at the desired temperature and location with the reservoir...Temperatures near this [8 to 12°C] range may exist in the top 100 feet...If this layer is present, it can be accessed by the multi-level intake gates..." [E-3-137, 138]

6. "The most significant adverse impact associated with the altered thermal regime would be accelerated incubation and early emergence of salmon fry...The modified sloughs or spawning channels designed to rectify or compensate for lost spawning and incubating habitat will be provided with a rearing pond at their downstream end...

Used to collect early emergents and hold them to prevent their downstream migration...Until appropriate conditions, including temperatures are reached in downstream habitats." [E-3-138]

7. The fry will be fed if natural food production is insufficient to support the number of fry present." [E-3-144]

In response to the above: The major problems appear to be flow alteration with resulting affects on slough access, hydraulics and water temperature. As might be expected, the determination of the degree of impact (loss of habitat and fish) is very difficult to quantify and there is not specific information provided. Instead, engineering solutions are proposed for engineering problems. Modified sloughs also known as spawning channels are addressed on a conceptual level. Somehow it is proposed, that an unquantifiable loss of fish will be rectified/compensated by a multi-purpose habitat modification program which includes channelization, flow control structures with day-to-day flow alteration, gravel cleaning, gravel introduction, enhancement of upwelling, rearing ponds with fry screens on the outlets and artificial feeding of fry.

The engineering, construction and operation of these channels is totally lacking in detail. There are not operational spawning channels for these species in Alaska. Canada has had mixed success, but they are located in environments far more temperate.

The cost of maintenance and operation of these channels should be included in any determination of feasibility. The proposed demonstration project should focus on fish production and survival as well as the physical properties of the modified slough.

The concern about changes in the thermal regime are inadequately addressed. It is apparent that the impoundment temperatures and hence the utility of a multi-level intake are not known. The rearing ponds at the downstream end of the channels may not be effective in accomplishing the desired objective. Emergence of fry will not occur within a short time span but over a period of weeks. Therefore, at any given time the fish in the slough or pond will cover a wide range of developmental stages. A schedule of "release" of these fry into the mainstream must be provided. Once emergence timing is upset due to altered temperatures it is unlikely that survival levels could be maintained by holding them in a pond.

Fry will not automatically feed on an artificial diet, there is an aspect of "training" which is obviously successful in a hatchery raceway. Washington has had some success with pond culture but the fish are generally hatchery lots of similar size.

Assuming that the 'operator' of these sloughs and the proposed rearing ponds determines that artificial feeding is required, how will this be accomplished through the ice cover that may develop on the rearing ponds?

SPECIFIC COMMENTS - WILDLIFE AND BOTANICAL RESOURCES

The following specific comments are intended to illustrate the types of deficiencies in the wildlife sections of the draft Exhibit E. The poor state of editing and overriding major problems listed in the general comments precluded a complete listing of inconsistencies, errors, omissions and other deficiencies.

Page

E-3-279

Rationale for considering alteration of habitat less significant than hazards is not supported.

Increased predation is mentioned on page 284, with no indication of its significance to the population, but ignored in the ranking of impacts. The current moose population is highly impacted by predators. The project is likely to increase the vulnerability of the moose population to predation in several ways. Brown bear and wolf populations are likely to be less affected than moose in the early years of the project, causing an alteration in predator/prey ratios. The project could reduce the availability of spring foods for bears and caribou for certain wolf packs, causing a further increase in predation on moose. The drawdown zone and ice conditions are likely to facilitate hunting of moose by wolves. The moose population may have reduced productivity because of poorer habitat quality, especially after severe winters, reducing its ability to sustain predation. These factors could allow predation to drive the moose population to very low levels and maintain it there for long periods. Similar situations have occurred throughout much of Interior Alaska. Ultimately predator populations would suffer and any habitat enhancement attempts could fail.

E-3-280

Sections relating to impoundment clearing are inconsistent, illustrating poor editing and confusion about the certainty of mitigative actions. Most sections assume the impoundments will be cleared in a stepwise manner, but on page 306 it says, "If portions of the impoundment are cleared..." On page 286 it suggests a brief increase in forage, but on page 287 it predicts a substantial reduction in value.

Moose are sometimes attracted to areas being logged by availability of branches of deciduous trees.

E-3-283

Overuse of winter range can lead to reduced natality as well as mortality. Moose that never use impoundment areas will be impacted by over utilization of adjacent areas (see page 287 also). This could expand the zone of impact for several decades.

E-3-284

No rationale for concluding that mortality factors will have a negligible effect on the population. Mortality along access routes should be considered along with dam construction activities because they occur together.

E-3-288

It should be possible to quantify areas subject to erosion (and other types of habitat alteration) and estimate the proportion that will revegetate. This is an example of an impact that is mentioned with potential negative and positive effects then dropped. The reader has no idea how much area will be affected and whether the net impact on moose will be positive or negative.

Effects of drifted snow on vegetation, availability of vegetation and phenology are not addressed.

E-3-289-290

See general comments on adequacy of assessment of downstream effects on vegetation. Frequency of flooding (290 first paragraph) is probably very important. No rationale is provided for assessment of the effects of ice scouring on vegetation. The potential effects of scouring should be quantified.

E-3-290

The effects of drifted snow on movements of moose are not mentioned here, but are for caribou (page 298).

E-3-292

Increased mortality resulting from increased predation should be considered. Floating ice during latter stages of breakup could have the same effect as floating debris.

Accidental kills will continue during operation of Watana.

E-3-294

The summary of impacts for Watana comes closest to addressing cumulative impacts. However it is not systematic, ignores some impacts mentioned earlier and contains many subjective judgements that are not supported by quantitative rationale. It also does not include impacts of access routes and transmission lines which must accompany Watana. The uninformed reader is likely to be confused and have no real concept of the range of potential changes in moose populations.

E-3-297

There is no basis for the conclusion that the Nelchina caribou herd will not use the area north of the impoundments at its current population size. It is highly likely that this area of high quality range will be used heavily in the future even at moderate population levels.

Large movements of caribou across the impoundment areas have only been observed once since 1973. Movements were not monitored closely in most years.

It is highly likely that the management goal of 20,000 caribou will be modified, perhaps before Watana is constructed. Therefore the conclusions about level of impact are invalid even if the assumptions about range use were correct.

E-3-298

Statements about drifting snow remaining in the impoundment conflict with statements made in the Feasibility Report. This needs to be clarified and documented.

E-3-298

The most significant mortality factor to caribou could be floating ice. In many years the spring migration to the calving grounds would coincide with breakup of the Watana impoundment. During a period of northerly winds, caribou could encounter open water when they reach the north shore. Seeing no obvious barrier they would start to swim across and would encounter a mass of broken floating ice. This would create a problem similar to floating debris. Mortality could be substantial in some years.

E-3-299

The impression is created that the four possible responses are mutually exclusive. More likely all four responses will be exhibited by varying proportions of the herd.

E-3-300

The statement that the Mount Watana sheep population does not occur near the impoundment is an example of a statement based on a brief period of observation. Sheep have been observed near the impoundment in the past.

E-3-301

All portions of exposed soil at the Jay Creek mineral lick are not used equally. Some of the most heavily used areas are low on the bluff. Therefore the percentage of the lick that would be inundated is misleading. This is also an example of an "operation" impact being discussed under "construction."

E-3-305

Carrion is not mentioned as a spring brown bear food in the first paragraph.

The assumption that spring foods are not important to bears is incorrect. Food intake during periods of stable weight or even weight loss can be absolutely critical because it reduces a negative energy balance. A prime example is the importance of winter forage for moose.

The suggestion that loss of carrion is more important than loss of green vegetation is questionable. A moderate quality, but abundant, food may be more important to the population than a high quality, but sparse, food.

The assumption that, because lactating female brown bear do not use areas that would be inundated, other bears could do well without those areas is not supportable. Females with cubs probably have overriding reasons to avoid these areas. This includes the cub's ability to travel and the risk of predation on cubs by males. Pregnant females develop heavier fat deposits that probably help sustain them during this period. A female that was not able to coast through this period would probably lose her cubs and move to riparian areas near the river. Spring foods in the impoundments are probably most important to yearlings which emerge from dens in poorer condition, particularly in years following poor berry crops, and suffer the highest rate of mortality. It is unreasonable to conclude that yearlings could survive as well as a lactating female without spring foods.

E-3-303-308

Importance of spring foods to brown bears is inconsistent among "construction," "filling" and "operation" sections.

E-3-308

While bears are capable of crossing the impoundments and some will, there still may be a hindrance of movements between seasonal food concentrations that could reduce productivity of the population. This section is inconsistent with a similar section on black bears (page 310). This is another example of where the potential significance of an impact to the population is not discussed in even general terms.

The fact that healthy bear populations exist where salmon are not available is not pertinent. Salmon are one of several seasonal food concentrations. They are probably most important during years when other summer foods, such as berries fail. Bear productivity and survival are probably higher because salmon are present and hence the population is generally higher.

The entire brown bear impacts section is filled with unsubstantiated speculation. Most of it is biased towards minimizing potential impacts. It fails to consider how several impact mechanisms may work in combination and how they might influence the population. The impact section should list important foods of bears by season, indicate how the project might influence the availability of each food to bears, and indicate the possible effects of these changes in availability on bear productivity and survival.

E-3-310

The consequences of disturbance of denning black bear during clearing are not emphasized. This is likely to cause problems for both bears and crews. A number of bears are likely to be shot. Many of the disturbed bears will not be able to find new dens and mortality is likely to be high. This can result in a more rapid, more violent and more visible adjustment of the bear population to the project.

E-3-310

There currently is no resident black bear population near the Tyone River confluence and the Fog Lake area supports low densities. Therefore it is unreasonable to expect these areas to support viable populations during operation.

E-3-310

Project facilities may block movements of bears from the Devil Canyon impoundment area to berry areas adjacent to Watana.

E-3-311-312

The entire wolf impact section is deficient in that it fails to adequately address impacts of reduced prey densities.

Caribou populations may be reduced. Even if changes in caribou numbers are minor the distribution is likely to be altered in a way that reduces availability of caribou to specific packs. There are data from the Susitna basin indicating that moose densities influence wolf territory size, pack size and pack stability. Some current territories may be reduced to the point where social factors would cause loss of a pack.

E-3-313

The statement that the amount of habitat lost would potentially affect only two wolverines is not completely accurate. The habitat lost will remove portions of territories of a number of wolverines, not all of only two territories.

E-3-314

Impacts of prey loss on belukha whales is inadequately addressed. This section appears to focus on adult salmon only. Outmigrating salmon and eulachon are more likely the foods attracting belukhas to the area. Eulachon in particular may be important. Until effects of the project on the availability of these foods are determined, no conclusions on impacts on belukha can be drawn.

E-3-340

Statements of climatic effects should be documented and quantified with regard to magnitude of impact.

Elimination of ice scouring is suggested as a benefit, yet ice scouring may be the most important factor maintaining early successional stages north of Talkeetna (on page 289 reduction in ice scouring is seen as detrimental). Even the potential short term benefits may be offset by current shrub communities advancing to more mature stages.

E-3-341

The flow regime would be used for fisheries management and its affect on vegetation should be identified. It could prevent vegetation of newly exposed substrate and further offset the potential benefits suggested on page 340.

E-3-340-342

The discussion of downstream effects of Devil Canyon Dam are misleading. On page 340 it states "moose may benefit from an increased availability of riparian habitat." Then, on page 341 it points out that much of the habitat will not be available in winter because of open water. (The potential effects of ice fog on use of these areas by moose is ignored.) Finally on page 342 it pulls the two statements together and states that effects on moose could be "moderate to severe." Then on page 370 it says changes in vegetation will have a "small population - level effect."

This is an example where the combined effects of several impacts have not been clearly thought out. The full range of possible changes in vegetation has not been discussed, only the most optimistic possibilities. When one of several potential overriding factors is identified, the acreage affected is not quantified.

A far more enlightening impact assessment should be possible by building a simple model with existing data. The analysis on page 172 takes a step in the right direction but does not carry it to a useful conclusion. It crudely estimates the maximum acreage that could become available for vegetation. This should be refined to estimate the amount that would enter productive successional stages annually during the life of the project. Uncertainties about rates of colonization would produce a broad range of estimates, but the order of magnitude of change and more importantly the chronological patterns of change should become apparent. Similar estimates for currently productive habitat that will advance to mature stages should be subtracted to provide an estimate of net change in acreage of value to moose. The proportions of this acreage that occurs on islands and would be inaccessible to moose during winter should be subtracted to produce a crude estimate of possible changes in available winter range.

A similar systematic approach should be applied to all areas that might be subject to habitat loss or alteration. Impacts that show a potential for serious effects can then be studied in more detail to refine the estimates for mitigation planning.

E-3-342

Devil Canyon impoundment will primarily affect different moose than Watana. Therefore the statement that moose population will have already been greatly reduced is misleading. The summary of impacts uses the word "minimal" five times in reference to impacts on moose in the upper basin, but completely fails to convey any impression of the range of population changes that could occur during the life of the project.

E-3-343

"... small proportion of acceptable black bear habitat ..." What proportion of what area? How important is that proportion?

E-3-350

The orientation of access routes in relation to wildlife concentrations and movement patterns should be considered. Some subpopulations will be more heavily impacted than others. Mortality and habitat loss from access routes should be added to other impacts affecting the same subpopulations during the same time periods.

E-3-351

Impacts of road and railroad traffic start at tidewater. Increases in unscheduled traffic on existing roads, particularly the Parks and Denali Highways are likely to be substantial. Levels should be estimated and impacts assessed.

E-3-352

The timing of railroad and highway traffic is more important than an average rate. Both seasonal and diurnal patterns should be considered. Scheduling of traffic should be considered as a mitigation measure.

Secondary impacts of access routes, other than hunting, should be considered.

Combined effects of access potential of transmission corridors and access routes should be considered.

E-3-355

Caribou calving north of the Susitna River is sufficiently dispersed that no alignment of the Denali access road will avoid calving areas completely.

E-3-356

Frequency of traffic will be substantially higher during construction unless unscheduled traffic is restricted.

E-3-355-356

It is not always clear which "herd" is being referred to. The Denali access road runs through a central part of the upper Susitna-Nenana subherd's range. It also runs through one of the highest quality portions of the main Nelchina herd's range. Use of the word "peripheral" is highly misleading.

Potential cumulative effects of the access routes and impoundments on caribou range use should be discussed.

E-3-359

Potential alterations of prey distribution, especially caribou, on specific wolf packs should be discussed.

E-3-360

The access routes will provide excellent access to tundra habitats. Therefore human use of areas important to wolverine during summer will increase.

E-3-366-368

Transmission corridors should be considered along with other impacts. For example where they intersect the range of a subpopulation the changes in habitat quality should be added to changes caused by other project features within the range of the same subpopulation.

Placement and management of transmission lines in proximity to roads and railroads can influence animal movements and rates of mortality. For example moose train collisions could be greatly increased if a transmission corridor attracted moose in a manner that increased crossings of the railroad.

E-3-370-371

The big game impact summary is completely inadequate. It addresses only impacts on existing populations. It ignores many impacts, including some judged substantial, suggesting that these need not be mitigated. It conveys no impression of the potential magnitude of change, even in current populations. The one effort at quantification uses the smallest possible number of moose that would be impacted by one mechanism. Even those numbers are stated in a misleading way. They are numbers estimated on one survey during a mild winter. There is no basis for the statement that this represents "most years," and it certainly does not represent even a minimum number of moose that would be eliminated by the project.

Appendix C

Susitna Hydroelectric Project, Draft Exhibit E
Volume 3, Chapter 5
Socioeconomic Impact

GENERAL COMMENTS

The ADF&G has continuously expressed concern regarding the adequacy of socioeconomic studies relating to the determination and assessment of potential impacts of the Susitna Hydroelectric project to fish and wildlife. Expression of these concerns dates back to initial meetings with the Alaska Power Authority in 1979. The original study plan developed by the ADF&G in 1979 contained an objective designed to assess these very impacts.

Upon review of this chapter, these concerns remain. In our view, little substantial progress has been made to define project related socioeconomic impacts.

Impacts to fish and wildlife users have not been adequately addressed, either in the areas most directly effected by construction or those areas outside the immediate project area. Portions of the fish and wildlife resources produced within the Susitna project area are harvested or utilized in other more distant regions. There needs to be an assessment of these uses of fish and wildlife with regard to (1) identification of resources used; (2) quantification of use levels; (3) description of use patterns including seasonality, its context within the local communities, etc.; and (4) description of geographic areas of use.

Throughout this chapter reference is made to current and/or planned studies. These studies, however, are not described, objectives are not presented and time of implementation or completion is not defined.

SPECIFIC COMMENTS

Page/Paragraph

E-5-6/1

Only characteristics of personal monetary income have been described. There should be some description (especially in the Local Impact Area) of relative importance of natural resource harvests as part of the household income. Any income determination need not necessarily be made in monetary terms, but should be done (1) qualitatively by (a) assigning importance values to the harvest and use of each resource; (b) assessing culturally significant practices; (c) describing the type of economic organization of the area; and (2) quantitatively by (a) assessing amounts of time spent harvesting resources; (b) assessing estimated proportions of household food consumption; (c) determining amounts of money spent in pursuit of wild resources; and (d) expressing the overall output or consumption of a household unit.

E-5-12/4-6

This section on recreational facilities related to fish and wildlife resources would be more appropriately termed recreational opportunities. This area has an abundance of opportunities but little development like trail systems, shelters and other man-made facilities. A full assessment of the use of these opportunities and existing facilities would be appropriate. Certainly there is information available on Mt. McKinley National Park and the State park recreation areas.

E-5-54/4

The indirect influences affecting commercial businesses dependent upon fish and wildlife resources as discussed are undefined.

E-5-54/5

The "partial short term displacement" as discussed is not defined. The statement made that with increased access, business opportunities will increase is purely speculative. One might also expect business opportunities to be reduced as a result of increased access, particularly if the business is associated with the commercial use the of limited fish and wildlife resources.

E-5-54/7

This paragraph indicates similar factors are necessary for both successful lodge and guide operations. This statement is incorrect.

Commercial lodges are most successful with improved access and visitation by large numbers of visitors or customers. With construction of new roads, railroads and airstrips the project area would appear to best fit this category.

A big game guide, on the other hand, appreciates and can tolerate less competition from additional hunters and recreational visitors. His type of business best functions at low levels of human activity and participation.

E-5-54/8

Loss of additional habitat, and the change in location and amount of salmon harvested as stated requires definition. The statement "long term" impacts to Cook Inlet fishermen and other fish and wildlife users will be small, is speculative. Long term is not defined, nor are "other user groups," or "recent activity levels." No supportive data or study results are presented to support this statement. Types of on-going studies should also be clarified and referenced.

This entire section includes many categories of users who are not licensed. Trappers and subsistence users, for example, are not required to have business licenses to operate. The definition of business needs to be presented.

SECTION 3.7, LOCAL AND REGIONAL IMPACTS ON FISH AND WILDLIFE USER GROUPS

General Comments

1. Organizationally, the section of FISH is not comparable to that of GAME which make it deficient in the presentation of vital information:

    a. It makes no mention of guided sport fishing activities which are a major use of the Susitna River and its tributaries.

    b. No mention is made of fishing lodge operations dependent on Susitna River fisheries.

    c. No category comparable to that of "The Hunter," E-5-75, is made for sport or subsistence fishermen.

    d. The category "Resources" on E-5-75 elaborates on game resources, their characteristics and the users of those resources. Only limited information is currently available pertaining to recreational and subsistence uses in the Susitna River Basin. There is a need for additional data collection.

e. In the Game section, no "Methodology" is presented as it is for Fish.

Although it may be true that impacts to the fishery resource depend upon loss of habitat and subsequent loss of fish, the issue in this section (3.7) is also the impact upon user groups. In this case, the methodology in this chapter should address both impacts to the respective user groups, and to fish and wildlife resources.

Specific Comments

E-5-68/1-3

This section is labeled "Methodology," but provides no methods appropriate to the evaluation of impacts to user groups. Implicit in this type of evaluation is the need for a measure of existing use. The only statement defining methods is included in Paragraph 2 which described data used to determine impacts of the dam on the fishery resources. It should be noted that pink salmon are more abundant on even years than on odd numbered years. As such, 1981 was a year of low pink salmon occurrence.

E-5-68

A survey of community usage of wild resources by Cantwell would be useful in assessing levels of use and importance of the salmon, moose, caribou, and other resources.

The Cantwell area is likely to be affected by (1) wildlife population fluctuations due to construction activity; (2) population fluctuations because of increased hunting pressure which could result from (a) increased human population, and/or (b) increased access to resources.

While local residents may not appear as a "significant" portion of the overall harvest, those resources may very well be important to the community in many ways.

E-5-68/4

The assumption is made in the first sentence that "...the commercial fishery for salmon produced in the Susitna system occurs only in Upper Cook Inlet." This assumption is invalid since Susitna River salmon stocks are harvested throughout Cook Inlet, including the lower district. Impacts to Susitna River fish are indeterminable because it is not possible to separate the mixed salmon stocks as they migrate through Cook Inlet.

E-5-68-69/5

The monetary figures presented here cannot be used to determine the specific financial loss of Susitna fish, because of the mixed stock (see comment E-5-68/4). Many of these fish are Kenai River or Kasilof River fish.

E-5-69/3

The first sentence states "The specific impacts which would result from construction of the Susitna dams have not been determined in a manner which allows accurate quantification." This statement invalidates comments in E-5-70/1-3, and statements in other Draft Exhibit E report chapters.

The paragraph does not address impacts to Susitna River salmon resources downstream of Talkeetna. Greater salmon occurrence exists in these areas, than does the area further upstream of Talkeetna.

E-5-70/3

Chinook salmon are harvested incidentally by commercial fishermen in both upper and lower Cook Inlet. Project impacts to these users requires definition as do the criteria for establishing "significant quantities" as stated.

E-5-71/1

Personal communications with sport fish biologists should be properly cited.

E-5-71/2

The discussion indicates the area and level of impacts to resident and migratory fishes is not determined. Chapter 2 and Chapter 3 of the Draft Exhibit E present relatively detailed presentations of these impacts.

The statement, "Data on specific angler use of the Susitna and tributaries above the Talkeetna River confluence are virtually nonexistent." is incorrect. Data are available on angling use in this area from the ADF&G Statewide Harvest Survey.

Impacts are limited not only to areas upstream of the Talkeetna River confluence, as implied. Sport harvest of stocks utilizing the upper Susitna River are thought to occur elsewhere in Cook Inlet, as far south as the Homer area.

E-5-71/4

Table E.5.40 as referenced in the paragraph omits burbot in the list of major species. This paragraph states study is underway to define recreational values of Susitna River fisheries resources which may be impacted by the project. We are unaware of these studies, and they should be referenced.

Section Summary:

The sport fish discussion is not complete nor does it compare with the commercial section in the presentation of figures and numbers. For example, population estimates are available for several species as are data regarding recreational utilization. These data are not presented. The research mentioned as "currently underway" is not referenced.

E-5-71/5

Generally, the section on Subsistence Fishing is based on the assumption that the harvests which occur in Cook Inlet are from the Susitna River. This assumption is not necessarily true as most of the effort occurred in the Central District where Kenai and Kasilof salmon stocks are taken. Information in Stanek (1980) indicated the residency of subsistence permit holders. Net survey information (Stanek, unpublished data) is available depicting general areas utilized by subsistence fishermen in the Northern District. Similar information is available for the Central District (ADF&G, 1980).

Additional assessment of user groups should be made under the category of domestic use of salmon. Salmon for domestic use is obtained from commercial, sport and subsistence fisheries.

Information on use of salmon resources in Tyonek is also available (Stanek and Foster, 1980). More recently, data were collected during the spring of 1982 on the specific uses of salmon by Tyonek residents (Foster, 1982). It is assumed that most of the chinook salmon caught in the subsistence fishery at Tyonek are Susitna River fish.

E-5-72/2

The value of "subsistence" caught fish cannot adequately be determined using a shadow price. Usher (1976) described the difficulty in determining the value of wild foods. The "point of subsistence capture estimate" would not adequately estimate value. A more appropriate value would be the processed cost. In addition, the nutritional value, cultural value, and equipment investment must be added as cost qualifiers.

It is also stated that value might be determined using "...the price of an equally desirable alternative food source." A major question would be how an equally desirable food would be determined when, for many people, there is not a better source in terms of quality, nutritional value, cultural value, social value and recreational value. Indeed, salmon is <u>the</u> standard by which value is determined.

E-5-73

Under the category of Game there is no section on methodology as under the Fish section.

In the section on "Guides and Guide Services" there is no quantification of the number of guides operating in the area or their revenue. In addition quantification of the numbers of people providing outfitting and transporting services that are not guides is required. Information is available from the ADF&G and from the Guide Licensing and Control Board.

E-5-74/2-3

There is no discussion of available data (Phase 1 of big game reports) that provide estimates of losses of animals, effects of access, new hunting regulations, etc., that would influence "available harvestable animals."

In the category of "Lodge Operators" no indication is made of the amounts of services and relative value of services furnished.

Many additional lodges on the highway system provide services to the individuals who hunt along the highway system or who use the highway system as a point of departure.

E-5-75/2

Apparently the intention of the statement "The impact of the proposed project on the lodge operators would be indirect and of the same nature as that of the guiding industry." is that any direct impacts would be upon the resources. However, in the case of the inundation of land areas utilized for hunting, camps and travel, the impact would be direct.

E-5-76/2

Reference to the figure 71,000 animals must be put into proper perspective with regard to the present management for the population and range carrying capacity.

E-5-76/3

The information presented deals with the residency of hunters rather than the experiences they seek.

E-5-77/1

A comparison is drawn between hunting pressures or numbers of hunters during the early 1970's and 1980's. Hunting pressure is a function of the number of permits and the number of animals in recent years. This paragraph is misleading and, in fact, the comparisons are invalid.

E-5-78/5

The category "Experience Sought" is inappropriate for the informational content of this section. It provides information on characteristics of user groups.

E-5-79/2

Although harvest ticket reports allow for the reporting of multiple means of transportation, analysis of the data allow for only one primary means of transport. The use of highway vehicles is the most common method of transport to the general area. Within the area, however, other forms are more common.

E-5-80/1

References should be noted with regard to who is doing the studies and their schedules for completion.

E-5-80/2

The first sentence is misleading and inaccurate because the implication is that regulations will be of greatest impact to the users. Regulations are a function of resource status and user groups characteristics. Those regulations which may be promulgated due to any reduction in quantities of resources are a reflection of resource status and perhaps increased user access to the area.

The statement, "In such cases, the project would cause little or no additional reduction in hunting opportunity." when referring to already stringent regulations on some species is inaccurate. Indeed, some regulations are more stringent as with caribou, but may become even more stringent if range is inundated and the area of available habitat is reduced. Regulations on increasing numbers of moose in the region may be relaxed in the near future, but if these prove unsatisfactory and mitigation measures do not compensate for moose losses in the impoundment area, further restrictions may be required.

E-5-80/3

The statements indicating that regulatory structures will be the major impact on the user is misleading and inappropriately identified as the major impact on the user.

E-5-80/4

There is no indication of how the quality of the surrounding environment will be changed thereby affecting the expectations of the user.

E-5-81/2

Subsistence users in the region have not been identified with regard to the use of game resources, except caribou. In this case, a set of criteria were developed which qualify a certain number of people on a first-come first-served basis. For other game resources, further work is required to determine resource use patterns. Information provided in the text refers only to caribou.

Although "bringing home food meat may be the 'main goal,'" there are other goals of the user. These include (1) obtaining a high quality goods at a relatively low price; (2) fulfilling certain cultural traditions and obligations to the community and/or family; (3) attaining goals of self-determination and independence of welfare programs; and (4) attaining the knowledge and ability to support one's self.

E-5-82/3-4 & E-5-83/1

Data limitations on trappers do exist; however, a survey of trappers in the Local Impact Area would be appropriate.

E-5-84/5

The term "on balance" is unclear. There is some question as to whether existing trappers will benefit or if there will just be more numbers of trappers due to access. It is doubtful that increased access to the inundated area will, in fact, benefit trappers since fluctuating water levels will not benefit more aquatic species especially if draw-downs occur during winter months where food caches and burrows may become inaccessible.

E-5-85/2-3

Construction of access roads and transmission lines may provide added access to some areas for trappers. However, the loss of habitat and increased pressure on martens from trapping and human activity generally may reduce the numbers of marten and thereby be a major loss to trappers. Paragraph 3 more accurately portrays likely impacts than does paragraph 2.

E-5-86/3-4

The assessment of trapping activity and its importance to users in the Local Impact Area should be more extensive. There is some confusion as who an Alaskan trapper is, compared to "recreational" trappers who supplement their income by trapping. Especially when, as stated in paragraph 4, "It is estimated that there are a large number of residents in the Local Impact Area who do some trapping on a part-time basis...," more information is required on how large this group is and the level of importance trapping is to them.

E-5-88/4-6

There is no mention of what people's attitudes were toward changes in section other than 3.1 and 3.5. Because natural resource use is important in the area, there should be some indication of local attitudes toward changes in the availability of resources.

It therefore follows from E-5-89/3 that only the attitudes presented with regard to section 3.1 and 3.5 are addressed.

No further mention is made regarding measures to mitigate impacts to resource users. There should be some indication as to what can be done to resolve the impacts.

Appendix D

Susitna Hydroelectric Project, Draft Exhibit E
Volume 4, Chapter 7
Recreational Resources

GENERAL COMMENTS

This report segment lacks supportive data for many statements related to project impacts. Statements or discussions are often simplistic, based on faulty assumptions and methodologies; and lack the necessary definitions to provide adequate project impact analysis.

In general, analysis of current trends in recreational boating and fishing in Upper Cook Inlet, leads to the conclusion that many of the recreational use projections in this report are far too conservative.

Discussion of project impacts in some instances is limited only to statements that anticipated impacts are similar to others discussed, or to other impoundment projects. The specific comments that follow will demonstrate many of these deficiencies.

SPECIFIC COMMENTS

Page/Paragraph

E-7-13/2

Fairbanks is not considered to be within the Southcentral area of Alaska.

E-7-13/3

The paragraph implies members of the Knik Kanoers and Kayakers are representative of the overall increase in recreational boating within the Susitna River basin. They are not, as they comprise only a minor segment of the recreational boating users. Substantially greater increase in boating, and water oriented recreation with other types of watercraft has occurred.

E-7-15/3

Lake Susitna, Tyone Lake and Tyone River are already major recreation areas. They are not potential areas for "future development" as stated in the text. Both Lake Susitna and Tyone Lake have numerous recreational cabins located around their perimeters.

Boaters are <u>not</u> able to float down the Susitna River and up to Lake Louise as stated. Powered watercraft are necessary (often equipped with jet or air-drive propulsion) to ascend the Tyone River, to Tyone Lake.

E-7-20/1

We are not aware of any recreational boaters traveling upstream on the Talkeetna River to Stephen Lake for fishing, due both to the distance and presence of major rapids on the Talkeetna River.

E-7-21/2

See comment (E-7-20/1)

E-7-24/2

Management of lands for public recreation and appreciation as presented in the paragraph requires additional clarification. It is not clear what will be accomplished to achieve these goals.

E-7-25/1

This paragraph refers primarily to wildlife related impacts, and little mention is made of potential fisheries impacts. In addition to quarry activities discussed for Tsusena Creek, it can be anticipated that the lower reaches of all Susitna River tributaries within the impoundment may be effected by vegetative clearing, road construction, gravel removal, as well as the stated water quality changes.

Paragraph one also implies the actual construction area is a relatively minor one. It in fact will be almost 50 miles in length, and one which does not constitute only a minor inconvenience to recreational users.

E-7-25/2

As in the previous paragraph the discussion is directed primarily to wildlife and wildlife related impacts. The discussion fails to address the fact that the lower reaches of all clear water tributaries to the Susitna River, within the impoundment, will be inundated. These areas are the most valued aquatic habitats at present, and are the areas where all recreational use currently occurs.

E-7-25/5

This paragraph does not clarify why fish populations are not expected to occur in the impoundment. Statements in Chapter 3 (fish, wildlife & botanical resources) indicate the impoundment waters are expected to provide additional fisheries habitat.

The apparent inconsistency in these statements, and report segments, requires clarification.

E-7-25/6

This paragraph is unclear as to locations of areas where sport fishing will be disturbed. Dredging reference is to "channel" but does not clarify if it is within the Susitna River or the tributaries where sport fishing currently occurs.

Additionally, dredging may create impacts other than just changes in water quality as stated. Quarry activities, road construction and resultant recreational use restrictions as a result of these activities are not discussed.

E-7-26/1

The flows predicted during the fill period will not only "temporarily diminish" fishing opportunities as stated, but will totally eliminate some of the slough and side channel habitats. The effects of slough dewatering during the fill period may result in the loss of several year classes of some species of fish, creating not a temporary impact, but a "long-term" one.

E-7-26/2

There is no information to support the statement of increased fishing opportunities with increased winter turbidity levels as stated.

E-7-28/1

No data exist to support the statement that the presence of construction workers will not have detrimental effects to the recreational resources, nor is there an adequate discussion of what constitutes "proper control."

E-7-28/2-3

References to the impacts of 550 workers, the loss of 32 miles of river, construction of a 34-mile road, and current uses of the river are treated superficially. Impacts to recreational resources resulting from improved road access alone will affect not only waters within the impoundment but those of adjacent areas as well.

E-7-29/3

This paragraph is speculative. No data are presented to support the statement that winter fishing is unaffected by increased turbidity levels. The increase in turbidity levels requires definition.

E-7-30/3

No data are presented to support the assumption that recreational use is non-specific to the area, and can simply be moved to adjoining areas. A definition of subject species and recreational uses discussed is required.

E-7-37/4

Data extracted from the 1970 report should not be used when similar data from the 1976 and 1981 reports are available. Existing ADF&G data suggest that per capita participation days and projected increases as published in the 1970 plan, and for demand estimation, are inappropriate for 1980 and 2000.

E-7-38/1

Quality is not the same for all activities and should not be discussed as though it were. The assumption that travel time and cost totally influences recreational use is faulty.

E-7-39/4

Data in this paragraph are interpreted incorrectly. A careful review of the evidence cited does not suggest that fishing effort has been decreasing in the impact area, or even that it has decreased relative to statewide trends. Areas used for yearly comparisons do not represent the impact areas. In addition, areas used for comparison were not the same from year to year.

E-7-40/4

No data are presented in this paragraph to support the assumption of a declining recreational demand in the Susitna River area. The discussion does not define the other "attraction values," nor does it address the increasing recreational needs of an increasing human population in the railbelt area.

E-7-41/4

The doubling of recreational use as presented is considered conservative. With the addition of a road system into the upper Susitna River area and the expanding human population, greater increases are expected to occur.

E-7-41/6

With the decreased flows downstream from Devil Canyon dam, and improved road access to the dam site, we would expect increased days of recreational use by kayakers, canoers and rafters.

Appendix E

Susitna Hydroelectric Project
Draft Exhibit E
Volume 4, Chapter 9
Land Use

GENERAL COMMENTS

This document is written in such a general manner that it is difficult to comment on. It contains information that contradicts statements made in other chapters, and ignores potential impacts to land use and access downstream from Gold Creek.

Although mitigation of impacts to land use is mentioned, there is no commitment to implementing possible measures. In addition, there is no discussion of which measures will be implemented or when or how. Some impacts to land users are completely glossed over and it is suggested that users will have to accept impacts or move elsewhere.

SPECIFIC COMMENTS

Page/Paragraph

E-9-2/7

> Activities such as consumptive, recreational or subsistence use of fish and and wildlife resources are considered as dispersed use and isolated non-site-specific activities which do not involve a commitment of resources at any particular site.

Harvest, and production of harvestable resources is specifically dependant on a commitment of a specific amount of land (habitat). Participation in the harvest of fish and game (levels of effort) is therefore site-specific. Consequently, the loss of species habitat including the lands and waters used as harvest areas will have a measurable impact both on management of wildlife and on public use.

E-9-3/5

An assumption is made that because the project is isolated and located in a subarctic environment, extremely low density land use results. However, use of land both by the public and wildlife is seasonal and can be very high for a specific season.

E-9-15/3

Hunting use of Zone 1 is less than in Zones 2 and 3. However, hunting in Zones 2 and 3 is basically associated with the existing lodges and cabins and is more readily quantifiable than identifying independent hunter effort. Use of ADF&G harvest statistics would help quantify independent hunter effort.

Figure E.9.5

Reference to rating public use of lands occurs throughout Chapter 9 and is ultimately reflected in Figure E.9.5 a map which identifies 11 use or sample use sites with evaluations of use intensities for each site.

The designation of Low, Medium and High intensity uses should be defined.

E-9-32/1

Proposed mitigation for the loss of public use of project lands has only addressed the consideration of establishing restrictive access regulations. Other mitigation alternatives should be identified including replacing opportunities lost with lands that provide equal value.

STATE OF ALASKA

DEPARTMENT OF NATURAL RESOURCES

OFFICE OF THE COMMISSIONER

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January 13, 1983

Mr. Eric Yould
Executive Director
Alaska Power Authority
334 W. 5th Avenue
Anchorage, AK 99501

RECEIVED

JAN 17 1983

ALASKA POWER AUTHORITY

Dear Mr. Yould:

The Alaska Department of Natural Resources has reviewed the draft Exhibit E application for the Susitna Hydroelectric Project. We are submitting comments on this document which in part satisfy the agency coordination requirements established by the Federal Energy Regulatory Commission, (FERC). The formal position of the Department of Natural Resources regarding the Susitna project is contained in the Exhibit E comments which follow; our April 16, 1982 testimony to the Alaska Power Authority Board of Directors (copy attached) and the letter to Eric Yould from Reed Stoops dated October 11, 1982 (copy attached). We request that an unabridged copy of these comments accompany the perfected application submitted to FERC.

ORGANIZATION AND PRESENTATION OF EXHIBIT E

In some cases the Exhibit E text, tables, and figures do not reference the documents from which the material was taken. The consequence of this inadequate documentation is that the reader cannot determine the specificity, accuracy or sufficiency of the Exhibit E. We recommend that the specific references to original documents be included in this Exhibit E before the application is submitted to FERC.

WATER QUANTITY AND QUALITY

(1) During the past two years the Department of Natural Resources has emphasized the great importance of acquiring a clear understanding of the relationship of various flow-release rates from the proposed dams and the corresponding impacts on downstream aquatic resources, habitats, and uses. This information is vital to enable DNR to make informed decisions with respect to instream flow reservations and water appropriations both of which are required in order to facilitate the Susitna Hydro Project. The flow releases schedules presented in Exhibit E for filling and operation of the Watana and Devil Canyon Dams have not been developed in consultation with the Department of Natural Resources or by a methodology approved by this Department which is charged by law with authority to adjudicate all water

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appropriations and instream flow reservations in the State. Indeed, Exhibit E does not explain the process by which these release schedules flows were devised. We strongly recommend that the license application contain a specific, detailed flow release schedule developed through a quantifiable instream flow analysis program coordinated with DNR and with state and federal fish and wildlife agencies.

Attached please find the entire text of the review comments from our Division of Land and Water Management. Please consult that text for additional specific comments relating to navigability, thermal modeling, and nitrogen gas supersaturation.

ACCESS

This department's comments regarding the proposed route from the Denali Highway to the project site should not be construed as support for that project route as the preferred means of access. This agency, along with the other state and federal resources agencies, has consistently favored road access to the project from the Parks Highway. However, if the route proposed in Exhibit E is selected, we recommend certain design modifications.

(1) We recommend that the principal design criteria for the proposed route be the enhancement of scenic values and public safety. We consider the proposed high-speed design of the road inappropriate. The long-term use of the road after dam construction will be primarily sightseeing and recreation. The highway should, therefore, be designed to take maximum advantage of the scenic potential of the area which traverses some of the most dramatic in North America.

In addition to being an unattractive counterpoint to the natural landscape, the high-speed road proposed (55 miles per hour with 40 miles per hour at difficult curves) may create serious safety problems. The long braking distance for a vehicle traveling 55 miles per hour on a gravel road endangers the stop and go driver and those who park and stand along the side of the road to take photographs. Although a high-speed road will yield cost savings during dam construction, it is questionable whether these cost savings outweigh the long term benefits of a scenic road. The rationale for a high-speed access road design should be based on an explicit quantification of the cost saved by that design. We believe the scenic and public safety benefits foregone by a high-speed design when accumulated over the expected life of the road are almost certainly greater than the costs saved by such a design to facilitate the brief construction phase of the dams.

(2) Although design standards for upgrading the Denali Highway between Cantwell and the proposed access road were not discussed in Exhibit E the issue merits comment because an upgrade will be necessary to accommodate project-related traffic. The portion of the Denali Highway affected provides exceptional views of the Alaska Range, Reindeer Hills and the

Talkeetna Mountains. The Alaska National Interest Lands Conservation Act (ANILCA) of 1981 called for a joint state, federal and private study of the scenic qualities of the Denali Highway. The intent was to encourage cooperative land management of lands adjacent to the highway to protect its important scenic values. The Denali Scenic Highway Study will be published in early 1983. DNR encourages APA to consider carefully the recommendations of that report and to support a design which is consistent with the study recommendations.

(3) Finally, we recommend re-routing of the proposed access road where feasible to take advantage of the extraordinary vistas. Presently the road transects a large wetland in the upper Brushkana drainage. Consultants responsible for the aesthetics portion of Exhibit E recommended that this section of the road be re-routed to higher ground to the west. We concur and support that recommendation, which will also protect the wetland from the impacts of road construction and should result in lower long-term maintenance costs because of better soil conditions.

RECREATION AND AESTHETICS

We agree with the consultants' conclusions that recreation plans be focused on those opportunities occurring elsewhere in the project area rather than those directly associated with the reservoirs. Because of fluctuating water levels and steep shorelines, the reservoirs themselves will not present an attractive recreation environment except for occasional use by speedboats. The greater recreation opportunities will be associated with the access road and the many lakes, streams, and alpine hiking areas that can be reached from that road. The consultants' identification of recreation resources on Cook Inlet Region, Incorporated (CIRI) land raises the question as to how these recreation opportunities might be realized. We recommend that the Power Authority consider some sort of leasing or concession arrangement with CIRI to facilitate public recreation use on Stephan Lake. At least one
(1) public use site of a suitable size (40 acres or more) should be provided at Stephan for camping, fishing, and as a staging area for those people using the lake for float trips down the Talkeetna River. In addition, legal access across village and regional corporation lands should be secured and a trail constructed from the reservoir to Stephan Lake. In order to most effectively enhance the recreational potential of the proposed projects, we
(2) would recommend that the recreational element of Exhibit E add three sites adjacent to the Alaska Railroad. These sites are Indian River, Gold Creek, and Curry. Each of these sites would provide a destination point for recreation users of the Alaska Railroad and would provide a greater diversity of recreation opportunities. We recommend that management of the off-site recreational facilities associated with the access road are best met through the budgeting process of the Alaska Power Authority. If the Division of Parks is expected to manage these sites, then we will have to
(3) work closely with APA to identify priorities for project funding.

In summary, we feel that the consultant has done an excellent job in identifying the recreation opportunities and resources available in the project area and would request that the scope of the study be expanded to look at the identified sites along the Alaska Railroad as described above.

HISTORIC AND ARCHEOLOGICAL

The report on historic and archeological resources is well done and addresses all the pertinent questions about mitigation. We concur with the mitigation plan as presented in the draft document.

We concur with and support the proposed education program described on Page E.4.114. We consider such a program to be a necessary and effective part of any large construction project. If project personnel are adequately trained and sites are clearly marked, avoidance should be a viable mitigative measure in many of the indirect and potential impact cases.

TRANSMISSION LINE

The Access Plan Recommendation Report dated August, 1982 proposes routing a transmission line through a non-roaded area south of the proposed road between the dam sites. The line was well sited taking advantage of terrain and vegetation to minimize environmental and visual impacts as well as minimizing construction costs. We support the route proposed in the August report. We have since been informally advised that APA has decided to route the transmission line along the road between the dam sites to allow year-round access for maintenance (winter over-land access via all terrain vehicle is feasible without a road). If road access is determined to be absolutely necessary, we agree with this decision; it would be inappropriate to have two east-west road corridors through this area. However, (1) presentation by consultants at the APA sponsored workshop in Anchorage during the week of November 29 to December 3, 1982, indicated that there may be excessive concern by maintenance engineers with year-round access. The consultants argued persuasively that maintenance by helicopters is not only feasible, but is cheaper than road maintenance and is a common practice in states other than Alaska. Helicopter maintenance has also proven itself in more rugged terrain and extreme weather conditions of southeast Alaska.

The need for road access in case of bad weather is a concern, but it is important to clarify precisely what is gained in terms of minimizing the risk of power outage by having road access. That gain should then be compared with the costs. In this case the major cost is a strong negative visual impact on the road between the dam sites. In contrast, the gain seems to be minimal. In short, the value of year-round access is not infinite and in this case may be significantly less than the costs.

SOCIOECONOMIC IMPACTS

The permanent townsite appears to have been located in an exceptionally wet area. Apparently the major criterion for locating the townsite was land status. A more appropriate location from the standpoint of land capability and general amenities for the inhabitants of the townsite would be in the Fog Lakes area south of the Susitna River on privately owned land. The townsite is particularly important because, as indicated in the Exhibit E, the tendency for workers to reside on-site depends on the quality of housing and other amenities. Exhibit E emphasizes that a high amenity site will minimize impacts on outlying communities by encouraging a higher percentage of workers to live on-site. We support this objective but do not think siting the townsite as proposed will help achieve it. We strongly suggest finding a more suitable location for the townsite.

Exhibit E projects minimal project impacts on local facilities and services due principally to the provision of on-site housing for workers. The total Mat-Su Borough population increase as a result of the project is projected as 4,700 in 1990 (peak year), 1,110 of whom are expected to live off-site in rural communities. Should that projection be accurate, the off-site impacts would, indeed, be limited. However, the projection assumes absolutely no in-migration by unsuccessful workers. This is a misleading assumption. In fact, in-migration by unsuccessful job seekers will probably be considerable. Such in-migration is a likely result of decreases in job opportunities in the lower 48 and has occurred in Alaska during construction of the oil pipeline. Current economic conditions would stimulate extensive in-migration to a greater extent than is predicted in Exhibit E.

If in-migration is seriously underestimated in Exhibit E, then a wide range of socioeconomic impacts is underestimated as well. Past experience in the state shows that boom conditions, such as the proposed dam construction would create, have led to rent increases, proliferation of sub-standard housing and strain on public facilities and services. The potential impact caused by unemployed in-migrants is particularly significant in light of their tendency to be more of a disruptive influence on small communities than employed in-migrants. Unemployed in-migrants, for example, tend to require more services such as public health and family assistance of various forms. They pay fewer taxes and may have little stake in the community, thus caring less about relatively minor issues such as yard maintenance and the appearance of local parks. In the small, rustic communities in the project area, these problems could create considerable tension between current residents and the new in-migrants. We consider the socioeconomic impact assessment to be inadequate without an attempt to estimate the numbers and effects of unsuccessful job seekers and their dependents who will move into the region.

It would be more accurate and useful to provide a range of projected population increases in affected communities rather than a precise number such as 263 in Talkeetna by 1990 or 75 in Trapper Creek. These numbers convey a precision not supported by the methodology or the probability of error inherent in such projections. More useful information for community planning purposes would be a high-low range. A key consideration in planning for public services is the population threshhold which requires new capital expenditures. For example, if a population increase of 300 would require a new community well in Talkeetna, the city would be better off knowing that it faces a probable increase of 250 to 350, rather than knowing that someone has disaggregated a series of numbers to produce an estimate of 263.

Exhibit E discusses generally the need for measures to ensure that the local unemployed get a chance at project-related jobs. Assuming there will be considerable competition for jobs by in-migrants and that the state's objective is to encourage local hire, it will be necessary to develop a clearly defined and legal program to achieve that objective. The measures recommended by Exhibit E are vague and do not reflect the significance of this issue to the state or the borough. We suggest more attention be given to developing a more comprehensive approach to address this issue in the Exhibit E application to FERC.

ALTERNATIVE ENERGY

The Exhibit E devotes about four and one half pages to the geothermal energy alternative. This information is factual and provides general background for the reader. The Exhibit E could be improved by noting that the Department of Natural Resources has a geothermal lease in the Mount Spurr area planned for May, 1983. The Exhibit E should acknowledge that geothermal energy is immune to fuel price escalation as is hydropower. We agree with the Exhibit E statement that little is known about the geothermal properties. Until exploration of the geothermal properties of Mt. Spurr has occurred the viability of geothermal power for the railbelt region is unknown. We recommend that the Exhibit E be revised to include this information.

In summary, we appreciate this opportunity to provide formal review comments to APA on the draft Exhibit E.

Sincerely yours,

Esther C Wunnicke

Esther Wunnicke
Commissioner

Attachments

cc: Division Directors
Special Assistants

MEMORANDUM State of Alaska

DEPARTMENT OF NATURAL RESOURCES DIVISION OF LAND AND WATER MANAGEMENT

TO: AL CARSON, Acting Director
Division Of Research And Development

DATE: December 23, 1982

FILE NO: 3430.3

TELEPHONE NO: 276-2653

FROM: Gary J Prokosch For
Y.R. (MOHAN) NAYUDU, Chief
Water Management Section

SUBJECT: Su Hydro Draft Exhibit E-FERC License Application

Paul Janke, Gary Prokosch and Mary Lu Harle of my staff have reviewed the Draft FERC License Application, Exhibit E, dated November 15, 1982, prepared by Acres American, Inc. and provide the folowing comments.

I. General - Organization
The report lacks documentation. With few exceptions, much of the textual material, tables and figures do not reference the documents from which the material was taken, the specific page numbers in the original documents, or where those original documents reside. These references should be incorporated into Exhibit E before the finalized license application is submitted to FERC. The organization of draft Exhibit E is poor. Separation of Volumes I and II, Chapters 2 and 3 makes review and evaluation of the Exhibit very difficult. Issues, impacts and mitigations should be combined in a more logical manner to allow easier evaluation.

Many of the statements and conclusions presented in this document are unquantified and speculative. The reviewer is continually confronted by words such as "may", "probably" and "is expected". Statements which are quantified should be so noted and referenced and speculative statements and conclusions should be so noted. Speculative statements must be quantified before effective evaluation of the document can be performed. As such, the document does not present enough data and analysis to adequately evaluate the project at the present time.

II. Major Issues
The following are major issues concerned with the draft Exhibit E. They are not in prioritized order.

A. Flow Releases
The flow releases presented for both filling and operation of Watana and Devil Canyon Dams have not been developed with nor approved by the Alaska Department of Natural Resources. The document does not, in fact, explain the process by which these flows were developed, except to say they were selected to satisfy power production requirements and fisheries concerns. Other water uses, including navigation, river based recreation and wildlife are assumed to be covered by these flows. This may not be the case, and this conclusion should be quantified. This department in its review comments on this project has continually asked for a range flows and their associated impacts. This has not been provided by this document, and should be included.

Further, the impacts from the selected flow releases are evaluated only for individual parameters, such as temperature, river morphology and ice, and are not well quantified. What is needed is the cumulative effects from all the affected parameters and their impacts on issues of concern, such as fisheries and navigation. Only then can mitigation measures be addressed. It appears from the data presented in this document that the proposed flow releases are inadequate.

B. Access Road
A final decision should be made now as to whether the access road to the dam sites will be public or private. Plans for road construction indicate the road will be built as a private road to move personnel, supplies and equipment to the construction sites. However, the recreation plan seems to indicate that the access road will provide public access for recreation to the area once the dams are operational. A decision should be made on this issue now to obtain public review and comment on this issue during the formal FERC review process.

C. Townsite
Further investigation into the townsite location should be conducted. The present location is apparently located in a swampy area. Additionally, the water supply is questionable. — why? Ground water is preferable to surface water for the water supply source as drilled wells are of less environmental consequence. However, a ground water source of adequate quantity is questionable in the present planned location.

D. Land Status
The land status of the land involved in the damsite, access roads and transmissions corridors should be addressed now. Types of land acquisition such as land exchanges, permitting, leasing and condemnation should be investigated and action begun in order to prevent delay to the project further down the line.

III. Specific Comments

There are many sections in this report where inadequacies are recognized by the authors. It would be a futile effort to reiterate all the statements made in this report that say "further work is on-going" or "documentation has not yet been made", etc. As a reviewing agency we also recognize this and would expect that the work will be done and the inadequacies addressed, without each statement having to be noted in these comments.

A. Volume I, Chapter 2 - Water Use and Quality

Pages E-2-26 and 27; E-2-49 and 50; E-2-66 and 67:

"Navigational difficulties between Devil Canyon and the confluence with the Chulitna River will be increased due to shallower water and a somewhat constricted channel. Although there will be sufficient depth in the river to navigate it, greater care will be required to avoid grounding". Since "greater care will be required", this is a project impact and therefore needs to be discussed along with proposed mitigation measures. This statement also differs from the following report: Susitna Hydroelectric Project, Task 7-Environmental, Subtask 7.04-Water Resources Analysis, A Preliminary Analysis of Potential Navigational Problems Downstream of the Proposed Hydroelectric Dams on the Susitna River, March 1982. The above statement does not indicate what depth is assumed to be sufficient for navigation. The above March 1982 report studies ice-free navigation only and assumes a depth of 2.5 feet is required for the following reasons: (1) The cross-sectional data used was obtained for purposes other than studying project effects on navigation, and (2) the accuracy of the predicted water surface profiles is, at best, approximately one foot. From an extrapolation of Figure 2 in this report, to maintain a depth of 2.5 feet at cross-section 32, located near Sherman, a discharge of 6500 cfs is required. Thus, from Table E 2.17, post-project navigational difficulties may occur near Sherman during both filling and operation during May, June, July 1-27, September 19-30 and October. This is when the project flows are less than 6500 cfs. This conclusion differs from the no navigational problems statement in Exhibit E. It is believed that the March 1982 report provides the latest information available. If a more recent report or different criteria are used, this should be stated and discussed.

Additionally, it is stated that "the reach downstream of Talkeetna is navigable under low flow condition but can be treacherous at times". What flows are considered low flows? Are the proposed releases from the project considered low flow when considering navigation? What flow conditions should be considered low flows in the areas above Talkeetna when considering the possible impacts on navigation?

The impacts on navigation, including commercial boating, recreational boating, float planes, and winter transportation use of the Susitna River from dam sites to Cook Inlet is inadequately addressed. The impacts need to be quantified and mitigation measures proposed.

Pages E-2-27; E-2-50
These sections say that information on recreation and recreational water uses are contained in Chapter 7 of Draft Exhibit E. However, Chapter 7 addresses a recreation plan for the Susitna Hydroelectric Project. It does not address project impacts on downstream recreational uses of the Susitna River by boats and float planes for sport fishing and hunting. This is a major use of the Susitna River in its entirety. The impacts on this water use should be identified and quantified and mitigation measures proposed.

If a more recent report or different criteria are used, this should be stated and discussed.

Pages E-2-36
The availability of groundwater for village and camp water supply in the location of Tsusena Creek is in question. Before construction begins on any water supply system a permit to appropriate water and construct a dam must first be granted by the Department of Natural Resources per AS 46.15.

Figures E-2-18 thru 2-25:
These figures do not include low or high flow frequency curves for January - April, November and December. These curves may be useful when looking at the minimum flow releases for these months.

Pages E-2-14, E-2-47, E-2-51, E-2-56, E-2-66, and E-2-72 thru 75; E-2-83:
Sloughs and side channels are very important fish and wildlife habitat. The effects on this habitat due to all phases of the project should be well documented. Some of the basic questions not answered are as follows:

Regarding ice, what will the effects on slough and side channel winter habitat be with minimum flows of 1000 cfs during filling of the Watana reservoir? Taking into account the increased temperature and associated lack of ice formation in the reach above Talkeetna, without the normal ice formation river staging will be lower. What are the effects of the lower staging on slough upwelling and water temperature? If water upwelling in the sloughs will be decreased, what effect will this have on all life stages of fish which use the sloughs.

With the predicted flows of 10,000 cfs during operation of Watana Dam, what effects will this have on the slough and side channels above Talkeetna and below Talkeetna? With increased flows and water temperature at 0°c below Talkeetna, increased ice formation will cause higher water stage than normal. What effect will these higher water stages have on sloughs and side channel habitat? Will the slough heads be overtopped? What effect would ice formation in the slough due to possible overtopping have on overwintering fish, out-migration, slough water temperatures, etc? If the sloughs below Talkeetna are overtopped due to increased ice formation and associated higher river staging and ice does from in the sloughs, beside the effect on overwintering fish and possible delays in out-migration due to cooler than normal water temperature, how will this ice and othr debris be removed from these sloughs without the annual spring flooding? If artificial flooding by scheduled release from the dam is tried, how will timing of flooding

Page E-3-55:
The fishery resource in some specific streams in the transmission line corridor is discussed. Also stated is: "Little is known about the other streams that will be crossed in this segment." Is it possible that valuable resources in other streams may be impacted by the transmission line? It appears more study is needed here.

Page E-3-58:
The discussion of the Watana dam construction states the following: "The movement of fill materials and the actual process of construction of the fill dam are potential contributions to turbidity and siltation." Acceptable levels of turbidity and siltation should be specified, and these should be written into the construction specifications. This is not discussed in mitigation of construction impacts, pages E-3-120 to 127.

Page E-3-73:
The statement "The entire canyon is expected to be passable by chinook salmon, allowing them to enter Tsusena and Fog Creeks" is found in the discussion of potential impacts from Talkeetna to Watana dam during filling of the Watana reservoir. What are the impacts of dam construction and operation on chinook salmon movement into these creeks? If there are impacts, what are the proposed mitigation measures? This is not discussed in the mitigation on pages E-3-128 to E-3-144.

Pages E-3-74 to 76:
In discussion of potential impacts from Talkeetna to Watana dam during filling of the Watana reservoir, the following statements are made:
a. "Many of the physical changes identified for mainstem habitats would also occur in side-channel habitats. Since side-channels are generally characterized by higher streambed elevations, the forecasted changes in streamflow may cause greater effects in side-channel habitats."
b. "Many side channels that normally convey water in May, June and the first three weeks of July, would likely be dewatered under filling flows..."
c. "In other side channels, flow may be reduced to an extent that the outmigration of salmon fry would be delayed."
d. "Some side channels above Talkeetna would be completely dewatered under the proposed filling flows..."
e. "Reduced flows in the spring may inhibit emergence and outmigration in some side-channel spawning area.."
f. "Forecasted August and September flows under the filling schedule may adversely affect spawning habitat in side-channels."
g. "It is unlikely that new spawning areas would become available under the filling flows."

It is understood that with reduced flow rates in sloughs and side-channels, beaver may become more active in these areas. Thus, it is possible that the beaver dams may block the outmigration of fry. What are the impacts from this? Mitigation measures associated with side-channels are not discussed on pages E-3-128 to 144.

Pages E-3-75 Through E-3-77:
The following statements are made with regard to the problems related to flow releases during the different times of the year, "reduced flows in spring may inhibit emergence and outmigration in <u>some</u> side channel spawning area", "August and September flows may adversely affect spawning

habitat in side-channels", "16,000 to 18,000 cfs is needed at Gold Creek to insure easy fish passage into sloughs", and "the stage of the mainstem at flows of approximately 12,000 cfs did not create backwater effects at the mouths of some sloughs great enough to allow free passage by adult salmon".

The total effect of low flows on the fisheries can not be evaluated until the total number of sloughs and side channels both below and above Talkeetna that will be affected, and to what extent they will be affected, is known. What percent of the total salmon population are using the slough or side channel habitats that are expected to be impacted, and at what time of the year these impacts will be most severe.

Page E-3-80 through E-3-85; E-3-95 through E-3-97
The impacts on the Cook Inlet to Talkeetna reach during both filling and operation are extremely generalized and lack documentation. Impacts on the mainstream, side channels, sloughs and tributaries must be investigated and quantified. This includes impacts resulting from changes in discharge and stage, water temperature, water quality, sediment transport, ice and river morphology. While this reach of the river will be impacted less than the Talkeetna to Devil Canyon reach, the possibility remains that small project changes may result in significant impacts. Of particular importance in this reach is the determination of the cumulative effect of the individual impacts noted above. Mitigation measures associated with these impacts are not addressed in pages E-3-128 to 144.

Page E-3-129:
The list of reasons for providing suitable flows should include the following additions:

1. Allow adult salmon access to slough and side channel spawning habitat.
2. Maintain flow through the spawning gravel during the incubation and rearing periods.
3. Maintain suitable flows to preserve slough upwelling waters.
4. Maintain flows to control proper water temperature needed in the mainstem, sloughs and side channels.

Page E-3-133:
Regarding winter flows, "Minimal impacts are expected". The possible impacts addressed on Page E-3-94 seem to be major.

The only rectification of impacts on sloughs that is presented is slough modification. This is an untested mitigation measure in this river system. What are the costs involved with design, testing, construction and operation and maintenence of slough modifications. How many sloughs will need to be modified. This section should include other alternatives besides slough modification to rectify impacts on sloughs.

Pages E-3-136:
On this page and elsewhere, the document predicts water temperatures in the reservoirs and downstream of the dams. No information, however, is given describing how these temperatures were predicted. The model used

should be given or referenced, along with the details describing its verification for use on this system. The validity and hence the accuracy of the temperatures predicted, therefore, must be questioned.

Page E-3-137:
"The impacts associated with alteration of the temperature regime during reservoir operation can be minimized by incorporating multiple level gates in the power intake." Not discussed are water quality parameters other than temperature associated with each reservoir level. A monthly schedule should be given that quantifies the water levels to be used and the associated water quality parameters of the release water. Of specific concern is the dissolved oxygen content of water released from Devil Canyon if the intake is drawing water from the hypolimnion.

Page E-3-140:
"Gas supersaturation will be avoided by including fixed-cone valves in the outlet facilities...A prototype test of Howell-Bunger valves showed them to be effective in preventing gas superstaturation (Ecological Analysts Inc. 1982)." Since this reference is an unpublished report, it can not be easily obtained. The bibliography leads one to believe that this valve was tested at one site. If this is true, it is inadequate. Due to the potential negative impacts from nitrogen supersaturation, the valves to be employed here should be well tested for this applicaiton. It appears that this in not the case for these Howell-Bunger valves.

IV. Summary

In summary, this draft Exhibit E is a start at answering questions regarding issues and resources to be affected by this project and their impacts and possible mitigation. However, a great deal more data collection and analysis is needed in order to answer still unanswered questions before this project can be effectively evaluated.

These comments on the Draft Exhibit E prepared by the Alaska Department of Natuaral Resources should be included unabridged with the finalized comments transmitted to the Alaska Power Authority.

cc: Mary Lu Harle
Gary Prokosch
Paul Janke

United States Department of t..e Interior

NATIONAL PARK SERVICE
Alaska Regional Office
540 West Fifth Avenue
Anchorage, Alaska 99501

IN REPLY REFER TO:

L3031 (ARO-P)

14 JAN 1983

Mr. Eric P. Yould, Executive Director
Alaska Power Authority
334 West Fifth Avenue
Anchorage, Alaska 99501

Dear Mr. Yould:

We have reviewed the proposed Susitna Project recreation plan as presented in the draft license application Exhibit E and have the following comments. Cultural resource management issue comments were addressed previously in the December 3, 1982, letter from our archeologist, Dr. Floyd Sharrock.

The recreation plan appears to be well-conceived. A diversity of recreation resource opportunities are planned with facility development in stages which will permit future modification where it is appropriate. The plan also reflects excellent coordination between its authors and appropriate public agencies and the private sector.

We support the following recommendations, many of which were shared with the EDAW, Inc., representatives at the December 1, 1982, workshops for recreation and aesthetics.

1. Before construction begins, existing river conditions from upstream of the project (perhaps the confluence of the Tyone and Susitna Rivers) to Gold Creek should be recorded on film. A high quality motion picture with narrative describing preconstruction resource conditions could be an effective interpretive tool for the visitor center(s). A permanent film record of the Devil Canyon whitewater is especially important. A film record of the project construction process and the project in operation, including a description of the recreation opportunities, should also be made and perhaps combined with the preconstruction film for use at the visitor center(s).

2. If normal operation of the Watana Dam will minimize the danger now associated with kayaking the unregulated Devil Canyon whitewater, consideration should be given to providing public access to the Susitna River below the dam prior to the completion and operation of the Devil Canyon Dam.

3. Consideration should be given to providing public access from the project transportation corridor to Portage Creek for fishing and/or kayaking.

4. Appropriate day use and/or overnight facilities should be considered for Gold Creek. These facilities could accommodate: river users coming out of the project, backpackers who enter the project area via the Devil Canyon Dam construction right-of-way, and other recreationists using the Alaska Railroad who wish to lay over in the Gold Creek area.

5. The status of the Stephan Lake-Prairie Creek corridor is presented on pages E-7-83, 84 as a lower priority resource area. The priority should be elevated to Phase One implementation as negotiations with Cook Inlet Region, Incorporated, and/or the village corporations could be lengthy. Public access to the Talkeetna River (a potential State Recreation River) via the Stephan Lake-Prairie Creek corridor is an important issue that needs to be resolved early so that public use may continue during project construction.

There is an incorrect statement in paragraph 6, page E-7-15, that should be revised. The text incorrectly states that the Susitna River has been studied for potential inclusion in the National Wild and Scenic Rivers System. A study and evaluation under the authority of the Wild and Scenic Rivers Act has never been undertaken.

Recently it came to our attention that the electrical transmission corridor between the Watana Dam and Gold Creek will now be relocated closer to the transportation corridor to facilitate maintenance. We trust that careful attention will be given to the development of appropriate mitigation measures to safeguard, as much as possible, the scenic values associated with the corridor.

My staff looks forward to continued involvement with the project and is available to answer any questions you may have concerning the above recommendations.

Sincerely,

Bill Welch

Associate Regional Director
Planning, Recreation, and Cultural Resources
Alaska Region

cc:
Jack Wiles, Division of Parks
Al Carson, Division of Research and Development
Robert Erickson, EDAW, Inc.
Bruce Bedard, Alaska Power Authority

STATE OF ALASKA

BILL SHEFFIELD, GOVERNOR

DEPARTMENT OF NATURAL RESOURCES

DIVISION OF FOREST, LAND AND WATER MANAGEMENT
NORTHCENTRAL DISTRICT

4420 AIRPORT WAY
FAIRBANKS, ALASKA 99701
PHONE: 479-2243

January 28, 1983

RECEIVED

FEB 3 1983

ALASKA POWER AUTHORITY

Bob Mohn
Susitna Hydro Project Manager
Alaska Power Authority
334 West 5th Avenue
2nd Floor
Anchorage, Alaska 99501

Dear Mr. Mohn:

The Southcentral District of the Division of Land and Water Management forwarded to this District your November 1982 Exhibit G and project maps of the Susitna Hydro Project FERC license application. The Northcentral District is concerned about the proposed 400' wide alignment of the right-of-way for the stub (transmission line) from Healy to Fairbanks and its impacts on past and present land disposal actions within the subject alignment.

We have mapped out the land disposals that are along the proposed route and the following text lists the status of those disposals.

1. Healy Agricultural Sale: Proposed for F.Y. 1985, a soil survey has already been ordered for this disposal.

2. Spruce Hill Large Lots: These lots will be offered during F.Y. 1985.

3. Windy Creek Remote: This area is currently open for staking and preliminary investigation indicates that the right-of-way passes through six leases; 402154, 408803, 407791, 402157, 402156, and 409474.

4. Windy Hills Subdivision: This was previously disposed of and is classified private recreation. It appears the line passes in proximity to sale 406226.

5. Southwind Remote: This is proposed for disposal in F.Y. 1985.

6. Windy Agricultural Sale: Proposed for F.Y. 1985 and a soil survey has already been ordered.

7. Proposed area of Tanana Industrial Site.

8. Goldstream Agricultural Sale: This disposal is proposed for sale in F.Y. 1984 and a soil survey has been done.

9. Alder Creek Subdivision: The proposed right-of-way line appears to be in close proximity to this subdivision which has already been offered for sale.

10. Northridge Subdivision: Portions of the proposed line appear to abut and/or cross into ASLS 81-214. All lots within this subdivision were sold in the last lottery and placement of the line in proximity to the subdivision would greatly effect the viewshed from the subdivision.

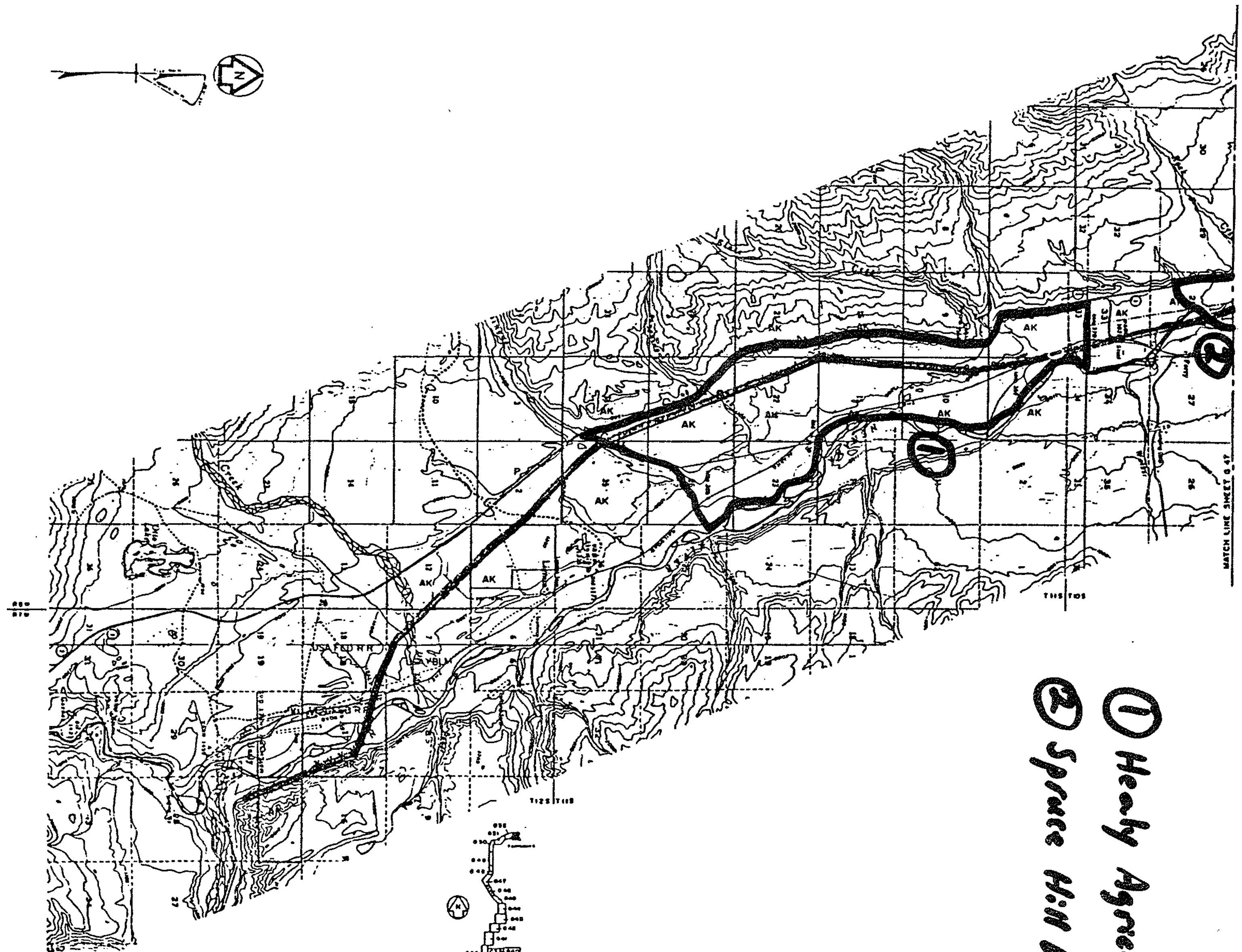
The overall District concern is the impacts the proposed right-of-way will have on land disposal actions and proper land management practices. Particularly, we would like to know why the new transmission line couldn't be placed adjacent to the existing transmission lines to lesson impacts? I am sure other questions and concerns will become evident as the project becomes more finalized. We look forward to working with you on the resolution of these conflicts. Please keep us informed on the progress of your studies in these matters.

Sincerely,

Jerry L. Brossia
District Manager

Attachment: Map Showing Conflicts

cc: George Hollett, Acting Director



① Healy Agricultural

② Spruce Hill Large Lots

LAND OWNERSHIP SCHEDULE

USA-BLM	– BUREAU OF LAND MANAGEMENT
AK	– STATE OF ALASKA
CIRI	– COOK INLET REGION, INC.
US ARMY	– UNITED STATES ARMY
USAF	– UNITED STATES AIR FORCE
USA FED RR	– UNITED STATES FEDERAL RAILROAD
P	– PRIVATE

NOTE: ALL LAND OWNERSHIP BY SECTIONS UNLESS OTHERWISE SHOWN

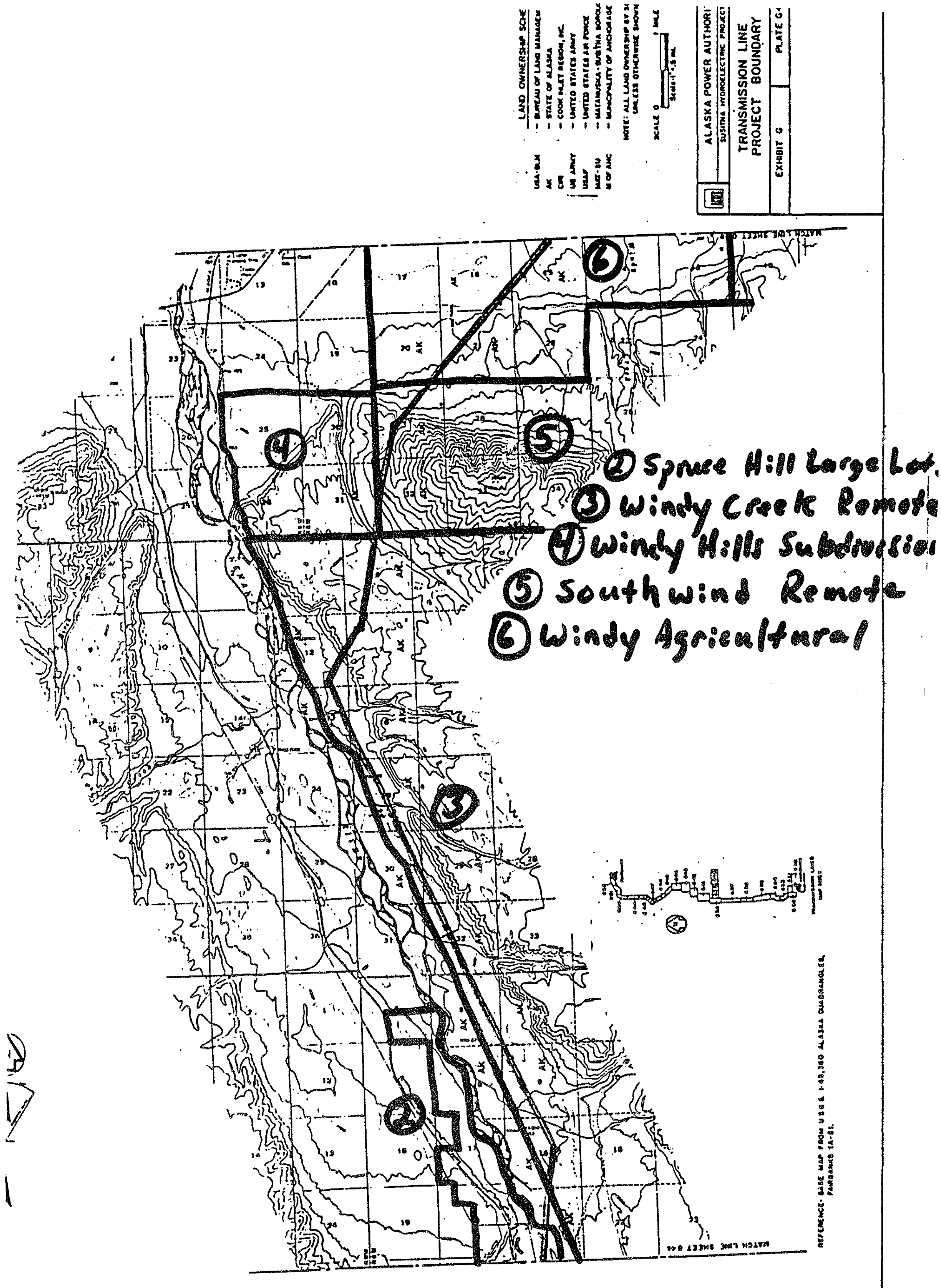
SCALE 0 ——— 1 MILE

Scale 1" = .5 mi

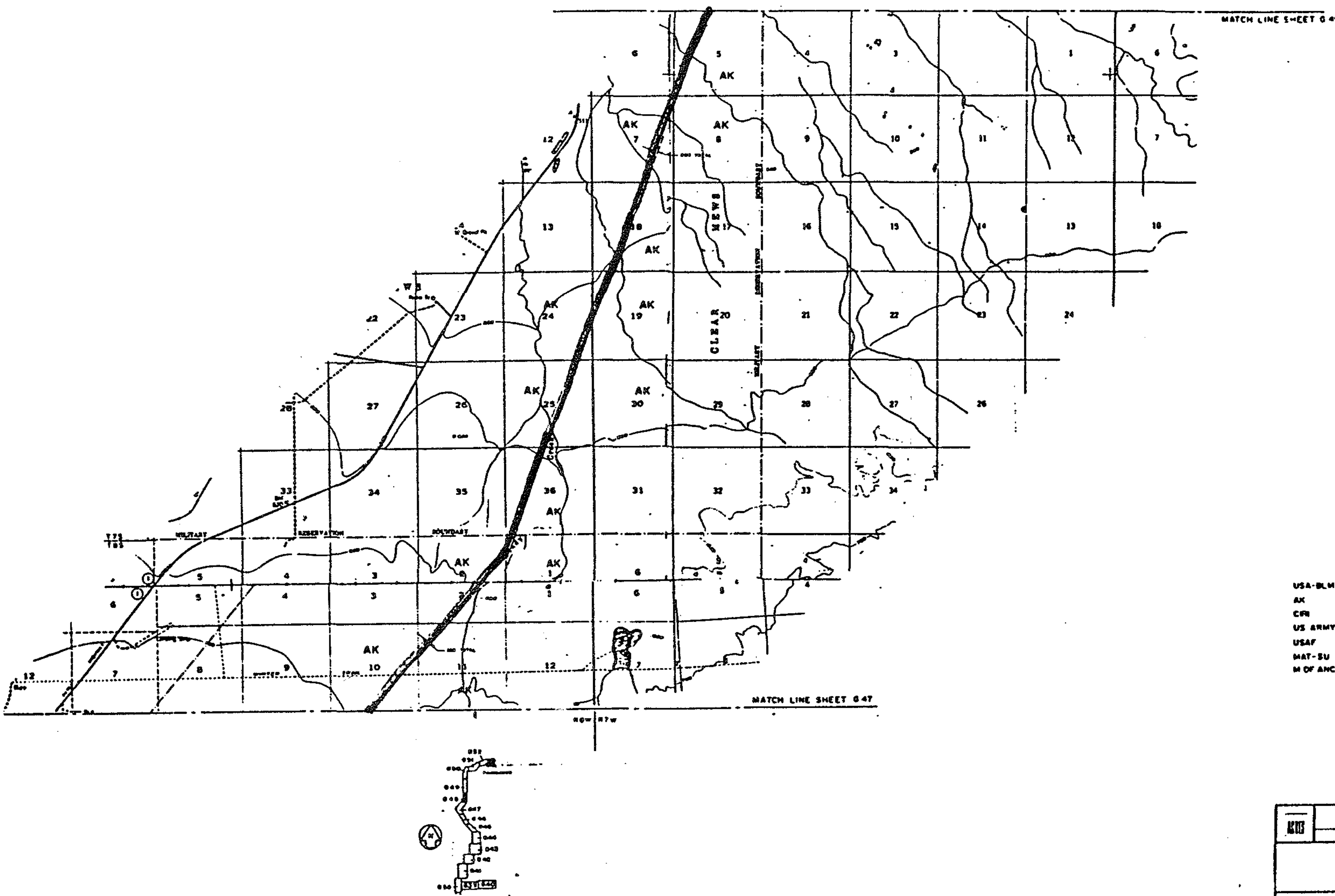
ALASKA POWER AUTHORITY

SUSITNA HYDROELECTRIC PROJECT

TRANSMISSION LINE
PROJECT BOUNDARY



② Spruce Hill Large Lot,
③ Windy Creek Remote
④ Windy Hills Subdivision
⑤ Southwind Remote
⑥ Windy Agricultural
LAND OWNERSHIP SCHE
USA-BLM - BUREAU OF LAND MANAGEM
AK - STATE OF ALASKA
CIRI - COOK INLET REGION, INC.
US ARMY - UNITED STATES ARMY
USAF - UNITED STATES AIR FORCE
MAT-SU - MATANUSKA-SUSITNA BOROUG
M OF ANC - MUNICIPALITY OF ANCHORAGE
NOTE: ALL LAND OWNERSHIP BY S UNLESS OTHERWISE SHOWN
SCALE 0 1 MILE
ALASKA POWER AUTHORI
SUSITNA HYDROELECTRIC PROJECT
TRANSMISSION LINE
PROJECT BOUNDARY
EXHIBIT G
PLATE G
MATCH LINE SHEET G
MATCH LINE SHEET G46
REFERENCE: BASE MAP FROM U.S.G.S. 1:63,360 ALASKA QUADRANGLES, FAIRBANKS (A-5).



LAND OWNERSHIP SCHEDULE

USA-BLM	— BUREAU OF LAND MANAGEMENT
AK	— STATE OF ALASKA
CIRI	— COOK INLET REGION, INC.
US ARMY	— UNITED STATES ARMY
USAF	— UNITED STATES AIR FORCE
MAT-SU	— MATANUSKA-SUSITNA BOROUGH
M OF ANC	— MUNICIPALITY OF ANCHORAGE

NOTE: ALL LAND OWNERSHIP BY SECTIONS UNLESS OTHERWISE SHOWN

SCALE 0 — 1 MILE

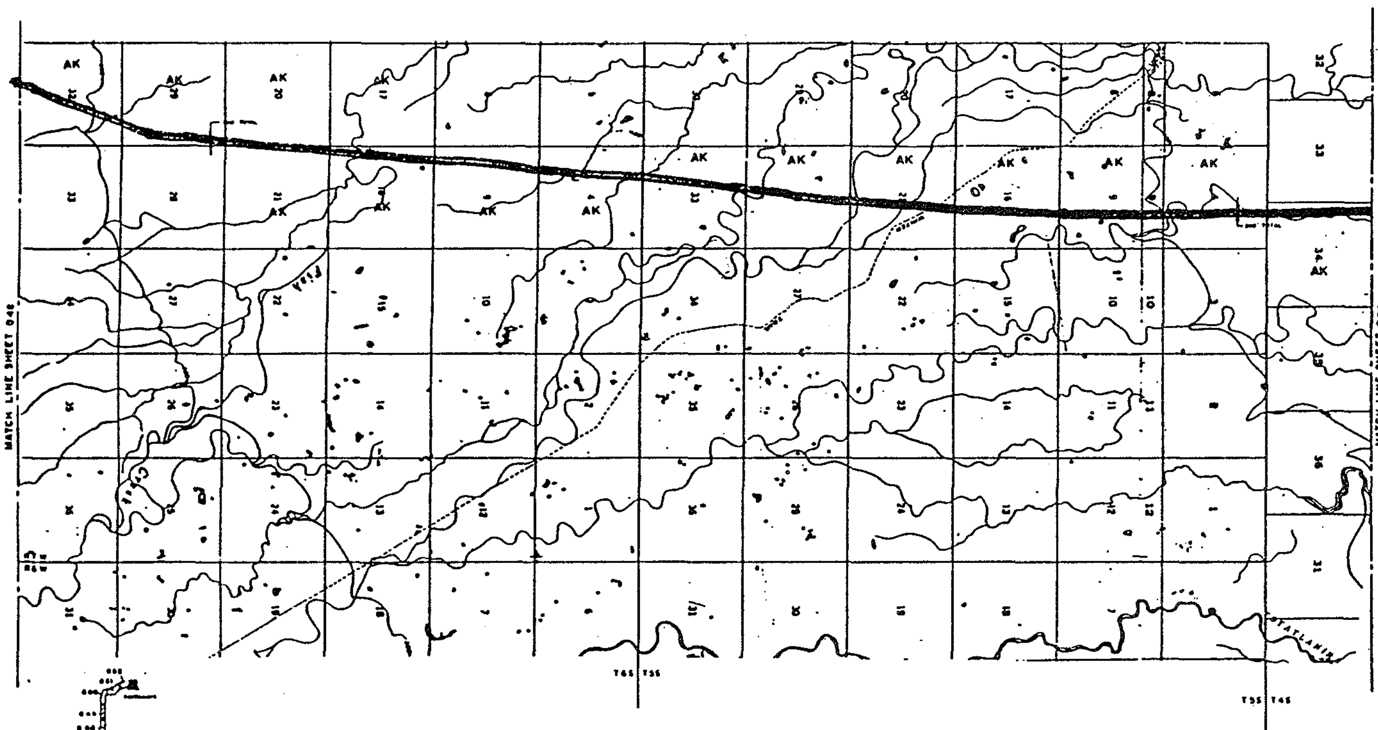
Scale 1" = .5 mi.

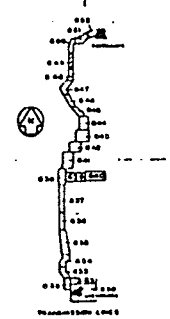
ALASKA POWER AUTHORITY

SUSITNA HYDROELECTRIC PROJECT

TRANSMISSION LINE PROJECT BOUNDARY

EXHIBIT G | PLATE G 48





REFERENCE BASE MAP FROM USGS 1:63,360 ALASKA QUADRANGLES, FAIRBANKS (B-4) AND FAIRBANKS (C-4)

LAND OWNERSHIP SCHEDULE

USA-BLM	– BUREAU OF LAND MANAGEMENT
AK	– STATE OF ALASKA
CIRI	– COOK INLET REGION, INC.
US ARMY	– UNITED STATES ARMY
USAF	– UNITED STATES AIR FORCE
MAT-SU	– MATANUSKA-SUSITNA BOROUGH
M OF ANC	– MUNICIPALITY OF ANCHORAGE

NOTE: ALL LAND OWNERSHIP BY SECTION UNLESS OTHERWISE SHOWN

SCALE 0 — 1 MILE

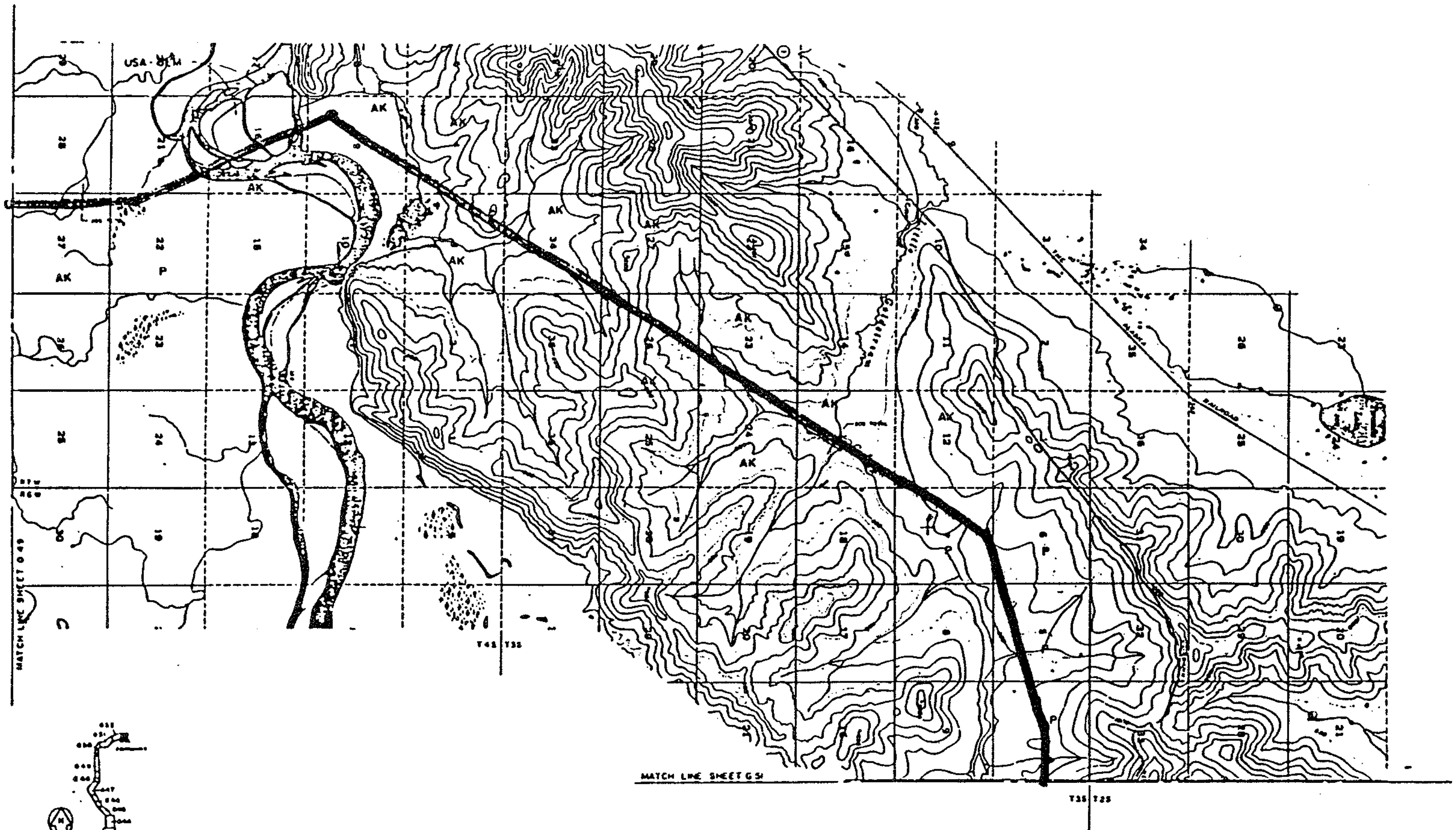
Scale 1" = .5 mi

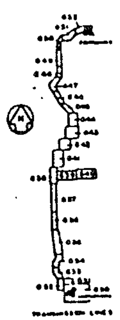
ALASKA POWER AUTHORITY

SUSITNA HYDROELECTRIC PROJECT

TRANSMISSION LINE
PROJECT BOUNDARY

EXHIBIT G	PLATE G 49





REFERENCE: BASE MAP FROM U.S.G.S. 1:63,360 ALASKA
QUADRANGLE, FAIRBANKS (C-4)

LAND OWNERSHIP SCHEDULE

USA-BLM	— BUREAU OF LAND MANAGEMENT
AK	— STATE OF ALASKA
CIRI	— COOK INLET REGION, INC
US ARMY	— UNITED STATES ARMY
USAF	— UNITED STATES AIR FORCE
P	— PRIVATE
M OF ANC	— MUNICIPALITY OF ANCHORAGE

NOTE: ALL LAND OWNERSHIP BY SECTION UNLESS OTHERWISE SHOWN

SCALE 0 — 1 MILE

Scale 1" = .5 mi.

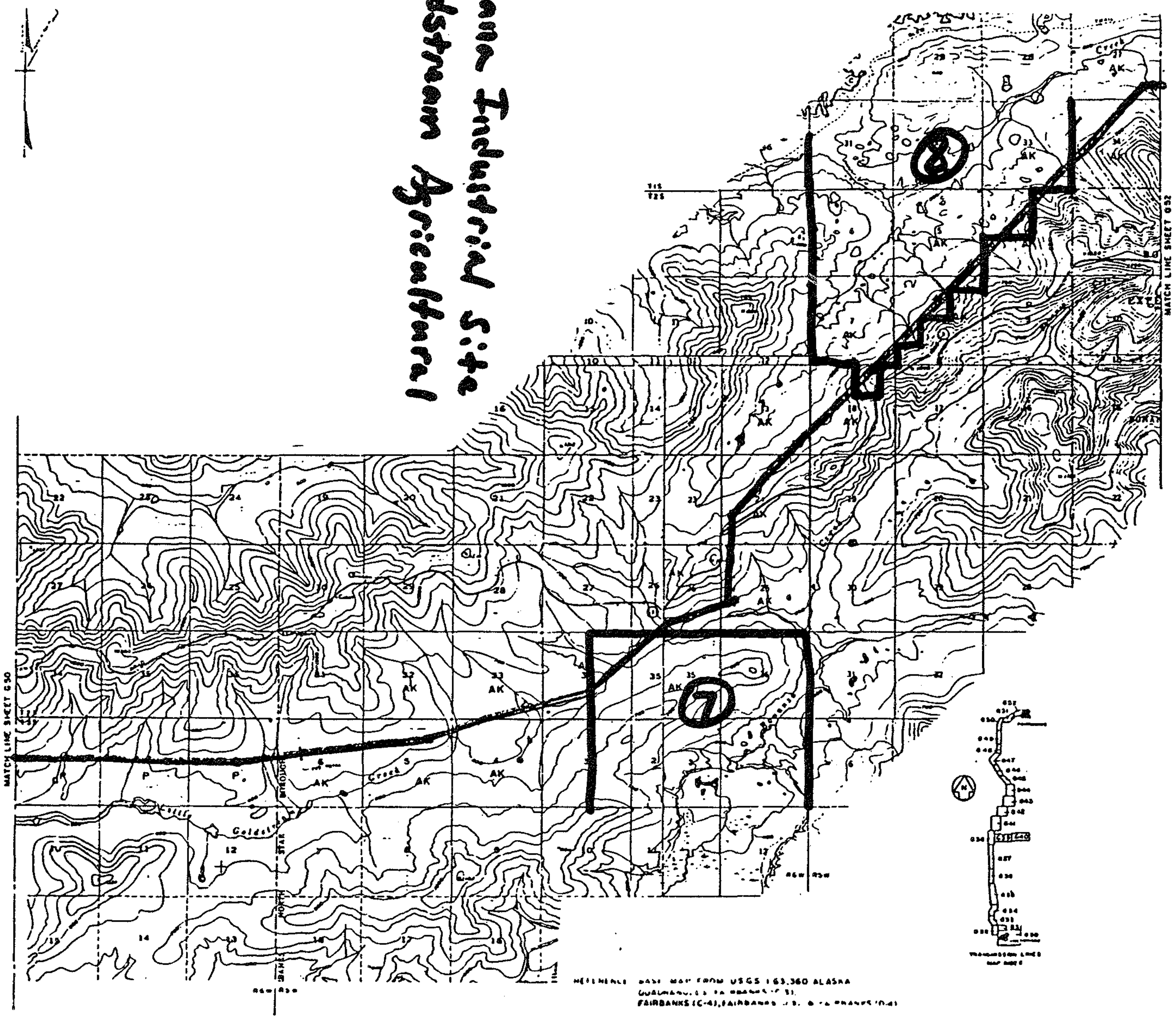
ALASKA POWER AUTHORITY

SUSITNA HYDROELECTRIC PROJECT

TRANSMISSION LINE
PROJECT BOUNDARY

EXHIBIT G | PLATE G50

⑦ Tanana Industrial Site
⑧ Goldstream Agricultural



LAND OWNERSHIP SCHEDULE

USA-BLM	– BUREAU OF LAND MANAGEMENT
AK	– STATE OF ALASKA
CIRI	– COOK INLET REGION, INC.
US ARMY	– UNITED STATES ARMY
USAF	– UNITED STATES AIR FORCE
MAT-SU	– MATANUSKA-SUSITNA BOROUGH
P	– PRIVATE

NOTE: ALL LAND OWNERSHIP BY SECTIO UNLESS OTHERWISE SHOWN

SCALE 0 1 MILE

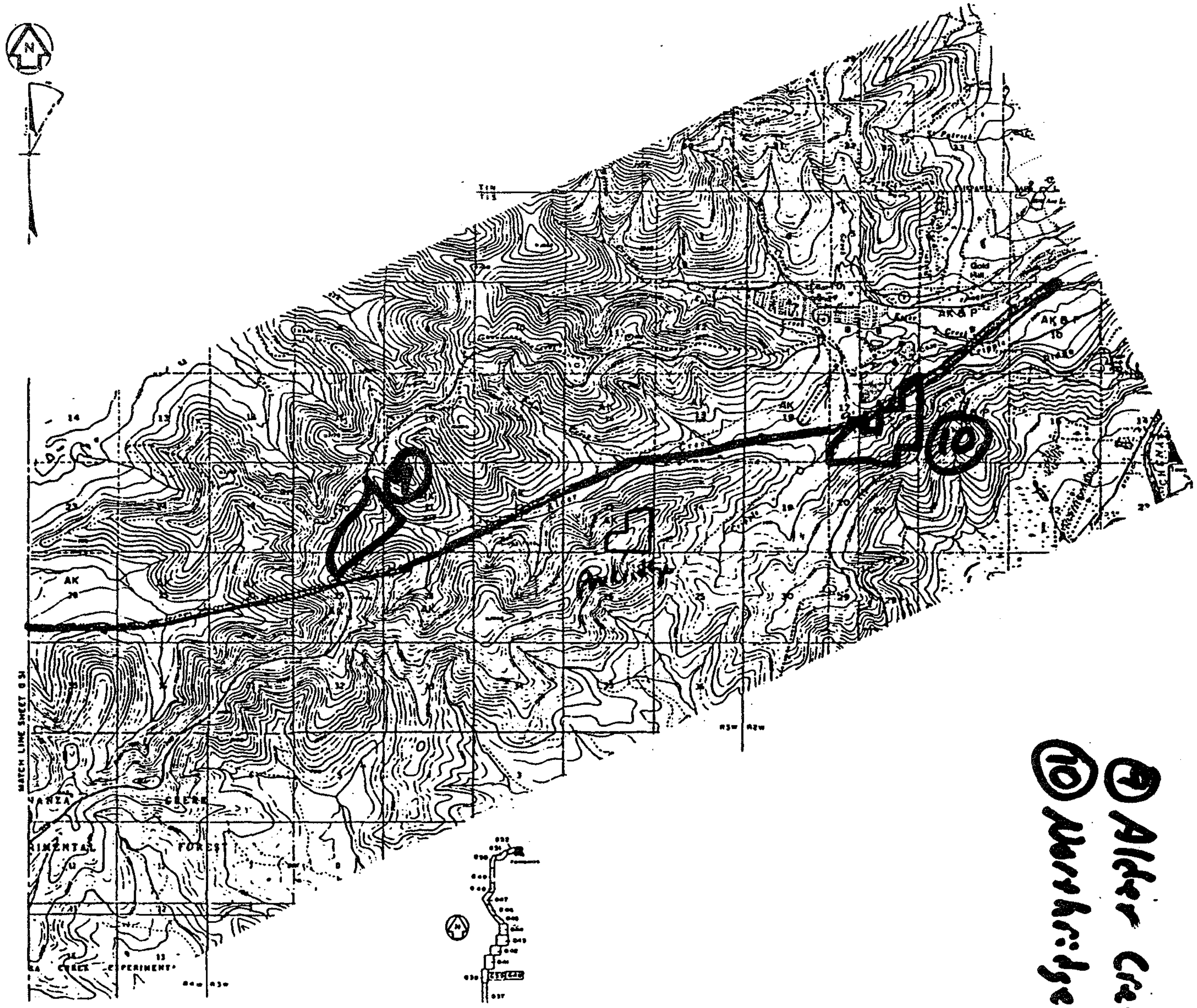
Scale: 1" = .5mi

ALASKA POWER AUTHORITY

SUSITNA HYDROELECTRIC PROJECT

TRANSMISSION LINE
PROJECT BOUNDARY

EXHIBIT G | PLATE G51



(9) Alder Creek Sub
(10) Northridge Subd.

LAND OWNERSHIP SCHEDULE

USA-BLM	– BUREAU OF LAND MANAGEMENT
AK	– STATE OF ALASKA
CIRI	– COOK INLET REGION, INC.
US ARMY	– UNITED STATES ARMY
USAF	– UNITED STATES AIR FORCE
MAT-SU	– MATANUSKA-SUSITNA BOROUGH
M OF ANC	– MUNICIPALITY OF ANCHORAGE
P	– PRIVATE

NOTE: ALL LAND OWNERSHIP BY SECTIONS UNLESS OTHERWISE SHOWN

SCALE 0 1 MILE

Scale 1" = .5 mi

ALASKA POWER AUTHORITY

SUSITNA HYDROELECTRIC PROJECT

TRANSMISSION LINE
PROJECT BOUNDARY

ALASKA POWER AUTHORITY

334 WEST 5th AVENUE - ANCHORAGE, ALASKA 99501

Phone: (907) 277-7641
(907) 276-0001

February 8, 1983

Department of Natural Resources
Division of Parks, NDC
4418 Airport Way
Fairbanks, Alaska 99707
Attn: Dave Sharski

Dear Mr. Sharski:

Re: Susitna Transmission Line Routing Effort

We appreciate your working with us to identify issues related to the proposed routing of the Susitna Hydroelectric Project Transmission Line near Anchorage (Fairbanks). The next step is for our consultant routing team (Harza/Ebasco Susitna Joint Venture) to actually begin its work of confirming the proposed route or suggesting improvements. We will contact you once this effort is underway.

There are a variety of objectives that will be considered in routing, including:

- Maximizing system stability.
- Minimizing construction and operation costs.
- Minimizing conflicts with land uses, communities, natural systems and cultural resources.
- Minimizing visual impacts.

Another item to resolve will be the appropriateness of sharing existing utility corridors.

We look forward to continuing the informal consultation recently begun, and please do not hesitate to contact us with any questions or comments you might have.

Sincerely,

Robert A. Mohn
Susitna Project Manager

United States Department of the Interior

NATIONAL PARK SERVICE
Alaska Regional Office
540 West Fifth Avenue
Anchorage, Alaska 99501

IN REPLY REFER TO:

L3031 (ARO-P)

04 FEB 1983

RECEIVED
FEB 09 1983
ALASKA POWER AUTHORITY

Mr. Eric P. Yould, Executive Director
Alaska Power Authority
334 West Fifth Avenue
Anchorage, Alaska 99501

Dear Mr. Yould:

We have had an opportunity to review the final draft of Exhibit E ("Report on Historic and Archeological Resources") of the Susitna draft license application and offer the following supplemental comment to our letters of January 14, 1983, and October 22, 1982, evaluating the final cultural resources report.

The mitigation plan proposed in Section 4 appears to us to be well conceived and designed, and the plan for implementation realistic. However, the role of the Advisory Council on Historic Preservation should be better developed and clarified. Specifically the detailed mitigation plan should be developed and approved by the State Historic Preservation Officer and representatives of all appropriate land managing agencies in the Project area. This document would be the basis for Advisory Council comment and, if approved by the Advisory Council as adequate and appropriate, would constitute the core of an Advisory Council Memorandum of Understanding.

We appreciate the opportunity to comment. If you have questions concerning our comment, please contact Dr. Floyd W. Sharrock (907/271-4051).

Sincerely,

Bill Welch

Associate Regional Director
Planning, Recreation, and Cultural Resources
Alaska Region

cc:
L. Wright/ARO-P

United States Department of the Interior

FISH AND WILDLIFE SERVICE
1011 E. TUDOR RD.
ANCHORAGE, ALASKA 99503
(907) 276-3800

IN REPLY REFER TO:
WAES

Eric P. Yould, Executive Director
Alaska Power Authority
334 West 5th Avenue
Anchorage, Alaska 99501

14 JAN 1983

Dear Mr. Yould:

The Fish and Wildlife Service (FWS) has been requested by letter dated 15 November 1982, from Acres American, Inc., to formally review and comment on the Federal Energy Regulatory Commission (FERC) draft license application Exhibit E for the Susitna Hydroelectric Project. This response is being provided as partial fulfillment of your request and is intended to be a constructive evaluation in regard to fish and wildlife resources. We hope that our comments will be of value in drafting the final license application.

The following FWS letters were also provided in response to formal pre-application requests on this project:

1. 23 June 1980, letter to Eric Yould.

2. 17 December 1981, letter to Eric Yould.

3. 30 December 1981, letter to Eric Yould.

4. 5 January 1982, letter to Eric Yould.

Since these letters were formally requested as part of the FERC pre-application coordination process we consider it appropriate that our responses be specifically addressed as part of the Exhibit E.

The following letters were provided as informal consultation to facilitate the Susitna Project planning process:

1. 15 November 1979, letter to Eric Yould.

2. 16 April 1982, testimony presented to the Alaska Power Authority (APA) Board.

3. 17 August 1982, letter to Eric Yould.

4. 5 October 1982, letter to Eric Yould.

We anticipated seeing in the draft Exhibit E specific responses to the concerns and recommendations raised in the letters and testimony provided. This is consistent with advice provided by the FERC1/. In that this did not occur, we recommend that the APA respond in the Exhibit E to the specific comments and recommendations which are contained in these letters and testimony.

The response provided by this letter, our previous letters (both those formally and informally requested), the testimony presented to the APA Board, and the letter recently provided to you on 19 November 1982, constitute the official position of the FWS on this project.

The principal authority of the FWS to provide comments and recommendations rests in the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.)2/. The Coordination Act requires that fish and wildlife conservation be given equal consideration with other project features throughout the Federal lead agencies' planning and decision-making processes. The Act also requires consultation with State and Federal fish and wildlife resource agencies to ascertain what project facilities, operations, or measures may be considered necessary by those agencies to mitigate and compensate for project-related losses to fish and wildlife resources, as well as to enhance those resources. The reports and recommendations of the fish and wildlife resource agencies on the fish and wildlife aspects of such projects must be presented to action agency decision-makers and (where applicable) to Congress. The Coordination Act requires more than a consultative responsibility; it is an affirmative mandate to action agencies. Like the National Environmental Policy Act (NEPA) (42 U.S.C. 4321 et seq.), it requires early planning and post-construction coordination and full consideration of recommendations made by resource agencies.

Our recommendations, under the Coordination Act, must be, "as specific as is practicable with respect to features recommended for wildlife conservation and development, lands to be utilized or acquired for such purposes, the results expected, and shall describe the damage to wildlife attributable to the project and the measures proposed for mitigating or compensating for these damages."

Similar language is found in NEPA's Section 102(2)(B) that agencies identify and develop methods and procedures which will insure that presently unquantified environmental amenities and values may be given appropriate consideration in decision-making, along with economic and technical considerations.

1/ Appendix A. FERC Application Procedures for Hydropower Licenses, Exemptions and Preliminary Permits. April 1982.

2/ The Federal Power Act (16 U.S.C. 791a-825r; 41 Stat. 1603), as amended, as interpreted in Regulations (F.R. Vol. 46, No. 219, 13 November 1981) specifies requirements to satisfy the Coordination Act.

Both the Coordination Act and NEPA, necessitate, commensurate with the scope of a project:

(1) A description and quantification of the existing fish and wildlife and their habitat within the area of project impacts;

(2) A description and quantification of anticipated project impacts on these resources; and

(3) Specific mitigation measures necessary to avoid, minimize, or compensate for these impacts.

We have reviewed the draft Exhibit E in consideration of these statutes. The adequacy of the review document has been examined in respect to whether or not the information, analysis, and mitigation plan provided would allow the FERC to be in compliance with the requirements of these environmental mandates if they issued a license to the applicant.

Our review has been undertaken in light of our former correspondence, including the 16 April 1982, testimony presented to the APA Board by Deputy Regional Director LeRoy Sowl. Except for item (8) we find the testimony as valid today as it was at that time. It is apparent that the consultation process has failed in so far as the intent of the FERC regulations3/. We have written numerous letters on this project to assist APA in planning measures to protect and enhance fish and wildlife resources. Responses to our letters have been non-existent, or too late to deal with the problem of concern (e.g., FWS letters dated 5 October 1982, and 19 November 1982). An illustration of what we have found to be an inadequate level of consultation can be found in the 15 December 1982, response to our 19 November 1982, letter. We considered our requests to be fully within the intent of the FERC regulations4/.

Attached to this letter are our formal comments on the FERC draft license application Exhibit E for the Susitna Project. Comments are provided on Chapters 2, 3, 5, 7, 8, 9, and 10. We have also reviewed Chapters 1, 4, and 6. However, we do not at this time have any comments to offer on these chapters.

The comments provided are organized into general comments and specific comments for each chapter. In our attempt to be as responsive as possible within the limited time frame APA has established for our review and comments, we have not been able to organize our comments into a comprehensive listing of deficiencies, clarifications, information needs, and recommendations. Many of these comments have been left within the context of the section within which they are raised. We feel by commenting in this way it will assist you in consistently correcting the deficiencies identified.

3/ See Footnote 1, supra.

4/ See Footnote 1, supra.

The following comments are generally applicable to several chapters and, in some cases, are applicable to all of the chapters:

1. It is our understanding that the projections of future power needs used in the license application are generally agreed to be high[5/] and are being reevaluated for submittal to the FERC after the license application is submitted (Acres American Deputy Project Manager John Hayden, personal communication). The changes in the load forecasts are dramatic. In the Acres American report evaluating economic tradeoffs of flow regimes[6/] the assumed moderate load forecast for the year 2010 is 7,791 gegawatt-hours (GWh). In the latest Battelle Newsletter[7/] the moderate forecast is 4,986 GWh and the low forecast is 3,844 GWh. The significant decline in projected power demands has large implications to many of the project assumptions which have constrained mitigation planning, for example: available water for downstream flows; mode, timing, and routing of construction access; and scheduling of work. The license application should fully discuss the implications of the latest load forecasts.

2. The intent of the Coordination Act and NEPA is that environmental resources be given equal consideration with project features. Consistent with NEPA, as well as the APA Mitigation Policy, avoidance of adverse impacts should have been given priority as a mitigation measure. We have found this generally not to be the case, for example: mode, timing, and routing of construction access; scheduling of work; type and siting of the construction camp/village; recreation development; instream flow regime; and filling schedule. Other examples can be found in our Specific Comments.

3. Engineering and environmental studies do not seem to be interactive. It appears that the findings of enviornmental studies have not been integrated into the engineering design. This may be due in part to the short time frame established for project planning. An examination of the sequencing of the studies illustrates this problem. It is our understanding that the Aquatic Studies Program, designed to be the basis for determination of impacts to the aquatic system and associated mitigation measures, was established as a five year study. We are now two years into this program. The analysis of the data to allow an assessment of impacts and formulation of mitigation proposals may add another year to this process. APA expects to obtain a license, and

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5/ Battelle. Newsletter #4 (Final): Railbelt Electric Power Alternatives Study. December 1982.

6/ Acres American. Energy Simulation Studies to Select Project Drawdown and Mitigation Flows. October 1982.

7/ See Footnote 4, *supra*.

begin construction in late 1984, or early 1985[8/]. Obviously, this does not allow for an impact analysis and mitigation planning based on these studies prior to licensing. Mitigation planning, and an assessment of the impacts of different mitigative options needs to be undertaken in regard to project costs, viability, socioeconomic considerations, and mitigation proposed for potentially competing interests. This should all be considered through the development of the environmental impact statement, and certainly prior to license issuance.

4. Numerous examples of lack of coordination and/or communication between the groups responsible for the different study elements are evident. Examples can be found by comparing discussions concerning minimum downstream flow releases in Chapters 4 and 10 to what is found in Chapters 2 and 3. Reservoir temperature modeling discussions in Chapter 10 are not consistent with what is stated in Chapters 2 and 3. Another example is found in the minimal level of concern expressed in Chapter 10 for socioeconomic (Chapter 5) considerations, such as impacts of license denial. More specific comments are included in the attached document. Other Exhibits were not provided to us for review although we requested them by letter dated 19 November 1982.

5. Research of background information is frequently inadequate and incomplete. An example would be the discussions concerning subsistence (Chapters 3 and 5). More adequate research of this very important area appears justified. We have listed several readily available references which would be of value in improving this discussion.

   In Chapters 2 and 3 minimal information is brought into the discussions concerning physical changes which have been observed at similiar hydropower projects. We are sure that many of the potential impacts that are discussed for Susitna (e.g., temperature concerns) are not unique to this project. The State's experience with the Trans-Alaska Pipeline System (TAPS) project could have been drawn upon more fully as an example, particularly in regard to socioeconomic (Chapter 5) discussions. Another example is the discussion concerning natural gas and geothermal electric generation as alternatives to Susitna (Chapter 10). Very little use was made of existing information bases.

6. Speculation is not always clearly distinguished from data-based conclusions. This problem is most apparent in Chapters 2 and 3 and should be corrected.

7. Lack of quantification is a recurrent problem in the Exhibit. Neither base line data nor impacts are appropriately quantified (e.g., Chapters 2, 3, 5, and 10). Statements in the document let us know that, "Much of the discussion is based on professional judgement," (page E-3-3), and, "Many of the statements are speculative . . . and . . . unsupported," (page E-3-56). Other statements let us know that ongoing, or planned studies, will fill these numerous data gaps to allow a quantification of the resources and impacts which would let us go beyond, "the conceptual

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8/ Alaska Power Authority. Request for Proposal No. APA-83-R-030 Construction Management Services for the Watana Phase of the Susitna Hydroelectric Project. 15 November 1982.

mitigation plan," (page E-3-116). Recognizing a problem does not, in and of itself, correct it. We were particularily concerned with this in our review of Chapter 3. In the Exhibit E, the existing resources should be quantified. The potential impacts to these resources should be quantified and then evaluated over the life of the project. Only at that point can specific, effective mitigation measures emerge. We consider quantification of existing resources and impacts and a specific, effective mitigation plan essential to the development of an acceptable environmental impact statement.

8. The ongoing, and planned studies, which are frequently noted (particularly in Chapters 2 and 3) should be fully identified so we can examine them in regard to their scope. We cannot, otherwise, determine what needs to be done and the time frame for accomplishment. Further discussion is provided in our Chapters 2 and 3 general comments, and throughout our specific comments sections.

9. In several of the chapters (e.g., Chapters 2, 3, and 5) we are faced with mitigation options to contend with identified (although frequently unquantified) adverse impacts. For example, in Chapter 3 there are discussions on the potential value of spiking spring flows for salmon out-migration and the installation of a fifth portal on the multi-level intake structure to provide warmer downstream temperatures during filling. If these mitigation proposals have validity, they should have been incorporated into the project design and operational plan. The document does not provide an adequate mitigation plan as required.

   In addition, mitigation measures which are presented should have proven successful in Alaska, or in a similar environment. If the proposals are not proven, then they would need to be demonstrated effective in the project area. Further discussion is provided in our Chapter 3 general comments sections.

10. The need for an effective monitoring program through construction and the operation phase is discussed in many of the chapters. However, the program is not adequately described. We fully support the establishment of a monitoring program. We believe the program should provide for participation by representatives of appropriate State, Federal, and local agencies and be financed by the project. This panel should have the authority to recommend modification of how activities are conducted to assure that mitigation is effective. Recommended changes in the mitigation program should be adopted through a mechanism established in the license, mutually acceptable to all concerned bodies.

11. Unfortunately the rush to meet the schedule for the license application has resulted in poor quality control, i.e., countless typographical errors, missing lines, misreferenced tables and figures, unclear sentences, internal inconsistencies, inadequate documentation, missing references in bibliographies, etc. This should have been eliminated in a thorough editing prior to release for agency pre-license application review. Our review for biological completeness was somewhat hampered by this problem.

In the previously referenced FWS letters and testimony, many of the same concerns discussed above and in the attached comments were raised. It is our view that unless the issues raised in this letter are satisfactorily resolved we do not believe the application could provide the basis of an acceptable environmental impact statement. In this respect we consider the license application to be deficient.

We recommend that you strengthen the license application by including information resulting from a thorough evaluation of the biological data collected during the 1982 field season. This would enable an assessment of the adequacy with the data base to support a sufficiently quantified impact analysis and, in turn, a specific, effective mitigation plan. We believe a realistic appraisal could then be made as to when any remaining deficiencies could be satisfied.

Sincerely,

Keith Bayha

~~Assistant~~ Regional Director

Attachment

cc: WAES
Yvonne Weber, WO-FWS
C. Debelius/Acres American
Quentin Edson/FERC
NMFS, EPA, NPS, USGS, BLM, ADEC, AEIDC - Anchorage
Al Carson/ADNR, Anchorage
ADF&G, Hab. Div., Su Hydro Studies, Anchorage

Chapter 1. GENERAL DESCRIPTION OF THE LOCALE: No comments.

Chapter 2. WATER USE AND QUALITY

General Comments

In examining Chapter 2 we were concerned that sufficient scope and quantifications are not provided to allow a quantified impact evaluation of the fisheries and other biological resources. The information provided should allow for the development of specific and effective measures which would fully mitigate for all adverse impacts. We are left with the definite impression that the project would, through changes in stream flow, water quality, temperatures, ice conditions, vegetation, and slough habitats, have significant effects upon the resources of concern to us, particularly the fisheries. However, quantification of the potential impacts is generally lacking, as are specific effective mitigation measures. Of course the latter can not be accomplished prior to the former, despite the attempts found in this chapter.

A significant portion of the lack of specificity found in Chapter 2 is due to the fact that although two years of data have been gathered (1981 and 1982) the Exhibit E reflects only the 1981 data. We have consistently stated that the 1982 data be analyzed and included in the Exhibit E (see Deputy Regional Director LeRoy Sowl's 16 April 1982 statement to the APA Board, and our letter dated 5 October 1982 to Eric Yould). Our position remains the same.

The chapter does not identify what studies have been completed, what studies were ongoing in 1982, and what studies are proposed. Until this is provided we cannot determine what studies we would like to see modified, and what we see as being missed. Without this type of information, the resource agencies are placed in a reactive mode, i.e. we can only comment on what should have been examined in completed studies. However, in so doing, we can better facilitate the applicant's efforts to plan a project we can support. An example of a proposed study which is not addressed in this chapter is the Arctic Environmental Information and Data Center (AEIDC) study. The following is a summary of this proposed study:

> The AEIDC proposal is designed to (1) accurately and comprehensively predict system-wide streamflow and temperature effects of the dam(s), and (2) interpret effects of such changes in terms of aquatic habitats and fish populations. To accomplish these general objectives, AEIDC proposes using a linked system of simulation models which requires data from other project studies, available literature sources, and professional judgement.
>
> The study is a result of the need to consider the special aquatic habitat relationships in the Susitna River basin and the need to account for the interrelated effects of ice, sediment, streamflow, and temperature changes which will accompany construction, filling, and operation of the selected dam or dams.
>
> Most assessments of hydroelectric projects are based upon impacts associated with changes in mean monthly streamflows and temperatures. However, the actual impacts of the project may not be caused by the mean events but through changes in the natural pattern of streamflow or temperature variation. Further, a single set of mean monthly flows does not actually reflect instantaneous flows in the river; the actual

predicted mean monthly discharge will probably not occur during a given month because of expected anomalies in hydrologic statistics. Therefore, it is necessary to predict the range of mean monthly flows expected, based on reservoir inflow, power generation requirements, and downstream demands.

The AEIDC model system would depend heavily upon a reservoir operation model to generate an exhaustive range of feasible weekly or monthly flow regimes and the expected variation over a 30 year forecast period.

The model system would include provisions for ice and sediment modeling to account for changes in substrate distribution, bed elevation or channel configuration which might result from project operation. At a minimum, ice and substrate modeling would support the assumptions that hydraulic boundary conditions either remain stable or change within predictable limits with project operation.

The array of predicted weekly or monthly flows and temperatures may be biologically interpreted in several ways. The available habitat data base is heavily weighted at this time toward known chum and sockeye salmon spawning areas in sloughs and side channels in the Susitna River between Talkeetna and Devil Canyon. Access and spawning dynamics with respect to mainstem discharge are the major simulation goals of several ongoing field studies. The AEIDC modeling system could provide a time-series approach to determine effects upon critical life history stages of these species. It is possible that the entire riverine life cycle of chum salmon might be simulated under various flow regimes to predict long-term population trends. A similar analysis of sockeye salmon might be possible.

The primary concept, again, is first to credibly and comprehensively predict all project operations and their effect upon the habitat-related physical parameters within the system; secondly, those effects will be interpreted, through long-term forecasting, in terms of their influences upon affected salmon populations.

We support the proposed AEIDC study. It should provide the basis for determining project instream flow impacts and a reasonable assessment of mitigative alternatives.

It is apparent that the proposed instream flow releases are designed for maximum power production and do not reflect biological needs. The 12,000 cubic feet per second (cfs) figure for August reflects the maximum amount of water that can be discharge without significant economic effects. It is our understanding that the project releases would be 10,000 to 12,000 cfs year round. No consideration was given to the potential impact of the project during winter when flows of this magnitude might prove highly detrimental to the fishery. The potential value of spiking flows during the spring to facilitate smolt out-migration and flush the sloughs of ice and debris is discussed. However, these flows are not reflected in the proposed releases.

We consider it very important that the license application contain a specific, detailed flow release schedule, which is designed to mitigate project impacts, protect or enhance conditions for fish spawning, feeding, unrestricted fish passage, out-migration, and provide overwintering habitat for fish in the Susitna River. This schedule should be developed through a quantified instream flow analysis which has been coordinated with the FWS, National Marine Fisheries Service, and the Alaska Department of Fish and Game (ADF&G).

In response to the APA request of 2 September 1982, the FWS, by letter dated 5 October 1982, provided input specific to the draft Exhibit E. We had expected our comments to be addressed in the draft Exhibit E. This is in compliance with the FERC recommendation that information included at the initiation of formal consultation, "...responds to the preliminary comments and recommendations of the agencies."[9/] Since this was not done, our 5 October 1982 letter should be made part of our formal response on the draft Exhibit E. As such, the points raised in that letter should be specifically addressed in the Exhibit E submitted as part of the license application. Many of the points raised would be most appropriately responded to in Chapter 2.

Avoidance of adverse impacts should, in compliance with the APA Mitigation Policy document, and NEPA guidelines, be given top priority in the license application. In particular, our concerns as to the decisions which led to such project features as the camp/village, transmission line routing, construction access routing, turbine configuration, filling regime, flow regime, etc., with regard to avoidance of impacts should be addressed.

Specific Comments

2 - BASELINE DESCRIPTIONS

2.3 - Susitna River Water Quality

(a) Physical Parameters

(i) Water Temperature

- Mainstem: Paragraphs 1 and 2: Those months which are being referred to by winter and summer should be indicated.

- Sloughs: Paragraph 1: The first step in understanding the temperature relationship between the mainstem and the sloughs is to measure the temperatures of both sites. This has been done. The relationship between the mainstem and the sloughs regarding temperatures (as well as other water quality parameters) then must be established. This process, apparently, is just beginning. To this end, one slough (#9) has been examined. This examination has focused, correctly, on the groundwater relationship. According to Tony Burgess (Acres American), in his Susitna Hydro Exhibit E Workshop presentation (12/1/82) on groundwater upwelling and water temperature in sloughs, the groundwater regime can be modeled, but locally the match is not very good: The groundwater temperatures near the surface do not match the predicted temperatures. Continued study is obviously indicated for slough #9. After an understanding is achieved for that slough, the program would need to be expanded to other sloughs, possibly sloughs 8A, 11, 19, 20 and 21. These sloughs have been more intensively examined than other sloughs in this reach of the Susitna River. We recommend that this general program be undertaken.

9/ FERC Application Procedures for Hydropower Licenses, Exemptions and Preliminary Permits. April 1982.

- Tributaries: Paragraph 4: The difference in temperatures of the Chulitna and Talkeetna Rivers should be referenced at least by month. It would appear that the cooler temperatures displayed by these rivers would be useful in an assessment of post-project temperatures effects at the confluence and further downstream. We recommend this be examined.

(ii) Ice

- Freeze-up: Paragraph 3: The impact of this process should be fully explained in regard to river morphology and maintenance of the present riparian zone.

- Winter Ice Conditions: Paragraph 2: Please refer to our comments on Section 2.3 (a)(i) - Sloughs. The sloughs should be identified by number, and percentage to which the statements apply.

(iii) Suspended Sediments: The percent contribution, by season, from the major suspended sediment sources should be indicated. An analysis of the anticipated changes, by season, due to the project operation should be made.

(ix) pH: The pH range, from 6.6 to 8.1, is broad and should continue to be monitored. The potential exists for a lethal pH shock to occur to aquatic life with a change of 1.0 pH. A change of this magnitude might be possible from a reservoir water release. A pH below 6.6 may be harmful to fish depending on the amount of free carbon dioxide present in excess of 100 parts per million. Egg hatchability and growth of alevins could be adversely effected at a pH range between 6.5 and 6.0. The need for a predictive water quality model is apparent given the toxic heavy metals that occur in the drainage. We recommend that one be utilized.

(d) Other Parameters

(iii) Others: The railroad right-of-way that parallels the Susitna River has been sprayed with various herbicides for vegetation control for a period of years. Herbicides used include amitrole, 2-4D, bromicil, and Garlon (tordon). Streams of primary concern are Chase, Indian, Lane, and Gold Creeks. A spill of Garlon occurred in Lane Creek in 1977. Sloughs located along the railroad right-of-way could also be recipients of some of the herbicide spray. No fish and/or wildlife tissues have been analyzed for food chain herbicide impacts in the area. Due to the type of herbicide used, we are certain that detectable amounts will occur over a long period of time. Please incorporate this information into your discussion.

2.4 - Baseline Ground Water Conditions

(d) Hydraulic Connection of Mainstem and Sloughs: It should be noted that the sloughs provide valuable rearing habitat for anadromous and resident fish. Additional comments concerning the groundwater connection and current studies are provided under Section 2.3 (a)(i) - Sloughs.

2.5 - Existing Lakes, Reservoirs, and Streams

(a) Lakes and Reservoirs: Paragraph 1: Project features include transmission lines, access roads, transmission line maintenance roads, railroad staging areas, etc. and should be examined within the context of this section. The proposed Recreation Plan would lead to the encouragement of impacts to numerous lakes throughout the upper Susitna basin. Secondary impacts resulting from the project would expand impacts to additional systems.

2.6 - Existing Instream Flow Uses

(b) Fishery Resources: Reference should be made to burbot and Dolly Varden as important resident species.

(g) Freshwater Recruitment to Estuaries: Paragraph 2: It should be noted that salt water intrusion and mixing would be related to tidal action.

2.7 - Access Plan

(a) Flows: Paragraph 2: The use of regression equations in calculations of peak and low flows in lieu of actual discharge data should not be a substitute for the collection of data, when sizing culverts for engineering integrity or fish passage. Washouts due to undersized culverts resulted on the north slope haul road and, more recently, at the Terror Lake Hydro construction site.

2.8 - Transmission Corridor: Base line information on the transmission corridor from the dam sites to the Intertie has been acknowledged as lacking within the Exhibit. As with other project features, the Exhibit E should provide base line data, impact assessment, and mitigative planning. We recommend that this be done for this project feature. For further comments please refer to our letter dated 5 January 1982 on the Transmission Corridor Report. We provided this letter as formal pre-license consultation and continue to view it as such.

3 - PROJECT IMPACT ON WATER QUALITY AND QUANTITY

3.2 - Watana Development: Reference is made to Exhibit A. By letter dated 19 November 1982 we requested a complete copy of all the Exhibits. This information has not be received.

(a) Watana Construction

(i) Flows: Paragraph 1: The significance of the loss of the one mile reach due to construction would more appropriately be assessed in Chapter 3, under Fishery Resources.

(ii) Effects on Water Quality

- Suspended Sediments/Turbidity/Vertical Illumination: Paragraph 2: Anticipated suspended sediment and turbidity levels should be compared, by month, to the ambient conditions. This would allow an evaluation and understanding of potential project impacts. The amount of spoil which would be generated and the extent to which grading and washing of material would be needed is not addressed. This has obvious implications in regard to water quality and spoil disposal. We do not at this time have sufficent data or maps with which to provide specific input. We would recommend to the extent possible, borrow material be obtained from within the future impoundment area.

It is stated that, "downstream, turbidity and suspended sediment levels should remain essentially the same as baseline conditions." This would not appear to be the case during the winter, when the ambient conditions are crystal-clear.

- Contamination by Petroleum Products: Spillage of petroleum products into the local grayling stream would have significant impacts on this fishery. An oil spill contingency plan should be presented in the mitigation plan which is in compliance with State and Federal regulations.

- Concrete Contamination: The types of potential problems associated with this activity should be identified and a pollution control contingency plan should be developed as a component of the proposed mitigation plans. Such a plan must be in compliance with State and Federal regulations. The Wastewater Treatment section (page E-2-37) is a much more appropriate level of analysis.

(iv) Impact on Lakes and Streams in Impoundment Area: Discussions regarding borrow and spoil materials are extremely general. The potential sites, quantity of material to be removed, or deposited, extent of cleaning that would be necessary, and biological description of the sites to be disturbed, should all be described. Mitigative analysis should address such issues as timing constraints on various operations and measures required to reestablish pre-project conditions for those sites which would not be permanently lost.

(v) Instream Flow Uses: Anticipated impacts for flows greater than the one in 50-year event should be described.

- Fisheries: Paragraph 2: The desirability of avoiding this fishery loss by gating the diversion tunnel should be discussed.

(vi) Facilities: General input is provided in our comments on Chapters 5 and 10. The decisions regarding the type, administration, and siting of the construction camp/village were made without input from resource agencies. In addition, the timing constraints placed upon the construction of this project are no longer supported by economic studies.. (Chapter 10. General Comments). The Exhibit should be revised to reflect updated forecasts. Reference is made to Exhibit F. Although we have requested this Exhibit, it has not been provided.

- Water Supply: It should be noted whether or not the features described in this section were coordinated with the Alaska Department of Environmental Conservation.

(b) Impoundment of Watana Reservoir

(i) Reservoir Filling Criteria

- Minimum Downstream Target Flows: Paragraph 1: The factors that went into this fishery vs economics tradeoff analysis for determining the appropriate downstream flows should be discussed in detail. At the Susitna Hydro Exhibit E Workshop (conducted on 29 November through 2 December) it was indicated that the analysis consisted of determining at what summer flows economic benefits drop off. Given that the economic analysis upon which this is based is generally considered out-of-date (Battelle Newsletter #4, Railbelt Electric Power Alternatives Study), confidence in this analysis from an economic perspective must be low. From a fishery perspective, it is unacceptable.

Paragraph 2: Once we have an acceptable instream flow regime, several gauging stations will be necessary to assure proper flows. It should be recognized that at least eight sloughs are located above Gold Creek and that several of these currently support fish. Flows to maintain or, if possible, enhance the productivity of these sloughs should be provided.

Paragraph 4: The out-migration of salmon in the spring is as likely related to photo-period and development as the other factors listed. Very low flows in the spring could cause many of the juveniles to remain trapped in backwater pools that are normally flooded under pre-project conditions.

Paragraph 6: The proposed flows of 12,000 cfs have not been demonstrated to maintain the integrity of slough morphology and provide the flushing flows needed to clean fines out of gravel. Also, the potential problem of beavers colonizing many of the sloughs, not being naturally controlled by flooding, and therefore interfering with fish usage of the sloughs should be addressed. Competing interests of aquatic and terrestrial project components such as salmon vs beaver conflicts have been given minimal attention in the Exhibit.

Paragraph 7: Adequate instream flows for the winter period should be established according to fish requirements. This is a critical period for fish and even minor dewatering may have significant deleterious effects.

(ii) Reservoir Filling Schedule and Impact on Flows: Once an acceptable instream flow study has allowed an evaluation of various flow regimes, an acceptable filling regime for the project which would minimize impacts to aquatic resources can be developed. The proposed filling regime has been established upon an inadequate biological information base.

(iii) River Morphology: Paragraph 3: The potential negative impacts on slough areas downstream of Talkeetna due to decreasing the recurrence intervals of what are now mean annual bank-full floods are not addressed.

(iv) Effects on Water Quality

- Water Temperature: The timing and consequences of the filling regime on downstream temperatures should be better defined. Just as modeling needs to define operational thermal changes, the thermal processes should be modeled for the filling period. From this we may be able to consider mitigative measures.

- Suspended Sediments/Turbidity/Vertical Illumination

. Watana Reservoir: Paragraph 3: Discussion should be provided on the impact of water quality changes on the photosynthetic process downstream of the reservoir.

Paragraph 4: It is stated that, "...the river will be clearer than under natural conditions." This may be true during the summer, however, it is our understanding that this will not be the case during the winter.

. Watana to Talkeetna: We believe the increase in winter turbidity might be more important in terms of potential fishery impacts. Quantification of potential changes should be provided. The methodology by which the summer turbidity levels were established and why it is not applicable to predicting winter conditions needs to be explained.

. Talkeetna to Cook Inlet: Anticipated changes during the winter should be discussed.

(v) Effects on Groundwater Conditions

- Impacts on Sloughs: Paragraph 1: The potential impacts on slough habitats are not clearly described. The discussion provides the impression that there is a greater understanding of the groundwater relationship between the sloughs and mainstem than is warranted by studies to date. Please refer to our comments under Section 2.3(a)(i) - Sloughs.

Paragraph 4: It is indicated that reduced staging would result from the decreased winter flows. The potential impact should be addressed in regard to the potential to dewater spawning and rearing habitats.

Paragraph 5: Although the temperature relationship of the mainstem and sloughs does not appear to be well understood, discussion should be included on this potential impact, particularly during the second year of filling when the differences from pre-project conditions are greatest.

(vii) Effects on Instream Flow Uses: Please refer to our comments on Section 2.3(a)(i) - Sloughs, and 3.2(b)(v) - Impact on Sloughs. The statements of no temperature effects are not supported by data or citation. The reduction of flows through these sloughs is not quantitatively defined. The loss of scouring flows to clean fines, remove beaver dams, and clear ice could result in significant loss or degradation of slough habitat for fish.

(c) Watana Operation

- Minimum Downstream Target Flows: The criteria are not provided which led to the development of the "target" flows. Apparently, no consideration is provided concerning maximum flows, which may be a more important consideration during winter than establishing a minimum flow level.

. Monthly Energy Simulations: Paragraph 1: The potential impacts of the water year 1969 extreme drought should be fully addressed. The effect of this naturally occuring event should be described in regard to Watana operations, how downstream flows would be maintained and how it would effect the biological resources. For example, we suspect that higher downstreams flows would be necessary to allow entrance to sloughs during this period.

. Daily Operation: In that the Devil Canyon development may not come on-line for many years, if ever, consideration should be given to operations without the Devil Canyon dam. A greater level of concern and discussion should be forthcoming on avoidance of potential impacts to the sloughs above Gold Creek.

- Floods

. Spring Floods: Paragraph 2: In that spring floods are part of the pre-project regime, discussion should be provided as to the importance of this phenomenon and whether or not post-project simulated spring floods should be included in the post-project flow regime.

(ii) River Morphology: Paragraph 2: The discussion on ice process should be expanded.

Paragraph 3: The discussion leads to a view that eventual loss of the slough habitats is inevitable. The flow regime proposed does not counteract this potential problem. Avoidance of this impact through flow modifications is consistent with the APA Mitigation Policy document and NEPA. It illustrates a low level of biological consideration in the formulation of the proposed instream flow regime.

(iii) Water Quality

- Water Temperature

. Reservoir and Outlet Water Temperature: Paragraph 2: 1982 data from Eklutna Lake, which Watana Reservoir is expected to mimic, was presented at the Susitna Hydro Exhibit E Workshop. During the winter, Eklutna Lake showed temperatures ranging from 0° to 3.6°C in the upper 2 meters, dropping to isothermal conditions below this depth. If Watana Reservoir exhibits a similar shallow winter stratification it would appear that Watana could not be operated to, "...take advantage of the temperature stratification within the reservior."

Paragraphs 5 through 7: Given that the temperature model has only been run for five months and has only one year of data for that period (1981) this discussion must be considered speculative. It is our understanding that input for this model is lacking because previous data was tailored to an earlier temperature model which is no longer considered applicable to this project. It would seem premature to place much faith in the new model based on the minimal level of testing to date. We recommend that data from two full years be inputted to the model and the results be provided in the Exhibit E.

Paragraph 8: This suggests that winter outflow temperatures between 1° and 4°C can be selectively withdrawn through a multi-level intake structure. This would be dependent upon the thermal profile of the reservoir during the winter, a period which has so far not been modeled. The statement suggesting that one degree water temperatures can be selectively obtained is speculative. It is also in conflict with the information provided at the Susitna Hydro Exhibit E Workshop where Eklutna Lake was presented as a model for Watana Reservoir. Eklutna Lake showed winter temperatures between 0° and 3.6°C within the upper two meters of the surface. If Watana Reservoir shows a similar winter stratification one should not expect to be able to tap temperatures other than 4°C with the proposed multi-level intake structure. It would have been appropriate to reference the Eklutna study findings here as is done on page E-2-61.

. Slough Water Temperatures: Paragraph 1: Please refer to our comments on Section 2.3(a)(i) - Sloughs.

- Ice: Paragraph 1: It should be clarified as to what would be the impact of the reduced contribution from the upper Susitna River. Estimations of post-project ice staging should be compared to pre-project conditions and the methodology by which the predictions were made should be explained, and/or referenced.

Paragraph 2: How ice is lost to the system, post-project, would dramatically change from pre-project conditions. The impact of this major change in this riverine system should be thoroughly explored, not merely noted.

- Turbidity: Paragraph 1: Please provide an explanation as to why, "Turbidity in the top 100 feet of the reservoir is of primary interest."

- Nitrogen Supersaturation: Discussion should be provided specific to the fixed-cone valves. It is stated that the valves would discharge spills up to a one in 50 year event, but we have no indication of the anticipated extent of their use. Withdrawing water from the hypolimnion they would often be counterproductive to what is intended to be achieved through use of the multi-level intake. The potential for thermal shock in fishes, or shock due to rapid shifts in other water quality parameters, should be evaluated. Rapid water level changes would also be an obvious result of their use, particularly between the dam face and the powerhouse.

3.3 Devil Canyon Development

(a) Watana Operation/Devil Canyon Construction: Paragraph 1: The referenced Exhibit A has not been provided, although we requested it.

(ii) Water Quality

- Concrete Contamination: Please refer to our comments on Section 3.2(a)(ii) - Concrete Contamination.

(vi) Facilities: Decisions regarding the Devil Canyon support facilities were made without input from resource agencies.

- Construction, Operation and Maintenance: The, ". . . appropriate preventative techniques . . ." should be described, and incorporated into the mitigation plan.

(b) Watana Operation/Devil Canyon Impoundment

(iii) Effects on Water Quality

- Water Temperature: The ability to continue to selectively remove very narrow temperatures bands would depend upon numerous unknowns; assuming the ability exists with operation of Watana alone. Removal of such a sizeable quantity of water in so short a period of time certainly would have implications for one's ability to select temperature bands during certain times of the year. It should be stated that the temperature model upon which this all rests only has input from five months of one year.

- Support Facilities: Please refer to our comments on Section 3.3 (a)(vi) - Construction, Operation and Maintenance.

(vi) Instream Flow Uses: It is our understanding that significant losses to the existing fisheries would result. The basis for the statement that, ". . . additional fishery habitat will become available . . ." with Devil Canyon Reservoir should be explained in detail.

(c) Watana/Devil Canyon Operation

(i) Flows

- Project Operation: It is indicated in the Feasibility Report Vol. 1, page 13-32, that compensation flow pumps would be installed. An explanation as to the function of these devices, their purpose, the flows which they would provide, whether or not they are to be installed in one dam or both, how water from this source would effect the water quality parameters of the water released from the powerhouse, and the basis for the flows which would be provided from this source should be provided. We would also like to see an explanation of the fixed-cone values regarding their expected periodicity of use (at least by month) and impacts on water quality parameters and flow levels.

(ii) Effects on Water Quality

- Water Temperatures: Since Devil Canyon Reservoir has not yet been modeled, the rationale for this discussion should be presented. The thermal models for Watana and Devil Canyon should provide information on the following:

(1) The temperature profile, depth to isothermal conditions, and timing of mixing;

(2) The timing of winter stratification;

(3) The extent of turbulence that would be generated at the reservoir intake; and

(4) The capability of the intake structure to select from one temperature layer in a stratified reservoir.

This should be included in the Exhibit E.

- Ice: Please refer to our comments on Section 3.2(c)(iii) - Ice. Information should be provided on the extent of scour in the sloughs under winter and spring break-up conditions. Discussion should address where the ice front would develop under "worst case" conditions for post-project Watana and Watana/Devil Canyon operations. Fluctuating high power demand in a record cold year and a record warm year should be discussed. Scenarios which would produce over-topping of river ice and multiple break-ups which may scour the river channel should be described.

- Nitrogen Supersaturation: Please refer to our comments under Section 3.3(c)(i) - Project Operation.

- Facilities: Erosion control measures should be described and incorporated into the mitigation plan.

3.4 Access Plan Impacts: Paragraph 2: Reference is made to Exhibit A. By letter dated 19 November 1982 we requested a complete copy of the license application. We have not yet received this Exhibit.

(a) Flows: Accurate discharge information on the creeks is needed to insure proper culvert sizing for fish passage. Utilization of culverts rather than bridges could result in more blockages to grayling migration due to beaver activity.

3.5 Transmission Corridor Impacts: Please refer to our letter dated 5 January 1982 regarding the Transmission Corridor Report.

5 - MITIGATION, ENHANCEMENT, AND PROTECTIVE MEASURES

5.1 Introduction: Paragraph 2: It is stated that, ". . . mitigative measures," were incorporated, ". . . in the preconstruction planning, design, and scheduling," yet we see construction camps/villages which were planned with no outside coordination with resource agencies, or even consideration of alternatives. The transmission corridor from the Watana dam was also planned with essentially no resource agencies input. We see scheduling, (based on an out-of-date economic analysis), determining access routing, timing of construction activities, and reservoir filling with no input from resource agencies. This has precluded an objective examination of alternative mitigation measures.

Minimum flows are proposed with the impression that they were arrived at through an as yet undisclosed fisheries vs. economic tradeoff. In the draft Exhibit E we have an evaluation of economically determined flow releases, the basis for which are no longer accepted by the economists that developed them (Battelle Newsletter #4 (Final), Railbelt Electric Power Alternatives Study, December 1982), competing against flow releases. The 12,000 cfs flow release is apparently the maximum discharge for August without significant economic effects.

We suspect that the flexibility for providing instream flows, once this issue has been resolved, is highly dependent upon the hydraulic turbines which are selected for the project. We recommend that a tradeoff analysis be presented to display the relationship of different hydraulic turbine configurations with both a one dam and two dam configuration related to maximizing flow release options vs more flexible turbine system alternatives. If the proposed turbines, in either dam, would adversely effect future instream flow options then the decision as to the preferred turbine configuration should be deferred until a specific, detailed flow release schedule, developed through a quantified instream flow analysis, is agreed upon which would mitigate impacts or enhance conditions for spawning, feeding, passage, out-migration, and overwintering in the Susitna River.

The proposed multi-level intake structure would provide the flexibility to select a desirable temperature regime only if the temperature bands exists in the reservoir of sufficient size and of sufficient depth. It has not been established that the multi-level intake would provide sufficient temperature control. At present, Watana Reservoir has been thermally modeled for five months of one year. It is our understanding that this is insufficient to even test the model for the five months for which it was run. Devil Canyon Reservoir has not been modeled, yet the recent incorporation of a multi-level intake here leads one to believe the applicant expects this reservoir might stratify. We recommend that modeling be carried out for both reservoirs, throughout the year, and the resultant data be incorporated into a river temperature model. This should be based upon two years of data (e.g. 1981 and 1982) and presented in the license application.

Reference is made to the incorporation of fixed-cone values to prevent nitrogen supersaturation. The frequency, periodicity, and anticipated volume of use is not addressed. Since they would be drawing upon water very low in the dam and then dumping an unknown volume of this water into an essentially dry riverbed we would expect potential adverse impacts to the mitigation flow and temperature regimes. The potential effects upon icing conditions and, depending upon the time of year, salmon movements needs to be assessed. We recommend that these potential impacts be discussed in the Exhibit E.

Paragraph 3: The importance of monitoring construction practices, operation and maintenance and monitoring of mitigation is recognized in the APA Mitigation Policy document. How this will occur needs to be examined in the Exhibit E. We recommend that a panel of appropriate State, Federal, and local agency personnel be established, at project expense to monitor project construction, operation and maintenance. The monitoring panel, mandate, and operational mechanisms should be discussed in the license application.

5.2 - Construction: Please refer to our comments above, Section 5.1: Paragraphs 2 and 3.

Paragraph 2: Please refer to our discussion of instream flows under Sections 5.1: Paragraph 2, 3.2(b)(i) - Minimum Downstream Target Flows, and 3.2(c) - Minimum Downstream Target Flows. Additional pertinent comments can be found throughout. The statements contained in Section 5.3 can only be considered speculative, to date there are no studies to support them. Only one slough, identified as #9, has received detailed study. In the November 1982 draft report provided at the Susitna Hydro Exhibit E Workshop, Preliminary Assessment of Access by Spawning Salmon to Side Slough Habitat above Talkeetna, the author noted that until the 1982 field data are analyzed, any statements regarding streamflows necessary for chum salmon access to the side sloughs are provisional. It should also be recognized that the examination of slough access flows is not only without support, but one dimensional. No analysis is put forth to examine other life phases of fish, or project related changes in water quality parameters.

Paragraph 5: Changes in downstream river morphology have not been fully assessed. It is premature to conclude that no mitigation would be necessary. The lack of ice scour and flood flows may cause sloughs to silt in and may reduce natural cleaning processes necessary to maintain productive spawning substrate and rearing areas.

Paragraph 6: It would seem appropriate to examine, in the Exhibit E, methods of mitigating the potential thermal effects anticipated during the filling period, to include extending the filling period.

5.4 - Mitigation of Watana Operation Impacts

(a) Flows: Paragraph 2: Please refer to our comments under Section 5.1: Paragraph 2 and Section 5.3: Paragraph 2.

Paragraph 3: It is stated that, "Watana, when it is operating alone, will be operated primarily as a base load plant." Please discuss the extent to which it is intended to be operated as a peaking facility. Of particular concern would be how it might operate under worst case conditions, such as fluctuating high power demand during a record cold year. The implications of scenarios like this should be explored in the Exhibit E if Watana is being proposed for periodic peaking use.

(b) Temperature and D.O.: Please refer to our comments addressing the multi-level intake structure and reservoir temperature modeling in Sections 5.1: Paragraph 2, and 3.3(b)(iii) - Water Temperature. We have provided additional comments on these subjects throughout.

(c) Nitrogen Supersaturation: Please refer to our discussion of the fixed-cone valves under Sections 3.2(c)(iii) - Nitrogen Supersaturation and 5.1: Paragraph 2.

5.6 Mitigation of Devil Canyon/Watana Operation

(b) Temperature: Discussion should be provided as to why multi-level intake ports are proposed at Devil Canyon. It would appear that it has been concluded, without benefit of a thermal reservoir model, that Devil Canyon would stratify.

Chapter 3. FISH, WILDLIFE, AND BOTANICAL RESOURCES

General Comments

Fishery Resources of the Susitna River Drainage

Periodically in the Fishery Section are disclaimers such as, "Much of the discussion is based on professional judgement," (Section 1.2, page E-3-3), or "Many of the statements are speculative...and ...unsupported," (Section 2.3, page E-3-56). Other statements let us know that ongoing, or planned studies, will fill these numerous data gaps to allow a quantification of the resources and impacts (Sections 2.2(b)(ii), 2.4(b)(ii), 2.5, 2.5(c)(ii), etc.) and let us go beyond, "the conceptual mitigation plan," (Section 2.5, page E-3-116) which is provided in this chapter. Recognizing a problem does not, in and of itself, correct it. We are concerned that the Fishery Section generally fails to quantify the existing resources, fails to quantify the potential impacts, and fails to provide specific mitigation measures to deal with identified, quantified, adverse impacts. Once we have potential mitigation measures, these proposals would need to be evaluated, for example, in regard to potential impacts on: project costs, design, and feasibility; socioeconomic considerations; and fish and wildlife resources other than those for which the mitigation is targeted. This type of evaluation would form the basis of an acceptable environmental impact statement and should be provided as part of the license application.

The ongoing and planned studies which are frequently cited (Sections 2.2(b)(ii), 2.4, 2.4(b)(ii), 2.5, 2.5(c)(ii), etc.) should be fully identified so we can examine them in regard to their scope. We cannot, otherwise, determine what needs to be done and what is being done (with assurances that it will be done).

Potential impacts are frequently identified in the Fishery Section, such as loss of the apparently important high spring flows for out-migrations (Section 2.3(a)(ii)), and 4°C flows during the second summer of Watana Reservoir filling (Section 2.3(a)(ii)). Potential mitigation to contend with these anticipated adverse impacts are suggested, such as spiking spring flows (Section 2.4(b)(ii)) and installing a fifth portal on the multi-level intake structure (Section 2.4(b)(ii) [SIC, iii]). If these mitigation proposals have validity, then they should be incorporated into the design and operations proposal.

Mitigation measures which are proposed should have proven success in Alaska, or in a similar environment. If the proposals are not proven, then they would need to be demonstrated effective in the project area. For example, hatchery propagation of grayling may need to be demonstrated as an effective alternative since grayling hatcheries have not been particularly successful in Alaska. Likewise, the proposed slough modifications are unproven and thus should also be demonstrated in the Susitna system before project operation.

We support the establishment of a monitoring program funded by the project, containing a board of representatives from appropriate State, Federal, and local agencies. The board should have the authority to recommend project modification measures to assure that mitigation is effective. The procedure by which this would occur should be incorporated into the license as an article. This type of monitoring program should be discussed in the mitigation plan.

Botanical Resources

At the recent Susitna Hydro Exhibit E Workshop, 29 November to 2 December, we were pleased to learn of the recent efforts to coordinate botanical and wildlife data needs. Vegetation types within the project area are apparently now being subcategorized and remapped on the basis of more recent, larger-scale photography and additional field work. Analyzing the value of vegetation as part of wildlife habitat, an information need we have consistently cited (e.g. FWS letter to Eric Yould, APA, 5 October 1982), will better allow quantification of project impacts and the development of mitigative measures. However, these efforts render the current Botanical Resources Section at least partially obsolete.

Because there is no explanation of ongoing studies, the reader is left with the perception that vegetation studies have been completed. We recommend that descriptions of the following be provided in the Exhibit E: (1) current remapping efforts for both overall vegetation and wetlands; (2) plans for summer 1983 ground truthing of this data; (3) 1984 field work which may be necessary for verifying wetlands; (4) proposed productivity studies relative to project moose studies (see Section 4.2(a)(i), page E-3-204, paragraph 2 and Section 4.3(a)(i), page E-3-281, paragraph 3); and (5) schedules for completing these investigations and analyses in conjunction with overall mitigation and project planning. Such information is provided, to some extent, relative to the Aquatic Studies Program, Section 2.5.

In general, the description of vegetation types and potential project impacts is thorough. Still, a major problem with this section involves incomplete coverage of wetlands. Minor problems involve the need for some additional maps and tables, and conflicting citations of figures and tables (e.g. referring to Figure W1 and Table W3 as Figure E.3.W1 and Table E.3.W3 in the text).

Wildlife

We found the Wildlife Section both too general and incomplete. Judgmental statements are rarely referenced (e.g. page E-3-376, last paragraph) qualitative terms are seldom defined (e.g. page E-3-315, last paragraph; page E-3-310). Perhaps most critical is the minimal detail and coverage of the mitigation plan.

Lack of quantification is a serious problem throughout this section. While baseline populations are occasionally estimated, impacts are typically qualified only as major or minor, and no values are provided for those mitigation measures which are recommended.

We are highly concerned with the lack of attention to habitat values, although we have repeatedly cited the need for project evaluations to consider habitat values as well as populations (please refer to FWS letters to Eric Yould, 5 October 1982, 5 January 1982, 23 June 1980, and 15 November 1979; and testimony of LeRoy Sowl, FWS, before the APA Board, 16 April 1982). We appreciate the initial efforts to evaluate habitats for furbearers and birds, and the reported plans to model carrying capacity for moose. Yet we see no evidence of how such evaluations will be continued, expanded to other species, and most importantly, used in developing timely, comprehensive mitigation measures, which are an integral part of project plans.

Where population information is provided, it is for the current situation. No accounting is given for long-term habitat potentials, for example, (1) habitats may be able to support greater populations over the long-term (e.g. pine marten near Watana Creek); (2) habitat values may decline as, through succession, vegetation proceeds to more mature stages which are less productive for moose; or (3) harvest management goals may be modified and caribou populations allowed to increase to where available habitats are more completely stocked.

We recommend providing information on continuing studies (including habitat modeling) and how data gaps identified here, in previous agency comments, and the August 1982 Adaptive Environmental Assessment (AEA) Workshop will be answered. Our Specific Comments below, further address this need. Another major problem is that the Wildlife Section is not integrated, nor is it consistent relative to impact potentials and mitigation options with other sections in Chapter 3 or with other chapters in the Exhibit E. For example, in Chapter 3 the impacts discussions are based on no access along the transmission corridor; in Chapter 5, such access is assumed (Section 3.7(c)(i), page E-5-84).

Not only do we recommend that this problem be corrected, but that evidence be provided as to this section has been integrated into project designs and scheduling. That integration is most critical with regard to the mitigation plan. Information should be provided on the mechanism for notifying project engineers of key wildlife areas and at the same time for the engineers to notify the environmental consultants and resource agencies of design changes or mitigation measures they believe are unfeasible. Additional information should be provided on the process to be followed for finalizing and then implementing mitigation requirements.

Integration of the various report sections would be aided through an overview discussion of overall project objectives for wildlife, fisheries, vegetation, recreation, land use, and socioeconomics.

Presently we find apparent objectives of the Wildlife Section often contrary to recreation or socioeconomics; within the Wildlife Section, objectives for one species may conflict with those for another species.

Because of the voluminous nature and complexity of material involved, it is difficult to assess population status, habitat values, impacts, and mitigation for each species relative to all other species. This is particularly important where mitigation for one species may be at the expense of another, as above. Thus we suggest some type of summary chart which would show, by species: (1) populations; (2) habitat types and values; (3) status (i.e. increasing/decreasing, upper/lower basin, etc.); (4) values (commercial, recreational, and/or subsistence with monetary figures where possible); (5) past and present harvest effort, success, and management restrictions; (6) impacts; and (7) mitigation alternatives. Please refer to our suggestions under Section 3.4 for evaluating mitigation alternatives as prioritized under NEPA guidelines. The schedule for filling resultant data gaps could then be outlined; additional mitigation needs or tradeoffs in benefits/impacts would also be obvious.

We recommend quantifying the level of mitigation to be achieved by different measures. This is particularly important where management policies are unclear (e.g. housing and transportation of workers, harvest regulations, and prohibitions on use of the access road pre- and post-construction will determine the magnitude of project impacts).

Finally, we are concerned that although the fragmentation of project impacts by project feature allows for a more comprehensible analysis, the report lacks a broad overview. Cumulative impacts are generally ignored. We recommend that such impacts be compiled in conjunction with a list of unavoidable adverse impacts.

Lack of key data has made it essentially impossible to more than outline the types of measures which should be included in the mitigation plan. In many cases, no evidence is provided for the proven success of recommended measures in Alaska or similar environments. For such unproven measures, demonstration projects should now be established or back-up mitigation measures outlined for implementation if unproven measures fail (e.g. blasting to enlarge the Jay Creek mineral lick, provision of artificial raptor nests).

The monitoring program we recommended under the Fishery Section should also be extended to wildlife resources in the project area.

Specific Comments

1 - INTRODUCTION

1.2 - Impact Assessments: Paragraph 1: Please refer to our Fishery Section - General Comments regarding quantification and the status of the project studies.

Paragraph 4: Several of these references do not appear in the bibliography.

1.3 - Mitigation Plans: Paragraph 8: Avoidance of adverse impacts rarely appears to occur, particularly in regard to project features. For example, missed opportunities to avoid adverse fish and wildlife resources impacts exist in: project scheduling; mode and routing of construction access; recreation planning; siting, administration, and type of construction camp/village; and instream flow regime.

The monitoring program, which has been supported in several chapters, should be fleshed out. The program should provide for participation by appropriate representatives of State, Federal, and local agencies, be supported by the project, and be able to recommend changes in the mitigation program to be adopted through a mechanism established in the license, mutually acceptable to all concerned bodies.

2 - FISHERY RESOURCES OF THE SUSITNA RIVER DRAINAGE

2.1 - Overview of the Resources

(d) Selection of Project Evaluation Species: Paragraph 4: Improving habitat conditions for an evaluation species would be helpful to other species with similar habitat requisites. However, we would expect other species, with habitat requirements that conflict with evaluation species, to be adversely affected. In addition, we recommend Dolly Varden and burbot be included as evalution species for the Susitna River downstream of Devil Canyon.

Paragraph 6: It is stated that, "Improved conditions in the mainstem are expected to provide replacement habitat...Juvenile overwintering habitats are not expected to be adversely affected." We are unaware of specific data to support these statements.

Paragraph 8: Evaluation species and life stages should be listed for the Cook Inlet to Talkeetna reach.

(e) Contribution to Commercial, Sport, and Subsistence Fishery

(i) Commercial: Species specific comparisons are made of commercial harvest to escapement. Perhaps a better gauge would be to provide estimated contribution to the commercial harvest, as is assessed in Chapter 5 (page E-5-70), or estimated contribution to the run. This, however, also would simplify the systems contribution, but would at least provide reviewers with a better understanding of production.

(ii) Sport Fishing: Paragraph 2: If more recent surveys are available, this section should incorporate them.

(iii) Subsistence Harvest: The following three ADF&G reports would allow for a more expansive discussion of this important topic:

1. Foster, Dan. November 1982. The Utilization of King Salmon and the Annual Round of Resource Uses in Tyonek, Alaska. ADF&G. 55 pp. + appendices.

2. Stanek, Ronald, James Fall and Dan Foster. March 1982. Subsistence Shellfish Use in Three Cook Inlet Villages, 1981: A Preliminary Report. ADF&G. 17 pp. + appendices.

3. Webster, Keith. April 1982. A Summary Report on the Tyonek Subsistence Salmon Fishery, 1981. Upper Cook Inlet Data Report Number 81-3. ADF&G. 16 pp. + appendices.

2.2 - Species Biology and Habitat Utilizaton in the Susitna River Drainage

(a) Species Biology

(iii) Resident Species

- Arctic Grayling: Paragraph 8: The statement that, "Assuming other conditions for spawning are favorable,..." should be expanded to allow an understanding of what these other conditions are and why we should assume they would be favorable.

(b) Habitat Utilization

(ii) Talkeetna to Devil Canyon

- Mainstem and Side Channels: References are made to low flow and maximum flow. The flows should be quantified so that an understanding of potential project impacts and mitigative flows can be related to how it would influence habitat.

.Species Occurrence and Relative Abundance: The baseline information and analysis should incorporate the 1982 field season data.

- Slough Habitat: Paragraphs 2 and 3: The effects of various flow levels should be referenced by the number of sloughs which would be impacted by the particular problem and the relative importance of the effected sloughs in terms of salmon habitat.

Paragraph 4: The basis for the intragravel temperature statements should be provided, whether conjecture or based upon a study of X number of sloughs.

.Significance of Habitat

..Salmon: Paragraph 2: The relative value of tributary sites (mouths?) vs sloughs may be a reflection of ease of study, or effort.

2.3 - Anticipated Impacts to Aquatic Habitats: Paragraph 3: Please refer to our discussion under Fishery Section - General Comments.

(a) Anticipated Impacts to Aquatic Habitat Associated with Watana Dam

(i) Construction of Watana Dam and Related Facilities

- Watana Dam

.Changes in Water Quality: Although turbidity levels may be decreased, on the average, throughout the year, a more appropriate impact evaluation would be to examine turbidity levels by season or month vs aquatic life stage.

Paragraph 11: Examples of "...good engineering practices, and a thorough SPCC plan," should be provided in the mitigation plan. The abbreviation of the plan should be spelled out.

.Direct Construction Activities: Paragraph 1: Material sources should generally be confined, unless unavoidable, to that area which would be inundated by the impoundment, or upland sites. In that the Devil Canyon dam is not a certainty, rehabilitation of Cheechako Creek should be planned.

Joyce, Rundquist, and Moulton (1980) is referenced several times. We request that this reference be provided, and the pertinent discussions from this paper be incorporated into this section.

- Watana Camps, Village and Airstrips

.Construction and Operation of Camps, Village and Airstrips: Paragraph 1: Reference is made to Exhibit A which has not been provided, although we have requested it.

..Indirect Construction Activities: We expect secondary impacts, avoidable and unavoidable, to be much greater than that indicated by this discussion. We provided comments on this topic in response to appropriate Chapter 5 sections, where this topic is also inadequately discussed.

(ii) Filling Watana Reservoir

- Watana Reservoir Inundation

.Mainstem Habitats: Paragraph 4: Although overwintering habitat would be increased, the overall impact would probably be a net loss of habitat value. The discussion does not identify what species might benefit from this increase in overwintering habitat.

Paragraph 5: The basis for the statement, "Reservoir temperatures in the top 100 ft are expected to be in the range of 1° to 2°C," should be provided. First, the reservoir temperature model has not been run for the period November through May. Second, the statement is in apparent conflict with the information provided at the Susitna Hydro Exhibit E Workshop in which Eklutna Lake was presented as a model for Watana Reservoir. Eklutna Lake shows winter temperatures between 0° and 3.6°C within the upper two meters.

- Talkeetna to Watana Dam

.Mainstem Habitats: Paragraph 1: In that the river would no longer be clear, the effect of this change in turbidity upon movement of juvenile salmon and resident fish should be addressed.

Paragraph 4: The apparent importance of the receding limb of high spring flows to stimulate out-migration is noted yet we see no effort to simulate this in the recommended instream flow regime.

Paragraph 9: It is recognized that the outflow temperatures during the second open-water season could have substantial adverse impacts. This problem in relationship to how it was handled at other hydropower projects should be discussed.

.Side-Channel Habitats: Paragraph 3: Until an adequate instream flow study is conducted, these statements will remain speculative.

Paragraph 4: It should be stated whether or not rearing habitat is considered limited.

Paragraph 5: The decreased temperatures expected would probably counteract any benefits derived through decreased suspended sediments.

.Slough Habitats: The potential impacts during filling should be discussed. Flows and temperatures would be changed from ambient. Until the ground water relationship, in regard to flows and temperatures, is adequately established the potential for impacts should not be dismissed. Whether or not the colder second year releases would have a delayed temperature effect upon the sloughs should be examined.

Paragraph 3: It should be explained that the basis for these statements is preliminary results from an examination of one slough (#9).

Paragraphs 4 and 5: The slough which had a backwater form above 14,000cfs should be identified. It is not explained whether this is typical of all sloughs, some sloughs, or even just that one unidentified slough. It is apparent from this section that 12,000cfs would hamper or restrict passage of adults into an undisclosed proportions of the sloughs and would not create a backwater effect for an unknown proportion of the sloughs. The biological basis by which 12,000cfs was chosen as the preferred flow for August should be explained in light of the discussion of this section.

.Tributary Habitats: Paragraph 4: It is noted that some creeks may become perched under the proposed filling schedule. The desirability and feasibility of altering the filling schedule to avoid this impact should be discussed.

- Cook Inlet to Talkeetna Reach: It has not been clearly established that the project would not adversely impact fisheries below Talkeetna during reservoir filling and project operation.

.Mainstem Habitats: It is our understanding that millions of eulachon spawn in the lower river. If this spawning run is stimulated by certain temperatures or peaking spring flows the project could significantly impact this species. Secondary impacts would occur to those species, such as bald eagle and belukha whale, which feed on them. This potential problem should be discussed.

.Slough Habitats: Paragraph 1: This discussion is in apparent conflict with Section 2.2(b)(iii) Slough Habitat - Significance of Habitat .. Salmon (page E-3-51) where it is stated that these habitats may be used for spawning.

..Tributary Habitats: Paragraphs 2 and 3: A 10 percent reduction in flows could mean a zero reduction in habitats of concern or 100 percent reduction or something in between. We recommend that these flow reduction percentages be related to their effect on habitats of importance to life stages of those species of concern.

(iii) Operation of Watana Dam

- Talkeetna to Watana Dam

.Mainstem Habitats: Discussion should be provided specific to the fixed-cone values. There is no indication of the anticipated extent of their use. In that they would be withdrawing water from the hypolimnion they would often be counterproductive to what is intended to be achieved through use of the multi-level intake. The potential for thermal shock, or shock due to rapid changes in other water quality parameters, should be evaluated. Rapid water level changes would also be a potential problem that should be explained.

Paragraph 8: Discussion appears to be in conflict with Paragraph 16 of this section concerning suspended sediment transport.

Paragraph 9: Sediment load and turbidity are not synonymous. Turbidity should increase substantially over ambient winter levels.

Paragraph 16: The observation that fish apparently overwinter in the turbid Kenai River allows one to conclude that, over a long period of time, these (unidentified) species can adapt to turbid conditions. The conclusion that the Susitna stocks can, in one year, adapt to Kenai River like conditions is a big step. Please more fully discuss this potential problem.

- Cook Inlet to Talkeetna Reach: Please refer to our comments under Section 2.3(a)(ii) - Cook Inlet to Talkeetna Reach.

(b) Anticipated Impacts to Aquatic Habitat Associated with Devil Canyon

(i) Construction of Devil Canyon Dam and Related Facilities

- Devil Canyon Dam

- Alteration of Waterbodies: Paragraph 3: Please refer to our comments on Section 2.3(a)(i) - Watana Dam . Direct Construction Activities.

.Disturbance of Fish Populations: Please refer to our comments on Section 2.3(a)(i) - Watana Dam . Direct Construction Activities.

- Devil Canyon Camp and Village

.Construction and Operation of Camp and Village: Paragraph 1: Reference is made to Exhibit A, which we requested. It has not been provided. We have not had input into the decisions regarding the type, administration, or siting of the construction camp/village. Avoidance of impacts to fish and wildlife resources should have been a major consideration in these decisions. In that we did not participate in these decisions and no alternatives to those which are considered "preferred" are examined in Chapter 10 we can only conclude that little, or no, consideration was given to this mitigation procedure.

.Direct Construction Activity: Please refer to our comments under Section 2.3(a)(i) - Watana Camps, Village and Airstrip . Construction and Operation of Camps, Village and Airstrips .. Indirect Construction Activities.

(iii) Operation of Devil Canyon Dam

- Talkeetna to Devil Canyon Dam

.Mainstem Habitats: Paragraph 1: We assume that the 500cfs flows in this reach would be provided by compensation flow pumps, discussion of which does not appear to be provided in this Exhibit. An explanation should be provided as to the function of these devices, their purpose, and how water from this source would effect water quality parameters of the water released from the powerhouse and the fixed-cone values, and the basis for the flows which would be provided from this source. Please provide the rationale for the statement that a reduction in flows of the magnitude which would occur would not be expected to adversely affect fish populations in this portion of the river.

.Slough Habitats: An explanation should be provided for the statement that changes in streamflow during the open-water season are not expected to affect slough habitats. We consider the potential for significant adverse effects to this habitat type to be high.

- Cook Inlet to Talkeetna: Small changes in flows can have dramatic impacts on habitat. The relationship between flows and impacts on habitat must be established before one can dismiss small changes in flows. We expect the AEIDC instream flow study will sufficiently define this relationship.

(c) Impacts Associated with Access Roads and Auxiliary Roads

(i) Construction

- Construction of Watana Access Road and Auxiliary Roads: Once an acceptable access routing is agreed upon, studies would need to evaluate the existing resources. Only at that point can specific mitigative measures be satisfactorily addressed, based upon quantified impacts. We recommend that you procede in this manner.

.Alteration of Water Bodies: The potential problem of beavers damming culverts and thus interfering with fish passage needs to be addressed.

- Construction of Devil Canyon Access Road and Auxiliary Roads: Paragraph 1: We assume that APA has decided on a preferred access plan to Devil Canyon consisting of road or rail access, or both. Whatever it is should be stated.

Paragraph 3: Although we have previously expressed our preference for rail access in lieu of road access, proper siting of rail is highly important to minimizing impacts, primarily through avoidance. Coordination specific to this issue should occur when siting decisions are being made.

(ii) Operation and Maintenance of Roads

- Operation of Watana Access Road and Auxiliary Roads

.Disturbance to Fish Populations: Paragraph 3: In that "... the increased accessibility of fish streams and lakes to fishermen..." would possibly be "...the greatest source of adverse impacts..." it would appear to be consistent with the APA Mitigation Policy document and NEPA to give emphasis to mitigation through avoidance of these impacts.

(d) Transmission Line Impacts

(i) Construction of Transmission Line

- Watana Dam: Paragraph 1: Base line information on the transmission corridor from the dam sites to the Intertie has been acknowledged as lacking within the Exhibit. As with other project features, the Exhibit E should provide base line data, impact assessment, and mitigation planning. Avoidance of adverse impacts would occur by a combined construction access/transmission line access corridor north of the Susitna River between the two dam sites. This is our preference. For further comments please refer to our letter dated 5 January 1982 on the Transmission Corridor Report. This letter was provided as formal pre-license consultation and we continue to view it as such.

(ii) Operation of the Transmission Line

- Watana Dam

.Alteration of Waterbodies: Please refer to our comments under Section 2.3(d)(i) - Watana Dam.

.Disturbance to Fish Populations: Please refer to our comments under Chapter 5, Section 3.7(c)(i) - Aquatic Species . Impacts of the Project

2.4 - Mitigation Issues and Proposed Mitigating Measures

(a) Mitigation of Construction Impacts Upon Fish and Aquatic Habitats: Please refer to our comments under Fishery Section - General Comments.

(i) Stream Crossings and Encroachments

- Mitigation: Please refer to our comments under Section 2.3(c)(i) - Construction of Watana Access Road and Auxiliary Roads . Alteration of Water Bodies.

.Methods of Installation: Paragraph 3: Certain construction practices should be scheduled to occur during the winter to minimize and/or avoid adverse impacts.

(ii) Increased Fishing Pressure

- Impact Issue: If the construction access and transmission line between the two dam sites were in the same corridor the impact could be partially reduced or avoided. Please refer to our letter dated 5 January 1982 on the Transmisson Corridor Report for additional comments.

(iv) Material Removal

- Mitigation: Please refer to our comments under Section 2.3(a)(i) . Direct Construction Activities: Paragraph 1.

Paragraph 3: Mining should be scheduled to avoid conflicts with fish migrations, spawning, or other important occurrences.

Paragraph 6: Please refer to our comments under Fishery Section - General Comments regarding monitoring.

(viii) Susitna River Diversions

- Mitigation: Grating of the diversion tunnel would prevent losses to fish and should be considered as a mitigative measure.

(x) Clearing the Impoundment Area

- Mitigation: If it would minimize these impacts, then clearing should occur during the winter.

(b) Mitigation of Filling and Operation Impacts

(i) Approach to Mitigation: Although, "Avoiding impacts through design features or scheduling activities to avoid loss of resources," is listed as top priority, in reality it has not received this type of emphasis.

(ii) Mitigation of Downstream Impacts Associated with Flow Regime: Under General Comments for Chapter 2 we have provided a synopsis of the AEIDC instream flow proposal which has been contracted by APA. We believe that this proposal would provide the basis for a reasonable, quantified instream flow impacts analysis which would allow an assessment of mitigative alternatives. Since APA has contracted this study, we assume that APA agrees with our view. The AEIDC proposal should be fully described in either Chapter 2 or 3. It seems premature to discuss mitigative flows prior to quantification of potential impacts.

- Impact Issue: Paragraph 1: Reference is made to Exhibit A. Although we have requested this, as well as other Exhibits, it has not been forthcoming.

- Measures to Minimize Impacts: Please refer to our comments under Sections 2.3(a)(ii) - Talkeeta to Watana Dam . Slough Habitats: Paragraphs 4 and 5 and 2.3 (a)(ii) - Talkeetna to Watana Dam . Mainstem Habitat: Paragraph 4. It is apparent that the flow release schedule neither minimizes loss of downstream habitat nor maintains normal timing of flow-related biological stimuli.

.Winter Flow Regime (November - April): Paragraph 1: Please refer to our comments under Section 2.3(a)(ii) - Cook Inlet to Talkeetna Reach . Tributary Habitats: Paragraphs 2 and 3.

Paragraph 2: We also feel strongly both ways.

.Summer Flow Regime (July - October): Paragraph 3: Discussion should be provided regarding the instream flow studies which lead to the conclusion that 12,000cfs is of sufficient magnitude to allow rectification of project impacts.

- Rectification of Impact

.Winter Flows: We strongly disagree with the conclusion reached in this section. How this conclusion can be derived from the information provided in this chapter and Chapter 2 needs to be fully explained.

.Summer Flows: We fully agree that the proposal must be demonstrated effective before it can be incorporated into a mitigation plan.

- Reduction of Impacts Over Time: Please refer to our comments under Section 2.4(a)(iv) - Mitigation: Paragraph 6.

- Compensation for Impacts: Paragraph 2: Please provide documentation on the success of this alternative in Alaska, or similar environs. Several ideas are discussed in this section which should be considered for demonstration projects during the 1983 field season.

Paragraph 9: Discussion of the development of a hatchery should be expanded. If other mitigation alternatives prove not to be feasible then we will need to fully understand what could be achieved through hatcheries.

(ii) Mitigation of Downstream Impacts Associated with Altered Water Temperature Regime

- Measures to Minimize Impacts

.Water Temperatures during Filling Watana Reservoir: If the addition of a fifth portal would, based upon thermal modeling of the reservoir, provide additional temperature control during filling, then we recommend that this be added.
.Water Temperatures During Operation of Watana Reservoir: Paragraph 3: Please refer to our comments under Section 2.3(a)(ii) - Watana Reservoir Inundation . Mainstem Habitats: Paragraph 5.

- Measures to Rectify Impacts: Documentation should be provided on the success on this type of proposal in Alaska, or other sub-arctic systems. Demonstration of the techniques would need to occur prior to incorporation into the mitigation plan. In that the sloughs are also utilized for rearing by chinook and coho juveniles, discussion should be provided on how chum salmon (we have assumed that chum is the species which is being managed for although it is not stated) would interact with the other species. Also, the mechanisms which might allow entrance to chinook and coho salmon into the sloughs while holding the chums from egressing needs to be explained.

- Compensation for Impacts: Documentation should be provided on the success of hatchery propagation of grayling.

(ii) Operation Mitigation

- Mitigations of Access and Impoundment Impacts: Paragraph 1: In that other study components (e.g. wildlife, and recreation) are also considering uses for the borrow areas, coordination should be directed toward resolving potential problems. Maps depicting the borrow pits and the agreed upon, "best" uses for the individual sites should be provided.

- Mitigation for Downstream Impacts: Paragraph 2: We fully support the statement that, "Continuing reservoir thermal modeling will allow an evaluation of available water temperatures throughout the year so that a detailed release plan can be developed. The release plan will need to consider both water temperature and volume in order to minimize impacts." We recommend that this be carried out and the proposed release plan be included in the license application.

2.5 - Aquatic Studies Program: Please refer to our comments under Fishery Section - General Comments.

2.6 - Monitoring Studies: Please refer to our comments under Section 1.3: Paragraph 8.

3 - BOTANICAL RESOURCES

3.1 - Introduction

(a) Regional Botanical Setting: A more complete description should be provided for vegetation north of the Susitna River to the Denali Highway, through which the proposed access road is to pass. The primary importance of botanical resources as a key component of wildlife habitat should be restated here as the object of this report (see Section 1.2, page E-3-3, paragraph 1).

(b) Floristics

(i) General: Paragraph 1: We suggest that the difference in numbers of plant species between the upper and lower basins are a result of the following: larger study area; greater time spent in sampling the upper basin, and the numerous vegetation communities associated with elevation changes and topographical diversity.

Paragraph 3: Please explain the quantification of plant species for the Willow-to-Cook Inlet and Healy-to-Fairbanks transmission corridors, when no floristics work was done in that area. (Section 3.2(e)(i) and (ii) and Tables W24 and W25).

(c) Threatened or Endangered Species: Since no plant species are officially listed, we suggest addition of the word "candidate" prior to any discussion of "threatened or endangered" plant species. In many places the discussion would be more accurate by referring to "plant taxa" rather than species since these plants are generally varieties or subspecies rather than distinct species. Please clarify that the calciphilic plants referred to in paragraph 4 of subsection (i) refer to Murray's, not FWS, categories for threatened or endangered.

(d) Contribution to Wildlife, Recreation, Subsistence, and Commerce: Because of their key functions both as habitat for fish and wildlife resources and in maintaining water quality relative to drainage, high water energy dissipation, flood storage, ground water recharge, filtering surface runoff, etc., wetlands and floodplains have been protected by Executive Orders (11990, 11998) and national legislation (e.g. Clean Water Act as amended in 1977). Since vegetation is a characteristic component of any wetlands, we suggest addition of a general section here on the prevalence of wetlands in the project area and their widely recognized biological and water quality values (please also see our following comments on Section 3.2(a)(vi), Wetlands.

(iii) Subsistence: Use of area timber resources for building or heating homes is an additional subsistence use which should be mentioned.

3.2 - Baseline Description: Paragraph 1: A brief description is needed here of the Viereck and Dyrness hierarchical vegetation classification system for Alaska, levels used for this study, and number of categories mapped (note, this description should cover the vegetation type maps now under preparation). An explanation for the mapping of up to 16 kilometers (km) from the Susitna River and .8 km from the impoundments should be provided.

Paragraph 2: A brief description should be given as to sampling intensity. Whether vegetation dominance within the project area and/or susceptibility to project impacts were considered in study design should be explained. General information on elevation, slope, aspect, and land form should be briefly related here and in subsequent sections of the report to better define areas and their vegetation cover. The prevalence of permafrost, a determining factor in some project impacts (e.g. pages E-3-166, paragraph 2 and E-3-170, paragraph 3), should also be considered.

Paragraph 3: Successive descriptions of vegetation types by project area would be clarified here by defining closed, open, and woodland forests, tall versus low shrublands, and wetlands (also see comment under Section 3.2(a)(vi)), rather than defining them in the following sections (a) and (i). The discussion would also be aided by including an overlay of project features on the vegetation map, Figure W1, as well as restating information on the elevation range for each proposed impoundment area. We recommend the license application include a larger, more readable vegetation map and that quantitative data on how common or uncommon specific vegetation types are, as well as the occurrence of various types relative to elevation or aspect, be presented in the text as well as tables. In so describing the revised vegetation classification, it will be possible to better evaluate potential project impacts on vegetation, and thus wildlife habitats, by project feature. This recommended level of effort also applies to the proposed access and transmission corridors.

(a) Watana Reservoir Area

(i) Forests: Please see comment under Section 3.2 re including quantified information in the text as well as tables. Providing the range of elevation in which these types were sampled rather than one average would show the extent and overlap in distribution of each forest type.

- Spruce Forest: Paragraph 5: Black spruce forests on poorly drained soils would most likely also be classified as wetlands. Please refer to our comments under Sections 3.1(d) and 3.2(a)(vi).

(ii) Tundra: Please refer to comments under Section 3.2: Paragraph 3 re providing quantitative data on the prevalence of different tundra types and of ranges rather than average elevations. The wet sedge-grass tundra should also be described as a wetland type, see Sections 3.1(d) and 3.2(a)(vi), as above.

(iii) Shrubland: Refer to comments under Sections 3.2(a)(i) and (ii) above.

(iv) Herbaceous: For consistency with the rest of the report, we recommend describing common species within the referenced herbaceous pioneer communities. Corresponding tables on the herbaceous vegetation types are missing.

(v) Unvegetated Areas: Again, quantification of the extent, and thus importance, of these areas should be provided.

(vi) Wetlands: This section is significantly lacking in three areas. First, the legislatively recognized importance and protection of wetlands should be described, including the U.S. Army Corps of Engineers' (CE) definition of wetlands and regulation of activities on these areas. (Please also refer to our comments under Section 3.1(d) regarding this concern.) Secondly, there should be a discussion of how wetlands may be a second level of classification applied to the vegetation types previously discussed. Finally, as with other ongoing studies, this section should cover the wetlands delineation scheme agreed to at the 2 December 1982 wetlands session of the Susitna Hydro Exhibit E Workshop. This agreement included the following: project consultants will meet with the FWS and CE to identify the appropriate detail for wetlands mapping; existing wetlands maps will be improved on the basis of additional aerial photography and overall vegetation remapping; soils information will be obtained from the CE; ground truthing, in consultation with FWS and CE, will be undertaken in summer, 1983; final maps should be available by fall, 1983; and additional field checks may be necessary in summer 1984 (see page 5 of Wetlands Meeting notes, received from John Hayden, Acres American, Inc.). Given the doubtful accuracy of existing wetlands maps, it would be inappropriate to include those maps in the license submittal.

Redefinition of wetlands to properly include such types as black spruce bogs, willow and poplar along watercourses, and herbaceous sedge-grass marshes, in addition to the more completely aquatic types now described under the wetlands section. A definition of "wet tundra" (paragraph 6) should be included. The final paragraph of this section would be a better opening statement to the expanded discussion needed on wetland values and types.

(b) Devil Canyon Reservoir Area: Please refer to comments under Section 3.2(a) re need for a brief elevational and landform description. Again, there will be need for an overlay of the impoundment area on the (revised) vegetation type map. We appreciate inclusion of the percent of the impoundment area covered by major vegetation types. Please refer to our previous comments re need for a comprehensive discussion and definition of wetlands.

(c) Talkeetna to Devil Canyon: Clarification of this specific area is needed. Again, refer to comments under Section 3.2(a)(i) and (ii), above. While early, mid, and late successional stages appear a suitable categorizaion for floodplain vegetation, these stages should be correlated with the forest, shrub, tundra, wetlands, etc. classification previously used.

(d) Talkeetna to Cook Inlet: Please refer to comments under Section 3.2(a)(i) and (ii), above. We believe that existing data do not substantiate the conclusion that the project will have minimal impacts on vegetation in this area. Thus we recommend mapping the area within the 10 year floodplain downstream of Talkeetna at least to the Delta Islands. Further discussions on expected impacts should be initiated to better pinpoint the precise area which should be covered.

(e) Transmission Stubs and Intertie: Again, we suggest adding a map, and elevation information, as well as quantifying the vegetation type, for each of the following four subsections.

(i) Healy to Fairbanks: Paragraph 5: Reference to "wet lowland sites" should be expanded to discuss wetlands per our comments on Section 3.2(a)(vi).

(ii) Willow to Cook Inlet: Paragraph 1: Here too, "wet sedge-grass marshes" should more completely be discussed as wetlands, see Section 3.2(a)(vi).

Paragraph 2: The first sentence is contrary to data provided in Table W25, please clarify.

Paragraph 5: Placement of this paragraph between the first and second paragraphs would be more logical.

(iii) Willow to Healy: The compatability of vegetation types as mapped by Commonwealth Associates, Incorporated (1982) with those mapped by McKendrick et al. (1982) should be described.

(iv) Dams to Intertie: We question the comparability of vegetation types mapped here at a scale of 1:250,000 with those in all other transmission corridors which were mapped at 1:63,360, e.g. Tables W27 and W28 document difficulties of mapping closed birch and balsam poplar types at the 1:250,000 scale. This transmission corridor should be separately mapped during ongoing mapping.

3.3 - Impacts: Fragmenting this analysis into a project feature by impact issue format is useful for a first overview. However the section lacks a comprehensive picture of cumulative impacts to vegetation. That cumulative picture is essential for understanding overall impacts of the project on fish and wildlife species occupying areas within and beyond each project feature. Although this section identifies the full range of vegetation impact issues, there is no attempt to quantify areas which may be potentially affected by changes in vegetation cover. A given change may be both beneficial to one species of wildlife yet adverse to another. By not completely prioritizing mitigation in the previous Fishery Section and later Wildlife Section, the report fails to identify the tradeoffs or objectives of a project-wide mitigation plan or mitigation plan alternatives. For example, information should be provided here on the tradeoffs analysis relative to fish, wildlife and botanical impacts, as well as cost and design considerations in the siting of project support facilities, roads and transmission lines. We remain concerned that we were not consulted in the siting of project support facilities.

(a) Watana Developement

(i) Construction

- Vegetation Removal: Paragraph 1: Again, we suggest restating the elevation range within which vegetation will be removed. Spoil areas should also be described.

Paragraph 2: Please provide the percent loss expected for birch forests as shown in Table W27. Loss of a vegetation type relative to its abundance within the basin is half the issue relative to the loss of vegetation; however the value of each type relative to other types for selected wildlife species should also be provided. In some cases habitat factors would also be considered; see our comments throughout the Wildlife Section.

- Vegetation Damage by Wind and Dust: Paragraph 1: Given the difficulty of reading the vegetation map supplied here and the later need to understand the potential for lost nest sites or wildlife cover, please describe the primary tree species and vegetation type(s) in which blowdown may occur on the southside of the Watana damsite.

Paragraph 3: Some relationship should be made between referenced possible delays in snowmelt and vegetation types which may be affected. Similarly, increases in cottongrass and decreases in mosses and lichens should be related to their occurrence in vegetation types adjacent to impoundment and borrow areas. Such relationships should be the basis for fully considering the impacts of project-induced changes on vegetation relative to wildlife (see our comments under Sections 4.3(a)(i), (ii), (iv), and (v)).

(ii) Filling and Operation

- Vegetation Succession Following Removal: In order to understand the magnitude of vegetation alterations, some quantification should be presented for the areas of forest, shrub, tundra, etc. which will be rehabilitated during project filling and operation. A scenario should be developed outlining potential acreages of each affected vegetation type and the various successional stages they will pass through during the life of the project.

. Forest Areas and Shrubland: Anticipated heights of each vegetation stage, over time, should be included here.

. Tundra: The extent of permafrost should be described, please see our comment under Section 3.2.

Information is needed on successional patterns in herbaceous vegetation types and on wetlands within each type, for consistency with Section 3.2(a). An additional concern is the nutritional quality and quantity of plant regrowth relative to wildlife.

- Effects of Erosion and Deposition: Paragraph 2: See preceeding comment and that under Section 3.2 re need to map and quantify the aerial extent of permafrost.

- Effects of Altered Downstream Flows: Overall, this discussion is too general. Consideration of daily flow fluctuations in response to peak power needs is neglected.

Several other potential project impacts are left unclear; especially those related to wetlands and floodplains. For example, please provide the extent of floodplain areas, (1) now subject to annual, 5 year, 10 year, etc. flooding, and (2) which will become exempt from flooding. Given the successional information depicted in Figure W3 and revised vegetation maps, it should be possible to quantify expected changes in vegetation, over time, for a variety of flow regimes. Such information is necessary to fully determine project impacts to wildlife and make mitigation recommendations. If existing hydrologic or vegetation information is considered insufficient for developing such models, additional studies should be initiated.

. Watana to Devil Canyon: A more detailed treatment of the potential for rimeice or icefog formation is needed here. For example, ice buildup on vegetation has been found to keep the soil surface open in forests.[10] Sapling tree stands heavily damaged by ice produced more brush whereas ice damage in mixed-oak tree stands resulted in loss of understory saplings and low tree branches with herbaceous plant growth enhanced in summer.[11] Such changes in understory or reduction in winter browse availability could be particularly critical to wildlife subject to extensive adjacent habitat losses.

The types of vegetation which may form, over the project life, on "newly-exposed areas with adequate soils" should be described relative to adverse or potential benefits for various wildlife species.

. Devil Canyon to Talkeetna: Paragraph 3: This quantified description of expected vegetation type changes is the type of detailed impact analysis necessary for other project areas (e.g. preceeding section on Watana to Devil Canyon and following section on Talkeetna to Yentna River). Once the revised vegetation mapping and analysis is completed, this type of analysis should be the basis for examining the positive and/or negative impacts to wildlife of these vegetation changes, over the life of the project.

Paragraph 4: The statement that, "Post-project ice formation in this reach will be similar to present conditions," appears to conflict with previous descriptions whereby ice formation will not occur until approximately river mile 130, slightly more than half way to Devil Canyon from Talkeetna (Section 2.3(a)(iii), page E-3-90). In order to understand how area vegetation may be less-influenced under post-project break-up, it would be useful to explain present impacts of break-up on the vegetation. Please address the change from a bank-full flood interval of 1 to 2 years for this section of the river. Quantification is needed of the area over which vegetation could be established with this schedule for less frequent disturbances.

. Talkeetna to Yentna River: Paragraph 2: Again, the vegetated areas and types which could become established on the active gravel floodplain under less frequent bank-full floods should be described.

Paragraph 4: We question the suggested vegetation changes between Talkeetna and the Yentna River. Vegetation allowed to establish over a longer period of time (e.g. 5 to 10 rather than 1 to 2 years) would seem less likely to be disturbed when the bank-full flood does occur. Given the annual flow

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10/ Butler, R.M., N.H. Wooding, and E.A. Myers. Spray-Irrigation Disposal of Wastewater. Special Circular 185. The Pennsylvania State University, College of Agriculture Extension Service, University Park, Pennsylvania. 17 pp.

11/ Wood, G.W., P.J. Glantz, H. Rothenbacher, and D.C. Krodel. 1975. Faunal response to spray irrigation of chlorinated sewage effluent. Research Publication No. 87. Pennsylvania State University, University Park, Pennsylvania. 89 pp.

variations over this stretch of the river, it would seem possible and necessary to predict areas of vegetation change for maximum and minimum flow scenarios.

- Climatic Changes and Effects on Vegetation: As for other ongoing studies, a schedule is needed for incorporating phenology study results into project plans.

Paragraph 3: We recommend calculating the potential vegetated area and types therein within the referenced 2.5 km area downwind of the reservoir within which air temperatures may be affected. Resultant impacts on timing of vegetation green-up or leaf-drop could be important for area wildlife.

Paragraph 4: A more extensive treatment of fog bank development should be included here, please refer to our comments under Section 3.3(a)(ii) - Effects of Altered Downstream Flows . Watana to Devil Canyon.

Also see comment above re calculating the area within 3 km offshore which may be affected by ice development.

- Effects of Increased Human Use: We have repeatedly cited the important opportunity for minimizing project impacts on fish and wildlife by carefully siting and regulating access (see FWS letter to Eric Yould, APA, of 17 August 1982). The potentials for off-road vehicle (ORV) use and accidental fires with project access described here confirm that such use may need to be effectively controlled as fish and wildlife mitigation. Please refer to comments under Section 3.4(c)(ii) re our recommendations to eliminate the Denali Highway access route and to restrict worker and public use of project access routes.

We are concerned about inconsistencies with the first sentence here, re greater access opportunities, and with points made in the Wildlife Section. That section appropriately contains repeated descriptions of (1) the significant negative impacts from increased use and access; and (2) the need to carefully control project area use and access (e.g. Sections 4.4(a)(i), (ii), (iv), and (r) and 4.4(c)(ii)). Please clarify.

. Off-Road Vehicles: Paragraph 3: In view of previous incomplete coverage of wetlands (see our comments under Section 3.2(a)(vi)), we question the definition behind use of the term wetlands here. This discussion illustrates the need for the improved wetlands map which is to be developed.

(b) Devil Canyon Development

(i) Construction: Other than quantifying direct vegetation losses from reservoir inundation, the section fails to provide any indication of the relative magnitude of other potential losses or alterations in vegetation.

- Vegetation Removal: Please refer to our concerns under Section 3.3 re lack of consultation in siting camp, village, and borrow areas.

- Vegetation Loss by Erosion: Again, a map of permafrost areas would be useful. Given the likely ineffectiveness of replacing topsoil and recontouring (Section 3.3(b)(i) . Indirect Consequences of Vegetation Removal), we suggest that clearing may be a significant source of erosion.

- Effects of Altered Drainage: We recommend that this section include the area of lakes, ponds, and other wetlands which may be affected by proposed borrow areas.

(ii) Filling and Operation: Paragraph 3: The potential for movement of the large landslide at river mile 175, causing upstream flooding and loss of mid- and late-successional vegetation in valuable riparian areas, should be described in more detail. For example, the potential size of the area to be impacted should be described.

- Vegetation Succession Following Clearing: Please refer to our previous comments, Section 3.3(a)(ii).

- Downstream Effects: The unknown consequences of frost buildup on vegetation adjacent to the reservoir represent a significant potential change in vegetation and thus impact to wildlife (see our comments under Section 3.3(a)(ii)). These consequences should be the subject of continuing studies and quantification.

(c) Access

(i) Construction: Paragraph 1: Please refer to our comment under Section 3.2 regarding omission of base line data on proposed access corridors. Because of this omission, the exact areas which would be cleared within the 34 meter (m) x 67 km access corridor described here are unclear. Please explain why this description appears to conflict with earlier descriptions of road width and length (Section 2.3(c)(i)). Inconsistent use of both metric and English units within the same report adds further confusion.

(ii) Operation: Paragraph 1: Our comments under Section 3.3(a)(ii) apply here also.

Paragraph 2: The potential for ice buildup on the railroad tracks and resultant impacts on vegetation should be examined.

(d) Transmission Corridors

(i) Construction: Paragraph 1: Please clarify the differences among hectares to be impacted by the transmission corridors as cited here and in Tables W24, W25, and W26. Moreover, referenced Table W29, has nothing to do with transmission corridors.

Paragraph 2: Wetlands, as used here, should be defined. Precalculation of affected vegetation types will need to be undertaken after the ongoing vegetation remapping. Notation should be made that, (1) low-lying vegetation types will remain largely undisturbed, and (2) beneficial impacts of increased browse production will be realized, only if access and ORV use along transmission corridors are effectively controlled. Quantification of potential increases in browse should be possible on the basis of succession models and continuing classification studies. Such quantification is needed to compare overall losses and thus mitigation requirements for the project.

(ii) Operation: Our comments above under Section 3.3(d)(i) apply.

(e) Impact Summary: An explanation is needed for the process or criteria for determining impact "priorities of importance."

(i) though (v): This qualitative summary describes several data gaps which we believe should be answered, e.g. the vegetated area which may be lost with land slumpage from permafrost, changes in downstream floodplain vegetation, etc. Overall, we are concerned with lack of attention to cumulative impacts, an inattention made more acute by nonquantification of most impacts. The numerous "minimal" and "minor" impacts for each project feature may cumulatively represent significant alterations or loss of vegetation. From the standpoint of fish and wildlife habitats, project-related activities throughout this primarily undisturbed area represent the first intrusions similar to those which have led to significant and losses of fish and wildlife throughout the conterminous United States. A serious omission in this section is consideration of impacts to wetlands and floodplains.

(vi) Prioritization of Impact Issues: We concur with the evaluation of acreage losses for a vegetation type relative to the proportion of that type in the region. Since vegetation is a key component of wildlife habitats, the basis for evaluating whether community changes are "good" or "bad" should follow in the Wildlife Section of this chapter. However as discussed there, an integrated evaluation of all species is lacking. There is little basis for making decisions on prioritizing species concerns or resultant tradeoffs in project impacts or mitigation alternatives. Our previous comments on each impact issue identified here apply. Additionally, we have a few specific comments.

- Direct Losses of Vegetation

Access Roads: While the actual area covered may be small relative to other project impacts, access routes indirectly impact a much larger area because of their linear nature.

. Transmission Corridors: We would like to be assured that the reference to a "median strip for transport of personnel and materials", is consistent with the environmental guidelines for transmission corridors (Appendix AE - Transmission Corridors, item 1) with which we concur. As with access roads, above, transmission corridors indirectly impact a very large area.

- Indirect Losses of Vegetation: The cumulative impact of project features mentioned previously, is of particular concern here. Many of the identified losses will be in riparian corridors which are of particular significance to wildlife species.

- Alteration of Vegetation Types: We again recommend that successional type changes over the project life be quantified in the license application.

3.4 - Mitigation Plan: We find the proposed plan incomplete and too general. There are two main problems with this plan. First, because impacts are incompletely quantified, it is not possible to determine the value of recommended/accepted mitigation measures or the magnitude of unavoidable, adverse impacts which will not be mitigated. Not integrating this plan with the fish and wildlife mitigation plans is the second main problem. Thus there is no comprehensive picture of overall project impacts, priorities for mitigation, potential for achieving those priorities, or tradeoffs among mitigation options for various area resources.

An approach similar to that for the Fishery Section mitigation plan (pages E-3-120 through E-3-144) would be more appropriate. We recommend restating the full range of mitigation alternatives here, prioritized in accord with NEPA guidelines: avoid, minimize, rectify, reduce or eliminate over time, and finally, compensate. This approach should be expanded to include reasons for rejecting high priority mitigation in lieu of lower priority measures (e.g. proposing regulations on access rather than alternate siting or scheduling of access). A mitigation plan, incorporating specific, effective measures which have been selected through this process, should then be presented.

Many of the identified impacts are not addressed in the mitigation plan itself. In those cases, impacts should be clearly identified as unavoidable, short or long-term, adverse impacts. Moreover, we find the report lacks information specifically required by FERC regulations (F.R. Vol. 46, No. 219, 13 November 1981), Section 4.41(f)(3)(iv), i.e. there are no implementation, construction, or operation schedules for recommended mitigation measures; which measures have actually been incorporated into project plans is unclear; and neither replacement lands nor habitat manipulations have been identified as to either suitable sizes or locations.

Generalities of the plan are exemplified by references to using, "depleted or non-operational upland borrow pits...as overburden storage areas where feasible" (page E-3-187) or reference to "a feasible haul distance," (page E-3-187).

(a) Watana Developement

(i) Construction: Paragraph 1: Mitigative features which have been incorporated into engineering design and construction planning should be clearly stated. Reasons for rejecting our recommendations have never been formally provided (e.g. access road siting). Location of the construction camp and village on shrublands (per Table W27) rather than forestlands may not minimize impacts, depending on the wildlife species of concern, erosion potentials, proximity to construction and access facilities, etc. Again, since we were not consulted in siting of those facilities and have not seen Exhibit A, we cannot fully understand the situation. A mechanism for enforcing the referenced prohibition of off-road or all-terrain vehicle use should be included (see FERC regulations Sections 4.41(f)(3)(iv) in F.R. Vol. 46, No. 219, 13 November 1981).

Paragraph 3: We suggest that facility siting to avoid wetlands be rereviewed in consultation with the FWS and CE and proposed revisions to the wetland maps. As with similar points about "minimizing" or "reducing", there is no quantification, particularly relative to the amount of wetlands, or other impacts in other report sections, which will be impacted and which can be avoided.

Paragraph 5: We concur that spoils should be placed in the inundation area as long as such placement will not create a sedimentation problem.

Paragraph 6: We recommend explaining whether project engineers have confirmed that floodplains or first-level terrace locations will not be needed for borrow for ancillary project facilities.

Paragraph 7: We recommend that similar detailed information be provided throughout the report.

(ii) Filling: Please refer to our General Comments, Botanical Resources, re identifying feasible habitat enhancement measures or replacement lands. The contention that moose winter browse "may be compensated" is useless, given that (1) there is no guarantee in this plan that enhancement or land acquisition will ever occur; and (2) quantification for how much/where/what type of land must be enhanced or acquired is lacking. Moreover, tradeoffs re compensation for moose to the neglect or adverse impact of other species have not been settled or even discussed.

Paragraph 3: Because of internal inconsistencies, the overall effect of siltation is unclear.

Paragraph 5: Whether rectification will be one percent or 99 percent is unclear.

Paragraph 7: We concur with revegetation plans to emphasize fertilization and minimize seeding where erosion will not be a problem.

Paragraph 8: We strongly support plans to rehabilitate all sites by the first growing season after they are no longer needed. Assurances should be provided that sufficient quantities of seeds would be stockpiled and regrowth potentials of available native strains will be tested prior to project abandonment of disturbed sites. Choice of plants for site rehabilitation should be in consultation with Federal and State natural resource agencies.

(iii) Operation: Paragraph 1: We concur with the proposed monitoring of downstream vegetation changes but note that monitoring in itself is not mitigation. Periodic controlled flooding to maintain primary and secondary successional stages must be coordinated with the Fishery Section and Wildlife Section mitigation plans.

Paragraph 2: We have assumed that nonessential portions of the disturbed areas will be promptly rehabilitated. Please specify.

(b) Devil Canyon Development

(i) Construction: Paragraph 1: Our comments relative to the Watana development (Section 3.4(a)(ii)) mitigation apply here also. An additional mitigation need is monitoring and enforcement relative to ORV and unauthorized access uses. Spoil disposal described here was not discussed or previously covered in the impacts Section 3.3(b)(i).

(ii) Filling and Operation: Again, our comments under Watana Development, Section 3.4(a)(ii) and (iii) apply.

(c) Access

(i) Construction: Paragraph 1: Please clarify why avoidance of closed forests was termed as a mitigative measure in siting of the Denali Highway to Watana access road. Section 4.4(b), paragraph 2 supports this siting re minimization of project impacts to pine marten. If this is the reason, that reference should be made here and further information is necessary on other species adversely affected by this siting and adverse/beneficial impacts of alternative sitings which were eliminated. Wetlands will need verifying per our previous comments (Section 3.4(a)(i)). At least one line of this paragraph was omitted.

Paragraph 3: We refer you to our previous comments on wetlands, Sections 3.2(a)(vi) and 3.4(a)(i).

Paragraph 4: Information is too general. We concur with the intent but do not have necessary specifics as to the extent of mitigation which will be achieved.

(ii) Operation: The referenced management provisions should be described here including busing of workers and restrictions on non-project-related uses.

Paragraph 2: The extent of mitigation which can be achieved for many project impacts will depend upon the management options under review by the APA. In the APA Mitigation Policy document and under NEPA guidelines, avoidance is to be the first priority in implementing mitigation. Therefore we refer you to our previous correspondence on this issue (letter to Eric Yould from FWS, 17 August 1982) as part of our pre-license consultation. In brief, the necessary avoidance should include elimination of the Denali Highway to Watana access road and prohibiting use of other project access routes for non-project-related access. Instead, construction access should be by rail from Gold Creek, along the south side of the Susitna River to Devil Canyon, and access on the north between the two dams. Non-project-related use of these access routes should be prohibited during project construction. A thorough analysis should be provided here of public access from the standpoint of adverse impacts to fish and wildlife and their habitats in comparison to any positive impacts for recreational and subsistence fish and wildlife uses.

We note some conflict between the statement that the APA is reviewing a variety of access management options with the suggestion that the project access route from the Denali Highway may be eligible as a National Scenic Highway. That designation would stimulate public access to the increased detriment of fish and wildlife, effectively foreclosing some mitigative management options.

Paragraph 3: Please refer to our more extensive comments on the Recreation Plan re consistency with fish and wildlife protection priorities. We strongly concur with the proposal to monitor fish, wildlife, and vegetation impact but again note the report's deficiency in not describing how and by whom monitoring will be completed (see our General Comments, Fishery Section). Moreover, the process for modifying project operations or the Recreation Plan to better effect mitigation is not described.

(d) Transmission

(i) Construction: Please clarify what criteria were used for siting of transmission corridors. Assurance is required that project plans include construction by helicopter or winter access.

Paragraph 2: Again, refer to our previous comments on wetlands. We recommend minimum 150 m buffers between swan nests and any portions of the transmission corridor.

(ii) Operation: We concur with this plan but are concerned that it may not be implemented. We hope to avoid a repeat of the Intertie situation where on-ground access was later guaranteed to the operating utilities contrary to residents' and agencies' recommendations. That guarantee already contradicts this plan, given the dependence and interrelationship of the Susitna project with the Intertie.

Since habitat manipulations, including fire, crushing, etc. (Section 4.4(a)(i) and (iv)) are being suggested as a prime mitigation measure for wildlife, we recommend that potential effects of those activities on vegetation types within different project areas be discussed here. The potential value for mitigation of various habitat manipulations should be explained similar to the discussion on fire, Section 3.2(a)(ii).

Two additional items which should be covered in this mitigation plan are the monitoring and surveillance plans referred to earlier and an erosion control plan specific to project features and schedules.

Specific comments on tables and figures relative to the Botanical Resources Section follow:

Table W3: Please change in accord with our recommendations under Section 3.1(c), to "Candidate endangered and threatened plant species", etc.

Tables W5 through W19: We suggest including a footnote or appendix briefly describing how these data were collected with some explanation of whether sampling intensity was commensurate with the availability of the vegetation type within the project area and potential for that type to be impacted by the project.

Tables W21 through W23: The number of sites sampled in each type should be included. As in our comments on the text, information should be provided on how these categories compare with the vegetation categories sampled within the upper Susitna basin.

Tables W24 through W26: Please clarify whether the 400 to 500 foot right-of-way or 110 foot cleared centerline area was used in these calculations. Per our previous comment on the transmission corridor, a similar table for the Intertie portion of the transmission corridor should be included. We also suggest a summary table showing the vegetation impacts from all segments of the transmission corridor.

Please refer to our comments in the text on need for an additional table showing vegetation types to be impacted by all access corridors, preliminarily identified borrow areas (e.g. borrow area G is not included in Table W23) and spoil areas. Where questions remain on the size of borrow/spoil areas to be used or the necessity of all potentially identified areas, notation should be made of potential maximum and minimum sizes and any ordering re use of these areas.

Figure W1: Granted, it is difficult to reproduce such a map at this scale. However, we recommend a larger reproduction be included in the final application. That map should include an overlay showing reservoir inundation areas, access roads, transmission corridors, and other project features. A corresponding map of downstream vegetation and overlay of transmission corridors is also needed.

Figure W3: Once the remapped vegetation classification is completed it should be correlated to this table to quantify potential vegetation changes and types over the life of the project.

Figure W4: As above, this figure should be a basis for analyzing downstream successional trends given the projected longer times between floods. Maintenance of habitat manipulations should be specified on the basis of this figure and mitigation objectives.

4 - WILDLIFE

4.1 Introduction: We recommend expanding this section to at least acknowledge the ecological values of all wildlife species, as well as to more clearly outline objectives of the report and resultant mitigation plan. We again point out the need for an overall discussion of fish, wildlife, and botanical resources, overall mitigation plans, and tradeoffs in benefits to some resources at the expense of others.

(c) Species Contributing to Recreation, Subsistence and Commerce: Not only birds, but all wildlife species in the project area contribute to non-consumptive forms of recreation. Incidental viewing of wildlife in conjunction with other activities is an unquantifiable but well documented value. For example, the importance of downstream fish and wildlife habitats to fish, wildlife, and the significant numbers of people using them has been recognized by the State and agreed to by the Matanuska-Susitna Borough Assembly. Fish and wildlife have been designated a primary use on every State land management unit on the east side of the Susitna River from Cook Inlet to just below its confluence with the Kashwitna River. These management units and state guidelines for protecting fish and wildlife are described in the recent State report, Land Use Plan for Public Lands in the Willow Sub-basin, October 1981, by the Alaska Department of Natural Resources (ADNR), Matanuska-Susitna Borough, and ADF&G.

A discussion as to why the evaluation species were selected and prioritized as described here is as applicable to terrestrial wildlife species as it is to fish (Section 2.1(d)). We suggest referencing that discussion here. Such information is particularly important with regard to mitigation plans for one species which conflict with another species. We also suggest noting values of key bird species, i.e. bald and golden eagles have received national protection (Bald Eagle Protection Act, 16 U.S.C. 668-668c); trumpeter swans are highly valued because of their former endangered status; and other migratory birds are protected under international treaties and the Migratory Bird Conservation Act (16 U.S.C. 701-718h).

Please note, all references to tables in the wildlife section of the text are to table numbers one greater than on the actual table. We have referred to tables as they are actually numbered.

4.2 Baseline Description

(a) Big Game

(i) Moose: Missing figures and values are a problem throughout this section.

- Distribution: Please document how moose are "one of the most economically important wildlife species in the region;" also see our comments on Chapter 5, Section 3.7(b).

. Special Use Areas: In view of your repeated citations that winter range is a key area for moose (e.g. Section 4.2(a)(i) . Seasonal Movements: Paragraph 6; Section 4.2(a)(i) . Mortality Factors: Paragraph 5; and Section 4.3 (a)(i) Winter Use), we suggest including a section here on the use and availability of winter range in both severe and mild winters, as well as the data gaps and plans to overcome them relative to this study. Maps showing use areas described here relative to project features would clarify this section.

Calving Areas: Paragraphs 3 and 4: Numbers of male and female moose radio - collared in each of the downstream study areas should be described here.

. River Crossings: To better understand how not only the reservoirs, but ancillary project features such as the Devil Canyon camp and village, may also influence moose crossings of the Susitna River, crossings both immediately up and downstream of the impoundment areas should also be described (also see our comments under Section 4.3(b)(i) - Interference with Movements).

- Habitat Use: The main problem with this and the following section on populations is that there has, apparently, been no integration of moose and vegetation data.

. Cover Requirements: Paragraph 7: Please describe the scope and schedule for the necessary studies of habitat use, or reference the discussion under Section 4.3(a)(i) - Quantification of Project Effects. Correlating aerial observations to the remapped vegetation types should provide additional information on habitat use. Elevation, slope, or other habitat parameters may also need to be incorporated in this analysis.

Habitat Use in the Upper Susitna Basin: Paragraph 3: Further information is needed on the understories associated with these habitat types. Please indicate when such information will become available.

Habitat Use in the Lower Susitna Basin: Paragraph 2: For consistency, the number of female moose radio-collared north of Talkeetna should be provided, also see our comments under this section, Calving Areas. The discussion is confusing due to frequent combining of quantitative data with qualitative statements such as "most female use," "at most relocation sites," etc. Where it is available, we recommend supplying quantitative information, with qualifying discussions on limited sample sizes, periods of observations, etc.

. Food Habits: Paragraph 2: Again, please describe the scope and schedule of ongoing analyses and how that information will be integrated into mitigation planning in a timely manner. Reference to your Section 4.3(a)(i) - Quantification of Project Effects will provide some of this information.

Paragraphs 4 and 5: We suggest examining how browse availability and vegetation types utilized by moose correlate with moose relocations in reference to the remapped vegetation types.

. Home Ranges

The Upper Susitna Basin: The rational should be given for selecting an 8 km wide analysis zone adjacent to the impoundment.

Lower Susitna Basin: Paragraph 2: Please describe or reference the scope and schedule for continuing studies. We recommend giving some consideration to the relative habitat values of all river study areas.

- Population Characteristics

. Historical Population Trends: Paragraph 1: An overlay of project features on the map of count areas (Figure W6) is needed.

Paragraph 2: Substantiating population and productivity data in Tables W32 through W34 should be referenced here.

. Population Estimates - Upper Susitna Basin: Please describe what types of habitat correlations can be made from remapped vegetation types and other habitat parameters for low, high, and moderate moose density areas.

. Population Estimates - Lower Susitna Basin: Paragraph 2: Please describe differences between habitats up and downstream of Montana Creek.

. Mortality Factors: Paragraph 1: We recommend describing how range quality has been decreasing.

Paragraphs 2 through 4: Please describe the comparability of brown bear populations and habitat types between the Nelchina and Susitna River basins.

We recommend expanding the discussion to include hunting as a mortality factor. Both recreational and subsistence hunting can affect population size and structure. Hunting figures prominently in later impact discussions. Historical hunting effort and success data relative to changing management regulations should be described, and coordinated with Chapter 5. Please also refer to our comments under Chapter 5, Section 3.7(b).

(ii) Caribou

- Distribution and Movement Patterns: Paragraph 6: Please describe how many animals were radio-collared and the numbers of radio locations made for each one.

Figures W9 and W10 of caribou radio locations should include the locations of project features.

- Habitat Use: Please clarify whether aerial observations or an overlay of radio locations on existing vegetation type maps were used to determine caribou use of different vegetation types. A correlation should be provided for the proportion of the basin which is in each type relative to the proportion of radio-collared caribou sightings within each type (Table W36). Please discuss whether vegetation remapping efforts will affect the interpretation of caribou data.

- Population Characteristics: Paragraph 1: This section should reflect present and future management plans and be consistent with Chapter 5, Section 3.7(b)(ii).

Paragraph 10: Changes in the number of permits from 1972 to 1981 should be described and percents of the herd harvested, by year, included in Table W38.

Paragraph 11: Please tabulate data on wolf population, wolf predation, and caribou numbers from 1957 to 1981.

(iii) Dall Sheep

- Distribution: Paragaph 2: We recommend including maps which more specifically delineate seasonal sheep use of the Susitna basin relative to project features.

Paragraph 5: We recommend further justification be provided to support the conclusion that impacts from the impoundments will be minor. Clarification of where the sheep winter and of sheep movements between seasonal ranges should be provided.

Paragraph 6: Reference should be provided for the judgement that the sheep population has remained stable or slightly increased.

Paragraph 8: Please provide a map of the Jay Creek mineral lick, and probable travel corridors to the area, relative to the Watana impoundment. We recommend providing historical harvest data and explaining how project surveys relate to area populations.

(iv) Brown Bears

- Distribution: We recommend providing data on the numbers of bears radio-collared and radio locations made, as well as maps of those radio locations relative to project use.

- Habitat Use: Paragraph 2: Please describe whether aerial observations or vegetation type maps were used to determine vegetation types relative to brown bear radio locations. An explanation should also be provided of how more detailed vegetation data and the vegetation remapping efforts will be integrated with the analysis of brown bear habitat use.

. Home Range: Paragraph 1: Please correct the referenced Table W42 which lists data from project studies in the Susitna, not the Nelchina basin.

Paragraph 2: An explanation should be provided as to why 1.6 km and 8 km were chosen as the breakdown for study zones around the impoundments.

Paragraph 4: Please describe data on bear radio locations relative to access roads, transmission corridors and ancillary project features.

(v) Black Bears

- Distribution: We recommend including maps of bear radio locations relative to project features.

- Habitat Use: Please describe how further vegetation studies and remapping will be integrated with the analysis of black bear habitat use.

- Food Habits: The scope, schedule, and integration of ongoing predation studies relative to further project planning should be addressed here.

(viii) Belukha Whales: Please note that several of the references cited here do not appear in the bibliography.

- Distribution and Habitat Use: Paragaph 5: We suggest integrating data on chinook salmon from the fisheries studies in order to obtain some estimate of the importance of that fishery and of project impacts to the fishery on belukha whales. Please also describe what data will be gathered on smelt for better evaluating project impacts on belukhas.

(b) Furbearers

(i) Beavers: We recommend including a map of the study area which details specific study sections, available density data, and representative main channel, side channel, slough, and clear water areas. The discussion should be expanded to cover the extent to which suitable beaver habitats are fully utilized or explanations where they are not.

Paragraph 4: We recommend investigating the extent to which bank lodges are used by beaver and to which the activity levels reported in Table W53 may be underestimated. An on-ground survey when beavers come out of their dens to forage just before spring break-up could verify such use.

Paragraph 8: Further quantification should be provided on trapping effort and success, see our comments under Chapter 5, Section 3.7(c).

(ii) Muskrat: Paragraph 2: Please clarify whether the 106 lakes surveyed contitute all the lakes between the Oshetna River to Gold Creek impact area. Please relate this discussion to the number of muskrats potentially inhabiting this area.

Paragraph 3: Please provide an indication of downstream muskrat populations and habitat quality.

Paragraph 4: Please quantify present and historical trapping effort/success.

(v) Marten

- Population Characteristics: Paragraph 2: No data is provided to substantiate that pine marten are the "economically most important furbearer," or to relate densities to populations and habitat quality. Please also refer to our comments under Chapter 5, Section 3.7(c).

- Habitat Use: Please refer to the comment immediately above.

(vi) Red Foxes

- Habitat Use

. Denning Habitats: Please provide information on the density of fox dens relative to habitat quality, and to other Alaskan and/or North American fox populations.

Paragraph 5: Some explanation should be provided for the disparity of more fox tracks on the south side of the river but more dens on the north side.

- Food Habits: Paragraph 3: The postulated link between fox and hare populations may be overstated. Apparently hare numbers have never been high or an important food source for fox in this area (Furbearer Study Coordinator Phil Gipson, personal communication; also see Section 4.2(b)(vii): Paragraph 3 and Section 4.3(a)(xiii): Paragraph 5).

- Population Characteristics: Please refer to our previous comments under Denning Habitats relative to habitat quality (Section 4.2(b)(vi)-Habitat Use). Again, trapper effort and success should be documented, also see our comments on Chapter 5, Section 3.7(c).

(vii) Lynx through (x) Least Weasel: We understand that none of these species were chosen as high priority for evaluating project impacts. However, we recommend providing some quantification for the descriptions of "fairly numerous" but not "limited," "locally abundant," and "sparse," in addition to trapper effort/harvest; also see our comments on Chapter 5, Section 3.7(c).

(c) Birds: Paragraph 2: Please note that waterfowl breeding pair surveys have been conducted by FWS in the lower Susitna River basin for over 20 years.[12/] The FWS has also conducted statewide surveys for trumpeter swans in 1968, 1975, and 1980.[13/]

Paragraph 3: We recommend further information be provided on how relative abundances of bird species were determined. Please clarify the difference between 60 percent of the area being in shrublands, as cited here, with the just over 40 percent in shrublands, as cited in Table W4. At the August 1982 AEA Workshop on the project, much discussion centered on problems with correlating the bird habitat classification scheme used by Kessel et al. for project bird studies with the Dyrness and Viereck Alaskan vegetation classification system used for project baseline vegetation maps. We recommend describing those problems here and how they will or will not be overcome by ongoing vegetation remapping. Throughout the bird sections of the draft application we are concerned that source(s) for referenced data, or data

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12/ The most current data is available in: King, J.G. and B. Conant. 1982. Alaska-Yukon waterfowl breeding pair survey, 18 May to 13 June 1982. USFWS, Juneau, Alaska.

13/ The computerized compilation of this data is available at the FWS' Alaska Regional Office, 1011 E. Tudor, Anchorage 99503; please contact Greg Konkel, (907) 263-3395; original data is available from Jim King, USFWS, Juneau, (907) 586-7244.

manipulations, may not be fully documented. Thus we recommend describing where and how data from more than one source has been manipulated for this report. In particular, the tables and figures should be more completely referenced, including explanatory footnotes.

(i) Raptors and Raven: Paragraph 1: We are concerned that 1980 and 1982 raptor surveys were not conducted at the optimum time: i.e. summer foliage would make it difficult to initially locate nests (we note that 50 percent more nests were found in 1981 than in 1980); according to Table W60, nesting raptors will have fledged their young by 30 September making it difficult to determine nest activity in October. Please indicate the experience of observer(s) conducting the raptor surveys and methods used, (e.g. whether surveys were by helicopter or fixed-wing aircraft). We also recommend that maps of actual nest locations be included. We note that goshawk nests are often difficult to find by air and thus question whether the number of nests cited here is a thorough assessment. Please clarify in the text whether all raptor nests active in 1980 were also active in 1981.

Paragraph 3: Please expand the discussion to more completely describe the habitat suitability of the project area for golden eagles, given their apparent high density.

Paragraph 4: Refer to our comment under Section 4.2(c)(i): Paragraph 1, above, re the late timing of 1980 and 1981 surveys for nesting bald eagles. Please provide a description of the survey methods used.

Paragraph 5: We recommend that discussion be provided relative to habitat values re how Susitna habitats compare with those along the Tanana River where slightly lower nesting densities are reported.

Paragraph 7: Due to the status of the arctic peregrine falcon (*Falco peregrinus tundrius*) as an endangered species under the Endangered Species Act of 1973, as amended (16 U.S.C. 1531-1543, as amended), we are particularly concerned with the adequacy of surveys for them, e.g. peregrines would have already left the area by October when the 1982 survey was done. Thus, we again recommend describing how the surveys were conducted, for how long, and by whom. We recommend that peregrine falcon surveys be conducted annually, in early July, throughout project studies and construction, or until there is sufficient evidence that peregrine falcons do not inhabit the project area. Sufficient evidence would be no sightings over several years of helicopter surveys, by a reputable observer during the proper time of year. Observers should be individuals who have worked with peregrine falcons. FWS review of specific times and survey techniques would be appropriate.

We recommend the discussion be expanded to describe the area's importance in raptor migrations as well as for breeding.

(ii) Waterfowl and Other Large Waterbirds: Please provide some quantification for terms used here, e.g. "large" concentrations of waterfowl (paragraph 1); "little used" (paragraph 4), etc.

Paragraph 3: We recommend you incorporate additional trumpeter swan data which is available from the FWS. Please refer to footnotes 12 and 13.

Paragraph 4: We agree with the conclusion, however we suggest that data from FWS annual surveys be included to quantify this statement (e.g. see footnotes 12 and 13, as well as Conant and King 1981 and King and Conant 1980 as referenced in this section.).

- Migration: Paragraph 1: We recommend referencing the specific study(ies) from which conclusions in the CE reference are taken. Please note that trumpeter swans are moving through the area in increasing numbers.

Paragraph 3: Please expain the discrepancy between the statement here that the "upper Susitna Basin was less important to migratory waterfowl in spring than fall," with data in Table W62 which shows spring waterfowl densities over twice that of fall densities.

- Relative Importance of Water Bodies: Paragraph 1: Given the previously described problems with the wetlands classification used for the project, and remapping efforts currently underway, please define "wetlands" as used here.

We suggest clarifying whether the reference is to 22.5 adult waterfowl/km^2 and 22.5 adult gulls/km^2 or to 22.5 adult (waterfowl and gulls) /km^2.

We question the validity of only comparing productivity of these wetlands to the most productive wetlands in Alaska. Upper Susitna area waterfowl productivity may be more typical of Alaska wetlands in general and represent average populations and productivity (FWS Marine Bird Management Project Leader John Trapp, personal communication).

Paragraph 3: Please clarify how "Importance Values" were calculated; also refer to our comments under Figures W19 and W20 and Table W63. We suggest describing any consumptive use of waterfowl within the project area.

(iii) Other Birds

- Grouse and Ptarmigan: We recommend mentioning any consumptive use of these species within the project area.

- Woodpeckers and Passerines: We recommend providing some discussion of the importance of the area to migration, as well as, breeding activities of these birds.

- Upper Basin Bird Communities: Please refer to our comments under Section 4.2(c) re the need to identify here how 1981 and 1982 data were combined, given that Kessel et al. (1982) only includes data from 1981.

Last Paragraph: Please describe how these habitat types do or do not correlate to vegetation types as now being remapped.

(d) Non-game (small) Mammals: We appreciate the thorough description of the ecological role of small mammals in project area ecosystems.

(ii) Habitat Use: We suggest updating the discussion to correlate with ongoing vegetation and wetlands mapping efforts.

4.3 Impacts

(a) Watana Development

(i) Moose: Paragraph 1: Criteria for concluding that moose is one of the "most important" species should be provided here.

Paragraph 2: We suggest that the proposed evaluation of carrying capacity incorporate consideration of habitat values over the life of the project. Please provide the referenced figure. Considering the severity of project impacts by spatial areas to be affected and numbers as in Ballard et al. 1982 (page 106) would improve the discussion.

We are further concerned with the inadequacy of the impacts definitions in not accounting for impacts to special concentration areas (e.g. breeding), in key seasons of use (e.g. calving), and under infrequent but critical conditions (e.g. severe winters), and the overall interspersion and availability of such important habitat features.

Paragraph 3: Lack of quantification prevents analysis of whether an impact is half, twice, three times, etc. as severe as one of lower priority. We again recommend integrating the analysis with that in Chapter 5 re also providing and discussing data on hunting pressure and success here (see our comments under Section 4.2(a)(i) . Mortality Factors). Please note provision of access is a major indirect impact; additional developments or settlement stimulated by this access would be a secondary impact.

Paragraph 5: We find the discussion entirely too general and inconclusive: (1) there is no indication of the relative difference between "some" moose which will disperse, adapt, die, etc; (2) both overall cumulative impacts, and secondary impacts from moose dispersing to adjacent areas are ignored; (3) impacts on habitat values from increased use are not considered; and (4) no explanation is given for how and when ongoing studies will "refine this assessment."

- Construction: We are concerned that we have been given no opportunity to comment on siting and scheduling for camps, townsites, etc. The location and use of these ancillary project features will influence the magnitude of resultant impacts. Alternative spoils sites have not been proposed, yet they should be part of the discussion.

. Habitat Loss: Paragraph 1: We recommend including a more thorough, quantitative discussion of habitat loss in the text. The necessary integration of vegetation and wildlife studies should include a discussion of (remapped) vegetation losses relative to their value as moose habitat i.e. winter range, calving and breeding areas, etc. We also see no quantification of these losses over the life of the project, i.e. the area of each type which will be lost forever, vs the area which will be lost for some length of time during construction, vs the areas in different successional stages throughout reclamation.

Paragraph 2: The paragraph is somewhat inconsistent with the Fishery Section. Given the mitigation proposed in that section of clearing areas just before flooding, successional growth development appears negligible (Section 2.4(a)(x) - Clearing the Impoundment Area).

Paragraph 3: Ongoing studies should be fully described. Please describe when the habitat use analyses will be reevaluated on the basis of remapped vegetation and forage quality studies.

Winter Use: Paragraph 2: Please clarify the first sentence and inconsistencies between that sentence and the previous paragraph.

Paragraph 3: It would be helpful to also express the number of moose in the impoundment area as a density and compare that density to areas outside both the impoundment and project area.

Paragraph 4. We recommend that ongoing studies provide data for quantifying the relative values (quantity and quality) of winter range within and outside the impoundment area. Such information is necessary for determining mitigation requirements.

Spring Use: Paragraph 2: Quantification is needed for the habitat areas described here.

Paragraph 3: We recommend tying this discussion to project impacts on brown bear which could compound the predation problem.

Summer and Fall Use: Paragraph 2: We are assuming that a heading for "-Disturbance" was omitted just before this paragraph.

Paragraph 4: Since the magnitude of project impacts would appear to significantly vary, depending on whether hunting and harassment of moose are effectively prohibited, we suggest providing "best" and "worse" case scenarios. Those scenarios should be used to quantify potential losses of habitat for comparing impacts and determining mitigation needs.

Paragraph 5: Please refer to our previous comments under Sections 4.3(a)(i) Moose and 4.3(a)(i) - Construction . Habitat Loss re the generality of this discussion.

. Mortality: Please refer to our comments under Section 4.3(c)(i).

. Alteration of Habitat: We suggest this discussion be dropped as inappropriate and unfounded. If this discussion only covers the construction phase of the development, then we would assume there would be no chance for successional growth. Moreover, the suggestion that moose could utilize these disturbed areas during construction conflicts with the previous discussions on how disturbance and increased susceptability to predators would cause moose to avoid major activity centers and large cleared areas. We also find the suggestion that borrow pits may provide forage inconsistent with the Fishery

Section which proposes to make fish ponds out of the pits (Section 2.4 (c)(i): Paragraph 2, Construction Mitigation). Please refer to our previous comments under Section 4.3(a)(i) - Construction, . Habitat Loss re the unlikelihood for forage development within the impoundment area. Moreover, under . Permanent Loss of Habitat, page E-3-287, moose use of the impoundment area prior to filling is discounted. The need to resolve conflicts between sections of the draft application is amply illustrated by the latter two points above. As we have recommended elsewhere, some mechanism should be instituted for resolving these types of conflicts and analyzing the tradeoffs of mitigating for one species to the detriment another.

- Filling and Operation

. Permanent Loss of Habitat: Paragraph 1: As we commented under Section 4.3(a)(i) - Construction, we are concerned with the lack of quantification. Of all possible impacts, loss of habitat can be most easily quantified. The analysis should include the area of each (remapped) vegetation type which will be inundated each year.

Paragraph 2: We again refer you to our comments under Section 4.3(a)(i) Construction re necessary quantification, study description, and incorporation of study findings into the quantification of losses required under FERC regulations (Section 4.41(f)(3)(ii) in F.R. Vol. 46, No. 219, 13 November 1981).

. Alteration of Habitat

Upper Susitna Basin: We concur with the points raised here. Please refer to our comments under Botanical Resources re the impacts of ice fog and rime ice formation, as to well as need for quantification. The discussion should also consider the effective loss of an even larger area than described here due to dust from project activities which would further retard snowmelt (see Section 3.3(a)(i) - Vegetation Damage by Wind and Dust).

Lower Susitna Basin: Paragraph 2: Given a mid-successional stage of approximately 25 years (see Figure W4) and project life of 50 years plus planning and development, we question the conclusion that vegetation favored by moose will still be available at the end of the license period. Please refer to our comments under Section 3.3(a)(i) - Effects of Altered Downstream Flows re quantifying these and other impacts described in the remainder of this section as well as discussing the potential for further alterations of habitat because of ice fog and rime ice formation.

. Blockage of Movements: Given the potential for moose to avoid clear cut areas (see discussion under Section 4.3(a)(i) - Construction . Interference with Seasonal Movements, page E-3-286), we suggest mapping the effective area which could be eliminated from use. Some discussion should be provided on the likelihood of moose crossing the flowing narrow river as compared to the wide impoundment, plus drawdown zone; maximum and minimum widths of the impoundment should be provided. Also refer to our comments under Section 4.3(a)(i) . River Crossings. Information presented here will be important to later considerations re choosing sites for habitat enhancements which may be undertaken as part of mitigation.

Paragraph 5: Again, please detail ongoing studies.

. Disturbance: Once more, we note the need to (1) consistently assess the potential for increased access and hunting; and (2) integrate consideration of this issue throughout the report. We again suggest listing and analyzing the impacts from alternative access and use options.

. Mortality: See comments under . Disturbance, above, the previous discussion for Section 4.3(a)(i) - Construction, and Section 4.2(a)(i) . Mortality Factors. Please define when postulated increases in hunting will occur relative to project development.

- Quantification of Project Effects: We appreciate this discussion of ongoing studies but note that references to this section should be made throughout the report. Once more, we recommend including a schedule and describing how the studies will be incorporated into the license application, project design, and mitigation planning. Please note, references in this section are not included in the bibliography.

- Watana: Summary of Impacts: The summary is a useful, qualitative description of project impacts, yet provides no quantification for minimal, moderate, or severe impacts. The definitions given under Section 4.3 (a)(i) Moose: Paragraph 2, should be restated if they are to apply here. To better evaluate the "ifs" common to the discussion, we again suggest analyzing an array of impact scenarios. Attention should also be given to the cumulative impacts of habitat loss, alteration, disturbances, etc. We disagree with the conclusion that "because hunting mortality can be easily regulated, this will not necessarily be a major impact." Because of the politics involved and independence from project development of hunting regulations, there is no guarantee that regulations consistent with project mitigation goals will be implemented. Moreover, increasing hunter demands for a diminished resource will further affect harvests and hunter satisfaction.

(ii) Caribou

- Construction: Paragraph 2: We recommend providing figures on the proportion of the herd which could be affected by borrow areas A, D, and F. Although these areas will be only temporarily used within the 50 year project life, that temporary use involves several years.

- Filling and Operation: Paragraph 3: Consideration should be given to the future management options which will be foreclosed with project development. That is, now that the herd has recovered from previously low numbers, the ADF&G could change their management goals, even before project construction begins. We recommend considering loss of this management option in mitigation planning.

Paragraph 7: We recommend also considering the compounding effect of predation on caribou which become injured in crossing the reservoir or which alter their movements due to the presence of the reservoir. Predation was earlier cited as responsible for up to 30 percent of annual adult mortality (Section 4.2(a)(ii)).

(iii) Dall Sheep: Paragraph 2: Please clarify the last sentence.

Paragraph 4: Please provide information on when and how seasonal Dall sheep ranges will be defined and used to influence siting and scheduling of possible borrow site C.

Paragraph 5: Please document other cases where remote mineral licks have been altered to remain available to wildlife; we are concerned with the unproven effectiveness of enlarging the area if partial loss of the Jay Creek mineral lick affects sheep. Thus there is a need to demonstrate the techiques to ensure that sheep would use the mineral source if one were provided.

- Filling and Operation: The potential for disturbance from increased recreational or hunting use in the area should also be covered here.

(iv) Brown Bear

- Construction: Paragraph 5: Please describe the scope and schedule of ongoing studies and plans for integrating those results into project designs and mitigation planning.

Paragraph 6: We are concerned that the discussion downplays the importance of project impacts from both disturbance and loss of additional food sources. Original project studies[14/] and other reports[15/] emphasize that disturbance from project features and associated human activities will cause bears to avoid those areas.

Paragraphs 7 through 9: Two other impacts to vegetative food sources should be discussed here. Green-up of critical spring food plants may be delayed because construction-caused dust may retard snowmelt on vegetation; at the same time, herbaceous growth in summer may be increased (see the Botanical Resources Section and our comments, Section 3.3(a)(i) - Vegetation Damage by Wind and Dust and - Effects of Altered Downstream Flows.

Paragraph 12: We question the statement that, "No measurable changes in the number of moose or other important prey species are expected." Previous lack

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14/ Miller, S.D. and D.C. McAllister. 1982. Susitna Hydroelectric Project Phase I Final Report: Big Game, Vol. VI - Black Bear and Brown Bear. Prepared by the ADF&G for the APA.

15/ Spencer, D.L. and R.J. Hensel. 1980. Environmental studies of the proposed Terror Lake Hydroelectric Project, Kodiak Island, Alaska. Brown bear studies; mountain goat studies. AEIDC. Anchorage, Alaska 100 pp.

of quantification and the ongoing nature of salmon, moose, and caribou studies make it difficult to fully assess project impacts to brown bear. However, preliminary indications that up to 2,400 moose will be affected by the project in the upper Susitna basin alone (Section 4.3(a)(i): Paragraph 4, page E-3-280), and other report findings that "moose populations will probably be reduced", (Section 4.3(a)(vi): Paragraph 5, page E-3-312) suggest that there will be both losses and distributional shifts in brown bear prey, with resultant impacts to brown bear. Brown bear concentrations on already fully utilized adjacent ranges may result in intraspecific conflicts and further decreases in brown bear populations (Spencer and Hensel 1980, footnote 15).

- Operation: Paragraph 1: Our comments under - Construction apply here too (Section 4.3(a)(i). Please discuss potential impacts to bears resulting from impacts to the salmon resource in greater detail.

Paragraph 2: Also refer to our comments under Section 4.3(c)(i) re the need to define access.

Paragraph 5: Please see our comments two paragraphs above (Section 4.3(a)(iv) - Operation) on the need to better evaluate the importance of salmon to area bears. Overall, we note the need to quantify impacts and discuss the cumulative effects of project impacts on brown bears.

(v) Black bears

- Construction: Paragraph 1: As in our comments under brown bears, above (Section 4.3(a)(iv)), we suggest that greater attention be given to impacts of reduced prey, compounded here by the significant loss of black bear habitat with the Watana development.

- Filling and Operation: Paragraph 1: Please refer to our comments under Section 4.3(a)(iv) - Construction re project impacts to vegetation. Since black bears will be subject to much greater impacts than brown bears, the cumulative impacts of each additional project-caused stress could be severe.

Paragraph 2: We question the ability of habitats to the east and west of the impoundment area to support bears now inhabiting the impoundment areas. If those areas are already fully stocked with black bears, resultant intraspecific strife and stress would ultimately lead to lower populations.

Paragraph 3: We again refer you to our comments under brown bear (Section 4.3(a)(iv)). Please describe ongoing studies and their integration with project design and mitigation.

(vi) Wolf: Paragraph 3: Please refer to our comments under Section 4.3(a)(xii) re the likelihood for wolf populations to decrease and coyote populations to increase in the project area.

Last Paragraph: Given the increased access expected with project development, an increased wolf harvest appears likely. We recommend that a quantification of project impacts should consider the effects of an increased harvest on wolf population levels. The cumulative impacts of (1) wolves concentrated in a smaller area due to disturbance, (2) effects on territoriality and stress, (3) relative values of impacted as compared to remaining habitats, and (4) reduction in prey, should also be considered here.

(ix) Beaver: We question the certainty of the statements here, given the undecided nature of the project water management regime. If reservoir releases are regulated to stabilize downstream flows, downstream beaver habitats may be enhanced. However, the extent to which that enhancement will offset beaver losses in the upper Susitna River basin is not provided. Such data is necessary to evaluate the relative tradeoff in alternative flow regimes (i.e., for beaver, fish, moose, etc.) and thus the overall magnitude of project impacts.

- Construction: We recommend that the location of beaver colonies be considered, in conjunction with other wildlife values, in siting borrow area access roads.

- Filling and Operation: Paragraph 1: Please quantify "few beavers" currently supported by the impoundment area.

Paragraph 4: Refer to our comments under Section 4.3(a)(ix), above; we recommend using hydrologic data in conjunction with the revised vegetation maps and vegetation succession dynamics to quantify the areas which may be affected under different flow regimes. We find some inconsistency between the statement here that, "Beaver habitat south of Talkeetna may also be enhanced as a result of the increased occurrence of favored food plants (page E-3-316)," and the statement in Section 4.3(a)(i) that, "few changes are expected in channel morphology, frequency of flooding, or vegetational succession" (page E-3-289, paragraph 1).

Paragraph 5: During the August 1982 AEA Workshop on the Susitna project, access was considered as much of a limiting factor to trapping pressure as was pelt price. This section justifies our mitigation recommendations under Section 4.4(b) for alternate access routing, restrictions on use of access routes, and prohibition of trapping by construction workers.

(x) Muskrat: Paragraph 1: We find no section correlating to the referenced Section 3.3(a)(ix). Please define "minor" impacts.

Paragraph 2: Please refer to our previous comments on quantifying improvements in downstream habitats under Section 4.3(ix). Accordingly, we question the contention that, "Improved downstream habitat will probably compensate for this loss."

Paragraph 4: Again, refer to our comments under Section 4.3(ix), re mitigation of trapping impacts.

(xi) Mink and Otter

- Upstream Effects: We recommend defining "moderately abundant" and "substantial impacts." Other than lacking quantification, the discussion thoroughly describes potential project impacts to mink and otter. Please clarify the reference to "65m" in Paragraph 3.

- Downstream Effects: We suggest the discussion be expanded to better explain the relative magnitude of project impacts to mink and otter. Since there was no previous quantification of those populations, we find it difficult to evaluate the significance of these impacts.

(xii) Red Fox and Coyote: Where human activities have developed in a previously undisturbed area, coyotes have become abundant while fox numbers have decreased (Furbearer Study Coordinator Phil Gipson, personal communication). For example, in the Cantwell to Healy corridor there has been a marked increase in coyotes with increasing numbers of people and area developments. Researchers believe there has been a corresponding decrease in both fox and wolf numbers, although both those species pass through the area from undisturbed habitats in the adjacent Denali National Park.

Per our comments on other furbearers, quantification of relative area populations, habitat quality, and trapper demand and harvest is necessary to fully evaluate project impacts.

(xiii) Other Furbearers: Again, quantification is needed re base line populations, habitat quality, and use, in order to fully evaluate project impacts.

Paragraph 3: Note should be made of the previous years' trapping activity which may be responsible for low trapping success of pine marten near Watana Creek (Furbearer Study Coordinator Phil Gipson, personal communication).

Paragraph 4: We suggest considering additional parameters for evaluating pine marten habitat quality (e.g. the availability of berries is important as late summer/fall food) in conjunction with remapped vegetation types to reevaluate impact estimates.

Paragraph 6: We question the extent to which snowshoe hare habitat may be improved by revegetation of disturbed areas, given the much larger amount of habitat which will be destroyed by the project and historically low hare populations in the basin.

Paragraph 8: No correlation is made between "moderate" levels of disturbance from logging and different levels of disturbance from the project re the applicability of these references to project impacts.

(xiv) Raptors and Raven

- Habitat Loss: Paragraphs 2 and 5: Please refer to our comments under Section 4.3(a)(xiv) - Disturbance, below concerning the taking of eagle nests.

Paragraph 4: In order to understand the relative magnitude of project impacts, we recommend discussing the estimated loss of golden eagles in terms of project area populations and habitat values.

Paragraph 5: Please clarify the statement that potential downstream nesting habitats may become more important as upstream habitats are lost with project development. Whether downstream habitats are fully utilized, their value compared to upper basin habitats, and potential disturbances from other project activities should be described.

Paragraph 9: Please clarify whether downstream raven habitats could absorb use by ravens displaced from upstream habitats.

Paragraph 10: The blowdown of trees near cleared areas represents an additional source of habitat loss (e.g. see Section 3.3(a)(i) - Vegetation Damage by Wind and Dust).

. Bald Eagles: Paragraph 3: We recommend describing the overall impacts of the project on salmon and other fish which serve as bald eagle food. Such consideration should include potential impacts to smelt runs near the mouth of the Susitna River. Any impacts to these resources could affect eagles now depending on them as food.

Paragraph 4: We question the significance of any compensation for lost eagle feeding habitat through attraction of waterfowl to the impoundment. Please quantify the potential for such compensation and/or provide an explanation of why waterfowl may be attracted to the reservoir without a concomitant increase in their food sources (also see our comment under Section 4.3(a)(xv) Waterbirds, below).

- Disturbance: Paragraph 1: We appreciate the description of protection afforded eagles under the Bald Eagle Protection Act (16 U.S.C. 668-668c). However we are concerned that the intent of this act relative to project design has not been adequately acknowledged or incorporated, as explained below.

Paragraph 6: Under a recent amendment to the Bald Eagle Act, the Secretary of the Interior may permit the taking of golden eagle nests which interfere with resource development or recovery operations (16 U.S.C. 668a). Regulations for implementing this amendment should be available within the next couple of months.

Paragraph 7: The Bald Eagle Protection Act does not authorize the taking of bald eagle nests which interfere with resource development or recovery operations. The Act does provide for the taking of nests for scientific and certain specific exhibition purposes when compatible with the preservation of this species. Service eagle permit regulations, 50 C.F.R. 22.21, implement this section of the Act. Secretarial approval is not required for the taking of bald eagle nests in Alaska provided no eagles are killed and the nest is not exported from the United States. Authority to take such nests has been delegated to the FWS Regional Director. We suggest that the applicant promptly consult with the FWS to reach a mutually satisfactory solution to this potential conflict.

(xv) Waterbirds

- Habitat Alteration: Paragraph 2: Please substantiate that "fish populations will probably remain sufficient" to support birds such as mergansers. According to Meeting Summary notes from the 2 December 1982, Susitna Hydro Exhibit E Workshop on Water Use and Quality and Fishery Resources, most of the grayling population (estimated to be at least 10,000 in Section 2.3(a)(ii) - Watana Reservoir Inundation) will be lost and any production of lake trout is expected to be limited.

Paragraph 3: We suggest quantifying the number of lakes, miles of streams, and acres of wetlands (per revised wetlands typing) which may be affected by project borrow areas, spoils sites, etc., as well as those which will be completely lost. We recommend including those habitat types in Table W78a. This information will allow better quantification of project impacts.

Paragraph 4: Please substantiate further the value of the reservoir as habitat for migrating birds. Since existing resident fish populations are expected to be severely impacted by reservoir development and no biologically productive nearshore zone will be developed, we question that there would be food necessary to support birds attracted to the reservoir. Moreover, winter open water areas could attract waterbirds to their detriment, particularly since food supplies are already limited. Swans attracted to open water at Red Rocks Lake National Wildlife Refuge in Montana must now be fed during winter; similar problems have occurred in other areas of the conterminus United States (FWS Migratory Bird Management Project Leader Rod King, personal communication).

- Disturbance: Paragraph 2: We suggest that greater emphasis be placed on the potential for the project to disturb trumpeter swans. Recent increases and overstocking of swans in the Gulkana Basin may result in more swans moving into the upper Susitna Basin (FWS Migratory Bird Management Leader Rod King, personal communication). Yet those habitats will become less suitable with the human activities and disturbances cause by the project. As areas in the Cook Inlet Basin and Kenai Peninsula have been affected by human use and development, swan use of those areas has shifted to areas largely inaccessible to people.[16/]

(xvi) Other Birds

- Construction

. Habitat Loss: We appreciate the thorough, quantitative discussion included here.

. Habitat Alteration: We suggest that species and their relative abundance be correlated to the postulated negative and positive effects of habitat alteration. This would provide some indication of net project impacts. Loss to the Watana impoundment of existing natural edge, e.g. rivers, ridgetops, etc., will undoubtedly be far greater than the increases in edge suggested here.

- Operation: We question whether any feeding habitat for spring migrant shorebirds will be created in the drawdown zone. The reservoir drawdown zone will remain an unvegetated mudflat. If current low bird populations indicate lack of high quality habitat, it seems doubtful that food organisms would suddenly proliferate with reservoir development.

16/ King, J.G. and B. Conant. 1981. The 1980 census of trumpeter swans on Alaskan nesting habitats. American Birds 35(5): 789-793.

(xvii) Non-game (small) Mammals: For small mammal species which inhabit identifiable vegetation types, we suggest describing whether the percent of the habitat to be lost is proportionately greater or less than the occurrence of the type within the entire basin.

(b) Devil Canyon Development

(i) Moose: Converting the number of moose in the Devil Canyon impoundment to a density figure and then comparing that to a similar figure for the Watana impoundment would allow a better quantitative comparison of impacts. We are concerned with the judgemental nature of the discussion in stating that impacts "are of less concern" and suggest that, "will be of smaller magnitude" might improve the statement (pge E-3-338). The smaller area of the Devil Canyon as compared to Watana area should also be mentioned, although we do note that moose density here is about half that of the Watana area. An evaluation of relative habitat values of the adjacent areas which will be less directly impacted, and any lands proposed for acquisition or enhancement, is necessary for a complete impact and mitigation anaysis.

- Construction: Again, spoils disposal is an additional impact which should be described.

. Habitat Loss: Our comments under this heading (Section 4.3(a)(i)), for the Watana development also apply here.

. Interference with Movements: The discussion should consider whether a 1.6 km crossing would also be a barrier to moose in that area or moose diverted from upstream crossings because of the Watana impoundment. Quantification should also be provided of the additional distances which might have to be traveled and consideration given to additional energy expenditures relative to forage quality should moose alter their movement patterns. Also refer to our comments under this heading, Section 4.3(a)(i), for the Watana development.

. Disturbance: Please refer to our comments under this heading, Section 4.3(a)(i), for the Watana development.

- Mortality: As above, our previous comments under Section 4.2(a)(i) . Morality Factors; 4.3(a)(i) - Filling and Operation, . Disturbance; and 4.3(c)(i) - Mortality apply.

- Filling and Operation

. Alteration of Habitat: Please refer to our comments under this heading, Section 4.3(a)(i), for the Watana development. We are concerned that increased water temperature could result in a larger area being affected by ice fog and rime ice formation, also see our comments under Section 3.3(a)(i). We again recommend quantifying several impact scenarios re successional vegetation changes from any of the impacts discussed here.

. Interference with Movements: By reducing browse availability due to rime ice formation, the presence of ice fog could be a compounding impact to moose.

Moose movements may already be inhibited because of greater visual exposure to predators in the vicinity of the reservoir. We refer you to our comments under the Watana development (Section 4.3(a)(i) - Filling and Operation . Blockage of Movements).

. Disturbance: Again, our comments for Watana (Section 4.3(a)(i)) apply.

. Mortality: Please refer to our previous comments on hunting (Section 4.2(a)(i) . Mortality Factors, and Disturbance and Mortality discussions under Section 4.3(a)(i)).

. Devil Canyon: Summary of Impacts: As we commented on the Watana impacts summary, quantification and better definition of impacts is needed here. We are also concerned about inattention to cumulative impacts. While habitat alterations, disturbance, or blockage of movements may each be a "minimal" impact, together they may be sufficient to severely stress moose or reduce moose use of the project and adjacent areas.

(ii) Caribou: Definitions for the qualitative terms used here should be provided (e.g. "little use").

(iv) Brown Bears: Lack of quantification here, as in Section 4.3(a)(iv) precludes evaluating even relative impacts from each major project feature.

(v) Black Bears: As in Section 4.3(b)(iv) above, lack of quantification prevents a thorough analysis. Consideration should be given to the cumulative effects of disturbances, loss of habitat, decrease in habitat value, and increased mortality from human/bear conflicts from the Devil Canyon development in conjunction with the Watana development.

(vi) Wolf: Please refer to our comments under Section 4.3(a)(vi) re the importance of disturbance and cumulative impacts.

(ix) Beaver: Refer to our comments under Section 4.3(a)(ix) re the need to quantify the amount and quality of downstream habitat improvements which could offset upstream habitat losses and the dependence of any habitat improvement on the operating flow regime. We suggest describing impacts under a variety of potential flow regimes.

(x) Muskrat: Please refer to our previous comments under Sections 4.2(b)(ii) and 4.3(a)(ix) - Filling and Operation re quantifying and controlling potential increases in trapping.

(xi) Mink and Otter: Again, we recommend providing some quantification, definition, or relative correlation among species and project areas for the qualitative impact descriptions.

(vii) Coyote and Red Fox: We would expect an increase in coyotes per our previous comments (Section 4.3(a)(xii)).

(xiii) Other Terrestrial Furbearers: Our comments under Section 4.3(a)(xiii) apply here too.

(xiv) Raptors and Ravens

- Construction and Filling

. Habitat Loss: Paragraph 1: Refer to our comments under Section 4.3(a)(xiv) - Disturbance.

Paragraph 2: Should any eagle build a nest, between now and filling of Devil Canyon Reservoir, which would subsequently be lost in construction and/or filling of Devil Canyon, please refer to our comments under Section 4.3(a)(xiv) - Disturbance.

Paragraph 3: Please clarify what is meant by the first sentence.

Paragraph 4: Please refer to our comments under Section 4.2(c)(i) re the difficulties in locating goshawk nests.

Paragraph 5: Please clarify the discussion and consider whether the cliffs and trees which may increase in nesting importance are as suitable as existing nest habitats.

. Disturbance: Paragraph 1: Again, please refer to our comments under Section 4.3(a)(xiv) - Disturbance.

Paragraph 2: See our comments under Section 4.3(b)(xiv) this section, Habitat Loss: Paragraph 2, above.

(xv) Waterbirds: Please refer to our comments under Section 4.3(a)(xv) as to the questionable value of the reservoir area, i.e. generally birds will not appear in the area any earlier; birds which remain in the area longer may have problems finding food when encountering frozen waterbodies once they do leave; no data has been provided re any supplemental food value in the reservoir area.

(xvi) Other Birds: Paragraph 2: Please clarify the last sentence.

Paragraph 3: Please quantify the extent to which open water in the reservoir will compensate for loss of dipper breeding habitat and describe what feeding habitat would be available in the reservoir.

(xvii) Non-game (small) Mammals: Please refer to our comments under Section 4.3(a)(xvi).

(c) Access

(i) Moose: The qualitative, general discussion precludes any definitive analysis of potential impacts. We suggest quantifying current and potential hunter demand and harvests, area moose populations and habitat quality for access route areas. Varying degrees of winter severity and the length of each access link should then be considered in conjunction with the information described above and data on vehicle/moose collisions in other areas of the state to assess the potential for railroad or automobile collisions with moose.

Since access is a key feature to any mitigation plan for the project, we again recommend evaluating the range of impacts which would result from a variety of access/use options and coordinating this with the Socioeconomics and Recreation Chapters. Please refer to our 17 August 1982 letter to Eric Yould re access alternatives; our comments there remain applicable.

Please correct internal inconsistencies in this paragraph: loss and alteration of habitat, disturbance, and mortality are certain, not "possible", impacts as verified in subsequent portions of this section (page E-3-350). Maps of proposed access routes should also be included.

- Mortality: Paragraph 2: Before discussing impacts from access, please specify any public access and hunter take restrictions assumed to be in effect for planning, construction, and operation phases of the project. Impacts will vary from severe with no restrictions to minimal with strong restrictions on access. In this respect, we find Chapter 3 confusing. The potential impacts from public access and hunting along project access routes are discussed here and then the suggestion is made that these impacts will be minimized by prohibiting worker access and hunting, yet the chapter never consistently describes what restrictions actually will apply. Project impacts, such as habitat degradation and population disturbance associated with increased access, could be further minimized by controlling public access (through restrictions on ORVs, seasons or times of day of use, etc.).

Please substantiate the conclusion here that "carefully managed hunting may effectively mitigate for some indirect project effects." The impact of diminished hunter opportunities is not fully described here or in Chapter 5 (see our comments there, Section 3.7(b)(ii) - Impacts on the Hunter).

Paragraph 4: Please define use of the terms "small" and "negligible." During severe winters, moose may seek cleared roadways as travel corridors and be subject to collisions. Since the Denali Highway is not kept open during the winter, it is not possible to fully compare the collisions on that road with the potential for collisions on project access roads. However, we suggest that a better understanding of the subject could be gained with information as described under Section 4.3(c)(i), above. We also note that if workers are allowed to commute to the project site or have free access in and out of the project area, the volumes of road traffic would be significantly higher. The analysis should be coordinated with that in Chapter 5. Consideration should be given to the times of year and day for recorded collisions and utilized in scheduling access if patterns exist in that information.

Paragraph 5: Please describe current railroad use as compared with the projected additional eight round train trips each week. We believe that project railroad use may be a significant impacts to wildlife in view of present winter use of four round trips each week.

The length of additional track, as well as existing track, should also be given for comparison with the mortality figures given here. Information on moose densities and habitat values in the area of the new as compared to existing railroad would also be helpful in quantifying potential impacts, as described above. We are concerned that in severe winters the loss of winter range may be compounded by the potential for numerous vehicle/moose collisions.

. Loss of Habitat: We concur with the analysis but suggest some quantification be made of areas and vegetation types which could become unuseable in a worst case scenario where disturbance causes moose to avoid using the road corridor area.

. Interference with Seasonal Movements: With respect to the seasonal migrations described here, please refer to our comments under Section 4.3(c)(i) - Mortality, re the compounded potential for even greater numbers of vehicle/moose collisions.

(ii) Caribou: Paragraph 1: We reiterate our recommendation to eliminate the Denali Highway to Watana access route (also see Section 3.4(c)(ii)) which, as documented here, is "likely to have a substantial effect on caribou movements."

Paragraph 6: Please provide substantiating data for the judgment that although cows calving in the area may avoid the road, there will not be an effect on herd productivity. We recommend quantifying the portion of the herd utilizing this area.

Paragraph 7: Please provide further information on times of day or seasonal variations expected for truck traffic. An additional concern in considering the potential severity of access-related impacts is the question of worker access. If project workers are all housed on site, the intensity of road use will still be greater than described here; workers traveling to and from the site at the beginning and end of their times off represent a substantial road, or even airstrip, use. Moreover, if workers are allowed to individually commute, or even if buses are used on a daily or weekly basis, road use will be even more significant.

Paragraph 9: Our previous comments on herd management apply (Section 4.2(a)(ii)). We recommend quantifying impacts described throughout this section.

(iii) Dall Sheep: Paragraph 1: The issue of disturbance from air access to the project should be covered here; as described in Section 4.3(a)(iii). Please provide information on the expected intensity of aircraft use for the period of construction.

Paragraph 2: Consideration should be given to increased recreation and other activities which may compound habitat loss impacts near the critical Jay Creek mineral lick. Please restate those impacts as described in Section 4.3(a)(iii).

(iv) Brown Bears: We concur with the assessment but recommend that quantification of impacts be provided.

(vi) Wolf: Our previous comments under Section 4.3(a)(vi) apply.

(vii) Wolverine: Paragraph 2: Quantification of trapping effort and potential increases relative to wolverine populations should be given. Please justify the inference that emigration from other areas will mitigate for loss of wolverine to trappers yet not affect overall populations.

(viii) Furbearers: In general, we find the discussion somewhat inconsistent with other sections, with no clear objectives outlined for mitigation (see paragraphs 2,8, and 9 of this section). Please also refer to our comments on the socioeconomics (Chapter 5, Section 3.7(c)(i) - Impacts of the Project) and our recommendations under the wildlife mitigation plan (Section 4.4(b)). We recommend you then ensure these sections are consistent with each other and with overall project objectives and mitigation goals. Specific comments follow.

Paragraph 1: Please provide further data to substantiate the conclusion that pine marten home ranges may become realigned along the access road. Although we appreciate the thorough discussion of potential project impacts, we are concerned that repeated lack of quantification makes if difficult to assess the relative importance of such "minor" impacts as compared to the more severe impacts of direct habitat losses and increased trapping mortality.

Paragraph 5: The well-documented likelihood of beavers using bridges and culverts for damsites more probably represents further negative impacts to beaver than a source of habitat improvement. Beaver use of those structures would conflict with project access, undoubtedly resulting in road maintenance to remove beaver dams. If that removal occurs at the wrong time of year, i.e. autumn, beaver in the area may be effectively eliminated (Furbearer Study Coordinator Phil Gipson, personal communication).

Paragraph 9: We are concerned with use of the word "desirable." Thus we suggest modifying the last sentence to say that to date, trapping pressure on mink and otter has been low in this part of Alaska (Furbearer Study Coordinator Phil Gipson, personal communication).

(ix) Raptors and Ravens

- Denali Highway to Watana Damsite: Paragraph 1: We recommend describing how this area was surveyed.

Paragraph 2: Our comments under Section 4.3(a)(xiv) - Disturbance would apply should golden eagles subsequently nest along the access road.

Paragraph 3: Refer to our comments under Section 4.3(a)(xiv) - Disturbances re the illegality of destroying a bald eagle nest.

- Watana Dam Site to Devil Canyon Dam Site

. Disturbance: We again refer to you to our comments under Section 4.3(a)(xiv) - Disturbance.

- Devil Canyon Dam Site to Gold Creek

. Disturbance: We recommend that the conclusions of minimal disturbance here, be consistent with those in Table W76 which says that "construction and operation activities may result in considerable disturbances." If the nest is active, we will recommend timing constraints on the construction activities near it (see Section 4.4(c)(i)).

(d) Transmission Lines As with the previous Section 4.3, (c) Access, the severity of impacts from the transmission lines will depend on restrictions on access (e.g. by siting, access to the lines, and/or access along the lines) as well as the methods of construction and maintenance (e.g. helicopter, winter, and/or onground). Please clarify what methods and schedule for construction and maintenance will be utilized and what restrictions, if any will be placed on access; we find the Exhibit E inconsistent on these points. The reference here is to helicopter and winter construction and only selective clearing of vegetation; in Chapter 5, reference is made to increased hunter access along the lines which infer greater clearing and road access (Section 3.7(c)(i) . Impacts of the Project). Increased snowmobile and ORV access and their disturbance along the transmission corridors should also be addressed here. Our comments under (Section 4.3(c)) Access on the need to quantify expected additional harvests also apply here.

Please refer to our transmission corridor comments under Botanical Resources, Sections 3.3(d) and 3.4(d). We refer you to our 5 January 1982 review letter on the 9 November 1981 Transmission Corridor Report. Our comments there remain applicable. In particular, we recommend incorporating into project plans: (1) on-ground evaluations with representatives of the FWS, ADF&G, and the Alaska Plant Materials Center regarding the appropriate management along various lengths of the transmission lines (e.g. the extent of clearing, maintenance, possible seeding, etc. should depend on the wildlife species of concern and vegetation types present; (2) coordinated access to the transmission lines with access to other project facilities; (3) controls on public access to the transmission lines during and post-construction to reduce habitat degradation and population disturbances; and (4) controls on access along the length of the lines. We would appreciate your response where project plans may be in conflict with either these points or the five specific recommendations in our January letter.

We are concerned with the generality and lack of quantification of this section. Using the vegetation remapping, a successional model should be applied; the selective clearing and maintenance to be used along the transmission lines should be factored into that model. Areas within each type to be impacted and vegetation type changes over the project life can then be calculated. Maps of the proposed transmission line corridors should also be provided.

(i) Big Game

- Cook Inlet to Willow: Paragraph 1: Again, the degree of impact will depend on the type of clearing and maintenance and thus, habitat alterations which result. We have recommended selective clearing, winter and helicopter construction and maintenance and controlled access along the line. Maintenance should involve selective clearing and topping of trees and tall shrubs to help maintain increased forage production. We agree that transmission line clearing may increase moose and black bear carrying capacities if vegetation types which can be enhanced are present along the line. Thus we recommend quantifying the types present and their value to big game.

Paragraph 2: Please describe the presence or absence of moose calving grounds and bear denning sites. The cumulative impacts of the transmission lines in conjunction with existing disturbances should be discussed.

- Healy to Fairbanks: Again, quantification of types to be impacted and successional changes over the project life should be provided.

- Willow to Healy: Please refer to our 5 January 1982 letter regarding the dependence of the Susitna project on the Intertie. Thus, we recommend full consideration of impacts from the Intertie within this analysis. Quantification of impacts is needed, as above.

- Watana Dam to the Intertie: Please provide a quantification of impacts, as above.

(ii) Furbearers: Paragraph 3: Please refer to our comments under Section 4.3(c)(viii) re inconsistencies between Chapters 3 and 5 in presenting impacts. We are also concerned with inconsistencies between the increased access acknowledged here and mitigation guidelines to prohibit such access (Appendix EE, item 1); please clarify. Our previous recommendations to quantify impacts apply here too.

(iii) Birds: Paragraph 1: We recommend providing references for the broad conclusion that species diversity may increase near the transmission lines. Removal of nest and forage trees will decrease available habitat for species such as pine grosbeak and boreal chickadee.

Paragraph 2: We concur. Please also refer to our comments under Section 4.2(c)(i) re continuing peregrine falcon surveys.

Paragraph 4: Powerlines are particularly deadly to swans.[16/] However, mortality from collisions, not electrocution, is the major adverse impact to swans. Locating and marking lines is the key to minimizing that impact (see our comments under Section 4.4(c).

We recommend expanding this discussion to describe: (1) the potential for swan collisions; (2) migrations of swans through the project area; and (3) swan use of remote lakes, including those in the Matanuska-Susitna Valley, for nesting and rearing. Refer also to our comments on increasing developments and disturbances which have caused swans to abandon areas, Section 4.3(a)(xv) - Disturbance, and our 5 January 1982 letter to Eric Yould, as above.

(e) Impact Summary

We are concerned with the emphasis of this summary on impacts which can be most easily mitigated. Consideration should also be given to documenting unavoidable, adverse impacts, cumulative project impacts, and differences between long versus short-term impacts. The uncertainty if predicting project impacts on the basis of existing information are clearly apparent here.

16/ Avery, M.E., P.F. Springer, and N.S. Dailey. 1980. Avian mortality at man-made structures: an annotated bibliography (revised). U.S. Department of the Interior, FWS/OBS-80/54.

Paragraph 2: We concur that increased human use is positive, but the habitat alteration and disturbance which may also result from increased access are often a significant negative impact to wildlife populations. There is a need to integrate this discussion with those in the Socioeconomic and Recreation Chapters of the Exhibit.

Paragraph 3: We recommend also considering habitat values and how they relate to wildlife populations over the life of the project.

(i) Big Game: Paragraph 1: As above, the increased access afforded to hunters is more of a concern from the standpoint of resultant population disturbances and habitat alterations; assuming that harvest is regulated to protect population levels.

Paragraph 3: We are concerned with the subjectivity of the first sentence here. Please provide quantitative data for comparison with the previous paragraph to justify the relative magnitude of project impacts.

Mention should also be made that project impacts will be particularly critical during years of severe winter. During such years, an additional impact to be considered would be moose/vehicle collisions. Cumulative impacts are also of concern with moose.

Paragraph 4: Inability to predict major impact on caribou, as cited here, is a serious data gap. We recommend describing additional information to be gathered to help make such predictions. Best and worst case impact scenarios should be described to provide at least an indication of how caribou could suffer from increased disturbance, impacts near calving areas, and alterations in seasonal movements.

Paragraph 6: Again, cumulative impacts are a concern in evaluating overall project impacts to both brown and black bear.

Paragraph 7: Disturbance from increased access and the presence of human activities should be the more direct concern here (please see our comments under Section 4.3(a)(vi)).

(ii) Furbearers: Paragraph 1: We again note the potential for red fox populations to decrease as coyote populations increase (please see our comments under Section 4.3(a)(xiii).

Paragraph 2: We suggest clarifying these conclusions to be consistent with previous impact descriptions, e.g. Section 4.3(a)(ix), paragraph 1, page E-3-315, says beaver populations are likely to increase, this paragraph says they "may increase," downstream (page E-3-371). We again recommend describing the water management regimes under which furbearer populations will most likely benefit. Overall, we are concerned with the uncertainties expressed in this discussion and recommend that additional furbearer work to satisfy these uncertainties be considered (e.g. we suggest focusing on beaver and pine marten per our comments under Section 4.4(b)). Since impacts to valuable habitat in the vicinity of Deadman Creek can be mitigated, by alternative road siting, they should be described here.

(iii) Birds: We recommend also describing the negative impacts from swan collisions and raptor electrocution with transmission line development. Similarly, disturbance to nesting swans and raptors is another negative impact which should influence mitigation planning.

4.4 Mitigation Plan: As was the mitigation plan for Botanical Resources, we find the mitigation plan for wildlife incomplete and too general. Our detailed comments on lack of quantification, lack of integration with other resources evaluated, and need to consider the full range of mitigation options possible should be considered here as well (see Section 3.4).

Because the wildlife analysis is much more qualitative than quantitative, we commonly found the emphasis on minor impacts rather than on major ones. A similar misemphasis is in the mitigation plan, where attention is often focused on small, more easily mitigated impacts. Alternatively, severe impacts are left to undefined and uncertain mitigation measures such as later habitat enhancement and/or lands acquisition. Please refer to our earlier comments on the need to clarify overall project mitigation objectives (Section 4.1).

This section should clearly explain why mitigation measures already recommended by FWS and other resource agencies have not been adopted. For example, negative impacts to wildlife from the Denali Highway to Watana development access route are consistently documented throughout the report: the road will result in substantial disturbances; the Deadman Creek area paralleling the road is particularly important habitat to numerous wildlife species (e.g. calving moose, Section 4.2(a)(i) - Distribution . Special Use Areas: Calving Areas: Paragraph 2; brown bear denning, Section 4.3(a)(iv) - Construction: Paragraph 10; caribou movements, Section 4.3(c)(ii); wolf denning, Section 4.3(c)(vi); valuable beaver habitat, Section 4.3(c)(viii); bald eagle nesting, Section 4.3(c)(ix), etc.). Mitigation of these impacts can be effectively accomplished by completely avoiding the impact, that is, alternative siting as recommended in our 17 August 1982 letter to Eric Yould and further detailed in our comments on the Botanical Resources mitigation plan, Section 3.4(c)(ii).

We also request that you (1) confirm the inclusion of recommended measures in project design, and (2) clarify the extent of public access and uses in the project area throughout planning, construction, and operation of the project. For example, please specify the extent to which the environmental guidelines in Appendices EA to EE have and will be guaranteed in project design and operation.

Establishment of a monitoring and follow-up program for all phases of project construction and operation is an essential feature of the mitigation plan. Key components of this program are that it: (1) include appropriate Federal, State, and local agency participation; (2) be fully supported by project funding; and (3) be utilized to modify, delete, or add to the mitigation plan in response to both information from ongoing studies and needs which become apparent as project impacts are realized. While monitoring by itself is not mitigation, actions taken as a result of that monitoring can ensure the effectiveness of the implemented mitigation plan.

Our final general recommendation on the mitigation plan is that continuing consultation between the license applicant and resource agencies include initiation of working sessions with project design engineers to fully incorporate wildlife mitigation plans.

(a) Big Game

(i) Moose: Paragraph 3: We concur with the processes now being used to quantify probable impacts of habitat loss and to develop selection criteria for replacement lands. Our previously described concerns for the need to evaluate habitat values are of particular note here; habitat quality must be a factor in quantifying the areas of specific land parcels which are to be enhanced or acquired as mitigation. A schedule for the availability and incorporation of this data into project plans is also needed. Some assessment should be made of the locations and potential sizes of such areas.

Paragraph 5: Further details should be provided on the schedule, potential size, habitat types, and studies, which would be involved in the Alphabet Hills burn. Land ownership, vegetation types, and other constraints to the potential value of burning or other manipulations to enhance habitat should also be described.

Paragraph 6: Please clarify the criteria to be used in replacement land selection. We caution that replacement lands only contribute to offsetting unavoidable habitat quality losses elsewhere when: (a) habitat value of the replacement land would be degraded by some predictable means other than the project during the life of the project but, through management for fish and wildlife that degradation could be prevented; or (b) replacement lands are currently degraded and through management for fish and wildlife, productivity could be increased over the life of the project; or (c) through management of fish and wildlife, the productivity of an existing natural unit of habitat could be increased by reducing or eliminating one or more factors limiting its productivity. Identified replacement lands must be a manageable unit.

Paragraph 7: To maintain the increased value of managed habitat, provisions should be included for ongoing management of them until such time as the project area is returned to the pre-project state.

Paragraph 8: The maximum design speed of 40 miles per hour referred to in Appendix EC, item 1, should be assured here as one means of minimizing the potential for moose/vehicle collisions.

Paragraph 9: We strongly support the proposal Environmental Briefings Program and recommend that it be a mandatory requirement for all project personnel before they begin work on the project.

Paragraph 10: Assistance from APA in regulating access should also be for the purposes of minimizing habitat degradation and unnecessary disturbances.

(ii) Caribou: Provisions to monitor and remove logs and other debris from the impoundments should be included in the overall project monitoring program, this will ensure that such debris does not inhibit caribou movements (see Section 4.3(a)(ii) - Filling and Operation, paragraph 9).

(iii) Dall Sheep: Please describe how the prohibition on visits to the Jay Creek mineral lick is to be enforced. We recommend that the portion of the reservoir adjacent to the lick be closed to boat and floatplane use. We suggest that the effectiveness of any measures to expose new portions of the mineral lick be demonstrated and then incorporated into the mitigation plan if effective.

(iv) Brown and Black Bear: Paragraph 2: We strongly concur with recommendations to promptly incinerate garbage and fence camps. Experience from other projects (e.g. Terror Lake hydroelectric project) shows the need to clearly sign and monitor gate closures to maintain the effectiveness of fencing. The Environmental Briefings Program referred to under Section 4.4(a)(i), paragraph 9, is particularly applicable here.

Paragraph 3: The habitat values to be gained from mitigation measures referred to here must be quantified before any mitigation for bear impacts can be claimed.

(v) Wolf: Please refer to our comments in the previous paragraph about quantifying recommended mitigation measures.

Beaver and pine marten are both ecologically and economically important; mitigation of some project impacts is possible. We recommend revising the first sentence to describe what process and/or criteria were used here in deciding to emphasize beaver and pine marten in mitigation planning.

Potential benefits to other species from beaver activities is the type of minor impact we believe to be overemphasized while more significant, and difficult to mitigate, impacts are not treated as thoroughly. For example, beaver activities may conflict with slough management plans for salmon. Moreover, benefits from beaver activities may ultimately be negated by increased trapping which will be facilitated by project access and transmission corridors. The consistent lack of quantification in the draft Exhibit E precludes evaluting the significance of any such benefits relative to overall project impacts and recommended mitigation measures.

Paragraph 2: We recommend discussion be provided on how proposed mitigative siting of the transmission corridor for pine marten will conflict with, or benefit, other wildlife species.

Paragraph 3: Per our previous comments, we recommend coordinating the discussions of impacts and mitigation measures between Chapters 3 and 5. We see a need to clearly and consistently state project objectives in both chapters. We concur that workers and their families be prohibited from trapping or hunting while working in the project area and request assurance that such prohibitions will be part of project plans.

Although increased access may be viewed as a net benefit to trappers, habitat degradation, disturbances to the population, and conflicts with project management (e.g. removal of beavers which conflict with road culverts) would result in less than expected benefits to these groups. Thus we recommend continued monitoring to assess that potential. We also then recommend that a process be developed for implementing further mitigation (e.g. recommendations to the Game Board on greater harvest restrictions, habitat manipulations, alternative flow regimes, etc.) should these efforts fail or impacts be found more severe than initially evaluated.

Paragraph 4: We request confirmation that project design plans will not include gravel extraction from Deadman Creek. Please provide further information on how disturbance of riparian vegetation will be minimized.

Paragraph 5: Please refer to our comments under Sections 4.3(a)(ix) and 4.3(b)(ix) re the need for quantified data to support the conclusions here. We strongly support the proposed monitoring and model development programs. These programs should also be the basis for verifying impact predictions. Although by itself monitoring does not mitigate project impacts, it should be the basis for determining additional mitigation needs.

Paragraph 6: We concur. To maximize the effectiveness of the mitigation plan, we recommend continuing studies to fill data gaps, quantify conclusions given here, and complete habitat models for beaver and pine marten.

(c) Birds

(i) Raptors and Ravens: Paragraph 1: We recommend expanding the list of major impacts to include loss of hunting habitat, a corollary impact to the loss of nesting habitat identified here. A mitigation need we have repeatedly recommended is realignment of roads and transmission corridors away from riparian corridors and other wetlands valuable in migration as well as breeding (e.g. letter from FWS to Eric Yould, 5 January 1982).

Furthermore, we recommend that the monitoring program include continuing surveys for peregrine falcons (see Section 4.2(c)(i)) as well as other raptors (see Sections 4.3(b)(xiv) . Habitat Loss), to confirm their absence in construction activities areas.

We are concerned with the emphasis on creating artificial nests. That emphasis is based on the assumption that nest sites are the limiting factor to raptor use of the project area. This has not, to date, been adequately supported by ongoing studies. For example, overall loss of feeding habitat may negate potential benefits from such structures.

- Creating Artificial Cliff-Nesting Locations: We concur with the recommendations to continually monitor for nest destruction and to provide additional mitigation later, if found necessary.

- Creating Artificial Tree-Nesting Locations: Paragraph 1: Please provide or correct the complete reference for creating successful bald eagle nests; it was apparently omitted from the bibliography. We question the suitability of presently unused habitats cited here as potential nest sites. Since eagles are not using these areas, food or some other habitat parameter may be limiting.

Paragraph 2: We suggest expanding the discussion to describe the comparability of habitats, circumstances, and species of birds using artificial nesting platforms as listed in Table W81. The success of those efforts may not be directly applicable to the project area, given the different habitats and species involved. Please include information on whether such structures have ever been successful in Alaska.

- Seasonal Restrictions: We strongly support the measures included here with the addition of three points. First, we recommend coordinating with project design engineers to ensure that such timing and siting restrictions are fully incorporated into project designs, schedules, and cost estimates. Secondly, our previous comments on the need for follow-up monitoring of raptor nesting in response to construction activities are critical here. Finally, for bald eagles, we recommend there be no blasting within 0.5 miles of nests.

(ii) Waterbirds: Paragraph 1: We recommend revising this paragraph to describe factors which may limit benefits outlined here (see our comments under Section 4.3(a)(xv)). An additional concern we believe should be described here is the potential for collisions of swans with transmission lines.

Paragraph 2: We recommend that the monitoring program described previously should be coordinated with ongoing FWS surveys for trumpeter swans and other waterfowl, with particular attention to the impacts of project disturbances on trumpeter swans. We again note the importance of carefully siting all project facilities, roads, and transmission lines away from wetlands (as being remapped), including stream corridors and lakes. Since trumpeter swans and other waterbirds frequently migrate along stream corridors, siting and marking of transmission lines is particularly critical to avoid collisions and electrocutions in those areas.

(iii) Other Birds: We again note the ecological importance of these species. We recommend that nest and roost boxes be considered as mitigation for passerines. Hairy woodpecker, boreal chickadee, and brown creeper would all adapt readily to such structures. These three species populations would be reduced by 10.1, 7.4, and 19.9 percent, respectively. The hairy woodpecker is on the National Audubon Society's "Blue List" and is thought to be declining in the Pacific Northwest. We also recommend that all unavoidable adverse impacts from the project be fully acknowledged.

(d) Small (non-game) Mammals: We refer you to our comments, above, re fully acknowledging unavoidable adverse project impacts.

Comments on Tables and Figures for Section 4 - Wildlife

Overall, many of the tables and figures are incompletely footnoted and referenced. Few will stand on their own and many are confusing or inconsistent even when referring to the text. We recommend cleaning up the tables and figures to alleviate these problems in general, as described in our comments on the text of the report itself, and as specified below. Rather than commenting on all editing or corrections needed, we have focused on major problems or points important in understanding our comments on other portions of the document.

Table W21, W22 and W23: Please include the number of sites, sampled in each community.

Table W64: We recommend footnoting a brief definition of "importance value ratings." Please provide dates for the summer 1981 survey.

Tables W65, W66, W68 and W78a: Please clarify how habitat types as classified here do or do not coordinate with the revised vegetation classification scheme. We are concerned that data manipulations not obvious from the original references be fully described here (see Section 4.2(c): Paragraph 3).

Figure W11: We suggest adding reservoir elevation levels.

Figures W19 and W20: We recommend including some description of how "relative importance" was determined and "Importance Indices" were calculated. Sources for this data should be cited here.

Appendices EA to EE

General Comments

Overall, we concur with the environmental guidelines to the extent that they are presented here. However, we are concerned that the guidelines are somewhat incomplete and lack specifics needed for effective implementation. Please specify the degree to which these guidelines are being incorporated into project planning. We recommend that you explain any situations where the guidelines will not be followed. In order to most effectively implement these guidelines, and thus, to achieve greater mitigation of project impacts to fish and wildlife, we recommend a team approach between project environmental specialists and design engineers throughout design, siting, and construction. The interagency monitoring group recommended previously should be part of this effort (see our comments on Section 4.4: Paragraph 5). Problems with lack of integration between project studies and different chapters in the Exhibit E would then be more easily overcome. Following are our Specific Comments on individual items in the environmental guidelines.

Specific Comments

A - All Facilities

1. The referenced buffer to waterways or wetlands should be a 500-foot minimum width, not maximum width as presented here.

7. Please define project "facility" as used here. We suggest the definition include project camps, access roads both to and within the project site, and any construction areas (including the dams, borrow areas, disposal sites, etc.).

   Trumpeter swan nests and caribou calving areas should be added to the list of areas to which the guideline is to apply.

8. Blasting determinations should be made in consultation with the resource agencies. Such determinations could be incorporated into the previously recommended monitoring program (see our comments on Section 4.4: Paragraph 5).

9. Please discuss the feasibility of disposing of part, or all, of project spoils within the impoundment area in accord with project scheduling. An estimate should be provided of the quantities which may be involved, or when those quantities will be determined. Stockpiling needs, and reclamation considerations should also be provided. We suggest this item be expanded into an additional appendix section similar to Appendix AD - Material Sites.

11. Please refer to our previous comments on the need to map permafrost areas (Section 3.2 and 3.3(a)(ii) - Effects of Erosion and Deposition).

13. We recommend specifying that fertilization and seeding be initiated in the growing season immediately following site disturbance. The interagency monitoring program referred to in item 8, above, should review and concur with species chosen for revegetation.

14. Please refer to our comments under item 13, above.

15. We concur; again please refer to our comments on item 13. Initiating test plots as part of continuing project studies would provide information on which successful site restoration can be based. Plantings to provide wildlife food and/or cover should also be considered in developing restoration plans.

16. We strongly endorse both programs outlined here. Reference should be made to U.S. Coast Guard (C.F.R. 33, Part 154(b)) and Environmental Protection Agency (C.F.R. 40, Part 112) regulations which require use of a Petroleum and Hazardous Substance Plan and Manual with such developments. It should be mandatory for all project personnel to take part in the Environmental Safety Program prior to starting work on the project.

17. We suggest that storage containers for fuels and hazardous substances also be located at least 1,500 feet from wetlands. All personnel involved in transfer and handling operations for such materials should carry portable spill containment/absorption materials. Impervious material used to line containment areas should be securely tacked in place and frequently monitored for tears; such tears should be promptly repaired and water which may collect in the areas should be promptly removed.

18. Please specify the degree to which this recommendation is being followed as described under our General Comments for these appendices.

19. We recommend addition of an item outlining the need for the contractor to train personnel, prepare, and follow an erosion control plan which is subject to resource agency review and comment (see our comments on Section 3.4(d)(ii)). That plan should then be incorporated into these guidelines.

<u>B - Construction Camps</u>

1. and 2. We concur and recommend that there be no trucking of garbage between camps; each camp should have its own incinerator capable of burning that day's wastes.

3. We concur; please refer to our comments under Section 4.4(a)(iv) on the need to clearly sign and monitor all gates to ensure they remain closed. We recommend the interagency monitoring group review and concur with the fencing specifications.

4. We suggest that the recommended effluent sampling and testing program be outlined in construction camp design plans.

5. Again, resource agency review and concurrence should be involved.

C - Access Roads

3. We concur and recommend that the proposed program for identifying wetlands in consultation with the CE and FWS be used in access route siting (see Section 3.2(a)(vi)).

5. Instream work should be scheduled to avoid critical spawning times and minimize sedimentation of downstream habitats.

6. through 10. Criteria should be included for determining when a culvert rather than a bridge can be used for stream crossings. Resource agencies should be consulted in the development of such criteria.

13. We suggest adding, "as well as after significant storm events" at the end of this item This issue needs further definition.

D - Material Sites

1. We concur and recommend that the interagency monitoring program be integrated with the interdisciplinary team effort so that resource agencies are consulted in the development and implementation of mining plans.

2. and 3. Please identify the extent of borrow materials needed for project construction which may be available within the impoundment area, relative to the extent of borrow which will have to come from other sites. Our comments under Appendix EA - All Facilities, item 9, on stockpiling and reclamation, and under Appendix EC - Access Roads, items 6 through 10 re criteria for determining when to use the lower priority mitigation measure (e.g. culverts instead of bridges; first-level terrace sites over well-drained uplands) apply here also.

7. We suggest that construction schedules be evaluated in order to determine optimum coordination and use of material and disturbance sites.

E - Transmission Corridors

1. We recommend addition of the phrase "and maintained" after the word "constructed" in line 2 of this item. Our text comments on the need to fully integrate Intertie development with all other project transmission lines apply here (see Sections 3.4(d)(ii) and 4.4(d)(i) - Willow to Healy).

3. Transmission towers should not be placed in wetlands, as defined by ongoing remapping efforts.

4. We concur, and suggest that selective cutting be used to control vegetation along transmission corridors.

Appendix EG: Please provide the source for data cited which was not provided by the University of Alaska Museum.

Chapter 4. REPORT ON HISTORIC AND ARCHEOLOGICAL RESOURCES: No comments.

Chapter 5. SOCIOECONOMIC IMPACTS

General Comments

We see this socioeconomic impact evaluation as an integral component of the overall evaluation of alternative means of satisfying energy needs in the least environmentally damaging way. Accordingly, we offer the following comments for consideration in the evaluation of this alternatives.

Evaluation of a proposal must examine impacts, positive and negative, and mitigation over the life of the proposal. Data bases provide the point from which this evaluation must progress. How this project could effect fish and wildlife resources over its life is strongly dependent upon how the project influences future user demand of those resources. This evaluation should incorporate: (1) a widely accepted projection of future population and economic growth (increasing user groups) or, if there is substantial uncertainty as to the validity of key assumptions (as we believe there is), then a multiple scenario model should be pursued examining at least high, medium, and low projections; and (2) a tradeoff analysis examining the competing mitigation proposals for the different interests. Chapter 5 fails in respect to both points.

The Base Case, as expressed in this document, is a minimum project impacts scenario. We are led to this conclusion by the following:

1. The recent downturn in State oil revenues directly leads to a downturn in State spending. Increased State expenditures result in economic expansion which then attracts and supports the new population (Department of Policy Development and Planning (DPDP) Policy Analysis Paper No. 82-10). The expected lower level of State spending should be reflected in decreased economic expansion and population. One could deduce from this that the without project economic and population Base Case should be substantially lowered from what is presented in this document. Since this turn of events obviously does not impact the cost of the project, the project socioeconomic impacts would be accentuated.

2. With less oil revenue the State would need to concentrate a greater percentage of its income and/or bonding capability on this project. The State would then not be able to afford projects in other areas of the State. We, therefore, believe a closer look at State-wide impacts is necessary.

3. The power which this project would provide could act as an attractant to various industries, to the detriment of other areas of the State.

4. Potential impacts due to the seasonality of the workforce is not fully addressed in this document. Other hydropower projects in Alaska, such as Terror Lake, and those constructed in other remotely situated areas should be examined to explore this potential impact.

5. Impacts result from the number of people attracted by potential jobs not by the number of jobs created, either directly or indirectly. This is supported by the letter to Eric Yould dated 27 March 1982 from the Alaska Department of Community and Regional Affairs (ADCRA).

6. The implications of item 5 above regarding local and regional hiring assumptions and impacts to local communities.

We have not previously had input into many of the decisions which were reached regarding the construction camp/village such as siting, type of camp, and administration. These decisions have large implications for the fish and wildlife resources and users. Consideration of a Prudhoe Bay type camp should be given. We are not aware of any construction camp alternatives having been discussed in terms of minimizing adverse impacts to fish and wildlife resources, and their use.

As illustrated by many of our comments, we are concerned that not only were the resource agencies not consulted previously on many of the actions described herein but that communication and coordination between the socioeconomic component and the fish and wildlife resources components has been insufficient.

It is stated several times in this chapter that monitoring of impacts is proposed and that this program would add flexability to the mitigation program. We concur. However, we believe this monitoring team should better reflect the spirit of the APA Mitigation Policy document. We believe a monitoring program should be established, at project expense, consisting of representatives of appropriate local, State, and Federal agencies, to carry out the function of assessing the extent of actual impacts and recommending modifications to the mitigation program. Modification of the mitigation plan, as represented in the license, would then be through license amendment.

Modification of the Base Case to accomodate the concerns raised in the ADCRA letter of 27 May 1982 and in our comments would dramatically change the impacts predicted and ultimately the mitigation requirement. Additionally, an assessment of socioeconomic impacts must be reactive to other study components. For example, to evaluate impacts to users of fish and wildlife resources, the impacts to the resources must first be assessed. In that many of these resource impacts have not been sufficiently quantified, one could not expect an acceptably quantified socioeconomic analysis. This could only have lead to a highly general mitigation plan, which is what we find here. In fact, reference is made to certain actions which (Section 4.2(a), page E-5-91), ". . . will be considered in the mitigation plan". A mitigation plan should be a part of this document, and be specific to the anticipated impacts based upon a broadly accepted data base. The burden of formulating an acceptable mitigation plan is the applicants.

Specific Comments

2 - BASELINE DESCRIPTION

2.1 - Identification of Socioeconomic Impact Areas

(c) State: We concur that identifiable impacts would be concentrated at the local level, and most difficult to evaluate on a state-wide basis. It should be recognized that how this project is approached economically has tremendous implications for the State. If the State provides a grant of billions of dollars, that money can't be spent on other programs. Bonding of the project would have a large impact on the State's ability to bond other projects. Additionally, the relationship between large projects and population growth should be given greater emphasis. Increased State expenditure results in economic expansion that attracts and supports the new population (DPDP Policy Analysis Paper No. 82-10). The State would be impacted through services provided to this project caused higher population level.

2.2 - Description of Employment, Population, Personal Income and Other Trends in the Impact Areas

(a) Local

(ii) Population: Paragraph 3: Acceptance of the projected Mat-Su Borough population figures would be on the basis of a review and acceptance of the underlying assumptions. Without these we are left with what appears to be relatively high projections which apparently come from a single source, the Mat-Su Borough, which could be viewed as having a vested interested in the project, and a high probability that the projections rest upon by the original, outdated project economic analysis. The impacts analysis and mitigation planning is strongly tied to population projections with and without the project. We recommend that the data base be broadened and projections updated.

Paragraph 4: We recently received a Scoping Document (dated 29 November 1982) for the Knik Arm Crossing from the Alaska Department of Transportation and Public Facilities (ADOT/PF). In that ADOT/PF is just beginning to evaluate the desirability of this project it would be premature for APA to view it as a foregone conclusion.

Paragraph 5: Please discuss the assumptions upon which these population projections are based.

(b) Regional

(ii) Population: Paragraph 2: We accept the underlying assumption that, in Alaska, population growth is strongly associated with natural resource development projects. Please identify the development projects that have been assumed to be going forth. The recent downturn in State income, due to weakening of oil prices, should be factored into this analysis.

3 - EVALUATION OF THE IMPACT OF PROJECT

3.1 - Impact of In-migration of People on Governmental Facilities and Services: Paragraph 2: The underlying assumptions which lead to the conclusion that this project would have minimal impacts to the Mat-Su Borough should be discussed in greater detail. Peak project employment would be 3,498 (page E-5-37) and 95 percent of these workers would have dependents, with an average of 2.11 dependents (page E-5-44). This would lead one to believe direct project worker impacts would be more than 10,000 people. If all these people were housed at the construction site we would have a city approximately three times the size of Palmer, with all the encumbent needs of this size community. This figure would be substantially inflated by secondary and induced jobs resulting from the project. Spreading these numbers out over the small, local communities would be expected to result in significant adverse impacts. In the 27 May 1982 letter from the ADCRA to Eric Yould it was noted that, ". . . given the current state of the economy, it seems reasonable to expect a sizeable influx of people from the Lower 48 seeking highly-paid employment, therefore competing directly with the local labor force. This was the State's experience during the Trans-Alaska Pipeline project (TAPS) and, in fact, just recently for the as-yet to be started Alaska Natural Gas Transportation System. Yet this proven phenomenon apparently was not considered in the analysis. This influx of people seeking instant riches in Alaska during major construction projects has historically contributed to impacts far in excess of what otherwise mights normally be expected."

In reference to, ". . . the buffering effect of the expected continued increase of the population," please refer to our Chapter 5 General Comments.

(a) Watana - Construction Phase

(i) Local

- Mat-Su Borough: As stated in our Chapter 5 General Comments we find it difficult to accept that, "In most areas of the Mat-Su Borough, the population influx related to the project will only add slightly to the substantial increases in need for public facilities and services that will be resulting from the population growth projected under the Base Case." It is stated in the previously referenced 27 May 1982 letter from ADCRA, "The State's experience has been that the impacts from large construction projects (most notably TAPS) are far in excess of what were originally anticipated. Those impacts were due to a substantially greater inmigration [SIC] of people than those anticipated based solely upon the size of the required construction and support work force. This was due in part to a large number of people who migrated to Alaska with no intention whatsoever of seeking employment, at least on the construction project. Another unforeseen impact was in the secondary job market. Inmigrants [SIC] competed for, and filled, secondary and induced jobs, many of which were vacated by local residents obtaining employment on the high-paying construction project. This situation only exacerbated the local unemployment situation.

"Certain public services were severely taxed as a result of the larger than expected influx of people. The public safety and public health were jeopardized by increased 'people problems'; too few public safety officials and inadequate or non-existent facilities delayed the State's ability to adequately respond. Lack of adequate housing led to overcrowded living conditions and sanitation problems. Increased vehicular traffic devastated the roads and at times created safety problems as well. Utilities, such as power and telephone, were overtaxed. Heightened demand for housing produced rent gouging, displaced families, hastily and poorly constructed housing, and use of substandard or even non-residential units as places of residence.

"It seems, therefore, that the potential exists for the types of impacts described above to occur as a result of the Susitna project, and to occur in large part in the Matanuska-Susitna Borough. Simply put, we believe that past experience has shown that more people will show up than originally anticipated, bringing with them all the problems attendant to a 'boom-town' situation. We do not feel that this was adequately addressed in the draft feasibility report, nor that the State's prior experience with TAPS was taken into account."

We would expect that a high percentage of those attracted to the area would become fish and wildlife resource users. This would lead to increased demand for these resources at the same time and in the vicinity of more direct project related impacts to these resources. Additionally, because the project work force would be highly seasonal, (page E-5-37) the impact of these employees on the fish and wildlife resources would be greater than other area residents.

. Public Recreation Facilities: Paragraph 1: Please clarify whether the assumption that full public access would be provided by the project through the upper Susitna Basin has been made. We understood this was not the case (see page E-5-24, Transportation).

Use projections and anticipated fish and wildlife resource impacts should be examined.

. Transportation: Paragraph 1: We concur that, "The ultimate status of the road is unsettled at this time." The road is a proposed project feature and as such the ultimate resolution or mechanisms for resolution of this issue needs to be provided in the FERC license, if in fact we do still have road access at that time as a project feature. We have not concurred that road access is either necessary or desirable.

Paragraph 3: Reference is made to, "scheduling of commuting workers". Yet, on page E-5-91 it is stated that, ". . . there will be no daily commuting . . . and workers will not have the opportunity to drive personal vehicles to the camp/village . . . ." These conflicts need to be resolved.

- Cantwell

. Transportation: Paragraph 2: Reference is again made to commuting workers. Please refer to our comments immediately above (Section 3.1(a)(i) - Mat-Su Borough. Transportation: Paragraph 3).

(ii) Regional: Please refer to our Chapter 5 General Comments and to our comments regarding Sections 3.1 and 3.1(a)(i). - Mat-Su Borough.

(b) Watana - Operation Phase and Devil Canyon - Construction Phase

(i) Local

- Mat-Su Borough: Please refer to our comments immediately above (Section 3.1(a)(ii)).

3.2 - On-site Manpower Requirements and Payroll, by Year

(b) Seasonality of Manpower Requirements: Please refer to our comments regarding Section 3.1(a)(i) - Mat-Su Borough. The seasonality of the project work force could, if they remain in the State, result in significantly higher use levels of fish and wildlife resources, and recreational resources than that found for residents employed year-round. We recommend that this should be examined. The TAPS project and in-state hydropower projects, such as Terror Lake, should provide valuable information.

3.3 - Residency and Movement of Project Construction Personnel: Paragraph 3: The proposed administration of the construction camp/village appears to simplify problems by minimizing constraints on the work force. Given the APA Mitigation Policy, which is consistent with NEPA and our Mitigation Policy, to first avoid adverse impacts to fish and wildlife resources we find it difficult to accept the construction site camp/village plan or administration of it. In many ways it tends to maximize adverse impacts to fish and wildlife resources, in direct conflict with APA's stated mitigation goals. It appears that plans other than that proposed have not been evaluated as none appear in Chapter 10. We recommend that a Prudhoe Bay type camp be examined as an alternative which could minimize project-related impacts to fish and wildlife resources and socioeconomic impacts to the local communities. Our position concerning rail vs road access to the construction camp/village has been previously stated (FWS letter to Eric Yould dated 17 August 1982).

(a) Region

(i) Regional Work Force: Paragraph 4: The assumptions stated for the on-site construction work force were questioned in the previously referenced 27 May 1982 letter from ADCRA, "Although there are currently enough unemployed in Southcentral Alaska to more than fulfill the project's labor demands, in terms of numbers, that does not necessarily mean that the appropriately skilled people are locally available. Also, given the current state of the economy, it seems reasonable to expect a sizeable influx of people from the Lower 48 seeking highly-paid employment, therefore competing directly with the local labor force." In addition on page E-5-94, it is stated, "There are at least a couple of reasons to believe that local labor might have a difficult time obtaining construction jobs." This would appear to support the contention that hiring assumptions are overstated, and thus the impacts of project-induced population increases are understated.

(iv) Relocating Workers and Associated Population Influx: Concerning secondary and induced population please refer to our comments under Section 3.1 and 3.1(a)(i) - Mat-Su Borough.

3.4 Adequacy of Available Housing in Impact Areas

(a) Watana - Construction Phase

(i) Local

- Matanuska-Susitna Borough: Paragraph 1: It is stated that, "The majority of construction workers on the project are expected to use the on-site housing facilities. These workers will not be in-migrating into established communities and therefore will have no impact on the housing market in the

Mat-Su Borough." Could we not conclude from the above that a minority of some unknown number of workers would not be housed on-site? This would lead one to expect workers commuting, and impacts to the housing market. Please quantify these potential impacts. Concerning commuting workers please refer to our comments on Section 3.1(a)(i) - Transportation: Paragraph 3. In addition, in the previously referenced 27 May 1982 letter from ADCRA, the following statement is provided:

> "The key supposition in support of the minimal impacts described is that the majority of the labor force and their families will live on-site and largely remain on-site throughout the duration of the project. This presumes affirmative actions are taken to preclude or limit mobility, particularly by private automobile, and to provide sufficient incentives for workers to locate their families on-site rather than in the more attractive and urban settings of Anchorage, Palmer, or Wasilla. If those conditions do not occur, workers and their families in some undetermined numbers will reside elsewhere, and the workers will commute. If that occurs, impacts on the Borough will increase dramatically."

3.5 - Displacement and Influences on Residences and Businesses

(b) Businesses: Paragraph 2: It would follow that if, "Most businesses in the upper basin are dependent upon abundance of fish, big game, and furbearer species," and the project holds the potential to severely impact these species through elimination of their habitats, then most of the businesses would suffer severe adverse impacts. This paragraph illustrates a possible problem relating to coordination or communication of Exhibit E study programs.

Paragraph 3: Please refer to our comments immediately above (Section 3.5(b): Paragraph 2).

Paragraph 4: Please refer to our comments above (Section 3.5(b): Paragraph 2). We cannot dismiss impacts to fish and wildlife resource users as insignificant. The existing user levels must be established in addition to fish and wildlife resource levels with and without the project. Proposals designed to mitigate for unavoidable fish and wildlife resource losses should then be examined as to potential impacts on these user groups.

3.7 - Local and Regional Impacts of Fish and Wildlife User Groups

(a) Fish

(i) Methodology: The work which was completed for 1981 did provide point estimates. The capability of the system to produce salmon is dependent upon a number of factors which are being examined as part of the Aquatic Studies Program (e.g. winter water temperature, availability of spawning gravel, flow regime, etc.). The number of fish that pass a point along the river does little to establish a river's production capability other than to establish a bottom figure for it.

A comparison of point estimates of 1981 vs 1982 demonstrates the great variability that exists in this system. Both years are "representative".

(ii) The Commercial Fishery

- Specific Impacts: Paragraph 1: We concur.

Paragraph 2: Given the qualifications stated in the first Paragraph, this discussion fails to recognize the potential of the project to impact fisheries downstream of Talkeetna, the potential of the river above Devil Canyon to support salmon (future opportunities lost), the importance of commercial fishing as a way of life, the importance of commercial fishing in terms of secondary and induced job creation, value of the fishery lost over the life of the project (based upon the same economic assumptions as the rest of the project), the cost of various mitigation proposals over the life of the project, etc. We recommend that a more detailed discussion be provided in the Exhibit E taking into account at least the factors listed above.

(iii) The Sport Fishery: Paragraph 4: We concur that the type of research described is necessary. Additional information on the scope and schedule for completing this work should be provided here. We would appreciate future coordination on this research as we had not been contacted previously.

(iv) Subsistence Fishing: The impact of the project on this issue has not been evaluated and remains a large data and analysis gap. The importance of the Susitna system to subsistence, potential losses, and how mitigation proposals affect subsistence use should be addressed in the Exhibit E. The data provided is not applicable to the project. Enactment of a State subsistence law in 1978, subsequent litigation, and changes to that law in 1982 invalidate direct comparisons of permit numbers for different years. Additionally, we do not consider the price of salmon at the supermarket an adequate reflection of the importance of the resource to this life style. Cultural, social, and recreational values should also be considered in this analysis.

(b) Game: The primary deficiencies of the Socioeconomics Chapter are prevalent here: (1) inconsistency with Chapter 3, Fish, Wildlife, and Botanical Resources; (2) lack of coordination such that mitigation recommendations from Chapter 3 are not evaluated in Chapter 5 and vice versa; in several instances assumptions in Chapter 5 directly conflict with recommended mitigation measures; and (3) data gaps and incomplete analyses which prevent full evaluation of socioeconomic issues (e.g. pages E-5-75, paragraphs 2 and 5; E-5-76, paragraph 1; E-5-81, paragraphs 1 and 4; and E-5-82 to 83 discussion under Section 3.7(c)(i) - Data Limitations).

(i) Commercial

- Guides and Guide Services: Paragraph 7: Please refer to our comments on Section 3.5(b). In that "worst case" potential loses were examined in Section 3.7(a)(ii) we recommend that a similar examination be provided here, particularly since moose estimates have previously been furnished by the ongoing Big Game Study Program.

Discussion should be included on the possible decrease in the area's attractiveness for remote, wilderness hunting given the increase in access and human activities with project development. By definition, guided hunting involves a more remote type experience. Loss of this remoteness and potential impacts to the guiding industry should be considered here. Ongoing data collection/analysis regarding this issue needed to be fully described.

(ii) Recreational

- Resources: We recommend expanding the discussion to consider relative demands and values for commercial, recreational, and subsistence hunting for each species in comparison to other species.

Including a section on "Management" would clarify the remaining discussion on recreational hunting. The section should briefly describe ADF&G management responsibilities and the Game Board; and include a map of Game Management Units in relation to major project features and access routes.

. Caribou: Including the map recommended under Section 3.7(b)(ii) - Resources above, would clarify the discussion.

Resource Status: The present permit system is designed to under harvest the herd so that it can continue to grow. This section should reflect the present and future management plans for this important resource, see similar comments under Chapter 3, Section 4.2(a)(ii) Population Characteristics.

The Experience Sought by Hunters: Please clarify by identifying the other area or resource to which hunting of the Nelchina herd by nearby Anchorage, Fairbanks, etc. residents is being compared.

Transportation to and from Hunting Grounds: Project impacts on hunter access, and indirectly, to the caribou herd should be discussed. We suggest coordinating the discussion with that in Chapter 3, page E-3-356, paragraph 3 and page E-3-371, paragraph 1, and our comments on those sections.

Hunting Pressure: Management changes invalidate direct comparisons between the number of hunters in 1980 and 1970. Increases of human populations should also be described. If it were not for the permitting system the hunting pressure would be much higher. Although the number of permit applicants provides a clearer picture of the importance of the herd we consider this figure to also underestimate the importance of the herd. Since the chance that an applicant would obtain a permit is low, many people are discouraged from applying. If warranted, a survey could provide an estimate of the number of people who would hunt the Nelchina herd if the permit system were removed.

To adequately evaluate potential project impacts to the herd one would need to examine ADF&G present and future managment plans, projected demand forecasts, most likely behavioral responses to the reservoirs, access routing and control, alternative reservoir filling and operation schemes, construction and public use of the access mode and routing alternatives, the tradeoffs involved in conflicting mitigative proposals, impacts of mitigative proposals on user groups, etc. We recommend that the impacts evaluation examine the aforementioned factors.

Supply and Demand for Hunting Opportunity: Again, the situation is not fully discussed. Data should be provided comparing rates of increase for both permit applications and human area populations.

Success Rate: The impact of hunting on caribou populations should be described here (e.g. see Chapter 3, pages E-3-220 to 222). Increases in herd numbers may have also contributed to the increased success rate. A map of take relative to existing and proposed project access points may aid in evaluating project impacts. An analysis of those impacts on existing supply and demand for caribou should be provided.

. Moose: Since the subject of this chapter is socioeconomics, we recommend expanding the discussion to include information on moose being the most economically important wildlife species in the region, per Chapter 3 (see page E-3-197).

Resource Status: The paragraph is inconsistent with Chapter 3 which includes 1981 data and an estimate of 4,500 moose in the upper basin. Recent and long-term ADF&G management plans for moose, as well as a map of applicable Game Management Units would help relate impacts described here to potential mitigation measures.

Transportation To and From Hunting Grounds: The discussion describes the type of data available yet fails to provide any quantification. Figures delineating present and project-related access points should be included and correlated to current hunting intensities.

Hunting Pressure: Please explain the hunting permit and/or habitat changes responsible for the significant decrease in hunters and harvest while area human populations have substantially increased. Reference to 2,859 hunters in 1981 is the same number of hunters as for 1980 in Table E-5-42. Please correct if this is not the case.

Success Rate: Refer to comment above, local human populations, permit regulations, and area moose populations are critical factors in the success rate which should be discussed.

. Other Species: We concur that a large data gap exists. The schedule for acquiring these data and incorporating them into project planning should be discussed. Once socioeconomic mitigation proposals are established, they must be examined in regard to impacts on fish and wildlife resource user groups. A tradeoff analysis would then be needed to examine conflicting mitigative proposals. Because coordination among project studies has been lacking, each study described impacts relative to optimal project management for the subject of that study, e.g. recreation, fish, moose, subsistence, power, etc. We recommend alternative management scenarios be evaluated within each study before the necessary tradeoff analysis is completed.

. Importance of Regulations: Paragraph 1: Access routes, restrictions on access, and construction schedules will also greatly influence opportunities to hunt in the project area. Quantification should be provided for possible impacts under at least two scenarios - severely restricted access and permits and open access without permits. Such analysis should be fully coordinated with ongoing big game studies and also discussed in Chapter 3. Given the substantial agency recommendations to omit any project access from the Denali Highway, and the importance of that recommendation as a wildlife mitigation measure, we recommend your analyzing the impacts on hunter access both with and without that road corridor. Additional discussion should also be provided on impacts both with and without restrictions on worker access and hunting. Again, regulation of such use is a significant mitigation measure. Quantification of possible use levels is necessary for full quantification of project impacts on moose populations in Chapter 3.

Paragraph 2: Consideration should be given to the greater losses expected for black bear than for brown bear habitat in view of the harvest regulations described here.

. Impacts on the Hunter: Factors contributing to a high quality hunt should be defined here. Availability and accessability of animals are key factors which will be affected by the project. Again, the schedule for quantifying recreational project impacts should be described. The present inability to quantify economic effects of the project is recognized as a major problem and should be resolved in the license application. The economics analysis should occur after quantification of wildlife impacts and formulation of mitigation proposals. Please refer to our comments under Sections 3.7(b)(i) and 3.7(b)(ii).

(iii) Subsistence Hunting: This section should be rewritten to more accurately reflect current laws and regulations. For example, non-residents cannot qualify as subsistence users. A complete, rather than partial, listing of all qualifications for subsistence use should be included here. The first sentence of the second paragraph pertains to a one-time only regulation which is no longer in effect. The last sentence of this paragraph is an editorial comment which should be deleted. Mention of the controversial nature of subsistence use would be appropriate. The referenced future data compilation and analysis should be provided in the Exhibit E. At a minimum, scope and scheduling of this work should be fully discussed. The concerns expressed under Section 3.7(a)(iv) Subsistence Fishing would apply to this section in regard to hunting. Please refer to Section 810 of the Alaska National Interest Lands Conservation Act (Public Law 96-487, 2 December 1980) for guidance.

(c) Furbearers

(i) Commercial Users: During the August 1982 AEA Workshop on the Susitna project, trapping was considered the primary mortality factor affecting beaver in the project area. Access, in addition to species abundance and pelt prices, is also a key determinant of trapping intensity.

- Data Limitations: Given that there are problems with available trapping data, the records which are available should be described here as a general indication of area trapping activities. We are concerned about the apparent lack of coordination with project furbearer studies which do provide some population and trapping data (see Chapter 3, pages E-3-250 to 251; E-3-253 to 256; E-3-315 to 317; E-3-321 to 322; E-3-344 to 346; E-3-361 to 362; and E-3-368.)

- Trapping Activity: Paragraph 1: Any examination of project impacts needs to examine future opportunities lost. Again, please provide whatever quantification of trapper numbers and harvest values is available. Consideration should be given to the number of additional trappers the area could support under alternative project access location and regulation alternatives.

Paragraph 3: Based on the suggested 25 mile trap line length, it is doubtful whether the project area, with projected access routes, could support more than an additional dozen trappers. There is some indication that the area may be near trapping saturation now (Furbearer Study Coordinator Phil Gipson, personal communication).

- Aquatic Species

. Baseline: Paragraph 2: To compliment and parallel the beaver discussion, information should be included on muskrat populations and habitat utilization; please refer to our comments under Section 3.7(c)(i) - Data Limitations, above.

Paragraph 3: Subsistence value of furbearer species should be identified.

Paragraph 4: References such as "abundant" and "common" should be deleted. Quantification should be available from the 1981 and 1982 field seasons for those species. Please incorporate these data into the discussion and analysis.

. Impacts of the Project: The conclusion that the access road and transmission lines would provide increased harvest opportunities through increased access appears to be in conflict with conclusions and statements offered in other chapters and sections (e.g. Chapter 3, pages E-3-317 to 323; E-3-345 to 346; E-3-360 to 363; E-3-368; and in particular, E-3-377). The statement offered in this section would lead one to conclude that open access is expected to be provided by the preferred access road and through a maintenance road for the transmission line from Watana damsite. It has been our understanding that the former has not been established and the latter was not to occur. Please refer to our comments on Sections 3.1(a)(i) - Public Recreation. Facilities: Paragraph 1 and 3.1(a)(i) - Transportation: Paragraph 1. The lost future opportunities and the potential impact that could occur to trappers due to the expected ice-free winter condition of the Susitna River above Talkeetna should be fully described in this section. The potential for furbearer populations to be trapped out, if open access is provided, should also be considered here.

- Pine Marten

. Impacts: Paragraph 1: Please refer to comments under Section 3.7(c)(i) - Aquatic Species: Impacts of the Project, above. The last two sentences are contradictory; there is some inconsistency with the last line of the second paragraph which otherwise appears to be an accidental repetition of Paragraph 1 under this section.

- Lynx: Paragraph 2: Again, quantification should be given to this trapping pressure and success rate relative to other area furbearers.

- Fox: Please refer to our comment under Section 3.7(c)(i) - Lynx, above. Consideration should also be given to project impacts on fox, as they may relate to the fox trapper (also see our comments under Chapter 3, Section 4.3(a)(xii)).

- Secondary Industries: In order to fully assess project impacts on secondary industries, the "relatively small percentage of Alaskan trappers who operate in the impact area" should be quantified here.

(ii) Recreational: Inadequacy of data base is identified. Information on this user group should be accumulated, impacts analyzed, mitigation proposed and then re-evaluated to assess effectiveness and impacts in the Exhibit E. The impact due to the loss of access across the upper Susitna River resulting from the probable loss of winter ice cover requires examination in this section.

We suggest addition of a paragraph (iii) Subsistence to complete this section. Information under paragraph 3, page E-5-84 would apply, see comment under that section (Section 3.7(c)(i) - Pine Marten o Impacts).

4 - MITIGATION: Paragraph 1: The definition should reflect that established in the APA Mitigation Policy document and the NEPA definition.

Paragraph 4: Without proper coordination between Susitna study components, actions designed to minimize one component's adverse impacts can unwittingly adversely effect the ability of another component to mitigate. The major mitigation proposals offered here are often in conflict with the mitigation goals of the fish and wildlife resources components. Greater communication, coordination must result in an open process to examine the tradeoffs when mitigation proposals are offered which may pose impacts to other components. Please refer to our comments concerning Section 3.7(c)(i) Aquatic Species which appears to indicate a lack of component coordination.

Paragraph 5: Appropriate local, State and Federal agencies need to have input to this process. Continued monitoring of changing mitigation needs in regard to compatability with mitigation goals of other components is very important.

4.2 - Mitigation Alternatives: How the goal of mitigation as expressed in this section conforms to the goals of mitigation in the APA Mitigation Policy document and the NEPA definition of mitigation should be explained.

(a) Tools that Influence the Magnitude and Geographic Distribution of Project-Induced Changes

Paragraph 3: Scheduling constraints need to be reassessed in light of the latest power needs forecasts. We recommend that the extent to which impacts could be mitigated in each study component be examined through a tradeoff analysis of the timing constraints which have been imposed.

Paragraph 4: Impacts to fish and wildlife resources, and thus indirectly to users of these resources, are related to the type of construction camp established, access provided (route and mode), and the administration of these facilities. We perceive little coordination designed to minimize impacts to fish and wildlife resources as a part of the socioeconomic analysis.

Paragraph 5: It appears as if management of the construction site is to be passive. That is, workers can come and go without restrictions. This appears to be in conflict with the statement on page E-5-91, "For this project, there will be no daily commuting." Also, the assumption that workers will maintain their existing residences would follow only if the assumption that the workers would come almost entirely from the local and regional areas households. This was strongly questioned in the previously referenced letter dated 27 May 1982 from ADCRA, and on page E-5-94, "There are at least a couple of reasons to believe that local labor might have a difficult time obtaining construction jobs."

Paragraph 8: This paragraph suffers from internal inconsistences concerning daily commuting and use of personal vehicles. Please clarify the discussion.

Paragraph 9: This section is supposed to be the mitigation plan.

Paragraph 12: The referenced studies should be coordinated with fish and wildlife resources analyses and mitigation planning. Please refer to Section 4: Paragraphs 4 and 5 for additional comments.

(b) Tools that Help Communities and Other Bodies Cope with Disruptions and Budget Deficits

Paragraph 2: In accordance with the APA Mitigation Policy document, a monitoring panel would need to be established, at project expense, consisting of representatives of appropriate local, State, and Federal agencies to carry out the function of assessing the extent of actual impacts and recommending modifications to the mitigation program. Modification of the mitigation plan in the license would be through license amendment.

Paragraph 10: Please refer to the comments immediately above (Section 4.2(b): Paragraph 2).

Paragraphs 13 and 14: The question of whether or not the labor needs of the project could be fulfilled largely through local hire (page E-5-44) or not obviously is going to substantially effect socioeconomic impacts. In that uncertainty exists, as expressed in these paragraphs and in the 27 May 1982 ADCRA letter to APA, we recommend a re-evaluation be carryed out as indicated in Section 4.3 (on page E-5-95) and incorporated into the Exhibit E.

4.3 - Impact Management Program: Paragraph 4: Item 1: In many respects the Base Case, as discussed in this document, is a minimum project impacts scenario; this opinion is clearly expressed in our Chapter 5 . General Comments. We believe that substantial uncertainty exists in key assumptions and that a multiple scenario model is in order. The study should be updated to reflect current state economic and population forecasts.

Item 2: Please refer to our comments on Section 4.2(b): Paragraph 2.

Item 3: Please refer to our comments on Section 4.2(b): Paragraph 2.

Item 4: Please refer to our comments on Section 4.2(b): Paragraph 2.

Paragraph 5: Please refer to our comments on Section 4.2(b): Paragraph 2.

Table E-5-42: We recommend the addition of population estimates and any changes in permit regulations from 1970 to 1981. The number of hunters in 1980 is attributed to 1981 on page E-5-79.

Chapter 6. GEOLOGICAL AND SOIL RESOURCES: No comments.

Chapter 7. RECREATIONAL RESOURCES

General Comments

Primary objectives of the Recreation Plan should be: a) to identify and mitigate the project related adverse impacts to the existing uses of fish and wildlife and other resources and, b) to maximize additional recreational opportunities that are not in conflict with existing uses and the resources they are based upon. This should be accomplished in the context of projected demand during the construction and operation phases of the project.

In general we find this chapter suffers from a lack of necessary information which would achieve these objectives. In particular, the chapter fails to outline alternative recreation options; evaluate the recommended plan and alternatives over the entire economic project life; distinguish between specific recreation users; recognize and identify specific responsibilities with regard to implementation and operation of the plan; and lacks specificity necessary to influence project development for the betterment of recreational opportunities.

To allow the maximum flexibility for meeting recreational demands, it is important that an array of alternative options be evaluated. This is emphasized by the lack of definitive demand projections and potential for access during the construction periods. Furthermore, we view the tremendous influx of people during the construction period as a major consideration for a recreation plan. Specific measures must be identified which will not only satisfy demand but also act as controls on overuse. The plan must also recognize the limited recreational carrying capacity of the area and deal with the fact that all demands may not be satisfied.

Identification of specific responsibilities for implementation and operation of the Recreation Plan should be included. It does not suffice to place the responsibility on the "management agencies," without a detailed coordinated effort with the agencies prior to issuance of the license. The plan must clearly identify the applicant's responsibility, the agencies' responsibility, and clearly outline the procedures to be followed. The plan must recognize the inherent restraints placed on the agencies and include as a project cost compensations of them as appropriate for mitigation of project-induced impacts.

The plan clearly fails to recognize the differences between sport, trophy, and subsistence use of particular wildlife resources. The tendency has been to lump these users as hunters with a major objective of bagging game. We submit these are clearly distinct groups and should be so recognized. Cultural differences regarding recreational pursuits have also been totally ignored in the plan.

Lastly, the plan appears to have been written in a clearly reactive mode. There is no recognition of any recreational planning initiative that has influenced the physical layout of the project. This lack of initiative has precluded development of recreational opportunities which could have avoided some impacts while maintaining a higher aesthetic quality to the recreational experience.

Specific Comments

3 - PROJECT IMPACTS ON EXISTING RECREATION

3.1 - Watana Development

(a) Reservoir

(i) Construction: The discussion in this section needs to be expanded to address non-consumptive and subsistence recreational users as well as sport and trophy hunters. Furthermore, the section needs to address the eminent competition between existing recreational users and construction workers.

(ii) Operations: Discussions should be provided to address a new recreational opportunity, i.e., boating on the reservoir, primarily for access to other areas.

(b) Talkeetna to Devil Canyon Fishery

(ii) Construction: Since a plan for flow releases during the construction and filling period has not been finalized, we do not know what effect flow will have on fishing opportunity. Mitigation measures will be aimed at maintaining existing fishing opportunities.

(ii) Operations: Since the proposed operational flow regime will likely reduce water quantity in the sloughs, we anticipate a reduction in fishing opportunity that must be mitigated, the potential for this adverse impact and appropriate mitigation should be addressed.

(d) Other Land Related Recreation

(i) Construction: Paragraph 2: Please expand and clarify the discussion. It is our understanding that the area will be open to the recreating public.

Paragraph 3: The discussion fails to address whether or not existing use shifts to other areas is dependent upon several factors; e.g., species involved, availability of and restrictions on use of those species elsewhere, existing demand already present in other areas, and cultural association with those species.

(ii) Operations: It is the responsibility of the project sponsor to identify specific mitigation measures and develop a comprehensive plan which will address this impact. "Proper control by landowners and managers," is not a mitigation measure without appropriate compensation to implement and operate the recreation plans. This cost should be identified and evaluated over the economic project life and included as a project cost.

3.3 - Access

(a) Watana Access Road

(i) Construction: Paragraph 2: Estimated recreational vehicle traffic both prior to and after 1993 should be presented.

(b) Devil Canyon Access Road

(i) Construction: Paragraph 2: Mitigation for excavation of the borrow areas could include the future use of these areas for recreation development. These measures should be specifically identified and incorporated as part of the Recreation Plan.

(ii) Operations: These "careful plans" should be a part of this document, if not, who will develop these plans and when? The associated costs should also be discussed and displayed as project costs. Also, management responsibilities during construction should be identified and discussed along with associated costs.

(d) Other Land-Related Recreation

(ii) Operation: We feel this will be a significant impact and specific plans should be identified and discussed in this document.

3.5 - Indirect Impacts -- Project-Induced Recreation Demand

(b) Assumptions: Paragraph 1: This paragraph is very confusing and needs to be clarified. In particular, that part dealing with mitigation. We would suggest, "The proposed recreation plan is designed as mitigation for recreation opportunities lost due to project development...."

Paragraph 3: Assumption 6: We would suggest that a likely scenario associated with this development will be a road access provided to the area without the project. This scenario could drastically affect your evaluation.

(c) Estimated Recreation Demand

(i) Per Capita Participation Method: Paragraph 8: This paragraph needs to be expanded to discuss how subunits were considered, since you rely on the "management agency" to control project demand, and this will be done on a unit and subunit basis.

Paragraph 17: The simplification of your methodology also does not consider that other recreation opportunities may become saturated, hence areas of low use (project area) may become much more important for future use and receive an increase in demand.

Chapter 8. AESTHETIC RESOURCES

General Comments

We find the chapter deficient in the following areas: 1) it lacks the detail necessary to distinguish the various user groups within the category "hunters and fishermen," e.g., the chapter characterized this group as only subsistence users; 2) avoidance has not been acknowledged as a mitigation measure, which could significantly reduce potential impacts; and 3) the chapter does not reference the incorporation of any mitigation measures into the project plans.

Specific Comments

3 - EXISTING ENVIRONMENT (STEP 3)

3.2 - Viewer Sensitivity (Step 4)

Types of Viewers

(A) Hunters and Fishermen: Your categorization of hunters and fishermen lacks the necessary depth to allow meaningful analysis. There are three distinct groups which must be identified and discussed, i.e., sport, subsistence, and trophy users. We submit that they are unique in their appreciation of aesthetic quality.

(D) Nonresident Outdoor Recreation Enthusiasts: Trophy hunting and fishing are readily identifiable user groups, especially in the Stephan Lake area. This should be identified and evaluated.

Expectation of Views (A): The prime concern of some users is not bagging their game or catching their limits. This distinction should be made.

5 - PROPOSED MITIGATION MEASURES (Step 9): The mitigation measures you have identified are commendable. However, there is no indication in this section that these measures have been addressed and incorporated into the project plans. Pertinent sections of the license application should be cited to show where these measures are addressed and/or reasons why they were not addressed. We are also concerned that "avoidance," as a mitigation measure has not been addressed. We refer specifically to project features which could be located elsewhere as a mitigation measure or be more easily mitigable in another location. Access routes and town sites would fall into this category.

Chapter 9. LAND USE

General Comments

With regard to Section 2.2.(d)(i), we find the chapter suffers from a lack of definitive information regarding wetlands and floodplains. These areas should be graphically displayed by type in the document. Furthermore, the chapter should discuss the specific values of these areas, their relationship with other vegetative types, and specifically address the effects of the projects on wetland and floodplains.

Mitigation measures recommended to minimize impacts to wetlands and floodplains should be discussed including alternative site locations.

This analysis is extremely important to avoid any delay necessitated to insure compliance with federal requirements with Section 404 of the Clean Water Act as amended (86 Stat. 884, U.S.C. 1344), associated regulations, guidelines and Executive Orders (11988, 11990).

Specific measures to mitigate impacts from the transmission line should also be addressed, including right-of-way management techniques.

Chapter 10. ALTERNATIVE LOCATIONS, DESIGNS, AND ENERGY SOURCES

General Comments

Mr. John Lawrence of Acres American, by letters dated 9 November 1981, requested that the FWS review the Development Selection Report and the Transmisson Corridor Report. These requests were made for the purpose of fulfilling the FERC requirements of formal pre-license application coordination. We responded to the first review request by letter dated 17 December 1981 and to the second by letter dated 5 January 1982. In that these letters were requested as part of the formal coordination process, they should be responded to at this time.

We have been requested to review the draft Exhibit E without benefit of the other draft license Exhibits. In Chapter 10 numerous references are made to other Exhibits (pp. E-10-1, E-10-1, E-10-14, E-10-16, E-10-23, E-10-28, E-10-32, E-10-38, E-10-62, E-10-81). Since we are unable to examine the other Exhibits we view this pre-license coordination as unsatisfactory. Additionally, in our examination of the Exhibit E chapters we have seen numerous examples of insufficient internal coordination and/or communication. In that this appears to be a problem within the Exhibit E, we can only assume that this problem occurs between the Exhibit E and the other Exhibits.

Examples of lack of coordination and/or communication between Chapter 10 and Chapters 2 and 3 are apparent in the discussion concerning minimum flow releases (pp. E-10-28, E-10-30), temperature modeling (pp. E-10-30, E-10-31) and socioeconomic consideration between this chapter and Chapter 5 (pp. E-10-138). These concerns are discussed within the text of our Specific Comments.

There is essentially no attempt in this chapter to assess the possibility of no Susitna project or how the Railbelt should contend with time delays of various lengths. Just listing various types of alternative energy sources does not allow an evaluation of what would, or should occur in the event that Susitna is delayed for a period of years, or is never built. We recommend that this type of planning effort be carried out to examine the effects of short-term delays and to examine long-term alternatives.

Any assessment of alternatives, needs to take into account the most current power needs projections. It is our understanding that the power projections which are being used in the license application are generally agreed to be high and are being reevaluated for submittal to FERC after the license application is submitted (Acres American Deputy Project Manager John Hayden, personal communication). The environmental implications are rather evident. Alternatives to Susitna should be examined on the basis of fulfilling future power needs rather than matching the power production of Susitna. Under previous projected power needs, it probably would have taken a combination of a greater number of individual power generating stations than under the latest projections. Several, smaller individual generating facilities should lead to greater flexibility in potential combinations and fewer adverse environmental impacts. We recommend that this be examined.

In the assessments provided on hydropower alternatives, Susitna as proposed and alternative basin developments are not evaluated on an equitable basis.

Tables are displayed which contrast the weak and strong points of these alternatives yet we never see how the Susitna project ranks. This is particularly unfortunate since Susitna would leave one with the initial impression (which is the level to which the alternatives are examined) that it would have significant adverse impacts to many of the environmental criteria (page E-10-4), including: (1) big game, (2) anadromous fish, (3) de facto wilderness, (4) cultural (subsistence), (5) recreation (existing), (6) restricted land use, and (7) access.

There is no attempt in this chapter to examine the environmental tradeoffs of the different power generation alternatives, including Susitna. Therefore, an assessment as to what would be the "best" power development for the Railbelt is not possible. Additionally, in that no single alternative source of power is contemplated to provide the same level of power as Susitna (assuming the updated future power demands projections assert that this power generation capability is needed) various power generation mixes should be examined. These alternative combination plans should then be compared to Susitna in a tradeoff analysis.

One obvious alternative power generation mix (which is further discussed in our Specific Comments) should center on the power generating capability of the West Cook Inlet area. In close proximity to each other and existing transmission lines we have Chakachamna hydropower, Beluga Coal fields, Mt. Spurr geothermal, and the West Cook Inlet natural gas fields.

Natural gas is considered by many to be a highly attractive alternative to Susitna.[17/], [18/] Yet the coverage devoted to this subject was disappointing, particularly when compared to other alternative power generating technologies. Three times as much space is devoted to nuclear power which is not generally considered as a socially acceptable alternative to Susitna. Biomass, as an energy source, received twice the coverage of natural gas, and wind power received more than four times the coverage devoted to natural gas. This confirms what we perceive as misappropriation of emphasis. Numerous reports have been issued over the last three years on the natural gas alternative, including the two footnoted below. Few reports are referenced in Section 10.3(c)(i) giving the impression that a very limited effort was expended in researching this section.

Section 10.3(f) fails to recognize the most attractive geothermal alternative, Mt. Spurr. Further discussion on this alternative is furnished in our Section 10.3(f) specific comments.

17/ Erickson, G.K. March 1981. Natural Gas and Electric Power Alternatives for the Railbelt. Legislative Affairs Agency, State of Alaska. 9 pp.

18/ Tussing, A.R., and G.K. Erickson. August 1982. Alaska Energy Planning Studies: Substantive Issues and the Effects of Recent Events (Draft). Institute for Social and Economic Research, University of Alaska. 15 pp.

Apparently no attempt has been made to assess alternatives to the proposed construction camp/village such as siting, type of camp, and administration of the camp. Alternatives to those proposed in the draft application obviously exist and need to be openly examined. These implicit decisions have large implications for the fish and wildlife resources and users. Considerations of a Prudhoe Bay type camp should be given. Construction camp alternatives should be discussed in terms of minimizing adverse impacts to fish and wildlife resources and their use. We are concerned that not only were the resource agencies not consulted previously on these actions but that communication and coordination between those responsible for this chapter and those involved in the socioeconomic, and the fish and wildlife components did not occur to a satisfactory level.

Due to the numerous inadequacies mentioned above the "concluding" Section 10.4 should not be expected to provide enlightenment regarding the consequences of license denial. It does not. Additional inadequacies are discussed in the Specific Comments which follow.

Specific Comments

10.1 - Alternative Hydroelectric Sites

(a) Non-Susitna Hydroelectric Alternatives: Paragraph 1: Reference is made to Exhibit B which was not provided, although we requested it.

(i) Screening of Candidate Sites: Paragraph 1: Reference is made to Exhibit B, which has not been furnished, although we requested it.

- Second Iteration: Paragraph 2: The criteria should reflect that: (1) just because salmon migrate above a site doesn't mean losses to anadromous fish are unavoidable (e.g. Chakachamna); and (2) just because anadromous fish are not found above a potential site, adverse impacts are avoidable (e.g. Susitna).

(ii) Basis of Evaluation: It would appear appropriate to include Susitna and within Susitna basin alternatives in the evaluation matrices.

(iii) Rank Weighting and Scoring: Paragraph 1: The interrelationships of the environmental criteria should be recognized and assessed. Dramatic changes in any one item would have repercussions to all others.

(iv) Evaluation Results: We recommend that all evaluation matrices include Susitna and within Susitna basin alternatives.

(v) Plan Formulation and Evaluation: We recommend that all evaluation matrices include Susitna and within Susitna basin alternatives.

This evaluation should be reassessed in terms of current projections for future power needs. The present examination apparently is geared toward looking at various power generation alternatives (which are not specifically described) on the basis of providing an equal amount of generating capacity to what Susitna would provide. We recommend that these alternative plans be reassessed in light of current power projections.

(c) Upper Susitna Basin Hydroelectric Alternatives: Paragraph 3: Reference is made to Exhibit B, which has not been furnished, although we requested it.

(ii) Site Screening

- Energy Contribution: Reference is made to Exhibit B, which has not been furnished, although we requested it.

(v) Comparison of Plans

- Energy Contribution: Paragraph 2: Reference is made to Exhibit B, which has not been furnished, although we have requested it.

10.2 - Alternative Facility Deisgns

(a) Watana Facility Design Alternatives

(i) Diversion/Emergency Release Facilities: Paragraph 1: Reference is made to Exhibit B, which has not been furnished, although we requested it.

It is stated that, "Tables B.61 and B.62 of Exhibit B show the minimum flow releases from the Watana and Devil Canyon dams required to maintain an adequate flow at Gold Creek. These release levels have been established to avoid adverse affects on the Salmon [SIC] fishery downstream." Perhaps a more accurate appraisal can be found in Chapter 4 (page E-4-3), "The impact of . . . upriver and downriver changes in hydrology . . . cannot be assessed at this time due to the lack of information concerning the amount, type and location of disturbances associated with these activities." In Chapters 2 and 3 it is stated that the reduced flows could impair fish migration, de-water spawning and rearing habitat, prevent access to slough and side channel habitats and lower or eliminate intragravel flows to slough and side channel spawning grounds. The minimum flows proposed were not developed using any recognized instream flow methodologies, and lack any biological basis other than the most rudimentary. In fact, no explanation is offered in the Exhibit E as to how the 12,000 cfs minimum operating flows for August and into September were arrived at.

(iii) Power Intake and Water Passages: Paragraph 2: The statement is made that a multi-intake structure would be used, ". . . in order to control the downstream river temperatures within acceptable limits." The Watana and Devil Canyon dams will cause changes to the existing water temperature of the Susitna River, generally releasing cooler water during summer months and warmer water in winter. This, in turn, may present significant impact to the downstream riverine environment. Temperature variations may affect the ability of fish to migrate, spawn, feed, and develop in the Susitna system. Ice formation may be delayed or possibly not occur above Talkeetna. This issue is discussed at length in Chapters 2 and 3 although an accurate description of post-project temperature impacts is not presented. The model which was developed to describe reservoir outflow temperatures contains input data from only five months (June through October) of one year (1981). The Devil Canyon Reservoir was not modeled, but in Chapter 2 it is stated that the location of ice formation (above Talkeetna) will depend on the outflow temperature from Devil Canyon dam (page E-2-83).

Paragraph 3: Please reference our comments on Section 10.2(a)(i) concerning minimum flows.

(b) Devil Canyon Facility Design Alternatives

(iii) Power Intake and Water Passages: Paragraph 2: Please refer to our comments on Section 10.2(a)(iii) concerning temperature modeling.

Paragraph 3: It should be clarified what "normally" and "the requirements of no significant daily variation in power flow" mean, particularly in regard to fish and wildlife resource impacts.

(c) Access Alternatives

(i) Plan Selection: Paragraph 2: Although input was solicited from resource agencies and the Susitna Hydro Steering Committee (SHSC), the selection certainly did not reflect this input. Please reference the SHSC letter dated 5 November 1981. In addition, we wish to incorporate into our comments, by reference, our letter dated 17 August 1982 to Eric Yould on this subject. As such, APA should respond to this letter as a part of our formal pre-license coordination.

(ii) Plan Evaluation: Paragraph 1: Reference is made to Exhibit B, which has not been furnished, although we requested it.

Item Number 5: Paragraph 1: It is acknowledged that a problem exists in the potential of the access road and traffic to affect caribou movements, population size, and productivity. Avoidance of the problem by eliminating the Denali Highway to Watana access segment would be consistent with the APA Mitigation Policy document, the recommendations of the resource agencies, and NEPA. As is stated in Appendix B.3 of the Susitna Hydroelectric Project Access Plan Recommendation Report (August, 1982), "From a caribou conservation viewpoint, the Denali access route is far less desirable than proposed routes originating on the Alaska Railroad and Parks Highway. The Denali route would most certainly have immediate detrimental impacts on the resident subherd and future negative impacts on the main Nelchina herd although these impacts cannot be quantified."

Item Number 7: Paragraph 5: Both the APA Mitigation Policy document and NEPA acknowledge that it is better to avoid an adverse impact than to try to minimize it, "through proper engineering design and prudent management." APA's approach should better reflect this in their decisions concerning access routing. In addition, reference is made to discussion "in Exhibit E." This is the Exhibit E.

(d) Transmission Alternatives: By letter dated 9 November 1982, Mr. John Lawrence of Acres American requested our review of the Transmission Corridor Report as part of the formal pre-license coordination process. We responded by letter dated 5 January 1982. In that it was requested as part of this formal pre-license coordination process and we responded with this understanding, the issues raised and recommendations made in that letter should be addressed at this time.

(iii) Identification of Corridors: Paragraph 2: Reference is made to Exhibit B, which has not been furnished, altnough we requested it.

(vi) Screening Results

- Central Study Area

Corridors Technically and Economically Acceptable

o Corridor One (ABCD) - Watana to the Intertie via South Shore of the Susitna River

. Environmental: Given the APA decision to have road access for the Watana damsite to the Devil Canyon damsite along the north side of the river, we do not understand how it can be considered best environmentally (rating of "A") to have the transmission line along the south side of the Susitna River. In our 5 January 1982 letter we stated, "How construction - and maintenance-related access is obtained to a great extent determines the project-related wildlife and socioeconomic impacts. Construction and maintenance of transmission lines should not provide for additional public access over that provided by the dam access route." and, "Access to the dams should be fully coordinated with transmission line routing. Access corridors which serve a dual purpose in regard to project access needs would be highly desirable from several decision-making criteria." This potential for increased access provided by the transmission line routing is readily acknowledged elsewhere in the Exhibit E (page E-5-84). This apparent inconsistency needs to be clarified.

o Corridor Thirteen (ABCF) - Watana to Devil Canyon via South Shore, Devil Canyon to Intertie via North Shore, Susitna River

. Environmental: Please refer to our comments above on Corridor One (ABCD).

(ix) Results and Conclusions: Paragraph 3: Reference is made to Exhibit G which was not provided, although we requested it.

(e) Borrow Site Alternatives: Unless unavoidable, borrow sites should be restricted to within the future impoundments and/or to upland sites. Selection should be coordinated with access and transmission line routing and with resource agencies. We have not previously been contacted for the purpose of providing input and we do not have any project plans or assessments upon which to provide specific input.

No attempt is offered to assess the environmental tradeoffs that would be made by selecting one borrow site alternative over another. We have assumed this is the underlying intent of including this type of alternatives comparison in the environmental Exhibit E. We recommend that this be undertaken to an equal level for alternative borrow sites, access routes, transmission routes, and other alternative project features.

10.3 - Alternative Electrical Energy Sources

(a) Coal-Fired Generation Alternative

There are three main deficiencies in the discussion of Beluga Coal development as an alternative to the Susitna project:

1. No quantitative estimates of the areas or resources to be affected by coal development are included. We recommend you include a description of: (a) schedules for development; (b) area fish and wildlife populations; (c) habitat types and areas to be disturbed, altered, or destroyed; (d) construction and operation work forces necessary for project development; (e) magnitude of commercial, recreational, and subsistence use of Beluga area fish and wildlife resource; and (f) numbers of fish and wildlife which may be impacted by project development.

   We realize that such information is still very tentative for the Beluga project and project impacts have barely been evaluated. However, recent field studies should allow you to approximate the magnitude of the resources involved and potential for impacts to them.

2. A direct comparison with Susitna development plans and anticipated impacts is lacking. Comparison of the information identified in 1., above, with similar information for the Susitna project should be provided. For example, the commercial, recreational, and subsistence harvests and pressures for use of the Beluga area should be compared to Susitna area resources. Acreages and habitat types that would be impacted by alternative development scenarios should be compared. The magnitudes of project impacts relative to fish and wildlife needs to be analyzed. Also, the work force and time frame which would be required for Susitna should be compared to Beluga developments, for the same power needs.

3. Reasons for rejecting Beluga coal-fired generation or Beluga coal in combination with smaller hydroelectric projects or other energy sources, as an alternative to development of Susitna hydropower are not given.

Paragraph 1: Since we were not provided with a copy of Exhibit B, we cannot comment on the adequacy of the referenced analysis of the economic feasibility of Beluga Coal. We would hope the analysis includes discussion of private financial backing for Beluga Coal development as compared to State financing involved with the Susitna project. Further discussion of the feasibility of alternative Beluga development schemes may be found in a State report by Gene Rutledge, Darlene Lane, and Greg Edblem, 1980, Alaska Regional Energy Resources Planning Project, Phase 2, Coal, Hydroelectric, and Energy Alternatives, Volume 1, Beluga Coal District Analysis. Current soft foreign market conditions are exemplified by recent slow downs of the most active Beluga coal lease-holders in completing ongoing environmental studies necessary for permitting. It would be helpful to know to what extent the State is working with the private leaseholders to consider State use of any portion of Beluga Coal production. We understand that the lease holders do not expect to complete financial feasibility studies before the second half of 1983.

Paragraph 2: Although specifics of plant design and location are not yet available, more detailed information can be provided on the magnitude, and probable initial development alternatives, including export of Beluga coal to Pacific Rim countries. We recommend addition of an area map with locations of existing leases, potential camps and development facilities, and alternative transportation and transmission corridors.

Paragraph 3: We recommend expanding this paragraph to consider the availability and probability of coal development in Southcentral Alaska. According to current industry plans, Beluga coal resources are sufficient to allow mining for export of 5 million tons per year (with possible expansion to 10 million tons) on Beluga Coal Company leases and 6 to 13 million tons per year from the 20,500 acre Diamond Alaska Coal Company lease for at least 30 years.[19] The availability of this or other developments as an energy source for Alaska has been increased with recent State promotions of additional coal exploration. The State has proposed a competitive coal lease sale during the first half of 1983 for 25,000 acres near Beluga Lake. Also under consideration is a non-competitive coal rights disposal west of the Susitna River. Moreover, Bering River coal development has been the subject of recent proposals for exploration and environmental studies.

(i) Existing Environmental Condition: As described earlier, the qualitative discussion provided here allows no comparison with the Susitna project. We recommend describing detailed U.S. Forest Service and Soil Conservation Service data for the area and ongoing studies which should result in a more detailed classification of area vegetation.

The predominance of wetlands, particularly near the coast, are discernable on FWS' National Wetland Inventory maps available for the area. Those wetlands are particularly important habitats for the diverse bird life described in later paragraphs.

o Fauna, Paragraph 1: Clarification is necessary regarding the referenced "Selvon fishery".

Paragraph 2: We recommend describing numbers of bald eagle and trumpeter swan nests relative to numbers in the Susitna project area.

- Aquatic Ecosystem: Additional information should be provided on the quantity and quality of this system (e.g. the extent to which spawning, rearing, and overwintering areas have been identified within and downstream of the lease areas).

- Marine Ecosystem: Although species presence is described, there is no quantitative information on their relative abundance, or habitat quality. Figures cited for the referenced Cook Inlet fishery is dependent upon Beluga, Susitna, and other area systems. An assessment of the proportion of that fishery which depends on the Beluga system compared to the Susitna system should be provided.

19/ Beluga Coal Company and Diamond Alaska Coal Company. January 1982. Overview of Beluga Area Coal Development Projects.

- Socioeconomic Conditions: The discussion should be expanded to cover current levels of commercial, subsistence, and recreational fish and wildlife use.

(ii) Environmental Impacts

- Air Quality: The potential for mitigating the air pollutants described here should be discussed.

- Terrestrial Ecosystems: The range of terrestrial habitat to be annually impacted should be quantified and compared with Susitna development plans. In addition to habitats disturbed by mining, project features such as roads and transmission corridors which could be expected with coal development should be described. While the road system required for coal development should be substantialy less than that for the Susitna project, the potential for restoring mined lands to original habitat values is untested for the area.

Paragraph 2: ADF&G harvest data should be included here. The correlation between hunting pressure and current access should also be discussed in quantifying roads and human population increases anticipated from Beluga Coal development. Human/wildlife conflicts (e.g. bears shot in defense of life or property, wildlife mortality from additional vehicle traffic and roads) is another critical impact not mentioned here.

- Aquatic and Marine Ecosystems: Some quantification of anticipated impacts can be made and should be included here. Development of both Beluga Coal Company's and Diamond Alaska Coal Company's lease holdings could eliminate nine stream-miles of existing anadromous and resident fish habitat. Stream restoration to original habitat quality will be difficult, to impossible, to attain. According to preliminary flow information, nearly half the total flow in the Chuitna River originates in or flows through the proposed mine pits. Assuming that half the anadromous fish production is lost from the Chuitna system, ADF&G estimates the annual loss of fish available to Cook Inlet fisheries will be within the following ranges:

Pink Salmon	70,000 - 650,000 mean = 275,000
Coho Salmon	5,250 - 48,750 mean = 20,625
King Salmon	2,100 - 19,500 mean = 8,250
Chum Salmon	700 - 6,500 mean = 2,750
Total Salmon	78,050 - 724,750 mean = 306,625

We recommend contrasting this information with preliminary impact assessments for Susitna and other alternative project developments in the license application. The comparison should also cover resident fish species, big game and furbearer populations and harvest levels, and areas and types of habitats to be altered or destroyed. Data gaps and uncertainties should be clarified in an accompanying discussion.

- Socioeconomic Conditions: Recently published reports by the ADF&G document the magnitude of subsistence hunting and fishing by Tyonek area residents.20/, 21/, 22/ We recommend that you discuss these findings in assessing fish and wildlife resource uses which may be affected by Beluga coal development.

A general discussion of the socioeconomic impacts on Tyonek from developing Susitna or Chakachamna hydropower projects, as compared to Beluga coal development is given in a recent report for the ADCRA.23/ Tyonek apparently supports coal development as long as it does not inhibit their ability to subsistence hunt and fish. Consideration should be given to similar local support or opposition to the Susitna project.

Although the purpose of this section is to describe Beluga as an alternative to Susitna, Beluga coal development would undoubtedly include additional mining for export. Thus while the discussion appropriately describes the incremental workers associated with the power generation facilities only, the entire development will influence the permanence of the workforce. The report is confusing in the discussion on whether a fly-in construction camp or permanent townsite is to be established (see pages E-10-81(a) paragraph 3, E-10-88, last two paragraphs, and E-10-89, paragraph 1). Some discussion is needed of both alternatives, resultant impacts on fish and wildlife uses, and the potential for mitigation.

20/ Foster, Dan. November 1982. The utilization of king salmon and the annual round of resource uses in Tyonek, Alaska. ADF&G, Division of Subsistence, Anchorage. 62 pp. (see page 36 for data on fish and wildife harvest).

21/ ________. March 1982. Tyonik moose utilization, 1981. ADF&G, Division of Subsistence, Anchorage. 29 pp. + appendices.

22/ Stanek, Ronald T., James Fall, and Dan Foster. March 1982. Subsistence shellfish use in three Cook Inlet Villages, 1981: A preliminary report. ADF&G, Division of Subsistence, Anchorage. 28 pp.

23/ Darbyshire and Associates. December 1981. Socioeconomic impact study of resource development in the Tyonek/Beluga coal area. Anchorage, Alaska.

(c) Thermal Alternatives other than Coal

(i) Natural Gas: In that natural gas is considered by many to be the best single source alternative to Susitna 24/, 25/ it is disconcerting to see so minimal an effort expended examining this alternative. The effort should be at least equal to that provided to the assessment of alternative hydropower sites and coal. Anything less must be considered inadequate. No examination specific to natural gas in regard to potential environmental impacts is provided nor is a tradeoff examination of natural gas, and other alternatives. Without this, one cannot determine whether or not a proposal is the best of all alternatives.

Discussion should be provided on the potential impact of the recent signing of natural gas supply contracts between the Enstar Corporation and Marathon and Shell Oil Companies. Discussion should focus on the impacts of these contracts, if approved, not only on allocated natural gas reserves, but also on predicting future use, pricing, potential future demand of electricity for home heating through the Matanuska-Susitna Borough, and future availability and pricing of natural gas for electrical energy generation.

(iv) Environmental Considerations: It is unclear as to what this section is in reference to. If it is meant to cover all types of fossil fuel burning power plants, it is insufficient. We do not consider the potential environmental impacts of burning natural gas to be the same as for diesel, oil, or coal. We recommend that environmental considerations be examined separately for each of these fuel alternatives. Then they should be examined through a tradeoff analysis which would include Susitna, as proposed, other hydropower projects, and alternative within basin alternatives, and other alternatives to Susitna.

Much of the section centers on the potential impacts/problems which would occur with increased dependence on coal for power generation. Given that the section is entitled (c) Thermal Alternatives other than Coal this would seem inappropriate.

(f) Geothermal: This section fails to recognize, other than parenthetically, the most attractive geothermal alternative, Mt. Spurr. We therefore, recommend that APA examine the feasibility of geothermal energy development at this site as an alternative to Susitna. Mt. Spurr is being considered by the Division of Minerals and Energy Management of the ADNR as their first

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24/ Erickson, G.K. March 1981. Natural Gas and Electric Power Alternatives for the Railbelt. Legislative Affairs Agency, State of Alaska. 9 pp.

25/ Tussing, A.R., and G.K. Erickson. August 1982. Alaska Energy Planning Studies: Substantive Issues and the Effects of Recent Events (Draft). Institute for Social and Economic Research, University of Alaska. 15 pp.

geothermal lease sale area. They concluded it is the best potential geothermal development site within their jurisdiction. It is being proposed because: (1) it has high potential; (2) it is located on State land; and (3) it is close to existing transmission lines (Beluga Station). In addition, it is in an area already being explored for power development, being located between the Chakachatna River and the Beluga Coal fields, and the area is crisscrossed by logging roads. It would also seem logical to explore the possibility of a West Cook Inlet power generation alternative to Susitna. This combination would be composed of Mt. Spurr geothermal, Chakachamna hydropower, Beluga coal, and West Cook Inlet natural gas. Obvious advantages would be found in the isolation of adverse environmental impacts to a relatively small area which already has transmission facilities.

10.4 Environmental Consequences of License Denial: This section provides little insight as to what might occur if Susitna were not built. We hope that a greater planning effort is ongoing to allow the State to adequately address this issue. It would seem that the first approach to this problem would involve a tradeoff analysis, looking at environmental as well as other issues, to examine appropriate alternatives to the Susitna project. The analysis should be directed at: (1) short-term planning, in the event that Susitna is delayed for various lengths of time; and (2) long-term planning so that we do have a fall back plan in the event that Susitna is not licensed. We recommend that this be undertaken.

There is no examination of socioeconomic impacts in the event that the Susitna project license is denied. We consider the potential for a boom-bust occurrence to be great with construction of Susitna. Without Susitna we, therefore, would consider this as much less likely. In the event we do not have Susitna, we would expect the construction of much smaller power generation units which would come on-line over a much longer period of time. We recommend that the socioeconomic implications of license denial be assessed.

STATE OF ALASKA
DEPT. OF ENVIRONMENTAL CONSERVATION

SOUTHCENTRAL REGIONAL OFFICE

BILL SHEFFIELD, GOVERNOR

437 E. STREET SECOND FLOOR ANCHORAGE, ALASKA 99501 (907) 274-2533

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P.O. BOX 1709 VALDEZ, ALASKA 99686 (907) 835-4698

P.O. BOX 1064 WASILLA, ALASKA 99687 (907) 376-5038

January 21, 1983

RECEIVED

JAN 21 1983

ALASKA POWER AUTHORITY

Mr. Eric Yould
Executive Director
Alaska Power Authority
334 West 5th Avenue
Anchorage, Alaska 99501

Dear Mr. Yould:

The Alaska Department of Environmental Conservation is pleased to respond to the Alaska Power Authority's request for comments on the Susitna Hydroelectric Project, Federal Energy Regulatory License Application, Exhibit E. These comments are organized into seven primary categories and are presented below.

A. Water Quality

1. The discussion on water quality impacts is well done for both the Watana and Devil Canyon dams. The major impact to water quality is from a change in the downstream water temperature that will occur with the project operation. The Reservoir Temperature Model (DVRESM) is designed to predict reservoir outflow temperatures to an accuracy of ±2°C. That is a range of variation of 4°C. A difference of 4°C in predicted outflow temperatures could have a significant effect on the actual versus the predicted impact on downstream fisheries. This modeling effort should be developed to predict reservoir operating parameters when using a given downstream impact, essentially working the model backwards. Accurate estimates of the predicted downstream river temperatures are an essential component of the impact assessment process.

2. The sheer magnitude of the construction project will create a high potential for soil erosion that may affect water quality. The Exhibit E needs to be more specific on how these problems will be mitigated. Methodologies need to be described in detail for construction of the road, dam and townsites, and other project entities.

B. Hazardous Substances

A very large amount of hazardous substances will be transported to, and utilized at, the project site. Discharges of hazardous substances could contaminate land as well as surface and ground water. Further impacts could occur to human welfare, fish, and wildlife.

The Exhibit E document does not address the major possible sources of fuel spills, but rather the minor ones (leaky hydraulic lines and water pumps). A very detailed oil spill contingency plan needs to be developed that will have several major objectives and be written to account for a major (i.e., tank truck roll-over), as well as a minor spill event.

The plan should be responsive to project needs and yet be simple enough to be functional. Major objectives of the plan are discussed in detail below:

1. To develop a training program that will stress spill prevention. This program needs to cover spill response under all project conditions and set up several response scenarios.

2. To develop the response capability to adequately handle the worst case spill expected. This response capability should be developed for the Watana and Devil Canyon camps and the railhead staging area. This would mean staging spill cleanup equipment at all sites. All hazardous substances that will be used on site need to be considered (solvents, chemical additives, etc.).

3. To develop an immediate response team for each work shift, consisting of personnel dedicated to spill containment and cleanup, should a discharge incident occur. This response team would have a designated leader who would direct the team. A complete training program in spill response for this team would be essential.

4. To contain a small section on the project area environment. This would include a map of major drainage areas, fish habitat and seasonal descriptions, and wildlife habitat and seasonal descriptions. The environmental section is very important in prioritizing spill response actions (i.e., most sensitive areas first), and for developing an appreciation for the impact a spill can have.

C. Wastewater Treatment

The type of wastewater treatment plant to be used at each camp site has to be described in greater detail to more adequately evaluate its effectiveness. The discharge from the Watana treatment facility may not meet fecal coliform standards because of inadequate dilution. The discharge zone should be well defined for both facilities. The Watana and Devil Canyon camp wastewater treatment plants are to be functioning and approved before each camp is in operation.

D. Concrete Batching Plant

Potential impacts that may occur from the concrete production process are not described in enough detail. The discharge from this process will also have, in addition to pH changes, problems with siltation, turbidity and possibly toxic additives used in the curing process. Siltation from concrete can form a mat over substrate gravels. This could suffocate emerging salmon fry or other indigenous organisms that require substrate habitat. Discharges that may have toxic concrete additives as a component may kill aquatic organisms. The batching process may also have airborne particulate problems. Specific control measures need to be described in detail for each type of problem that may be encountered.

E. Access Corridors

The access route (Plan 17) was determined, during the access route selection process, to have greater potential for major environmental impacts than the other route options. The major impacts of concern were:

1. The Denali Highway to Watana Dam site portion passes through habitat that has historically been used by portions of the Nelchina caribou herd.

2. Many native grayling streams can potentially be affected during the construction of the Denali Highway to Watana Dam site access section.

3. Access along the south side of the Susitna River from the Watana to Devil Canyon Dam sites passes through the Stephan Lake region. This region is important habitat for moose, wintering caribou, migrating waterfowl, and fur bearers.

4. Wetlands habitat is crossed southwest of Devil Canyon.

Because of the greater potential for major impacts associated with the Plan 17 access option, more attention should be given to defining the methods that will be implemented to mitigate these impacts. For example:

1. How will the access route be designed to minimize disruption to the caribou herd?

2. What technique will be implemented to prevent impacts to native grayling streams from road construction?

3. How will impacts to the Stephan Lake region be reduced?

4. How will project and post-project access be controlled to prevent secondary impacts related to access?

F. Fishery Impact Assessment

The field data base is incomplete for an accurate prediction of the impact the Susitna Hydroelectric Project will have on fishery resources. A good set of data has been collected for only two years. Fishery population and related water quality data can have inherent fluctuations from year to year. Long term, large-scale programs need to be implemented in order to make a reasonably accurate population estimate. Very specific detailed studies designed to correlate physical and chemical aspects of the aquatic habitat to population fluctuations need to be part of the long term program. This program should be continued through project construction.

If impacts cannot be accurately predicted, a worst case (100% loss) estimate of the fishery population should be assumed and the implications this impact would have to the aquatic community and related resource use need to be discussed. By assuming a worst case estimate, a type of mitigation program can then be developed where compensation to the fishery population can occur to result in an acceptable loss.

A long term post-project aquatic monitoring program should be developed as an integral part of the project. Funds should be allocated in advance to insure the continued existance of this program. The monitoring program is essential to determine the effectiveness of mitigation measures that are implemented.

G. Interagency Review Board

It is strongly recommended that a formal interagency review board be established to work with the Alaska Power Authority in the development of the Susitna Hydroelectric Project. This board will identify and comment on socioeconomic and environmental issues and regulatory requirements. It is suggested that the Formal Designation of the Susitna Technical Advisory Committee (see attached memo to you dated November 17, 1982) be implemented to accomodate this recommendation.

Once project construction begins, a similar interagency board should be established to monitor the socioeconomic and environmental impacts and regulatory compliance. This board would make recommendations to the Alaska Power Authority to correct associated problems as necessary.

The Alaska Department of Environmental Conservation appreciates this opportunity to comment on the Susitna Hydroelectric Project, Federal Energy Regulatory License Application, Exhibit E and hopes that these comments will be useful to you. If you have any questions, or if we can be of further assistance, do not hesitate to contact Bob Martin or Steve Zrake in Anchorage.

Sincerely,

Richard A. Nevé
Commissioner

Attachment
cc: Bob Martin, ADEC, Anchorage
Steve Zrake, ADEC, Anchorage
Su-Hydro Steering Committee

MEMORANDUM

State of Alaska

TO: Board of Directors
Alaska Power Authority

DATE: November 17, 1982 RECEIVED

JAN 21 1983

FILE NO:

TELEPHONE NO: 274-2533 ALASKA POWER AUTHORITY

FROM: Al Carson, Chairman
Susitna Hydro
Steering Committee

SUBJECT: Formal Designation of the
Susitna Technical
Advisory Committee

INTRODUCTION:

The Susitna Hydro Steering Committee was established in 1979 as an ad hoc advisory group comprised of representatives of State and federal agencies to provide comments and advice to the Alaska Power Authority (APA) staff regarding feasibility studies of the Susitna Hydroelectric Project. The group has met on an "as needed" basis over a period of some two years, reviewing reports prepared for the Susitna Feasibility Study by various contract consultants to the Power Authority. In recent testimony before the Power Authority Board the majority of State and Federal agencies expressed the need for a more formal mechanism to provide advice to the APA staff and Board on a variety of subjects relating to Susitna. In response to agencies testimony on this topic, the A.P.A. Board requested that a charter and agreement be drafted to formalize the advisory relationship between the State and federal regulatory agencies and the APA. Therefore, we recommend that the following organization and charter be considered for adoption.

FORMAL ORGANIZATION & CHARTER:

It is proposed that an interagency, interdisciplinary organization of State and federal personnel be established to provide advice and comment on feasibility studies and FERC applications to the Alaska Power Authority staff and Board of Directors. The focus of this Susitna Technical Advisory Committee (STAC) would be in an advisory capacity to comment on the adequacy of studies done for the FERC application for the Susitna Project. The committee would be charged with advising the APA staff and Board on the acceptability of feasibility and mitigation studies. The charter includes the formal designation of agency representatives, and a memorandum of agreement (attached) which all parties would be signatory to. The committee's tasks would be specified in detail via the cooperative agreement.

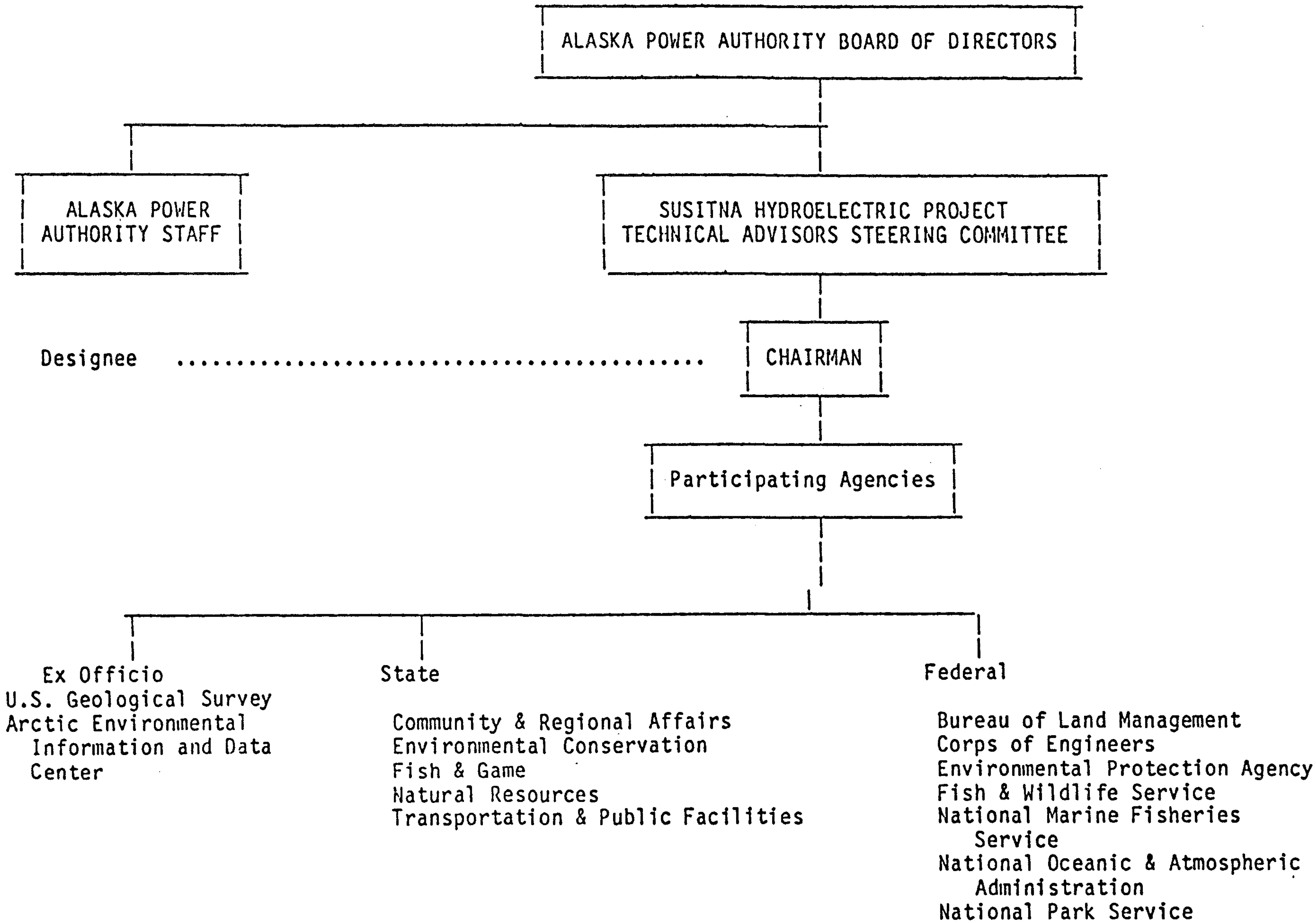
The APA staff would commit sufficient support to the STAC to provide clerical assistance in typing and mailing information and STAC meeting minutes to STAC members. In addition, the APA staff would provide briefings by its staff, contractors and External Review Panel members on those project matters germane to the STAC. Formal STAC participation would be limited to those agencies which share a responsibility for reviewing and/or issuing permits for the project. The respective State and federal agencies in cooperation with the APA Staff will provide advice on the State and federal permit activities and with the FERC licensing process. This agreement in no way affects, binds or changes the authority or responsibility of any participating agency with respect to project permitting or formal comments and recommendations to FERC.

PROPOSED ORGANIZATION CHART:

The following chart (attached) represents a proposed organization of the State and federal agencies to coordinate with and advise the APA Board regarding all technical aspects of the Susitna Hydroelectric Project.

ORGANIZATION AND SCOPE:

The Susitna Technical Advisory Committee (STAC) would operate in an advisory capacity to the APA staff and Board. The APA would provide staff assistance to the STAC. The focus of this organization is to provide advice on studies and required permits, appropriate to assist the APA to meet the goal of fulfilling the Exhibit E requirements of the FERC license application (Federal Register, Vol. 46, #219, November 13, 1981).


ALASKA POWER AUTHORITY BOARD OF DIRECTORS
ALASKA POWER AUTHORITY STAFF
SUSITNA HYDROELECTRIC PROJECT TECHNICAL ADVISORS STEERING COMMITTEE
Designee
CHAIRMAN
Participating Agencies
Ex Officio
U.S. Geological Survey
Arctic Environmental Information and Data Center
State
Community & Regional Affairs
Environmental Conservation
Fish & Game
Natural Resources
Transportation & Public Facilities
Federal
Bureau of Land Management
Corps of Engineers
Environmental Protection Agency
Fish & Wildlife Service
National Marine Fisheries Service
National Oceanic & Atmospheric Administration
National Park Service

COOPERATIVE AGREEMENT
Between
the State of Alaska Resource Agencies,
the Federal Resource Agencies,
and the Alaska Power Authority
Board of Directors

This cooperative agreement formalizes an interagency, interdisciplinary Susitna Technical Advisory Committee (STAC) to be staffed by both State and federal resource agencies to provide the APA staff and Board of Directors assistance in assessing the feasibility of the Susitna Hydroelectric Project. The State agencies, including the Alaska Departments of Community & Regional Affairs, Environmental Conservation, Fish & Game, Natural Resources, and Transportation & Public Facilities and the federal agencies including the Bureau of Land Management, Corps of Engineers, Environmental Protection Agency, Fish & Wildlife Service, National Park Service, and National Oceanic & Atmospheric Administration, agree to serve collectively, as described herein, in an advisory capacity regarding the utility, relevance and appropriateness of studies funded by the APA for the Susitna Hydroelectric Project through possible licensing and implementation. This agreement in no way affects, binds or changes the authority or responsibility of any participating agency with respect to project permitting or formal comments and recommendations to FERC.

Terms of the Agreement

Each agency agrees to designate an appropriate level official to serve as the representative to the STAC and to provide the necessary support to enable its representative to the STAC to advise the APA staff and Board on regulatory requirements associated with developing the Susitna Hydroelectric Project. It is agreed that the objective of the STAC is to identify the socio-economic and environmental issues that should be addressed in order to assist the APA to comply with the FERC licensing process. It is further agreed, that the STAC will provide in writing, comments to the APA staff and Board:

a) on study requests for proposal(s) and scope(s) of work required to meet permiting and FERC licensing requirements;

b) on draft technical study documents;

c) on compatibility of study products with agency management objectives, guidelines and criteria;

d) regarding analysis and investigation necessary to determine mitigation measures;

e) on project timing as it may relate to regulatory matters;

f) regarding coordination issues within the purview of the STAC.

It is further agreed that the participants shall designate a chairman from their members for the STAC, and that the STAC will provide a written report as needed to the APA staff, Board and participating agency administrators.

It is agreed that the APA staff and Board will:

a) provide clerical support to type meeting minutes and mail information to STAC members;

b) provide to the STAC access to appropriate project documentation and presentation of briefings by APA staff, contractors and External Review Panel members on relevant project matters.

c) respond in writing to STAC requests, correspondence and recommendations within 15 days of receipt.

Amendments to this Agreement become effective upon approval of all signatores. This Agreement becomes effective on signature by all parties, and remains in force until terminated by mutual consent.

STATE OF ALASKA

Alaska Power Authority

by ______________________
Chuck Conway
Chairman of the Board

by ______________________
Eric Yould
Executive Director

Departments of:

Community & Regional Affairs

by ______________________
Lee McAnerney, Commissioner

Environmental Conservation

by ______________________
Ernst W. Mueller, Commissioner

Fish & Game

by ______________________
Ronald O. Skoog, Commissioner

Natural Resources

by ______________________
John Katz, Commissioner

Transportation & Public Facilities

by ______________________
Robert W. Ward, Commissioner

FEDERAL AGENCIES

Bureau of Land Management

by ______________________
Curt McVee, State Director

Corps of Engineers

by ______________________
Colonel Neil Saling
District Engineer

Environmental Protection Agency

by ______________________
Ron Kriezenbeck, Director
Alaska Operations Office

Fish & Wildlife Service

by ______________________
Keith Schreiner, Regional Director

National Oceanic & Atmospheric Administration

by ______________________
Robert McVey, Regional Director-NMFS

National Park Service

by ______________________
John Cook, Regional Director

Effective this ___ day of ____, 1982.

January 21, 1983

Mr. Keith Bayha
Regional Director
U.S. Department of the Interior
Fish & Wildlife Service
1011 East Tudor Road
Anchorage, Alaska 99503

Dear Mr. Bayha:

Thank you very much for your timely and thorough response to our recent request for consultation on the Susitna Hydroelectric Project. realize how imposing the draft Federal Energy Regulatory Commission (FERC) license application was and the extensive staff resources needed to carefully review it.

Your comments relating to proposed mitigation measures will be integrated into the appropriate chapters of Exhibit E. Your letter will appear in its entirety in a new chapter of the Exhibit and will be accompanied by our responses.

In some cases, we will have fully addressed your concern in the rewritten Exhibit E, in others we will identify ongoing work which will lead to acceptable answers. Also, there will be instances where we will need to insure that the coming year's study program is designed to provide the information you identify as being lacking. Over the next several months you will be asked to review the study plan so we can be confident the program will result in the desired information.

It is my firm belief that the extent of the Susitna project's impact, prior to mitigation, has been well defined. A mitigation approach has been proposed, but it will need to be refined over time as the effectiveness of the various measures are more fully evaluated. The environmental study program will then be continued to monitor that effectiveness.

Sincerely,

Eric P. Yould
Executive Director

ALASKA POWER AUTHORITY

Distribution List
Susitna Hydroelectric Project

Mr. Keith Bayha
Regional Director
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Ms. Esther Wunnicke
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Mr. Robert W. McVey
Director, Alaska Region
U.S. Department of Commerce
National Oceanic & Atmospheric
 Administration
National Marine Fisheries Service
P.O. Box 1668
Juneau, Alaska 99802

February 4, 1983

Mr. Keith Bayha
Regional Director
U.S. Department of the Interior
Fish & Wildlife Service
1011 East Tudor Road
Anchorage, Alaska 99503

SUBJECT: Agency Comments Draft Exhibit E (November 1982)
Susitna Hydroelectric Project

Dear Mr. Bayha:

As a follow-up to our January 24, 1983, letter regarding your agency's draft Exhibit E comments, be advised that we will address all comments, point by point, in Exhibit E, Chapter 11, "Agency Consultation" of the formal application.

When the Application is submitted to the Federal Energy Regulatory Commission, we will provide you with a complete license application, including Chapter 11. We anticipate that you will receive your copy during the first week of March 1983.

Thank you for your past responsiveness, and do not hesitate to contact us if you have any questions.

Sincerely,

Eric P. Yould
Executive Director

ALASKA POWER AUTHORITY

Distribution List
Susitna Hydroelectric Project

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U.S. Department of the Interior
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 Administration
National Marine Fisheries Service
P.O. Box 1668
Juneau, Alaska 99802

February 2, 1983

Mr. Curtis V. McVee
U.S. Department of Interior
U.S. Bureau of Land Management
701 "C" Street, Box 13
Anchorage, Alaska 99513

Re: Agency Coordination Subsequent to Application for License - Susitna Hydroelectric Project

Dear Mr. McVee:

To facilitate communication and coordination with State, Federal and Local resource agencies, with respect to the Susitna Hydroelectric Project, the Alaska Power Authority has designated Mr. Thomas J. Arminski as Agency Coordinator. Mr. Jack Robinson of Harza-Ebasco has been designated the formal agency contact for the design consultant.

Mr. Arminski will be responsible to my Susitna Project Manager to insure that coordination channels remain unobstructed, that agency suggestions are provided to the appropriate members of the project team, and that we, in turn, keep you advised of how your suggestions have been accommodated.

We are extremely appreciative of your past efforts in working with the Power Authority on the project. With the designation of these two positions, we hope to maintain a responsive relationship with your agency throughout the licensing phase of the project.

Mr. Arminski and Mr. Robinson may be contacted as follows:

Mr. Thomas J. Arminski
Alaska Power Authority
334 West Fifth Avenue
Anchorage, Alaska 99501
907 277-7641 or 276-0001

Mr. Jack Robinson
Harza-Ebasco Joint Venture
8740 Hartzell Road
Anchorage, Alaska 99507
907 349-5881

Please be advised that designation of formal coordinators does not preclude informal communications between your agency and project staff.

Please feel free to contact us if you have any questions or comments.

Sincerely,

Eric P. Yould
Executive Director

cc: Mr. John Merrick

DISTRIBUTION LIST

LETTER	CARBON COPY
Curt V. McVee U.S. Bureau of Land Management 701 "C" Street, Box 13 Anchorage, Alaska 99513	John Merrick U.S. Bureau of Land Management 4700 E. 72nd Avenue Anchorage, Alaska 99507
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John E. Cook Regional Director National Park Service 450 West Fifth Avenue Anchorage, Alaska 99501	Larry Wright National Park Service 1011 E. Tudor Road, Suite 297 Anchorage, Alaska 99507
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Mr. Keith Schreiner Regional Director Keith Bayha, Assistant Regional Director-Environment U.S. Fish and Wildlife Service 1011 East Tudor Road Anchorage, Alaska 99503	Lenny Corin, Field Supervisor Western Alaska Ecological Services U.S. Fish & Wildlife Service 605 West 4th Avenue, Room G-81 Anchorage, Alaska 99501 Robert Bowker U.S. Fish and Wildlife Service 605 West 4th Avenue, Room G-81 Anchorage, Alaska 99501

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LETTER (Cont.)	CARBON COPY (Cont.)
	Janet Burleson Mat-Su Area Manager Division of Land & Water Management Centara Plaza, Suite 202 Pouch 4008 Wasilla, Alaska 99687
Ms. Lee McAnerney Commissioner Department of Community and Regional Affairs Pouch B Juneau, Alaska 99811	Ed Bushch, Director Division of Community Planning 225 Cordova, Building B Anchorage, Alaska 99501
Daniel A. Casey Commissioner Department of Transportation & Public Facilities Pouch Z Juneau, Alaska 99811	Keith Morberg Dept. of Transportation & Public Facilities Design & Construction Division Pouch 6900 Anchorage, Alaska 99502
Claudio Arenas Planning Director Matanuska-Susitna Borough P.O. Box B Palmer, Alaska 99645	

Appendix E11J

Comments Received from Agencies Concerning the Draft License and the Power Authority's Response to These Comments

APPENDIX 11.J

RESPONSES TO AGENCY COMMENTS

This appendix contains the Alaska Power Authority's responses to all comments received on the Draft Exhibit E. These are presented by agency in a comment-response format. Portions of this appendix contain numbered footnotes; the explanations of these footnotes can be found in the U.S. Fish and Wildlife Service covering letter contained in Appendix 11.I.

DEPARTMENT OF ENVIRONMENTAL CONSERVATION

COMMENTS CONTAINED IN ALASKA DEPARTMENT OF ENVIRONMENTAL CONSERVATION'S LETTER OF JANUARY 13, 1983

The Alaska Department of Environmental Conservation is pleased to respond to the Alaska Power Authority's request for comments on the Susitna Hydroelectric Project, Federal Energy Regulatory License Application, Exhibit E. These comments are organized into seven primary categories and are presented below.

A. Water Quality

Comment 1

The discussion on water quality impacts is well done for both the Watana and Devil Canyon dams. The major impact to water quality is from a change in the downstream water temperature that will occur with the project operation. The Reservoir Temperature Model (DYRESM) is designed to predict reservoir outflow temperatures to an accuracy of $\pm 2°C$, a range of variation of 4°C. A difference of 4°C in predicted outflow temperatures could have a significant effect on the actual versus the predicted impact on downstream fisheries. This modeling effort should be developed to predict reservoir operating parameters when using a given downstream impact, essentially working the model backwards. Accurate estimates of the predicted downstream river temperatures are an essential component of the impact assessment process.

Response

We concur that predicted downstream river temperatures are an essential component of the impact assessment process. DYRESM is a state-of-the-art reservoir temperature model and, in our opinion, is as good as any other computer model that is available. It was selected for use on the Susitna Hydroelectric Project only after a thorough search of all models was conducted. DYRESM is a process-oriented thermal model requiring only minor calibration. The model has been successfully used on the Wellington reservoir in Australia and in Kootenai Lake, British Columbia. Recently, it has been used to model Eklutna Lake. Results are presented in Figures E.2.166 and E.2.167. Outflow temperatures are predicted to within 1°C, thus indicating the suitability of the model.

Comment 2

The shear magnitude of the construction project will create a high potential for soil erosion that may affect water quality. The Exhibit E needs to be more specific on how these problems will be mitigated.

Methodologies need to be described in detail for construction of the road, dam and townsites, and other project entities.

Response

We agree that the magnitude of the construction project will create a high potential for soil erosion that may affect water quality. Discussion on how soil erosion will be mitigated can be found in Chapter 3, Section 2.4.3(c)(iii) and Chapter 2, Sections 4.1.1(c)(iii) and 6.2.

B. Hazardous Substances

Comment

A very large amount of hazardous substances will be transported to, and utilized at, the project site. Discharges of hazardous substances could contaminate land as well as surface and ground water. Further impacts could occur to human welfare, fish, and wildlife.

The Exhibit E document does not address the major possible sources of fuel spills, but rather the minor ones (leaky hydraulic lines and water pumps). A very detailed oil spill contingency plan needs to be developed that will have several major objectives and be written to account for a major (i.e., tank truck roll-over), as well as a minor spill event.

The plan should be responsive to project needs and yet be simple enough to be functional. Major objectives of the plan are discussed in detail below:

1. To develop a training program that will stress spill prevention. This program needs to cover spill response under all project conditions and set up several response scenarios.

2. To develop the response capability to adequately handle the worst case spill expected. This response capability should be developed for the Watana and Devil Canyon camps and the railhead staging area. This would mean staging spill cleanup equipment at all sites. All hazardous substances that will be used onsite need to be considered (solvents, chemical additives, etc.)

3. To develop an immediate response team for each work shift, consisting of personnel dedicated to spill containment and cleanup, should a discharge incident occur. This response team would have a designated leader who would direct the team. A complete training program in spill response for this team would be essential.

4. To contain a small section on the project area environment. This would include a map of major drainage areas, fish habitat and seasonal description, and wildlife habitat and seasonal descriptions. The environmental section is very important in prioritizing spill response actions (i.e., most sensitive areas first), and for developing an appreciation for the impact a spill can have.

Response

Federal law requires that as part of the management procedures there will be an oil spill contingency plan (40 CFR) 102.F). This is discussed in Chapter 3, Section 2.4.3(c) (ii).

C. Wastewater Treatment

Comment

The type of wastewater treatment plant to be used at each camp site has to be described in greater detail to more adequately evaluate its effectiveness. The discharge from the Watana treatment facility may not meet fecal coliform standards because of inadequate dilution. The discharge zone should be well defined for both facilities. The Watana and Devil Canyon camp wastewater treatment plants are to be functioning and approved before each camp is in operation.

Response

All wastewater discharges from the treatment facilities will meet permit requirements. Chlorine will be utilized, if deemed appropriate, to ensure discharge water will meet fecal coliform standards.

D. Concrete Batching Plant

Potential impacts that may occur from the concrete production process are not described in enough detail. The discharge from this process will also have, in addition to pH changes, problems with siltation, turbidity, and possibly toxic additives used in the curing process. Siltation from concrete can form a mat over substrate gravels. This could suffocate emerging salmon fry or other indigenous organisms that require substrate habitat. Discharges that may have toxic concrete additives as a component may kill aquatic organisms. The batching process may also have airborne particulate problems. Specific control measures need to be described in detail for each type of problem that may be encountered.

Response

Potential impacts associated with concrete wastewater and preliminary mitigative measures are discussed in Chapter 2, Sections 4.1.1(c) (vi), 4.2.1(c) (vi), and 6.2.

E. Access Corridors

Comment

The access route (Plan 17) was determined, during the access route selection process, to have greater potential for major environmental impact than the other route options. The major impacts of concern were:

1. The Denali Highway to Watana damsite portion passes through habitat that has historically been used by portions of the Nelchina caribou herd.

2. Many native grayling streams can potentially be affected during the construction of the Denali Highway to Watana damsite access section.

3. Access along the south side of the Susitna River from the Watana to Devil Canyon damsites passes through the Stephan Lake region. This region is important habitat for moose, wintering caribou, migrating waterfowl, and furbearers.

4. Wetlands habitat is crossed southwest of Devil Canyon.

Because of the greater potential for major impacts associated with the Plan 17 access portion, more attention should be given to defining the methods that will be implemented to mitigate these impacts. For example:

1. How will the access route be designed to minimize disruption to the caribou herd?

2. What technique will be implemented to prevent impacts to native grayling streams from road construction?

3. How will impacts to Stephan Lake region be reduced?

4. How will project and post-project access be controlled to prevent secondary impacts related to access?

Response

1. The initial alignment of the access route has been modified to avoid the major portion of the caribou range. In addition, specific design features to be utilized are discussed in Section 4.4 of Chapter 3.

2. Impacts to native grayling streams from road construction will be avoided or minimized by adhering to specific design and construction practice criteria. These criteria, when applied to stream crossing and encroachments, give consideration to location of crossing, type of crossing structure, flow regime, and method of installation. In addition, continued monitoring of the construction facilities and activities will ensure that impacts to grayling streams are avoided or minimized. A detailed presentation of these criteria is found in the text under Section 2.4.3.

3. The access road passes north between the damsites, therefore avoiding the Stephan Lake region.

4. Project access will be restricted to the construction work force. Post-project access is discussed in Chapters 7, 3, and 9.

F. Fishery Impact Assessment

Comment

The field data base is incomplete for an accurate prediction of the impact the Susitna Hydroelectric Project will have on fishery resources. A good set of data has been collected for only two years. Fishery population and related water quality data can have inherent fluctuations from year to year. Long-term, large-scale programs need to be implemented in order to make a reasonably accurate population estimate. Very specific detailed studies designed to correlate physical and chemical aspects of the aquatic habitat to population flucutations need to be part of the long term program. This program should be continued throughout project construction.

If impacts cannot be accurately predicted, a worst case (100% loss) estimate of the fishery population should be assumed and the implications this impact would have to the aquatic community and related resource use need to be discussed. By assuming a worst cast estimate, a type of mitigation program can then be developed where compensation to the fishery population can occur to result in an acceptable loss.

A long-term, post-project aquatic monitoring program should be developed as an integral part of the project. Funds should be allocated in advance to insure the continued existence of this program. The monitoring program is essential to determine the effectiveness of mitigation measures that are implemented.

Response

It is recognized that continued studies are needed to refine impact predictions and develop appropriate mitigations. The data are considered adequate for evaluating the magnitude of potential impacts to the selected evaluation species. These potential impacts are assumed as reasonable worst case scenarios in the revised document. The Power Authority is continuing to support studies that will refine these estimates. The mitigation monitoring program is discussed in Chapter 3, Section 2.6.2

G. Interagency Review Board

Comment

It is strongly recommended that a formal interagency review board be established to work with the Alaska Power Authority in the development of the Susitna Hydroelectric Project. This board will identify and comment on socioeconomic and environmental issues and regulatory requirements. It is suggested that the Formal Designation of the Susitna Technical Advisory Committee (see attached memo to you dated November 17, 1982) be implemented to accommodate this recommendation.

Once project construction begins, a similar interagency board should be established to monitor the socioeconomic and environmental impacts and regulatory compliance. This board would make recommendations to the Alaska Power Authority to correct associated problems as necessary.

Response

The Power Authority believes there is little reason to establish a formal interagency review board at this late date. Past agency and Su-Hydro Steering Committee coordination has identified environmental and socioeconomic concerns in sufficient detail to have allowed the Power Authority to begin and, in some cases, complete studies from which impacts in these areas can be quantified. Future efforts will be directed towards development of mitigation measures, monitoring impacts, and assessing efficacy of mitigation.

The Power Authority does believe, however, that there needs to be continuous, effective coordination between itself and agencies. To accomplish this, the Power Authority has designated a person from within itself and its design consultant to take the responsibility for insuring that agency concerns, suggestions, and questions are addressed.

The Power Authority has designated Mr. Thomas J. Arminski as its Agency Coordinator and Mr. Jack Robinson, of Harza-Ebasco, as the formal agency contact for the design consultant. With this clear assignment of responsibility, it is believed that working relationships among all parties will be improved.

The Agency Coordinator will be responsible to the Susitna Project Manager to insure that coordination channels remain unobstructed, that agency comments and recommendations are provided to the appropriate members of the project team (environmental, engineering, regulatory, etc.), and that the Power Authority keeps agencies advised of how their recommendations have been dealt with.

We foresee this well-defined effort as being superior to the proposed Steering Committee concept which, in the past, has been less than effective, both from the Agencies' and the Power Authority's perspective.

With respect to regulatory requirements and permitting, the Power Authority has already formally requested that each agency with regulatory authority designate a contact with whom the Power Authority can coordinate all pemitting activities. This facet of agency coordination has been underway for several months and is resulting in early identification of permits.

As for monitoring, it is the intention of the Power Authority to establish a monitoring program that responds to and implements the articles of any forthcoming Federal Energy Regulatory Commission (FERC) license for the Project.

We invite and also expect your agency, as well as other regulatory entities, to play a major role in the formulation of the specifics of the program. With respect to monitoring the effectiveness of mitigation measures and compliance with stipulations of the license application, we see that as the licensee's responsibility.

Comment

The Alaska Department of Environmental Conservation appreciates this opportunity to comment on the Susitna Hydroelectric Project, Federal Energy Regulatory Commission License Application, Exhibit E, and hopes that these comments will be useful to you. If you have any questions, or if we can be of further assistance, do not hesitate to contact Bob Martin or Steve Zrake in Anchorage.

Response

The Power Authority appreciates the input from the DEC and will continue to pursue active coordination throughout the FERC license review process.

DEPARTMENT OF NATURAL RESOURCES

COMMENTS CONTAINED IN THE DEPARTMENT OF NATURAL RESOURCES
LETTER OF JANUARY 13, 1983

Comment 1

The Alaska Department of Natural Resources has reviewed the draft Exhibit E application for the Susitna Hydroelectric Project. We are submitting comments on this document which in part satisfy the agency coordination requirements established by the Federal Energy Regulatory Commission, (FERC). The formal position of the Department of Natural Resources regarding the Susitna project is contained in the Exhibit E comments which follow; our April 16, 1982 testimony to the Alaska Power Authority Board of Directors (copy attached) and the letter to Eric Yould from Reed Stoops dated October 11, 1982 (copy attached). We request that an unabridged copy of these comments accompany the perfected application submitted to FERC.

Response

Receipt of the above comments is acknowledged. An unabridged copy of these comments is included in Chapter 11 along with responses prepared by the Power Authority.

Comment 2

ORGANIZATION AND PRESENTATION OF EXHIBIT E

In some cases the Exhibit E text, tables, and figures do not reference the documents from which the material was taken. The consequence of this inadequate documentation is that the reader cannot determine the specificity, accuracy or sufficiency of the Exhibit E. We recommend that the specific references to original documents be included in this Exhibit E before the application is submitted to FERC.

Response

The accuracy and completeness of documentation has been improved in the final license application.

Comment 3

WATER QUANTITY AND QUALITY

During the past two years the Department of Natural Resources has emphasized the great importance of acquiring a clear understanding of the relationship of various flow-release rates from the proposed dams and the corresponding impacts on downstream aquatic resources, habitats, and uses. This information is vital to enable DNR to make informed decisions with respect to instream flow reservations and water appropriations, both of which are required in order to facilitate the Susitna Hydro Project. The flow releases schedules presented in Exhibit E for filling and operation of the Watana and Devil Canyon Dams have not been developed in consultation with the Department of Natural Resources or by a methodology approved by this Department which is charged by law with authority to adjudicate all water appropriations and instream flow reservations in the State. Indeed, Exhibit E does not explain the process by which these release schedules flows were devised. We strongly recommend that the license application contain a specific, detailed flow release schedule developed through a quantifiable stream flow analysis program coordinated with DNR and with state and federal fish and wildlife agencies.

Attached please find the entire text of the review comments from our Division of Land and Water Management. Please consult that text for additional specific comments relating to navigability, thermal modeling, and nitrogen gas supersaturation.

Response

A discussion of the rational and process for selecting the operation scheme is contained in Chapter 2, Sections 3.2 and 3.8. Alternatives are discussed in Chapter 10.

Comment 4

ACCESS

This department's comments regarding the proposed route from the Denali Highway to the project site should not be construed as support for that project route as the preferred means of access. This agency, along with the other state and federal resources agencies, has consistently favored road access to the project from the Parks Highway. However, if the route proposed in Exhibit E is selected, we recommend certain design modifications.

We recommend that the principal design criteria for the proposed route be the enhancement of scenic values and public safety. We consider the proposed high-speed design of the road inappropriate. The long-term use of the road after dam construction will be primarily sightseeing and recreation. The highway should, therefore, be designed to take maximum advantage of the scenic potential of the area which traverses some of the most dramatic in North America.

In addition to being an unattractive counterpoint to the natural landscape, the high-speed road proposed (55 miles per hour with 40 miles per hour at difficult curves) may create serious safety problems. The long braking distance for a vehicle traveling 55 miles per hour on a gravel road endangers the stop and go driver and those who park and stand along the side of the road to take photographs. Although a high-speed road will yield cost savings during dam construction, it is questionable whether these cost savings outweigh the long term benefits of a scenic road. The rationale for a high-speed access road design should be based on explicit quantification of the cost saved by that design. We believe the scenic and public safety benefits foregone by a high-speed design when accumulated over the expected life of the road are almost certainly greater than the costs saved by such a design to facilitate the brief construction phase of the dams.

Although design standards for upgrading the Denali Highway between Cantwell and the proposed access road were not discussed in Exhibit E, the issue merits comment because an upgrade will be necessary to accommodate project-related traffic. The portion of the Denali Highway affected provides exceptional views of the Alaska Range, Reindeer Hills and the Talkeetna Mountains. The Alaska National Interest Lands Conservation Act (ANILCA) of 1981 called for a joint state, federal and private study of the scenic qualities of the Denali Highway. The intent was to encourage cooperative land management of lands adjacent to the highway to protect its important scenic values. The Denali Scenic Highway Study will be published in early 1983. DNR encourages APA to consider carefully the recommendations of that report and to support a design which is consistent with the study recommendations.

Finally, we recommend re-routing of the proposed access road where feasible to take advantage of the extraordinary vistas. Presently, the road transects a large wetland in the upper Brushkana drainage. Consultants responsible for the aesthetics portion of Exhibit E recommended that this section of the road be re-routed to higher ground to the west. We concur and support that recommendation, which will also protect the wetland from the impacts of road construction and should result in lower long-term maintenance costs because of better soil conditions.

Response

The extent and mode of post-construction public access has not yet been determined. The Power Authority sees this issue as one which should be reviewed in the latter stages of project construction to determine public preferences and then current resource tradeoffs. The recreation plan and impact analysis assumes public access so far as to not understate possible impacts.

While the ultimate use of the access road will probably not be resolved for almost a decade, we agree that the road design criteria and routing should consider eventual public use and therefore its scenic potential. It must be remembered, however, that the first 15 years of its life will be dedicated primarily to construction activities. Therefore, its suitability for construction uses is also very important. The tradeoff between construction cost savings and long-term scenic values will be considered in an interdisciplinary review of the access design during the first half of 1983. This review will also consider the recommendations of the Denali Scenic Highway Study.

Comment 5

RECREATION AND AESTHETICS

We agree with the consultant's conclusions that recreation plans be focused on those opportunities occurring elsewhere in the project area rather than those directly associated with the reservoirs. Because of fluctuating water levels and steep shorelines, the reservoirs themselves will not present an attractive recreation environment except for occasional use by speedboats. The greater recreation opportunities will be associated with the access road and the many lakes, streams, and alpine hiking areas that can be reached from that road. The consultants' identification of recreation resources on Cook Inlet Region, Incorporated, (CIRI) land raises the question as to how these recreation opportunities might be realized. We recommend that the Power Authority consider some sort of leasing or concession arrangement with CIRI to facilitate public recreation use on Stephan Lake. At least one public use site of a suitable size (40 acres or more) should be provided at Stephan for camping, fishing, and as a staging area for those people using the lake for float trips down the Talkeetna River. In addition, legal access across village and regional corporation lands should be secured and a trail constructed from the reservoir to Stephan Lake. In order to most effectively enhance the recreational potential of the proposed projects, we would recommend that the recreational element of Exhibit E add three sites adjacent to the Alaska Railroad. These sites are Indian River, Gold Creek, and Curry. Each of these sites would provide a destination point for recreation users of the Alaska Railroad and would provide a greater diversity of recreation opportunities. We recommend that management of the off-site recreational facilities associated with the access road are best met through the budgeting process of the Alaska Power Authority. If the Division of Parks is expected to manage these sites, then we will have to work closely with APA to identify priorities for project funding.

In summary, we feel that the consultant has done an excellent job in identifying the recreation opportunities and resources available in the project area and would request that the scope of the study be expanded to look at the identified sites along the Alaska Railroad as described above.

Response

The Alaska Power Authority will investigate the recreational opportunities associated with possible site development adjacent to the railroad at Indian River, Gold Creek, and Curry. These facilities and Stephan Lake would not be any more accessible as a consequence of the Project, and their development must be assessed with respect to their non-profit related development as opposed to their general and regional contribution, which would more appropriately be undertaken by recreation agencies.

Comment 6

HISTORIC AND ARCHEOLOGICAL

The report on historic and archeological resources is well done and addresses all the pertinent questions about mitigation. We concur with the mitigation plan as presented in the draft document.

We concur with and support the proposed education program described on Page E.4.114. We consider each program to be a necessary and effective part of any large construction project. If project personnel are adequately trained and sites are clearly marked, avoidance should be a viable mitigative measure in many of the indirect and potential impact cases.

Response

Comments noted.

Comment 7

TRANSMISSION LINE

The Access Plan Recommendation Report dated August 1982 proposed routing a transmission line through a non-roaded area south of the proposed road between the dam sites. The line was well sited taking advantage of terrain and vegetation to minimize environmental and visual impacts as well as minimizing construction costs. We support the route proposed in the August report. We have since been informally advised that APA has decided to route the transmission line along the road between the dam sites to allow year-round access for maintenance (winter overland access via all terrain vehicle is feasible without a road). If road access is determined to be absolutely necessary, we agree with this decision; it would be inappropriate to have two east-west road corridors through this area. However, presentation by consultants at the APA sponsored workshop in Anchorage during the week of November 29 to December 3, 1982, indicated that there may be excessive concern by maintenance engineers with year-round access. The consultants argued persuasively that maintenance by helicopters is not only feasible, but is cheaper than road maintenance and is a common practice in states other than Alaska. Helicopter maintenance has also proven itself in more rugged terrain and extreme weather conditions of southeast Alaska.

The need for road access in case of bad weather is a concern, but it is important to clarify precisely what is gained in terms of minimizing the risk of power outage by having road access. That gain should then be compared with the costs. In this case, the major cost is a strong negative visual impact on the road between the dam sites. In contrast, the gain seems to be minimal. In short, the value of year-round access is not infinite and in this case may be significantly less than the costs.

Response

A reevaluation of the access road and transmission line arrangement as proposed in the draft Exhibit E of November 15, 1982, indicated that the south bank alignment of the transmission line would require helicopter access unless a pioneer road was constructed as well. The terrain would require significant construction to provide ground access as a back-up alternative to helicopter service of the line. Relocating the line onto the north bank would permit emergency service of the transmission line without any prior construction of an access road. The requirement for high reliability and quick response in any weather conditions indicates that the north bank route provides the best configuration with the least overall environmental impact.

Comment 8

SOCIOECONOMIC IMPACTS

The permanent townsite appears to have been located in an exceptionally wet area. Apparently, the major criterion for locating the townsite was land status. A more appropriate location from the standpoint of land capability and general amenities for the inhabitants of the townsite would be in the Fog Lakes area south of the Susitna River on privately owned land. The townsite is particularly important because, as indicated in the Exhibit E, the tendency for workers to reside on-site depends on the quality of housing and other amenities. Exhibit E emphasizes that a high amenity site will minimize impacts on outlying communities by encouraging a higher percentage of workers to live on-site. We support this objective but do not think siting the townsite as proposed will help achieve it. We strongly suggest finding a more suitable location for the townsite.

Response

The permanent townsite location will be the subject of an interdisciplinary review conducted during the first half of 1983. The review will consider the proposed alternative location in the Fog Lakes area south of the Susitna River.

Comment 9

Exhibit E projects minimal project impacts on local facilities and services due principally to the provision of on-site housing for workers. The total Mat-Su Borough population increase as a result of the project is projected as 4,700 in 1990 (peak year), 1,110 of whom are expected to live off-site in rural communities. Should that projection be accurate, the off-site impacts would, indeed, be limited. However, the project assumes absolutely no in-migration by unsuccessful workers. This is a misleading assumption. In fact, in-migration by unsuccessful job seekers will probably be considerable. Such in-migration is a likely result of decreases in job opportunities in the lower 48 and has occurred in Alaska during construction of the oil pipeline. Current economic conditions would stimulate extensive in-migration to a greater extent than is predicted in Exhibit E.

If in-migration is seriously underestimated in Exhibit E, then a wide range of socioeconomic impacts is underestimated as well. Past experience in the state shows that boom conditions, such as the proposed dam construction would create, have led to rent increases, proliferation of sub-standard housing and strain on public facilities and services. The potential impact caused by unemployed in-migrants is particularly significant in light of their tendency to be more of a disruptive influence on small communities than employed in-migrants. Unemployed in-migrants, for example, tend to require more services such as public health and family assistance of various forms. They pay fewer taxes and may have little stake in the community, thus caring relatively less about relatively minor issues such as yard maintenance and the appearance of local parks. In the small, rustic communities in the project area, these problems could create considerable tension between current residents and the new in-migrants. We consider the socioeconomic impact assessment to be inadequate without an attempt to estimate the number and effects of unsuccessful job seekers and their dependents who will move into the region.

Response

We agree that it is reasonable to expect an influx of persons seeking Susitna construction and construction-related jobs. This influx of persons would probably create the types of impacts that you mention, especially in the greater Anchorage area and, perhaps, Fairbanks.

We did review the TAPS experience. We found no analysis of the impact of unsuccessful job seekers on Fairbanks and the State; nor could we find any analysis of the degree to which "outside" labor displaced Alaska labor. We could not even find any data that would allow such analysis to be done.

Aside from this lack of information, it should be noted that even if appropriate studies had been done on TAPS, they would have been of little help in trying to estimate the number of persons who will be attracted to Alaska by the Susitna Project. This is because each project (e.g. TAPS, ANGTS, and Susitna) is unique, and different economic forces prevail in different years. For example, the types and amounts of workers, and wage rates are different for each proect. This will influence the attractiveness of the project to workers living "outside". Also, economic conditions "outside" relative to those in Alaska change and influence the attractiveness of Alaska projects to outsiders.

For these reasons and several others it was not possible to estimate how many persons would be attracted to Alaska by the Susitna

Project. The monitoring and mitigation program discussed in Section 4.5 is designed to detect the total project-induced increase in population and to help appropriate institutions mitigate impacts that might be caused by persons who come to the Railbelt region in search of Susitna construction and construction-related (secondary and induced) jobs.

Comment 10

It would be more accurate and useful to provide a range of projected population increases in affected communities rather than a precise number such as 263 in Talkeetna by 1990 or 75 in Trapper Creek. These numbers convey a precision not supported by the methodology or the probability of error inherent in such projections. More useful information for community planning purposes would be high-low range. A key consideration in planning for public services is the population threshhold which requires new capital expenditures. For example, if a population increase of 300 would require a new community well in Talkeetna, the city would be better off knowing that it faces a probable increase of 250 to 350, rather than knowing that someone has disaggregated a series of numbers to produce an estimate of 263.

Response

The purpose of the population increase projections in the FERC license application wes to provide best point estimates of the increases in population that are expected to occur in affected communities, where possible. In Cantwell, the level of uncertainty about the ability of the community to provide housing for large influx of people necessitated use of a range of high and low impacts (see Section 3.4).

We agree with the Department of Natural Resources that a high-low range of projected population impacts will be most useful to planners in the affected areas. During Phase II of the Susitna project, the impact model will be updated to include new developments, and the results will be shared with Mat-Su Borough and other relevant planning agencies, in a high-low range form, where possible.

Comment 11

Exhibit E discusses generally the need for measures to ensure that the local unemployed get a chance at project-related jobs. Assuming there will be considerable competition for jobs by in-migrants and that the state's objective is to encourage local hire, it will be necessary to develop a clearly defined and legal program to achieve that objective. The measures recommended by Exhibit E are vague and do not reflect the significance of this issue to the state or the borough. We suggest more attention be given to developing a more comprehensive approach to address this issue in the Exhibit E application to FERC.

Response

The Power Authority's approach to encouraging local hire will be formulated during the design phase of the project in cooperation with the Power Authority's Construction Manager and legal advisors. The formulation of a clearly defined and legally defensible local hire program is a high priority of the Power Authority.

Comment 12

The Exhibit E devotes about four and one-half pages to the geothermal energy alternative. This information is factual and provides general background for the reader. The Exhibit E could be improved by noting that the Department of Natural Resources has a geothermal lease in the Mount Spurr area planned for May, 1983. The Exhibit E should acknowledge that geothermal energy is immune to fuel price escalation as is hydropower. We agree with the Exhibit E statement that little is known about the geothermal properties. Until exploration of the geothermal properties of Mt. Spurr has occurred the viability of geothermal power for the railbelt region is unknown. We recommend that the Exhibit E be revised to include this information.

Response

This information has been incorporated into Chapter 10 of Exhibit E.

DNR MEMORANDUM

From: V.R. (Mohan) Nayuda
Chief, Water Management Section

To: A.L. Carson, Acting Director
Division of Research and Development

as attached to the letter from DNR to the Alaska Power Authority dated January 13, 1982.

Paul Janke, Gary Prokosch and Mary Lu Harle of my staff have reviewed the Draft FERC License Application, Exhibit E, dated November 15, 1982, prepared by Acres American Inc. and provide the following comments.

Comment 1

General - Organization

The report lacks documentation. With few exceptions, much of the textual material, tables and figures do not reference the documents from which the material was taken, the specific page numbers in the original documents, or where those original documents reside. These references should be incorporated into Exhibit E before the finalized license application is submitted to FERC. The organization of draft Exhibit E is poor. Separation of Volumes I and II, Chapters 2 and 3 makes review and evaluation of the Exhibit very difficult. Issues, impacts and mitigations should be combined in a more logical manner to allow easier evaluation.

Many of the statements and conclusions presented in this document are unquantified and speculative. The reviewer is continually confronted by words such as "may", "probably" and "is expected". Statements which are quantified should be so noted and referenced and speculative statements and conclusions should be so noted. Speculative statements must be quantified before effective evaluation of the document can be performed. As such, the document does not present enough data and analysis to adequately evaluate the project at the present time.

Response

The draft Exhibit E submitted for review on November 15, 1982, was indeed a draft. Significant revisions have occurred in producing the final document.

Comment 2

Major Issues

The following are major issues concerned with the draft Exhibit E. They are not in prioritized order.

A. Flow Releases

The flow releases presented for both filling and operation of Watana and Devil Canyon Dams have not been developed with nor approved by the Alaska Department of Natural Resources. The document does not, in fact, explain the process by which these flows were developed, except to say they were selected to satisfy power production requirements and fisheries concerns. Other water uses, including navigation, river based recreation and wildlife are assumed to be covered by these flows. This may not be the case, and this conclusion should be quantified. This department in its review comments on this project has continually asked for a range flows and their associated impacts. This has not been provided by this document, and should be included.

Further, the impacts from the selected flow releases are evaluated only for individual parameters, such as temperature, river morphology and ice, and are not well quantified. What is needed is the cumulative effects from all the affected parameters and their impacts on issues of concern, such as fisheries and navigation. Only then can mitigation measures be addressed. It appears from the data presented in this document that the proposed flow releases are inadequate.

Response

Chapter 2 Section 3, entitled Project Operation and Flow Selection, has been added to the license document. This section discusses the factors considered in the selection of downstream flows. Alternative operation scenarios are discussed in Chapter 10.

B. Access Road

A final decision should be made now as to whether the access road to the dam sites will be public or private. Plans for road construction indicate the road will be built as a private road to move personnel, supplies and equipment to the construction sites. However, the recreation plan seems to indicate that the access road will provide public access for recreation to the area once the dams are operational. A decision should be made on this issue now to obtain public review and comment on this issue during the formal FERC review process.

Response

We believe a final decision on this issue at this time is premature. As stated in the text, the recreation plan is based on the premise of public access. If there is no public access a recreation plan is not needed.

C. Townsite

Further investigation into the townsite location should be conducted. The present location is apparently located in a swampy area. Additionally, the water supply is questionable. Ground water is preferable to surface water for the water supply source as drilled wells are of less environmental consequence. However, a ground water source of adequate quantity is questionable in the present planned location.

Response

The permanent townsite location will be the subject of an interdisciplinary review conducted during the first half of 1983. The review will consider the alternative location in the Fog Lakes area south of the Susitna River as proposed in Commissioner Wunnicke's letter to the Power Authority of January 13, 1983.

D. Land Status

The land status of the land involved in the damsite, access roads and transmissions corridors should be addressed now. Types of land acquisition such as land exchanges, permitting, leasing and condemnation should be investigated and action begun in order to prevent delay to the project further down the line.

Response

This subject is being actively pursued by the Power Authority.

Comment 3

There are many sections in this report where inadequacies are recognized by the authors. It would be a futile effort to reiterate all the statements made in this report that say "further work is on-going" or "documentation has not yet been made", etc. As a revieweing agency we also recognize this and would expect that the work will be done and the inadequacies addressed, without each statement having to be noted in these comments.

Response

Comment noted.

SPECIFIC COMMENTS

VOLUME I - CHAPTER 2 - WATER USE AND QUALITY

N-2-001 Pages E-2-26 and 27; E-2-49 and 50; E-2-66 and 67:

"Navigational difficulties between Devil Canyon and the confluence with the Chulitna River will be increased due to shallower water and a somewhat constricted channel. Although there will be sufficient depth in the river to navigate it, greater care will be required to avoid grounding". Since "greater care will be required", this is a project impact and therefore needs to be discussed along with proposed mitigation measures. This statement also differs from the following report: Susitna Hydroelectric Project, Task 7-Environmental, Subtask 7.04-Water Resources Analysis, A Preliminary Analysis of Potential Navigational Problems Downstream of the Proposed Hydroelectric Dams on the Susitna River, March 1982. The above statement does not indicate what depth is assumed to be sufficient for navigation. The above March 1982 report studies ice-free navigation only and assumes a depth of 2.5 feet is required for the following reasons: (1) the cross-sectional data used was obtained for purposes other than studying project effects on navigation, and (2) the accuracy of the predicted water surface profiles is, at best, approximately one foot. From an extrapolation of Figure 2 in this report, to maintain a depth of 2.5 feet at cross-section 32, located near Sherman, a discharge of 6500 cfs is required. Thus, from Table E.2.17, post-project navigational difficulties may occur near Sherman during both filling and operation during May, June, July 1-27, September 19-30, and October. This is when the project flows are less than 6500 cfs. This conclusion differs from the no navigational problems statement in Exhibit E. It is believed that the March 1982 report provides the latest information available. If a more recent report or different criteria are used, this should be stated and discussed.

Response

We concur that the March 1982 report, A Preliminary Analysis of Potential Navigational Problems Downstream of the Proposed Hydroelectric Dams on the Susitna River, provides the latest information available, except that supplemental information was collected during the summer and fall of 1982 at Sherman and Alexander Slough.

A reconnaissance made in September 1982 between River Mile (RM) 127.0 and RM 128.5, where the Susitna shifts its main channel from the west side to the east side, indicated that the central channel in this reach was still navigable at flows of 6000 cfs at Gold Creek (Butera 1982).

Chapter 2 of Exhibit E has been modified to reflect the navigation criteria used in the above mentioned report and a quantitative analysis has been provided. Since there could be a project impact near Sherman, mitigation measures have been incorporated.

If navigation problems result at a discharge of 6000 cfs, flow will be increased to 6500 cfs (the no navigation impact flow identified by ADNR 1982) or the channel elevation will be lowered.

A reconnaissance of Alexander Creek undertaken on August 18 and 19, 1982, indicated that with a Susitna Station discharge of approximately 90,000 cfs, the channel depths at the inlet to the slough were of the order of 6 feet.

N-2-002 Additionally, it is stated that "the reach downstream of Talkeetna is navigable under low flow condition but can be treacherous at times". What flows are considered low flows? Are the proposed releases from the project considered low flow when considering navigation? What flow conditions should be considered low flows in the areas above Talkeetna when considering the possible impacts on navigation?

Response

The intent of the statement "the reach downstream of Talkeetna is navigable under low flow conditions but can be treacherous at times" was meant to imply that the reach downstream of Talkeetna would be navigable under the reduced post project flows. We agree that the statement as worded is unclear. The document has been modified to reflect a clearer understanding of the navigability of this reach.

N-2-003 The impacts on navigation, including commercial boating, recreational boating, float planes, and winter transportation use of the Susitna River from dam sites to Cook Inlet is inadequately addressed. The impacts need to be quantified and mitigation measures proposed.

Response

As mentioned in the response to comments N-2-001 and N-2-002 above, navigation impacts have been quantified and mitigation measures proposed in Chapter 2.

N-2-004 Pages E-2-27; E-2-50

These sections say that information on recreation and recreational water uses are contained in Chapter 7 of the

Draft Exhibit E. However, Chapter 7 addresses a recreation plan for the Susitna Hydroelectric Project. It does not address project impacts on downstream recreational uses of the Susitna River by boats and float planes for sport fishing and hunting. This is a major use of the Susitna river in its entirety. The impacts on this water use should be identified and quantified and mitigation measures proposed.

If a more recent report or different criteria are used, this should be stated and discussed

Response

Project impacts on downstream recreational uses of the Susitna River by boats and floatplanes for sport fishing and hunting has been incorporated in Section 4.1.2 (h)(iii).

N-2-005 Page E-2-36

The availability of groundwater for village and camp water supply in the location of Tsusena Creek is in question. Before construction begins on any water supply system a permit to appropriate water and construct a dam must first be granted by the Department of Natural Resources per AS 46.15.

Response

We appreciate that before construction begins on any water supply system, a permit to appropriate water and construct a dam must first be granted by the Department of Natural Resources per AS 46.15. This will be undertaken during the detail design phase. It is unlikely that ground water for village and camp water supply will be necessary because of the potential water supply available from Tsusena Creek. However, ground water wells are currently being drilled at Watana camp. These wells should provide information on the availability of ground water.

N-2-006 Figures E-2-18 thru 2-25

These figures do not include low or high flow frequency curves for January - April, November and December. These curves may be useful when looking at the minimum flow releases for these months.

Response

High and low flow frequency curves for January - April, November and December have now been included in Chapter 2 as Figures E.2.43-E.2.62.

N-2-007 Pages E-2-14, E-2-47, E-2-51, E-2-56, E-2-66, and E-2-72 thru 75; E-2-83:

Sloughs and side channels are very important fish and wildlife habitat. The effects on this habitat due to all phases of the project should be well documented. Some of the basic questions not answered are as follows:

Regarding ice, what will the effects on slough and side channel winter habitat be with minimum flows of 1000 cfs during filling of the Watana reservoir? Taking into account the increased temperature and associated lack of ice formation in the reach above Talkeetna, without the normal ice formation river staging will be lower. What are the effects of the lower staging on slough upwelling and water temperature? If water upwelling in the sloughs will be decreased, what effect will this have on all life stages of fish which use the sloughs.

Response

The filling regime from November through April has been modified so that natural flows are passed through Watana. Therefore, there will be essentially no impact on slough and side channel winter habitat from ice-related effects.

In reaches above Talkeetna where an ice cover will not form, the ice formation river staging will be lower. The effects of the lower staging on slough upwelling and water temperature are discussed in Sections 2.4.4 and 4.1.2 (f)(ii). Upwelling rates in the sloughs will essentially be unchanged, although an area at the upper end of the slough may be dewatered as the result of a lowering of the ground water table; this is discussed in Section 4.1.2(f)(ii). Because there is a minimal upwelling decrease in the sloughs, no effects on any life stage of fish which use the sloughs are anticipated.

N-2-008 With the predicted flows of 10,000 cfs during operation of Watana Dam, what effects will this have on the slough and side channels above Talkeetna and below Talkeetna? With increased flows and water temperature at 0°C below Talkeetna, increased ice formation will cause higher water stage than normal. What effect will these higher water stages have on sloughs and side channel habitat? Will the slough heads be overtopped? What effect would ice formation in the slough due to possible overtopping have on overwintering fish, out-migration, slough water temperatures, etc.? If the sloughs below Talkeetna are overtopped due to increased ice formation and associated higher river staging and ice does form in the sloughs, beside the effect on overwintering fish and possible delays in out-migration due to cooler than normal water temperature, how will this ice and other debris be removed from thse sloughs without the annual spring flooding? If artificial flooding by scheduled release from the dam is tried, how will timing of flooding be determined?

Response

The effects of the winter flows of 10,000 cfs during operation of Watana Dam on the slough and side channels above Talkeetna are discussed in Section 4.2.3. At present there is insufficient information to evaluate the effect on sloughs and side channels below Talkeetna.

Fish utilization of habitats downstream from Talkeetna is not well understood since most effort was expended in the Devil Canyon to Talkeetna reach; thus the role of sloughs as fish habitat is preliminary. Further data are forthcoming in the June 30, 1983, analytical reports. If these studies indicate that sloughs downstream from Talkeetna represent significant fish habitat, then impacts to these habitats will be further analyzed and your recommendations will be considered in the development of futher studies.

CHAPTER 3 - SECTION 2 - DEPARTMENT OF NATURAL RESOURCES

Comment 1

Page E-3-55: The fishery resource in some specific streams in the transmission line corridor is discussed. Also stated is: "Little is known about the other streams that will be crossed in this segment." Is it possible that valuable resources in other streams may be impacted by the transmission line? It appears more study is needed here.

Response

The information available on some of the streams transversed by the transmission line is limited and your suggestion that additional study is needed will be considered in future study programs.

Comment 2

Page E-3-58: The discussion of the Watana dam construction states the following: "The movement of fill materials and the actual process of construction of the fill dam are potential contributions to turbidity and siltation." Acceptable levels of turbidity and siltation should be specified, and these should be written into the construction specifications. This is not discussed in mitigation of construction impacts, pages E-3-120 to 127.

Response

As indicated in the mitigation section of the text under water quality, effluents will comply with DEC effluent standards specified under 18 AAC 70.020.

Comment 3

Page E-3-73: The statement "The entire canyon is expected to be passable by chinook salmon, allowing them to enter Tsusena and Fog Creeks" is found in the discussion of potential impacts from Talkeetna to Watana dam during filling of the Watana reservoir. What are the impacts of dam construction and operation on chinook salmon movement into these creeks? If there are impacts, what are the proposed mitigation measures? This is not discussed in the mitigation on pages E-3-128 to E-3-144.

Response

During construction of Watana Dam, flows which for average years are too high to allow for passage of adults, will follow the natural regime. Flows during operation of the dam will be significantly reduced, allowing for passage of adult chinook salmon through the canyon and entrance into Tsusena and Fog Creeks.

Comment 4

Pages E-3-74 to 76: In discussion of potential impacts from Talkeetna to Watana dam during filling of the Watana reservoir, the following statements are made:

a. "Many of the physical changes identified for mainstem habitats would also occur in side-channel habitats. Since side-channels are generally characterized by higher streambed elevations, the forecasted changes in streamflow may cause greater effects in side-channel habitats."

b. "Many side channels that normally convey water in May, June and the first three weeks of July, would likely be dewatered under filling flows..."

c. "In other side-channels, flow may be reduced to an extent that the outmigration of salmon fry would be delayed."

d. "Some side-channels above Talkeetna would be completely dewatered under the proposed filling flows..."

e. "Reduced flows in the spring may inhibit emergence and outmigration in some side-channel spawning area..."

f. "Forecasted August and September flows under the filling schedule may adversely affect spawning habitat in side-channels."

g. "It is unlikely that new spawning areas would become available under the filling flows."

It is understood that with reduced flow rates in sloughs and side-channels, beaver may become more active in these areas. Thus, it is possible that the beaver dams may block the outmigration of fry. What are the impacts from this? Mitigation measures associated with side-channels are not discussed on pages E-3-128 to 144.

Response

The pre-project spawning habitat in the side channels is limited such that these areas play a minor role in salmon production. Efforts, therefore, have concentrated on assessing the impacts to the habitat in the more productive slough areas. Similarly, mitigation measures have focused on maintaining the slough habitats, which include possible impacts from beavers.

Comment 5

Pages E-3-75 through E-3-77: The following statements are made with regard to the problems related to flow releases during the different times of the year, "reduced flows in spring may inhibit emergence and outmigration in some side-channel spawning area", "August and September flows may adversely affect spawning habitat in side-channels", "16,000 to 18,000 cfs is needed at Gold Creek to insure easy fish passage into sloughs", and "the stage of the mainstem at flows of approximately 12,000 cfs did not create backwater effects at the mouths of some sloughs great enough to allow free passage by adult salmon".

The total effect of low flows on the fisheries cannot be evaluated until the total number of sloughs and side-channels both below and above Talkeetna that will be affected, and to what extent they will be affected, is known. What percent of the total salmon population are using the slough or side-channel habitats that are expected to be impacted, and at what time of the year these impacts will be most severe.

Response

The total number of sloughs and side-channels both below and above Talkeetna that will be affected by low flows and to what extent they will be affected are the subjects of ongoing studies by the Aquatic Studies Program. The number of adult salmon using the slough habitats that are potentially impacted during spawning is presented in the revised text. Emphasis in studies to date has focused on the extent to which habitat is affected by flow alterations. An attempt to estimate the percentage of the total salmon population that is impacted on a species/life stage and seasonal basis is being addressed by the AEIDC instream flow analysis.

Comment 6

Page E-3-80 through E-3-85; E-3-95 through E-3-97: The impacts on the Cook Inlet to Talkeetna reach during both filling and operation are extremely generalized and lack documentation. Impacts on the mainstream, side-channels, sloughs and tributaries must be investigated and quantified. This includes impacts resulting from changes in discharge and stage, water temperature, water quality, sediment transport, ice and river morphology. While this reach of the river will be impacted less than the Talkeetna to Devil Canyon reach, the possibility remains that small project changes may result in significant impacts. Of particular importance in this reach is the determination of the cumulative effect of the individual impacts noted above. Mitigation measures associated with these impacts are not addressed in pages E-3-128 to 144.

Response

Available data regarding changes downstream from Talkeetna certainly indicate minimal impacts. The sufficiency of the data base will be considered in formulating the future study program for FY 1984.

Comment 7

Page E-3-129: The list of reasons for providing suitable flows should include the following additions:

1. Allow adult salmon access to slough and side-channel spawning habitat.
2. Maintain flow through the spawning gravel during the incubation and rearing periods.
3. Maintain suitable flows to preserve slough upwelling waters.
4. Maintain flows to control proper water temperature needed in the mainstem, sloughs and side-channels.

Response

The side-channels support only limited spawning activity and providing access to these areas was not considered a primary fishery concern. The sloughs are significantly more productive areas and efforts have been directed on maintaining these habitats. The flows provided to allow access to sloughs are expected to maintain access to most side-channel habitats.

Comment 8

Page E-3-133: Regarding winter flows, "Minimal impacts are expected". The possible impacts addressed on Page E-3-94 seem to be major.

The only rectification of impacts on sloughs that is presented is slough modification. This is an untested mitigation measure in this river system. What are the costs involved with design, testing, construction and operation and maintenance of slough modifications? How many sloughs will need to be modified? This section should include other alternatives besides slough modification to rectify impacts on sloughs.

Response

The actual impacts to slough habitats resulting from post-project winter flows are not fully defined at this point. Establishment of a mainstem discharge-slough habitat relationship is required for both ice-covered and open-water winter flow conditions. These relationships are the subject of the AEIDC instream flow study and the ongoing Aquatic Studies Program. Nevertheless, the text has been revised and mitigative measures are presented to minimize adverse impacts.

Additional details are provided in the text on rectification of impacts for the sloughs.

Comment 9

Page E-3-136: On this page and elsewhere, the document predicts water temperatures in the reservoirs and downstream of the dams. No information, however, is given describing how these temperatures were predicted. The model used should be given or referenced, along with the details describing its verification for use on this system. The validity and hence the accuracy of the temperatures predicted, therefore, must be questioned.

Response

Water temperature predictions are addressed in detail in Chapter 2.

Comment 10

Page E-3-137: "The impacts associated with alteration of the temperature regime during reservoir operation can be minimized by incorporated multiple level gates in the power intake." Not discussed are water quality parameters other than temperature associated with each reservoir level. A monthly schedule should be given that quantifies the water levels to be used and the associated water quality parameters of the release water. Of specific concern is the dissolved oxygen content of water released from Devil Canyon if the intake is drawing water from the hypolimnion.

Response

The effects of the project on water quality parameters are discussed in detail in Chapter 2.

Comment 11

Page E-3-140:

"Gas supersaturation will be avoided by including fixed-cone valves in the outlet facilities...A prototype test of Howell-Bunger valves showed them to be effective in preventing gas supersaturation (Ecological Analysts Inc. 1982)." Since this reference is an unpublished report, it cannot be easily obtained. The bibliography leads one to believe that this valve was tested at one site. If this is true, it is inadequate. Due to the potential negative impacts from nitrogen supersaturation, the valves to be employed here should be well tested for this application. It appears that this in not the case for these Howell-Bunger valves.

Response

Acres' analysis of the physical and geometric characteristics of freely discharging diffused jets and the aeration efficiency of similar fixed-cone valves indicated that no serious supersaturation of nitrogen is likely to occur with spills up to the 1:50 year recurrence interval. The results of the field tests cited support this conclusion. This subject is discussed further in Chapter 2, Section 6.4.3 - Gas Supersaturation.

Comment IV

Summary

In summary, this draft Exhibit E is a start at answering questions regarding issues and resources to be affected by this project and their impacts and possible mitigation. However, a great deal more data collection and analysis is needed in order to answer still unanswered questions before this project can be effectively evaluated.

Response

See response to Comment 6 in the U.S. Fish and Wildlife Service covering letter of January 14, 1982 to the Power Authority.

DEPARTMENT OF FISH AND GAME

ALASKA DEPARTMENT OF FISH AND GAME (ADF&G)
COMMENTS CONTAINED IN LETTER OF JANUARY 13, 1983

GENERAL COMMENTS

The Alaska Department of Fish and Game (ADF&G) has reviewed the Draft Exhibit E, dated November 15, 1982, that was prepared for inclusion in the license application for the Susitna Hydroelectric Project that the Alaska Power Authority (APA) intends to submit to the Federal Energy Regulatory Commission (FERC).

The Department's review of the Draft is based on the adequacy with which the fish and wildlife resources affected by the project, the impacts to those resources attributable to the project, and specific mitigation proposals to offset impacts are identified and quantified.

The types of information required for an adequate assessment of feasibility, with respect to fish and wildlife resources were originally identified for the APA in November 1979 through correspondence relative to the Plan of Study and were most recently identified in Commissioner Ronald Skoog's statement to the APA Board of Directors on April 16, 1982.

Our review comments on the following chapters are appended to this letter:

Appendix A - Chapter 2 - Water Use and Quality;
Appendix B - Chapter 3 - Fish, Wildlife, and Botanical Resources;
Appendix C - Chapter 5 - Socioeconomic Impacts;
Appendix D - Chapter 7 - Recreational Resources; and
Appendix E - Chapter 9 - Land Use.

The time afforded the ADF&G to review the Draft Exhibit E has not been sufficient to allow a detailed review of all the chapters, nor has it enabled us to present our comments in as thorough and refined a manner as we would have liked. We do, however, expect to take advantage of future review opportunities to further address these issues.

The appended reviews (Appendices A-E) contain general statements regarding the overall adequacy of each chapter. Following these are specific comments addressing the technical content of the report. In the specific comment section, we have on occasion clarified the Department's policies and positions with respect to the proposed Susitna Hydroelectric Project.

Response

The above information has assisted the Power Authority in reviewing the ADF&G comments.

Comment

Throughout the chapters of the Draft Exhibit E that we reviewed, both the information presented and the assessment of impacts are generally insufficient for the kind of a planning and source document needed for preparation of an EIS. We are concerned that the benefits and cost aspects of the project have not been presented completely and clearly. The general problems with the Draft Exhibit E chapters that were reviewed by the ADF&G are as follows:

1. Data and information contained in the Exhibit E are, in many cases, incomplete or not properly interpreted.

2. Many potential impacts and issues attributed to the Susitna Hydroelectric Project are not addressed. Impacts to fish and wildlife resources and users that are addressed are not adequately quantified and proposals to mitigate impacts are not sufficiently developed.

3. Not all source materials, other Draft Exhibit E chapters, or the results of other study disciplines that are pertinent to the project are referenced.

4. Throughout the document there is a failure to discriminate between fact and speculation.

Response

These comments have resulted in modifications to the Draft Exhibit E. Specific comments relating to these problems are addressed in Chapter 11.

Our comments, recommendations, and suggestions to strengthen the material contained in Draft Exhibit E in relation to the problem areas identified above are as follows:

Comment 1

The APA should examine the specific comments appended to this letter and clarify or expand sections in the Draft Exhibit E chapters where inadequate treatment of the data or information is suggested. The suggestion here is that while some interpretations by the authors are not necessarily inaccurate, they are incomplete. This type of problem in the Draft Exhibit E may be either editorial or a function of the short time frame allotted to assemble, assess and analyze the information available. The Draft Exhibit E chapters should utilize currently available and relevant information and data sources.

Response

Appropriate sections of the Draft Exhibit E have been clarified or expanded to address the specific comments.

Comment 2

The Draft Exhibit E chapters should accurately reflect the current state of resource knowledge and information on impacts which are understood and those which are still undetermined. Consequently, the mitigation plans cannot be considered adequate unless the information and analysis of impacts is current and comprehensive. The mitigation plans should clearly indicate how impacts are considered in the design of the project; what measures will be taken to avoid, minimize or rectify impacts; and how effective these measures will be in mitigating losses.

Response

We have made attempts to ensure that our data base and impact assessment is as current and comprehensive as possible. However, as must be appreciated by your department, there is often a considerable lag between the collection, analysis and availability of baseline data. In our opinion Exhibit E accurately reflects the current state of resource knowledge as based on available data. As more information becomes available, our understanding will become more detailed. Consequently, our mitigation planning is considered adequate to date with the understanding that refinement will occur during the licensing and final design phases.

Comment 3

Source material in the Draft Exhibit E is not adequately referenced. Furthermore, data and information reported in chapters of the document should be consistent with other chapters. The lack of coordination between the resource groups and the engineering and construction groups is evident; conflicts have not been clearly identified between uses and disciplines. To remedy this deficiency all conflicts between engineering and construction groups is evident; conflicts have not been clearly identified between uses and disciplines. To remedy this deficiency all conflicts between engineering and economic factors and environmental alternatives should be identified and the consequences of altering those factors should be listed. The environmental concerns should be weighed equally with engineering and economic constraints.

Response

Referencing and documentation has been improved in the final Exhibit E. Discrepancies between chapters have been corrected. Throughout the planning process, environmental concerns have been given equal consideration.

Comment 4

Throughout the document, there is not always adequate discrimination between fact and speculation about resource values, concerns, issues, impacts and mitigation alternatives.

Response

Most assessments are on a continuant somewhere between fact and speculation. However, efforts have been made to identify for the reader the degree of speculation or data base support associated with various statements.

Comment

In some cases adequate referencing and reporting of data in the chapters may resolve this. Where baseline data collection is required to remove speculation it should be done, or if relevant data and information are available elsewhere they should be collected and evaluated.

Response

Adequate referencing and reporting of data has resolved many of the above concerns. Data collection and analysis is ongoing to further refine many of the impact predictions and mitigation plans.

Comment

The Department of Fish and Game recognizes the general character of the above recommendations. These recommendations are made based on an overview of the ADF&G comments for the chapters we have examined. We invite further consultation by the APA with our agency to discuss the specifics of the chapters we reviewed and our general recommendations.

Response

The character of the above recommendations is understood. The more specific comments attached augment these general comments. Further consultation will be pursued throughout the FERC license review process.

Comment

The fish and widlife resources of the Susitna River basin are of high value. Construction and operation of the proposed Susitna Hydroelectric Project can have wide ranging implications for these resources and their users. It is the objective of this Department to help Governor Sheffield insure that fish and wildlife resources are considered along with other project features during all stages of project planning, construction and operation.

Response

Fish and wildlife resources have been and will continue to be, considered along with other project features during the planning, construction, and operation of the Susitna project. It is anticipated that most, if not all, impacts will be mitigated.

Comment

Based on the above overview of the Draft Exhibit E and the chapter-specific comments contained in the enclosed Appendices, the ADF&G does not believe that this planning document is sufficiently complete. Furthermore, we believe that the APA can best insure expeditious review and approval by FERC if it does as much as possible to resolve agency concerns or establishes the mechanism to resolve those concerns.

Response

Refer to the response to Comment 6 of the USFWS letter dated January 14, 1983.

Comment

We hope our review assists the APA in addressing the concerns expressed herein and consider that this review represents only part of the process needed to reach the objective we wish to attain. It is highly important from our perspective that the FERC License Application scheduled for submission in February and the process of consideration of the Exhibit E will positively contribute to the equitable consideration of fish and wildlife concerns.

Response

The ADF&G's timely review was appreciated by the Power Authority.

Comment

Thank you for the opportunity to review and comment on this document. We would appreciate your providing an explanation of how you eventually respond to the comments we have made.

Response

A letter dated January 21, 1983 was forwarded to ADF&G explaining our response procedure.

COMMENTS CONTAINED IN ALASKA DEPARTMENT OF FISH AND GAME
LETTER OF JANUARY 13, 1983

GENERAL COMMENTS - WATER USE AND QUALITY

Comment 1

This document generally fails to cite supporting evidence for the statements made or for potential impacts considered to be of major importance to this agency. An example can be found in the discussion of ice processes in the lower river. The ice formation processes are simply stated as causing staging of 4 feet at Talkeetna to 3 feet at Sherman (E-2-59). The method used to determine this estimate has not been defined. Also, no references have been provided that evaluate whether ice processes are or are not a problem below other hydro projects. If this is a purely speculative scenario, it should be so noted. Otherwise, a scenario assuming that the staging would be 6 to 8 feet at Talkeetna during the winter months and annual floods would occur is just as supportable as the statements provided.

Response

Referencing has been expanded where appropriate. These include references to field observation reports, such as the R&M Consultants reports of 1982(a) and (d) which documented the 2- to 4-foot average water level change observed during the 1980 freezeup, methodology reports which outline the analytical or forecast techniques employed, and support documents which provide evidence of similar scenarios occurring elsewhere.

Considerable effort has been involved in modeling both pre- and post-operational ice processes. It has been assumed that reviewers would know that changes in ice process can and have been a problem below other hydro projects. None of the scenarios discussed are purely speculative. Estimated changes are based on a sound technical understanding of the physical processes associated with ice formation, a mathematical model that has been tested on other hydro projects, and direct observations and measurements on the Susitna River. The degree of uncertainty associated with forecasted changes is provided.

Comment 2

The failure to provide a separation of the speculative comments from the segments of the text supported by documentation creates severe problems in assessing the overall credibility of the report.

Response

In all sections of Exhibit E, efforts have been made to identify the extent of judgment associated with the various predictions. However, it is not always possible to provide an absolute separation between speculation and fact. Most, if not all, statements addressing impact predictions or suitability of mitigation planning are based on a combination of baseline data (with an associated degree of error), predictive methodologies (with an associated degree of error, assumptions, and subjective evaluation), and professional judgment.

Comment 3

This document also needs a preface on how the flow scenario and access route were selected for the license submittal and a discussion of other available options. The Exhibit A document referenced on page E-2-86 on access routes was not provided for our review.

Response

Discussion of alternatives is contained in Chapter 10. Section 2.3 addresses Access Alternatives and Section 3 addresses Alternative Operating Scenarios.

SPECIFIC COMMENTS

G-2-001 E-2-3/4
The source of the 40 percent stream flow statistic should be identified.

Comparison of Table E2.3 indicates that for the 32 year filled in record, mean annual flow at Denali, Maclaren and Gold Creek were 2850, 980, and 9650 cfs respectively. From this, it can readily be determined that Denali and Maclaren provide 39 percent of the Gold Creek flow.

G-2-002 E-2-3/5
State that all the flows listed other than upper Susitna River are also mean annual flows.

The text has been modified to state that all flows listed are mean annual flows.

G-2-003 E-2-4/1-4
References are needed to support the flood information discussed.

References are provided where appropriate.

G-2-004 References are needed to support the statement that the shape of the listed duration curves is indicative of flow from northern glacial rivers.

Reference is provided in text.

G-2-005 E-2-5/3
Reference(s) are required to support the discussion regarding Susitna River morphology.

Much of the discussion on river morphology is contained in the report River Morphology, R&M Consultants 1982. References are provided in the document where appropriate.

G-2-006 E-2-10/1
The description of sloughs as having a steeper gradient than the mainstem is misleading. The gradient within the sloughs is generally variable, with a steep upper section and a lesser slope in the lower end. In upland sloughs, those without scour channels, the gradient appears to be even less. Overall, the sloughs have a steeper gradient, but the variability of their gradient is important to their fisheries production.

We agree with this comment. Section 2.1.2 has been modified to include the ADF&G comments.

G-2-007 E-2-11/2
There is a need to cite specific references in the water quality text even though a general reference section was provided in the preface for the water quality section.

The specific references cited in the preface to the water quality section were for criteria purposes. Specific criteria levels for each parameter are provided in the water quality data summary Figures E.2.71, E.2.78, E.2.81 and E.2.83 through E.2.119. The sources of water quality data (USGS, R&M consultants and/or ADF&G) are cited in the figures and the text, where appropriate.

G-2-008 E-2-12/3 & 4
The months that are included in the "winter, spring and summer" time frames need to be identified.

The winter months normally include the months of October through April when the flow is predominantly base flow and water temperatures are approximately 0°C, whereas the summer months include the period after breakup through the high runoff period, (September). Paragraphs 2 and 3 have been clarified to reflect the intended meaning. A description of the monthly breakdown of the three seasons, as defined for water quality data compliations, is provided in Section 2.3, paragraph 3.

G-2-009 E-2-12/5

Clarification needs to be provided as to whether the Gold Creek temperature data presented in Figure E.2.30 were correct. The location of this station was determined to be influenced by Gold Creek flows in 1981 and the station location was changed in 1982 to the northwest bank as a consequence.

The data presented in Figure E.2.30 (revised number E.2.71) are USGS spot measurements at all gaging stations. Data from continuously recording thermographs were not available at all stations, so spot measurements were compiled to maintain consistency. It is not believed that the spot data collections at Gold Creek would be influenced by the Gold Creek tributary contributions since a cross-sectional sampling technique is used by the USGS.

G-2-010 E-2-14/1

A reference is needed for the Portage Creek temperature data.

The reference for the Portage Creek temperature data is the Alaska Department of Fish and Game. The reference has been noted in the document.

G-2-011 E-2-14/3

It should be noted here that under natural conditions, staging during freezeup reportedly causes flooding of portions of the town of Talkeetna near the downtown airport. There is a need to reference the material presented in this paragraph.

The 2 to 4 foot increase in water level noted in the document was the average water level change observed during the 1980 freezeup as reported by R&M Consultants (1982a, 1982d). These values were not intended to provide the maximum water level increase, but rather the average change. Near RM 96 and the town of Talkeetna, ice advance has resulted in localized flooding of side channels and sloughs. Daily stage readings during freeze up 1982 have revealed overnight water level increases of 4 to 5 feet in the slough adjacent to RM 97 on the left bank. This flood condition persists only as long as it takes the leading edge of the ice front to pass.

G-2-012 E-2-14/5 & 6

The term frazil ice should be defined for the readers. Also it cannot be overstated that ice jams could have severe consequences to portions of the community of Talkeetna.

Frazil ice is slush ice formed by ice crystallization at the water surface when the water temperature is at 0°C and the air temperature is below freezing. Photograph E.2.1 illustrates frazil ice on the Susitna River.

Without the implementation of flood control features or measures, staging due to the freeze up process could have consequences to portions of the community of Talkeetna.

G-2-013 E-2-17-5

In order to properly assess the effects of the project on the downstream fisheries and fisheries' potentials of the impoundments, a relationship of suspended sediment and associated particle size to vertical illumination is desirable. This does not appear to have been done, in that no quantitative measurements of vertical illumination have been obtained.

Vertical illumination for photosynthesis in the environment downstream from the project site varies widely through the year. Estimation of the depth to which light is available for photosynthesis may be made by direct measurement, or by inference from other parameters, such as turbidity. Depth of the euphotic zone is taken as the depth of penetration of 1 percent of the illumination available at the surface (St. John et al. 1976).

Direct measurement of light available for photosynthesis was attempted in overflow water in slough 21 using a LiCor Model LI-1925B Underwater quantum Sensor, on September 9, 1982. The euphotic zone depth as defined above was calculated to be 1.1 meters from the limited sampling data. Visual observations at the time of sampling, however, indicated mainstem turbidity was much greater than in slough 21. Consequently, the euphotic zone in the mainstem could be inferred to be significantly less than 1.1 meters on this date.

Vertical illumination has been successfully related to turbidity at the surface in studies at Eklutna Lake. Application of this relationship to turbidities in the Susitna River downstream from the project would yield a minimum euphotic zone depth of about 0.1 meter for the 1982 season peak turbidity (1060 NTU) from a sample from the Susitna River at Sunshine (RM 84) on August 18, 1982. By this relationship the euphotic zone would extend beyond 10 meters in depth when turbidity in the stream drops below 10 NTU, as is typical through the winter.

While the relationship between turbidity and vertical illumination is quite good for the range of turbidity apparent in Eklutna Lake, the complex relationship between optical properties such as turbidity, and the physical and mineralogical properties of the suspended sediment is not fully understood. It is likely that a water sample containing a greater suspended sediment surface area will reflect or scatter more incident light, resulting in a higher turbidity value and a corresponding decrease in light penetration. This would be the case if water of a given sediment concentration contained sediment with a smaller mean particle size, elongated or flake-shaped particles, or lighter-colored minerals.

The lake environment features sediment concentrations much lower than the summer stream values and particle sizes much smaller than those might be expected in pre-project downstream conditions. (Typical mean particle size by weight for 27 lake samples was 3-4 microns equivalent diameter versus 16.67 microns equivalent diameter for a depth-integrated river sample taken August 18, 1982 from the Susitna River near Chase (RM 103). Sediment concentrations ranged from 0.14 to 63.5 mg/l in the lake compared to typical values of 156 mg/l to 769 mg/l in the river near Chase during the 1982 summer season).

Because of this difference in suspended sediment regime between stream and lake, some caution should be used in obtaining values of vertical illumination from available turbidity and sediment data. It is likely that illumination in the river is somewhat greater during the summer than might be inferred from turbidity alone.

G-2-014 E-2-20/5

The dissolved gas concentrations above the Devil Creek rapids were not supersaturated and were recorded as approximately 100 percent. The 105 percent value was recorded above the Devil Canyon damsite.

Refer to Chapter 2, Section 2.3.6(b) for incorporation of this correction to our document.

G-2-015 E-2-24/2

These sloughs also contain important anadromous and resident fish rearing habitat.

The statement that sloughs provide valuable rearing habitat for anadromous and resident fish has been added to Section 2.4.4. Additional information can be found in Chapter 3, Section 2.2.2(b)ii.

G-2-016 E-2-25/5

Power generation could be considered an instream flow use under only unusual circumstances. In the case of reservoirs which store water for later power generation, the storage of water is definitely an out-of-stream use. Using the terminology of "instream flow" in the context presented here for power generation is inappropriate and inaccurate.

We disagree that power generation could be considered an instream flow use under only unusual circumstances; hydroelectric power generation is a use of the water in the stream.

G-2-017 E-2-26/3

Fry emergence occurs at different times within and among species. Emergence is most closely correlated with accumulated thermal units and has little to do with the hydrograph. Also burbot and Dolly Varden should be added to the list of important resident species.

We agree that fry emergence occurs at different times within and among species and that emergence is most closely correlated with accumulated thermal units. The statement should have read that fry out-migration occurs on the ascending limb of the hydrograph. The importance of burbot and Dolly Varden as important resident species has been noted in Chapter 2 Section 2.6.2.

G-2-018 E-2-28/6 & E-2-29/1

Seasonal salinity measurements should be collected and correlated to a wide range of flow levels and tide conditions instead of to a few selected flow levels.

The recommendation that seasonal salinity measurements should be collected and correlated to a wide range of flow levels and tide conditions instead of a few selected flow levels will be considered in the planning of future studies.

A planned winter collection trip will attempt to gather data at a low tide range throughout a tidal cycle. This data will help define the maximum extent of saltwater instrusion during low flows. If saltwater intrusion is not appreciable at existing winter flows, additional data collection on salinity would not be warranted.

G-2-019 E-2-29/2

The location of the sampling site and a definition of the mouth of the Susitna River should be provided to give credence to this statement. Saltwater intrusion would be expected to be dependent upon tidal action, so this must also be taken into account when describing saltwater mixing and intrusion.

The mouth of the Susitna River has been defined as the point where the coastline of Cook Inlet is extended across the Susitna River, i.e., Susitna River enters Cook Inlet. This is at a point just below Delta Island.

The location of the furthest downstream sampling site is at RM 0.5.

Saltwater intrusion is related to tidal action. The larger the tide, the greater the mixing and the less the salinity intrusion. At the time of the August 18 and 19, 1982 salinity measurements, spring tides (i.e. large tide range) were occurring in Cook Inlet. This would have the effect of reducing the saltwater intrusion. However, even with neap tides (i.e. small tide range) and the approximate 90,000 cfs discharge at the mouth of the Susitna River, sufficient mixing would exist to prevent salinity intrusion upstream from the mouth.

G-2-020 E-2-29/4-5

The use of regression equations to calculate the peak and low flows without data on actual discharge of the tributary streams to be crossed by the access road is inappropriate and should not be used as a substitute for collection of discharge information. This is particularly important to the design of bridges or culverts for engineering integrity or for fish passage. The sizes of many drainage structures placed in the North Slope haul road and pipeline workpad were underestimated when these methods were applied. This resulted in hydraulic erosion and structure failures that were unnecessary.

We disagree that regression equations are inappropriate for a preliminary estimate of the discharge of the tributary streams to be crossed by the access road. During final design of the access road, culverts will be sized to maintain fish passage according to the criteria established by the Alaska Department of Fish and Game. The recommendation that actual discharge data be collected will be considered in the development of future field studies. However, the value of regression equations should not be underestimated.

G-2-021 E-2-29/6

It is stated that "The line between the dam and the intertie has yet to be designed, sited or constructed." The Exhibit E should include information on the siting (corridors) of the transmission lines, baseline information on resources which may be impacted, an assessment of the impacts, and the methods proposed to offset impacts.

The transmission corridor from the damsites to the intertie has been rerouted. Both the transmission line and access road now share a common corridor. Further information can be found in Chapters 3 and 10, Section 2.4, Exhibit A Sections 4 and 10, and Exhibit B Section 2.7.

G-2-022 E-2-30/1-5

Discharge measurements should be collected at any stream crossings associated with the transmission lines if road access is to be developed. These measurements should be used in determining the size of bridges or culverts for fish passage and engineering integrity. If any other transmission line routes were considered they should be listed.

The recommendation that discharge measurements be made at stream crossings associated with road access to the transmission line will be considered in planning future studies. While these measurements would be useful this would not be sufficient to size the culverts because of the limited number of years of data that would be available before construction is scheduled to commence.

G-2-023 E-2-31/General Comment on Section 3, Project Impact on Water Quality and Quantity

It is essential to present a discussion of the rationale and process for selecting the operational schemes on which the impact discussions were based. In other words, it needs to be made clear why this specific operational scheme was selected above other alternatives, what the engineering rationale is and how considerations of environmental values, concerns or needs were incorporated into the judgment that this is a satisfactory operation scheme.

A discussion of the rational and process for selecting the operation schemes on which the impact discussions were based is contained in Chapter 2 Sections 3.2 to 3.8.

G-2-024 E-3-32/1

The statement that dewatering a 1-mile section of the Susitna River will not result in any serious impacts is incorrect. This area is used by grayling for wintering, and dewatering will result in a permanent barrier to migrating fish in the system. Data collected by the ADF&G in 1981 on intrasystem movements of grayling between Deadman and Tsusena Creek indicated migration between these systems.

The significance of the loss of the 1-mile reach due to construction is assessed in Chapter 3, Section 2.3.1(a) (i). Note that once the dam is completed this section of river will be permanently lost.

G-2-025 E-2-33/4

The statement does not address the large amount of spoil that will be generated and the large amount of grading and washing that will be necessary to obtain proper sized materials for the construction of the dam. This will generate an enormous water quality and spoil disposal problem that has not been addressed. Spoil disposal sites should be located in a manner to preclude introduction of sediments into the Susitna River and fish-bearing tributaries.

> The disposal of spoil materials and the extent of grading and washing are addressed in Chapter 2, Sections 4.1.4(c)(iii) and 6.2.

G-2-026 E-2-34/4

Petroleum and petroleum product spills in the smaller grayling streams can have significant impacts on these fisheries. An oil spill contingency plan is essential to provide proper direction to prevent or mitigate spill events.

> Federal law requires that as part of the management procedures there will be an oil spill contingency plan (40 CFR 102.7). This is discussed in Chapter 3 Section 2.4.3(c) (ii).

G-2-027 E-2-34/5

The description of the treatment of the wastewater is totally inadequate. The discussion of wastewater treatment should describe the volume of the wastewater, the nature of the contaminant, a documented system for appropriate water treatment, the anticipated quality and the volume of the effluent, and an analysis of the instream concentrations of the effluent.

> Refer to Chapter 2, Sections 4.1.1(c)(vi) and 4.2.1(c)(vi) for discussions of the concrete wastewater, its treatment and potential impacts. A wastewater control contingency plan, in compliance with state and federal regulations will be developed. Additional information is provided in Chapter 2, Section 6.2

G-2-028 E-2-35/1

Ground water can be impacted by polluted surface water drained into a well.

> We agree that ground water can be impacted by polluted surface water drained into a well. The greatest opportunity for this to occur will be in the construction area. However, safeguards such as an oil spill contingency plan will minimize the risk of this occurrence.

G-2-029 E-2-35/2

The term minor impacts, to describe the effects of excavation of borrow material, appears to be a mis-statement. If borrow material is taken from streams or lakes in the impoundment area, the impacts could have serious consequenes on these fish populations. The types and volume of borrow materials to be removed, and the availability of materials need to be identified. An inventory of the fisheries in these areas needs to be made and baseline water quality conditions need to be documented. An analysis of the effects of borrow removal and mitigative actions to reduce the impacts by altering site locations or construction and operation techniques should be presented. This is a major oversight in this document.

At present, Tsusena Creek is the only stream scheduled for borrow material removal (Borrow Site C). No sites are proposed adjacent to any lakes.

A description of the types and volumes of borrow material, the availability of material and the potential impacts are discussed in Section 4.1.1(c)(iii). A preliminary description of proposed mitigative measures is provided in Section 6.2. Additional information is presented in Chapter 3. Potential impacts to the fisheries resources are discussed in Chapter 3, Section 2.4.3(d).

G-2-030 E-2-35/5

Structural measures to prevent downstream movement of fish through the tunnels is a necessary mitigative action that is not addressed. Downstream movement of fish without passage upstream essentially means these fish are lost to the population.

An expanded discussion of the impacts of the diversion tunnels on fish is contained in Chapter 3, Section 2.3.1(a)(i) and 2.4.3(h).

While it is valid to assume that individual fish will not necessarily be lost by filling the reservoir, the lost tributary and mainstem habitat and the low habitat value in the reservoir subsequent to filling is expected to significantly reduce the populations of fish susceptible to passage through the diversion tunnels. The temporary mitigative measure of structural protection from passage through the tunnel will provide only short lived benefits. It would be more appropriate to provide mitigations that will provide long-term benefits.

G-2-031 E-2-35/6

Upstream migration of fish will be completely blocked by the velocity barrier in the diversion gates.

We concur that upstream migration of fish will be completely blocked by the velocity barrier in the diversion gates.

G-2-032 E-2-36/5

As with earlier comments (E-2-29/4-5), the regression analysis of peak and minimum discharges should not be substituted for the collection of discharge information.

Refer to response to question G-2-020 (ADF&G comment E-2-29/4-5).

G-2-033 E-2-37/3

The level of analysis presented here and detail of mitigation of the effluent should be provided for all effluents related to the project, not just sewage.

Additional details and analysis of borrow material removal, concrete wastewater, and accidental petroleum spills have been provided in appropriate sections.

G-2-034 E-2-38/6

Reference to this information as a personal communication is inappropriate. The outmigration of salmon in the spring is as likely related to photoperiod and development as the other factors listed. Very low flows in the spring could cause many of the juveniles to remain trapped in backwater pools that are normally flooded by the mainstem under pre-project conditions.

Reference as a personal communication has been deleted from the document as per the Alaska Department of Fish and Game request.

We concur that the out-migration of salmon is as likely related to photoperiod and development as stage, discharge and temperature. We disagree that very low flows in the spring could cause many of the juveniles to remain in backwater pools that are normally flooded by the mainstem under pre-project conditions. Local runoff from the spring melt and/or rainfall in combination with ground water inflow will provide sufficient flow for out-migration. For example in slough 9 there is a backwater pool that extends about 700 feet upstream from the slough mouth at a discharge of 12-16000 cfs (Figure). The berm which controls the pool elevation is approximately 400 feet downstream from the mouth. From this berm to the mainstem, there would be a reach 400 feet in length that would be dewatered if the mainstem flow were reduced to 6000 cfs and no slough flow. Using the very conservative assumptions that local runoff during spring plus ground water flow is only 1 cfs, the flow spreads laterally over a 100 foot width (i.e. no unevenness in the topography which would concentrate flow and increase depth over less width), the depth of flow can be calculated to be one half inch by Manning's equation (Manning's $n = 0.035$, slope = .0038). This would be sufficient to permit out-migration of salmon fry.

G-2-035 E-2-39/2

The proposed flows of 12,000 cfs have not been demonstrated to maintain the character of sloughs and provide the flushing flows needed to clean fines out of the gravel. Also the cycle of vegetation succession will be altered if flows do not wash away old vegetative growth. Consequently, what is now aquatic habitat may become terrestrial habitat over time.

While the proposed flows of 12,000 cfs will not provide the flushing flows to clean fines out of the gravel or maintain the integrity of the slough morphology, during wet years flows will often be sufficiently high to overtop many of the upstream berms of those sloughs which have not been increased in elevation for fishery mitigation. (In sloughs where the upstream berm elevation will be increased, the sloughs will be maintained on a 5-year rotating schedule.) If, during filling, the flood volume storage criteria are exceeded, Watana flows will be increased as high as 30,000 cfs (Section 4.1.2(b) [ii]). During project operation, once the Watana reservoir is filled to the normal maximum operating level, outflow will be increased to equal inflow up to the operating capacity of the release facilities. From the weekly reservoir simulations, flushing flows of 20,000 cfs will occur once every seven years on the average with "Watana only." When Devil Canyon comes on line there is a 50 percent chance annually that a flushing flow of at least 20,000 cfs will occur. As energy demand increases, flushing flows of 20,000 cfs will occur about once every five years.

G-2-036 E-2-39/3

Minimum flows for the winter period should be established according to fishery resource requirements. This is a critical period for the populations of overwintering fish and even minor dewatering may have significant deleterious effects.

We agree with the importance of ensuring adequate flows for fisheries in the mainstream during the winter months. Adequate mainstem flows are most critical during this period when climatic conditions are harsh and the mainstem is being utilized for overwinter rearing. Hence, during Watana reservoir filling, instream flows will be maintained at natural levels for the period November through April. Chapter 2, Section 4.1.2 has been modified accordingly.

G-2-037 E-2-39/5 & E-2-40

There needs to be an analysis of longer filling periods and associated consequences. The short filling period evaluated (3 years) may produce unacceptable consequences to fisheries resources. An extended schedule for filling may provide for a higher and more preferable mitigation option for fisheries through the 3-year schedule.

By maintaining the proposed 3-year filling period, adverse temperature impacts can be avoided. With the present design there is, at most, one year of impact (refer to Chapter 2, Section 4.1.2[e][i]). With an extended filling regime, downstream flows would continue to be discharged through the low-level outlet for a longer period. Alternative options will continue to be investigated.

G-2-038 E-2-42/5
The potential negative impacts to slough areas downstream from Talkeetna resulting from decreasing the recurrence intervals of what are now mean annual bankfull floods is not addressed.

Insufficient information exists to predict the negative impacts to slough areas downstream from Talkeetna resulting from decreasing the recurrence interval of what are now mean annual bankfull floods.

G-2-039 E-2-43/2-5
The timing and the consequences of the thermal regimes created within the reservoir during filling to downstream water temperatures must be better defined.

After the initial summer of filling, the Watana reservoir will necessarily cool to 4°C. From this point until water can be passed through the release facilities, the Watana outlet temperature will be 4°C. This is because the outlet will be approximately 400 feet below the water surface at the end of the first summer of filling, and there is no mechanism for any significant heat transfer to the water at this depth' The volume of water stored in the reservoir after October of the first summer of filling will be about 2.2 million acre-feet. From November through April, 500,000 acre-feet of 4°C water will be evacuated from the reservoir and be replaced by 0°C water which was contributed as inflow during this time. The 0°C water, because it is less dense than 4°C water, will tend to float on top of the 4°C water. Although there will be some mixing of 0°C and 4°C water, this will be confined to the upper layers. Even with cooling before the ice cover forms, only insignificant cooling will occur at a depth of 175 feet. It is the 500,000 acre-feet stored below this depth which will be discharged during winter.

In spring the ice on the reservoir surface will melt and the reservoir will warm to 4°C, probably by about the end of May. Then the surface will continue to warm above 4°C and slowly this warmer water will penetrate more deeply. Also, warm Susitna River water will be contributed to the reservoir. Although there will be some mixing, the warmer surface water, because it is less dense, will float on the denser 4°C water. Through mid-September, approximately 1.8 million acre-feet of 4°C bottom water would be released from the reservoir if the low-level outlet was continuously used. This would still leave a reserve of 4°C water. However, it is anticipated that sometime in late July or August the reservoir will be sufficiently full to allow discharge through the release facility.

G-2-040 E-2-43/5

The water temperatures downstream from Watana need to be defined more accurately. The cause of these low temperatures should be identified.

Using the 4°C outlet temperature as a boundary condition, the downstream water temperatures have been modeled for the first winter of filling and the second spring through August (using both mean-monthly flows and low-monthly flows, and assuming release facilities are not operational). In the second winter of filling, the release facilities will be operating and water close to 0°C will be drwn from the surface and released. In the event a low flow year occurs during filling and the water level is not high enough for the release facilities to be operational, the resultant temperatures for a reduced discharge of 6000 cfs were examined. The resulting temperature profiles from this discharge and selected filling discharges are illustrated.

G-2-041 E-2-44/4

What are the predicted depths at which photoshynthesis will occur and how will the quality of water discharged downstream compare with the pre-project conditions with regard to photosynthetic processes? Data or discussion regarding this question should be presented.

Vertical illumination in the reservoir is limited by absorption and scattering of light by suspended particulate matter. Data from glacially fed Eklutna Lake reveal a close correlation between the rate of decay of illumination with depth and surface turbidity levels, which will vary seasonally (R&M Consultants 1983). Quiescent settling of particulate matter in winter allows relatively low turbidities in early summer and a corresponding maximum depth of vertical illumination. If the depth of the euphotic zone is taken as the depth of penetration of 1 percent of illumination available at the surface, photosynthetic activity in the reservoir may extend from the surface to as much as 17 meters depth. Suspended sediment introduced by summer streamflow will quickly increase surface turbidity levels and reduce the depth of the euphotic zone accordingly. Mid to late summer euphotic zone depths may be as low as 2 meters. With reduced surface turbidities in the fall, an increase in vertical illumination is expected. However, during the breakdown of density stratification in the fall, turbulent mixing of turbid strata in the water column will increase turbidities once again, reducing illumination somewhat until inverse temperature stratification and ice cover formation occur.

The nature and concentration of suspended sediment in the powerhouse intake will control turbidity and vertical illumination in the river downstream between Watana and Talkeetna. The reduction in summer turbidity levels from pre-project conditions will cause an increase in vertical illumination and hence photosynthesis. In fall and winter, relative post-project increases in downstream turbidities will reduce illumination intensity, although 1 percent light penetration depths are likely to be greater than 2.4 meters in open water areas with a gradual increase in light penetration through the winter.

G-2-042 E-2-45/3

The method used to estimate the 30-50 NTU values should be defined and better described. The reasons why winter turbidity levels are neither quantifiable nor subject to estimation should be clarified.

Data gathered from outside sources, and analysis of sediment concentration/turbidity data from the Susitna River, indicate that Watana reservoir turbidity levels will be in the range of 10-50 NTU. This range has been determined from the regression equation developed between turbidity and suspended sediment concentration using existing USGS data for the Susitna River.

To establish seasonal trends in turbidity at the reservoir outlet, information on inflowing sediment concentrations, settling characteristics of fine sediments, and water travel time through the reservoir were compiled.

Sediment inflow is at a peak in mid-summer with concentrations as high as 1000 mg/l. Data from the USGS shows that approximately 20 percent of this sediment is in the 4 micron or finer size range. Using the turbidity-suspended sediment regression line, 200 mg/l of sediment concentration corresponds to 30-40 NTU.

Travel time of summer inflow in the live storage zone is approximately 150 days. Given the settling characteristics of glacial sediment, particles larger than 4 microns will settle out of the active zone before reaching the reservoir outlet. Therefore, shortly after ice cover formation, expected turbidity in the surface layers would be on the order of 40 NTU.

The rate of settlement under ice will be accelerated due to reduced wind-induced and thermal currents that tend to keep sediment in suspension. We have assumed that once an ice cover forms, sediment less than 2 microns will settle out from the active zone. The 2 micron size constitutes an average of 12 percent of the total incoming sediment. During the summer months this is equivalent to approximately 120 mg/l which corresponds, in turn, to 20 NTU. Sediment inflow drops off in the fall as contribution from the basin glaciers declines: The average sediment input is 300 mg/l with approximately 36 mg/l in the 2 micron and finer range. This corresponds to approximately 7 NTU.

Based on this analysis of seasonal trends, it appears likely that winter turbidity values at the outlet after formation of an ice cover on the reservoir will be in the 10-20 NTU range, summer values will be in the 20-50 NTU range, and maximum expected values at freezeup would be 40-50 NTU. Again, it should be stated that these values are based on the turbidity-suspended sediment concentration relationship developed from the existing USGS data for the Susitna River. Also, the analysis assumes that water will move through the reservoir as a plug with no accounting for significant lateral or longitudinal mixing.

Turbidity data collected in Eklutna Lake in summer of 1982 consistently indicated that maximum turbidity levels were 30-50 NTU at Station 11, a point 5 miles down the lake from its inlet. Surface turbidity values were in the 20-40 NTU range.

Turbidity values at Eklutna Lake become more uniform as the fall overturn period caused convection currents. This was observed in mid-October 1982 with near-uniform turbidity values of 30-35 NTUs. By November 4, 1983, turbidities had decreased to 25-30 NTUs, with no ice cover on the lake. Turbidity values in mid-January showed a slightly decreasing trend with depth at two sites, with values near 20 NTU at the surface.

Additional information on the sampling data at Eklutna Lake is included in Chapter 2, Section 4.1.3(c)(iii), and in the report Glacial Lakes Studies - Interim Report, R&M 1982.

G-2-043 E-2-47/6

The section regarding impacts to slough habitats is not adequately presented. Basically, the relationship of mainstem discharge to slough discharge should be illustrated graphically. The response of the ground water wells to changes in the mainstem at the various locations (for those wells that were not silted in) should be plotted; a gradient profile of the ground water, rather than just the thalweg of the slough, should be illustrated; and a map of the locations of upwelling in the sloughs should be presented. The text as written does not present data and many speculative comments are provided without appropriate qualifications.

The section describing the impacts on slough habitats during filling has been expanded. Once the heads of the sloughs are overtopped there is a unique relationship between the mainstem discharge and slough discharge because mainstem discharge dominates the contributions from the ground water and local surface runoff. This information has been collected by the Alaska Department of Fish and Game and will be available in the supplemental June 30, 1983 report. However, when the heads of the sloughs are not overtopped there is not a unique relationship between mainstem discharge and slough discharge.

The response of ground water wells to changes in the mainstem discharge has been presented in Chapter 2, Section 2.4.4. Ground water contours have also been presented. The locations of upwelling in the sloughs is not available. Further information can be found in the report on Ground Water Studies (Acres 1983).

G-2-044 E-2-49/2

The statements suggesting that there will be no changes in the temperature of upwelling ground water and consequently, no impacts to incubating salmon eggs are not supported by data or citation. The reduction of flows through these sloughs is not quantitatively defined and could easily be major as well as minor. The loss of scouring flows that remove sediment in these sloughs as well as beaver dams and removal of spring ice buildups could easily cause a senesence process to begin which may ultimately destroy the sloughs, are not addressed.

Support for these statements is found in Chapter 2, Section 4.1.3(c)(i). The upwelling temperatures reflect the long term average water temperature of the Susitna River. Since this averge temperature is not expectd to change significantly, the upwelling temperatures should remain the same (Acres 1983).

G-2-045 E-49/4-5

There are no citations, references or data to support these statements.

This section has been revised.

G-2-046 E-2-50/1

There is no reference to the commercial boat launch at Sunshine located immediately below the Parks Highway bridge on the east bank, nor is there acknowledgement of the boat launch at the Talkeetna Village airstrip which is becoming more heavily used due to bank degradation and channel erosion at the "new" Talkeetna boat landing. If the mainstream of the Chulitna River moves west from its present position as defined in the Draft Exhibit E (E-2-42/4), access to the Chulitna River and Susitna River north of Talkeetna River confluence could be considerably more difficult than at present. The source of the data, analysis or other documentation to support the comment that minor restriction on upstream access to Alexander Slough may occur during years of low stream flow needs to be provided.

The commercial boat launch at Sunshine located immediately below the Parks Highway bridge on the east bank is located on a constricted segment of the river. This site was not specifically investigated as water depths immediately offshore are sufficiently deep for launching even at existing low flows.

There is no boat ramp at the end of the Talkeetna airstrip. However, the river bank is low in that area, and some people do launch boats by backing down the river bank. This site has relatively deep water.

The data available and presented in A Preliminary Analysis of Potential Navigation Problems Downstream of the Proposed Hydroelectric Dams on the Susitna River, (Alaska Department of Natural Resources, 1982) was sufficient to define the flow at Susitna Station required to keep upstream access to Alexander Slough open. However, discussions with Paul Gabbert, owner and operator of Gabbert's Fish Camp in Alexander Creek, indicated that there are access problems through that route every year at low flow (Gabbert, October 1982). Furthermore, the channel morphology changes every year due to high flows, making selection of a flow required to keep access open highly variable.

G-2-047 E-2-51/1

Downstream flow requirements have not yet been determined or agreed upon.

We acknowledge that downstream flow requirements have not been agreed upon.

G-2-048 E-2-51/2

The criteria used to develop the 5000 cfs minimum flow as well as any of the other "target" flows should be presented. There must be some documentation of the rationale, review or selection process by which these "target flows" were developed and justified.

The 5000 cfs minimum flow from October through April represents the approximate average flow that would be available for this period if a flow as low as the drought of WY 1969 were to occur. Under normal circumstances flow would be much greater than the 5000 cfs minimum. However, there is only a finite storage volume available in the reservoir and without use of the low level outlet it would not be possible to provide more than 5000 cfs, during a severe drought such as occurred in WY 1969. Once power generation commences it is expected that a different fishery regime will establish itself. Therefore, if a power outage were to occur, rather than provide natural flows of 1000 to 2000 cfs which could be detrimental, it was determined that providing flows of 5000 cfs, during the power outage, would be preferable.

G-2-049 E-2-52/1

Optimally operated reservoir scenarios should be examined for other target flows downstream using the new synthesized flows.

Optimally operated reservoir scenarios have been examined for other target flows downstream. This is discussed in Chapter 2, Section 3.2 through 3.8.

G-2-050 E-2-52/3

A scenario wherein Devil Canyon is not constructed in the projected time frame should be presented.

If Devil Canyon Dam is not constructed in the projected time frame, Watana will continue to operate as discussed in Chapter 2, Section 4.1.3(a).

G-2-051 E-2-56/2

A detailed discussion on ice processes should be presented.

An expanded discussion on ice processes is presented in Chapter 2, Section 2.3.2.

G-2-052 E-2-57/5

To evaluate the effectiveness of the multiple level intake structures, their efficiency at removal of a layer of water at a particular depth must be analyzed hydraulically. The velocity at the port of the intake structure must be low enough to prevent upwelling at the face of the dam. This is a common occurrence that effectively eliminates the functionality of these types of structures.

These comments will be considered during the development of further design studies.

G-2-053 E-2-58/1

The strata modelled for the reservoirs during the winter under alternative operational scenarios must be presented. The ability of the structures to control temperature during the winter needs further documentation.

An expanded discussion of the winter reservoir modeling is presented in Chapter 2, Section 4.1.3[c][i]).

G-2-054 E-2-59/2

The process by which staging elevations were estimated should be documented. Under pre-project conditions with lesser flows, staging is often much higher than these levels. Local flooding in November reportedly affects the town of Talkeetna.

Staging evaluations were computed through the use of an ice model. This is further discussed in Chapter 2, Section 4.1.3(c)(ii). For a discussion of local flooding in November at Talkeetna refer to response to comment G-2-011.

G-2-055 E-2-61/1

There should be an explanation why turbidity in the top 100 feet of the reservoir is the main interest.

Sediment near the surface would have the most impact in scattering or absorbing radiation, thus having the most significant impact on the depth of the photosynthetic zone in the reservoir. The 100 foot designation for turbidity was somewhat arbitrarily assigned to reflect this. In fact, turbidity at greater depths is important, depending on where water is being withdrawn from the reservoir. The statement on the top 100 feet of the reservoir being of primary interest has been modified in Chapter 2, Section 4.1.3(c)(iv).

G-2-056 E-2-63/5

Other potential sources of wastewater need to be listed.

The discussion provided in Chapter 2, Section 4.1.3(c)(v) refers to dissolved oxygen levels. It is anticipated that human wastes generated by the residents of the town, recreational visitors to the area, and the inhabitants of new camps that may be developed in the project area will be the primary sources of oxygen demanding wastewater in the project area. This information is referenced in Chapter 2, Section 4.1.3 (c)(v).

G-2-057 E-2-64/3

We recognize that this section refers to the operation phases; however, there is no explanation how the valves will be operated during the initial filling and startup procedure. An explanation of the thermal effects of using these valves is also needed, since the valves will facilitate discharge of waters from the hypolimnion.

> The operation of fixed-cone valves during initial filling and during startup has been incorporated in Section 4.1.2(c).
>
> The release facilities will be drawing water from between El 2025 and El 2085. This corresponds to an average depth of 135 feet when the reservoir water surface is at El 2190. Since flow releases occur only after the reservoir is full and since this occurs in August or September, then, if it is assumed that the calculated temperature profiles are appropriate and water is drawing uniformly over the intake, the water temperature will be about 8°C. Hence, through the Watana release facilities most water will be withdrawn from the Watana epilimnion.

G-2-058 E-2-66/1-3

Data to support this presentation should be provided.

> Support data has been included in Chapter 2, Section 4.1.3(d)(ii).

G-2-059 E-2-66/5-6

We disagree that navigation and transportation will not be significantly impacted. These are somewhat contradictory to the statements in E-2-66/5-6. Information to substantiate this conclusion should be presented.

In the continuation of paragraph 6 on the next page it is stated that E-27/2 refers to the winter season and the fact that winter travel by snowmachine and dog sled will be impeded.

> Navigation and transportation impacts in the Watana to Talkeetna reach have been quantified and expanded in Chapter 2, Section 4.1.3(f)(ii). The seemingly contradictory statements have been modified in Chapter 2, Section 4.1.3(f)(ii) to reflect the intended meaning.
>
> During winter, after a solid ice cover forms, travel across the reservoir will be possible by dogsled and snow machine. However, this use will occur later in the year than under natural conditions. Downstream from Watana, the river will remain open all winter through Devil Canyon.

G-2-060 E-27-67/1

Reduction of floating debris will not benefit navigation significantly, in our opinion. Low water flows are expected to be the most significant hazard in the downstream reach. The source or data to support statements in this paragraph should be provided.

We concur that on the Susitna, low water could be potentially more dangerous than floating debris because a boat operator cannot necessarily see the river bottom. Additional information can be found in Chapter 2, Section 4.1.3(f)(ii).

G-2-061 E-2-60/2

This paragraph conflicts with Page E-3-137, second paragraph, wherein it states the dam construction will adversely impact temperature from a fisheries perspective.

We disagree that this paragraph conflicts with page E-3-137. There will be no detectable difference in water temperature at Devil Canyon or points downstream resulting from construction of Devil Canyon. Temperatures will be the same as during the operation of Watana. The paragraph on Page E-3-137 discusses filling of Devil Canyon reservoir. Here, there will be temperature differences.

G-2-062 E-2-70/3

See earlier review comments for E-34/5 concerning the analysis needed to determine the water quality hazard from the discharge of concrete wastewater.

Refer to Chapter 2, Sections 4.2.1(c)(vi) and 4.1.1(c)(vi) for discussions on concrete wastewater, its treatment and potential impacts. A wastewater control contingency plan will be developed in compliance with state and federal regulations as discussed in Chapter 2, Section 6.2

G-2-063 E-2-76/4

Documentation of the statement that, "As Devil Canyon reservoir is filled, additional fishery habitat will become available in the reservoir" should be provided.

A discussion on the additional fishery habitat that will become available in the reservoir is provided in Chapter 3, Sections 2.3.2(c) (i).

G-2-064 E-2-87/1

Accurate discharge information on the creeks is needed to insure proper culvert sizing and fish passage. This information is needed to insure proper mitigation of potential impacts.

See response to comment G-2-020.

G-2-065 E-2-90/2

The minimum flow to maintain fisheries should be refined because 12,000 cfs may not be adequate.

A discussion on the minimum flow to maintain fisheries is presented in Chapter 2, Sections 3.4 and 3.6. It is our opinion that the fisheries impacts associated with a flow of 12,000 cfs are mitigatable and thus the loss in net benefits associated with higher flows is not warranted.

G-2-066 E-2-90/3

The seasonal timing of the construction has not been addressed. This is an important factor in addressing fish and wildlife impacts.

The seasonal timing of construction is illustrated in Exhibit C. The impacts on fish and wildlife can be found in Chapter 3.

G-2-067 E-2-91/2

Twelve thousand cfs for a flow at Gold Creek will not afford adequate access to 50 percent of available slough spawning habitat. A higher flow is required to maintain adequate access. This flow must be determined by an analytical process. Also, other life phases of fish in the downstream reaches below Devil Canyon are not addressed. All of the statements regarding the effects of 12,000 cfs flows are purely speculative and are not supported by data or measurements yet available. The release of water through the valves may present downstream thermal problems by releasing cold water in mid-summer.

We have seen no data to confirm the ADF&G statement that 12,000 cfs will not afford adequate access to 50 percent of available slough spawning habitat. However, we are confident that with a relatively stable 12,000 cfs and incorporation of the mitigation measures discussed in Chapter 3, access will be provided to the sloughs. As discussed in Chapter 3, Sections 2.3.1(a) (ii) and 2.4.4(a) (i), the analysis did consider other life phases. The thermal impact of a release through the final cone valves in mid summer during filling is discussed in Chapter 2, Sections 4.1.3(c)(i) and 4.2.3(c)(i).

G-2-068 E-2-91/4

Changes in downstream river morphology have not been fully assessed. To state that no mitigation is necessary to maintain slough habitats is premature. The lack of ice scour and flood flows may cause an aggradation of sediment in sloughs and may reduce natural cleaning processes necessary to maintain productive spawning substrate and rearing areas.

As discussed in the fishery mitigation section in Chapter 3, sloughs that will be adjacent to ice-covered sections of the mainstem and berms constructed at their upstream ends will be maintained on a five-year, rotating basis. At sloughs located upstream from the ice front, excess flow will be released from the damsites during the wet years; this will provide flushing flows. Refer to Chapter 3, Sections 4.1.3(a) and 4.2.3(a).

G-2-069 E-2-91/5 Line 8
Mitigation should be required and should be borne by the project developer as a standard project cost.

Methods of mitigating the potential thermal effects anticipated during the second year of filling will continue to be investigated during the detailed design process. One potential mitigation is a shorter filling regime. This would enable a flow release through the outlet facilities early in the second summer of filling.

G-2-070 E-2-92/1
Data to support statements in this paragraph should be provided.

We are uncertain as to the paragraph referred to. If it is in regard to the minimum downstream flow selection, this is discussed in Sections 3.2 to 3.7. If the comment refers to the operation of Watana as primarily a baseloaded plant, this is discussed in Section 4.1.3(a).

G-2-071 E-2-92/3
Thermal control by withdrawing water close to the surface can result in vortices causing air entrainment and supersaturation which is detrimental to fisheries. This subject should be addressed with supporting analysis to ensure that surface withdrawal of water can occur without detrimental impacts to fisheries.

There are as many engineering reasons as there are environmental reasons for avoiding vortices that cause air entrainment. This subject will be dealt with during detailed design.

G-2-072 E-2-92/4
The report cited did not demonstrate supersaturation because of faulty analytical techniques. The sample of water was not pressurized before gas chromatographic analysis as is required by standard methods. Therefore, any supersaturation would have probably dissipated before the sample was analyzed. The study did show, however, that the thermal conditions will not be affected by the valve and that the temperature downstream will essentially be the same as the temperature at the withdrawal layer in the dam.

The accuracy of these results is being investigated.

G-2-073 Tables
E-2-1 through E-2-20
References to data sources for tabular material should be made where they are missing.

References to data sources for tabular material have been made where appropriate.

G-2-074 Figures
E-2-1 through E-2-39
Reference to data sources for figures should be made where they are missing.

References to data sources for figures have been incorporated where appropriate.

SUSITNA HYDROELECTRIC PROJECT, DRAFT EXHIBIT E

FISH, WILDLIFE AND BOTANICAL RESOURCES

DEPARTMENT OF FISH AND GAME

GENERAL COMMENTS - FISH

Comment 1

This report lacks sufficient data to support most of the statements on project impacts, whether adverse or beneficial. It does not reference or use the literature or experience obtained from other hydro projects. Many of the statements regarding populations of fishes do not adequately reflect consideration of the instream flow requirements necessary to sustain those populations. It does not separate opinion from statements supported by correlative data regarding responses of the fishery to river regulation and impoundment. It also does not refer to or cite in the text the economic consequences of the flow regime presented. The document does not provide information relative to Alaska or other locations as to the success or failure of proposed mitigation measures. In short, the data base presented is insufficient to support most statements of impacts or the quantitative effects that the project will have on downstream fisheries.

Additional difficulties in reading the report are encountered due to lack of literature references, processes by which conclusions or assumptions were developed, and an absence of lists of technical documents and their locations. Sources of tabular or figure material often are not cited. In general, mistakes are common, many errors are apparent, and the report is neither well organized nor edited.

Response

Most of these general comments are presented in a more detailed and constructive manner under the heading of specific comments. Detailed responses to the specific comments have been prepared. In the finalization of Exhibit E these comments have been taken into account, to the extent possible.

DEPARTMENT OF FISH AND GAME

GENERAL COMMENTS - WILDLIFE AND BOTANICAL RESOURCES

Comment 1

There are numerous typographical errors, incomplete sentences, and inconsistent or contradictory statements. The format is frequently violated with impacts of one project feature incorporated into the discussion under the heading of another feature. Terminology is at times inconsistent or vague. The level of detail varies greatly from one subsection to another with "minor" impacts often treated more comprehensively than "major" impacts. There are numerous examples of incompletely thought out ideas, some of which will not stand up to close scrutiny. These are all indications that the terrestrial portions of Draft Exhibit E, especially the impact sections, were written too quickly before information was organized and had received very little proofing. The draft is in such poor shape that a meaningful, detailed review is very difficult if not impossible. However, some major problem areas that require extensive modification of the impact and mitigation sections can be identified and specific examples of types of deficiencies can be cited.

Response

The text of Exhibit E was circulated for review in draft form. Since that time, substantial revisions have been made to content and format. Your constructive criticism is appreciated, and we are confident that the final text will represent a major improvement over the draft.

Comment 2

Quantification of impacts: Magnitude of impacts are rarely indicated except in terms such as "minimal" or "moderate." Even those terms are rarely supported by a rationale. Most judgments of the significance of impacts appear to be subjective. While studies are incomplete, and some data (such as available vegetation maps) are of marginal value, it should be possible to place outer limits on many impacts, at least indicating the order of magnitude. Indication of the general proportion of a population's range subjected to a particular impact would be useful as a crude indicator of magnitude that could be refined at a later date. As written, the reader does not know if a species will lose 10 percent or 90 percent of its habitat.

Response

The text has been rewritten to incorporate available data. Where quantification is reasonable and available, such data have been provided. Where possible, we have provided a defensible analysis of anticipated impacts. Habitat is, for most species, a nebulous and poorly-defined term. We have indicated the importance of identified vegetation types to each species as indicated in ADF&G Phase 1 Reports and the literature, and we have provided data on areal extent of various vegetation types lost and proportions of basin totals these represent.

Comment 3

Impacts based on current populations: Current populations are almost always used as the basis for impact assessment. Impacts are judged under current management plans and management strategies. This approach is not adequate for assessing many of the impacts of the Susitna Hydroelectric Project. Impacts should be assessed in terms of the range of population levels that could reasonably be expected to occur during the life of the impact. Current populations might be adequate for short-term impacts, as the population would not change greatly during that period. However for long- term impacts, such as those resulting from inundation of habitat, a full range of population levels that could be supported by the habitat (carrying capacity) and the range of management objectives that could be supported by those population levels should be presented.

It should be recognized that carrying capacity as well as population levels may vary over time. Consequently, likely changes in carrying capacity during the life of an impact should be considered. Any action that maintains carrying capacity at a generally higher or lower level than expected in the absence of the project would have a positive or negative impact respectively.

Carrying capacity cannot always be measured. Where current populations are near carrying capacity, they are an appropriate measure even for long-term impacts. Where current populations are believed to be below carrying capacity, some estimate of carrying capacity is required. In some cases, historical population data may suffice. In other cases, measures of habitat quality may be used as direct or indirect indicators of carrying capacity.

There are numerous examples where the Draft Exhibit E completely ignores these concepts. Prime examples are caribou and wolf. Both populations are currently at levels below carrying capacity, caribou because of current management goals and wolves because of high harvest, much of which is illegal. Exhibit E concludes that project impacts would be minimal under current harvest levels and avoids discussing impacts that would occur if these goals and actions were altered and the populations were allowed to increase. Wildlife populations, user demand, and management goals have changed dramatically over the last 50 years and can be expected to continue to change over the life of the Susitna project. For example, increased hunter demand is likely to result in an upward adjustment of the caribou population and harvest goals, perhaps even before construction begins. If the Susitna project precludes attainment of goals that could have been attained without the project, there will be a negative impact that has not been adequately addressed by the Draft Exhibit E.

Response

The impacts sections have been largely rewritten to address these problems. We agree that carrying capacity cannot always be measured. Its utility as a management tool or for assessing impacts is therefore questionable in those cases. Species' priorities and conflicts between species' management strategies indicate that carrying capacity is seldom used by the ADF&G in managing harvest levels of most species -- wolves, bears and wolverine in particular. Where carrying capacity data are not available in ADF&G Phase I reports which are the basis of this document, it is obviously impossible to assess the magnitude of attenuation of potential management goals.

Comment 4

Failure to discuss cumulative impacts: Impacts are usually discussed one at a time, with little discussion of the potential cumulative effects on the population. Often each impact is sufficiently isolated that its effect on the population is judged "minimal." However the cumulative effect of all habitat alteration and all mortality factors may significantly affect the population's ability to sustain major impacts such as habitat loss. For example, inundation of moose winter range may reduce carrying capacity, increasing the impact of severe winters on the population. Project induced mortality could slow or even prevent recovery during subsequent years of milder winters. At the very least, there would be an impact on the amount of hunter use the population could sustain.

Response

Cumulative impacts are discussed in the revised Impacts Summary, Section 4.3.5, where appropriate. When quantitative data are not available, no assessment of the magnitude of cumulative impacts is possible.

Comment 5

Ranking of impacts: When impacts are ranked, the most significant impact listed is often one that is easily mitigated. For example, increased hunter harvest resulting from improved access is often suggested to overwhelm all other impacts. In such cases, the discussion of other impacts is often cursory. However, hunting can be regulated and it is certain that the Board of Game will take measures to minimize adverse effects of hunting on wildilfe populations, usually shifting the impact to the users. This treatment is inconsistent with that of other easily mitigated impacts such as borrow pits where the impact after rectification (revegetation) is discussed.

By suggesting that the greatest impact will be unregulated hunting, a distorted view of total impacts is created. Less easily mitigated impacts such as loss of critical foods tend to be obscured and are discussed only superficially.

Response

Some populations, which ADF&G has apparently given low management priority, may not be sufficiently protected from the adverse effects of hunting. We find this comment somewhat inconsistent with others emphasizing our poor treatment of the impact of reduced sustainable yield. However, we have rewritten impacts assessment sections to clarify our concerns for all severe impacts and to reevaluate our assessment of increased mortality from hunting for those high-profile species for which hunted take may be adequately regulated. Impacts were never ranked according to ease of mitigation.

Comment 6

Incomplete and inconsistent treatment of impacts of improved access: Some of the greatest and longest term impacts of the Susitna project will be secondary effects of improved access and attraction of people to the area. This will likely precipitate development and increased recreational use of the area that might not occur for decades without the project. Impacts of improved access through hunting, including direct mortality, disturbance, and ORV use, are discussed repeatedly, often to the exclusion of less controllable impacts. But impacts of improved access through individuals other than the hunters are almost completely ignored. This is inconsistent and ignores a significant source of impacts.

Response

Secondary development is an indirect impact which cannot be predicted or controlled by the Alaska Power Authority (see Section 4.3 paragraph 1), and it is excluded from this discussion. Impacts to wildlife populations by recreational users other than hunters are nearly always of minor significance relative to hunting. In specific instances, where sensitive wildlife areas may be affected, this impact is thoroughly treated.

Comment 7

Inadequate treatment of habitat alteration: Habitat alteration is consistently treated superficially. As noted above, this is sometimes done through failure to even roughly quantify the impact or consider cumulative effects. There are other examples where alteration is dismissed without adequate rationale. The most serious example is downstream impacts to moose habitat.

It is concluded that habitat may be enhanced between Devil Canyon and Talkeetna during the license period. However it fails to consider that areas of current early successional stages may become mature more rapidly than new areas will become vegetated, resulting in an immediate loss of habitat quality.

Changes in frequency of flooding are dismissed because bank full floods will still occur every 5 to 10 years. However this could reduce the rate of cutting and filling to 20 percent of current levels with a corresponding reduction in habitat created by that mechanism. Effects of peak floods and ice scouring below Talkeetna are dismissed even though changes in stage will exceed 4 feet in some areas.

This is an example where conclusions were presented without supporting rationale. Close scrutiny of the problem shows that the underlying rationale was either faulty or that alternative conclusions are possible.

The problems listed above, singly or in combination, work to systematically minimize potential impacts that might require mitigation. This appears to stem from a tendency to seek a rationale that nullifies the need to fully discuss impacts. However, if an underlying assumption is rejected (e.g., downstream effects on moose habitat), the entire section of the impact becomes inadequate. Virtually every section of the wildlife impact assessment suffers from at least one of the problems listed.

Response

Downstream impacts on moose have been reassessed with the provision of a scenario provided through consultation with project hydrologists and engineers. We consider our analysis defensible and our mitigation plan flexible enough to allow modifications if the current predicted impacts are erroneous. We have indicated when impacts are difficult to predict and monitoring is necessary.

We have never intended to systematically de-emphasize impacts. Impacts are treated to the extent that available information from ADF&G Phase 1 reports allows analysis. Impacts are ranked according to 1) the magnitude of their effect on population levels, and 2) their ability to be predicted. We sincerely hope the revisions we have made clarify our interest in adequately addressing the anticipated and hypothesized impacts to wildlife resulting from this project.

Comment 8

Mitigation Plan: The wildlife mitigation plan is too incomplete to warrant detailed comments. Measures to avoid, minimize, or rectify impacts are scattered. Some are included in the vegetation section, but there is little indication of how effective these measures will be for wildlife. It also is not clear which measures have been incorporated into the project design and which are merely recommendations from environmental consultants. The mitigation plan should clearly indicate how wildlife impacts are considered in the design of the project; what measures will be taken to avoid, minimize, or rectify impacts; and how effective these measures will be in mitigating losses. This is necessary to demonstrate that the option analysis the Susitna Hydroelectric Project Fish and Wildlife Mitigation Policy has been followed and so that residual impacts can be estimated for compensation planning.

The inadequacies of the impact assessment are evident in the mitigation plan. There is no mention of compensation for impacts to species other than moose. It is suggested that mitigation measures for moose will partially mitigate for losses to bears and wolves, but that will depend on what actions are taken and where. No mention of options for out-of-kind compensation is made.

Response

The mitigation plan has been entirely rewritten. This document is the description of project design; it is provided by the Alaska Power Authority and is not composed of mere recommendations for environmental consultants. Measures presented herein are guaranteed incorporation into project design and construction.

CHAPTER 3, SECTION 2 - FISH

G-3-001 E-3-2/5: In this paragraph it is stated, "...criteria for assessing the relative importance of biological impact issues have been provided by ...(2) comments and testimony by the Alaska Department of Fish and Game (Skoog, 1982; ...)". We have reviewed the text of Skoog, 1982 and, we do not believe this statement can be construed as establishing "...criteria for assessing relative importance of biological impact issues..." The context of the comments by ADF&G were specific to three alternative access plans, Numbers 13, 16 and 17, and provided qualitative assessment of impacts for each of those plans. It was clearly noted in several areas of the letter that ADF&G's assessment was subjective and qualitative. We would like to state that the criteria by which project impacts are judged should lead to a quantifiable determination of impacts. These criteria for project access routes to our knowledge have not been established. Programs which will collect quantifiable information to ensure equal consideration of fish and wildlife and their habitats and mitigation of those impacts in access corridors have not been performed.

A reference to Commissioner Skoog's April 1982 testimony to the APA Board of Directors would be appropriate. Also, references to comments and testimony provided by Schneider (1979, 1982 a.b.c.) are not cited in the bibliography.

Response

The reference has been revised to correctly reference Commissioner Skoog's testimony on April 11, 1982, and not the August 20, 1982, letter regarding the access road. The Schneider references have been added to the bibliography.

G-3-002 E-3-3/1: The ADF&G disagrees that its policy implies "...that project impacts on fish and game species will be of greater concern than changes in the distribution and abundance of non-game wildlife and invertebrate species." First, the terms "fish and game" and "fish and wildlife" are used interchangeably throughout our policy document, and secondly, the ADF&G's greatest concern is fish and wildlife habitat and its ability to maintain productive populations. As stated in ADF&G policy, "The overall mitigative goal of the Department of Fish and Game is to maintain or establish an ecosystem with the project in place that is as nearly desirable as the ecosystem that would have been there in the absence of that project." We are primarily interested in maintaining the quality, quantity and diversity of the habitat for fish and wildlife with the project that is similar to that existing without the project.

Response

It is recognized that the goal of the various mitigation policies is to maintain habitat that will allow the entire ecosystem productivity to be maintained. It is, nevertheless, true that ADF&G policy places priority concern on certain species or groups of species. The term "fish and game species" is incorrect and the concept of evaluation species has been substituted. As evidence of this prioritization, the ADF&G mitigation policy document contains reference to AS 16.05.840, which provides for free passage of fish. The draft Habitat Regulations (Edfelt 1981) define "fish" by presenting a list of 17 species and species groups that does not include all species of Alaskan fish. Two species common in the Susitna Basin, sculpin and stickleback, are not included. There obviously has been a species prioritization. Under AS 16.05.870, there are special protections for anadromous fish streams. Again, anadromous fish have been prioritized over resident fish. In AS 16.20.185, endangered species are prioritized over nonendangered species. While in theory all species should be given equal consideration, in practice, available time and resources must be concentrated on the most sensitive species. Sensitivity is often defined as high human use value, ecological value or sensitivity to impacts. By avoiding or minimizing impacts to the habitat of these sensitive species (i.e., evaluation species), the habitat of many, or most, other species can also be maintained. This evaluation species concept has been used in Exhibit E.

G-3-003 E-3-3/2: The general tone of statements in this paragraph indicates a process of rationalization rather than of a clear sense of direction and logic. It is stated in this paragraph, "Where there is a high degree of confidence that an impact will actually occur, it has been ranked above impacts predicted with less certainty." For this thesis to have any validity, one must also specify the vulnerability of the resource to be evaluated. The same applies to assessing the process for evaluating the probability that an impact will occur. It is equally important, if not more so, to specify the magnitude of the impact that will occur.

Response

The statement has been revised to clarify the intended meaning.

G-3-004 E-3-3/3-4: The priority sequence for ADF&G mitigation policy is not only for mitigation option analysis in a planning sense but also for mitigation option implementation. We have 5 potential options for implementation as listed, and require an assessment which quantifies project impacts, and determines the parameters under which the project must operate to implement each option. The highest priority mitigation option which is feasible is the one which this Department will require for direct implementation. Quantifiable information sufficient to determine whether an option is feasible must be available to enable the ADF&G and others to select the appropriate mitigation option. As stated in the ADF&G mitigation policy, "The burden of proof to justify lower estimates of damage to fish and wildlife habitat lies with the developer."

Response

This comment does not conflict with the concepts discussed in the referenced paragraphs and is in agreement with Power Authority policy.

G-3-005 E-3-5/3: We suggest that management strategies will require the concurrence of resource management boards and agencies.

Response

The Power Authority will be seeking such concurrence.

G-3-006 E-3-7/2: Chinook, pink, chum and coho salmon mill at the entrance to Devil Canyon. Chinook salmon spawn in Devil Canyon in Cheechako Creek (RM 152.5) and Chinook Creek (RM 156.8). The lower limit of Devil Canyon is defined as RM 152. It would therefore be correct to state that "The Susitna River is a migrational corridor, spawning area and juvenile rearing area for five species of salmon from its point of discharge into Cook Inlet to upstream within Devil Canyon."

Response

The fact that chinook, pink, chum and coho mill at the downstream entrance to Devil Canyon has been incorporated. A discussion of spawning chinook at Cheechako and Chinook creeks is included in the baseline section.

G-3-007 E-3-8/1: Impacts to less sensitive species with similar habitat requirements would be mitigated; however, species with a lower evaluation priority may be highly sensitive to change and may not be mitigated. For example, species that are adapted to turbid waters may be adversely affected if a project creates substantial decreases in turbidity. Burbot are an example of a species which may be so affected.

Response

It is true that some species with a lower evaluation priority may be more sensitive to change. In the Susitna River, however, the four Pacific salmon species selected as evaluation species (chum, chinook, coho, and pink) utilize almost all available habitats at some point in their life cycle and are considered to be highly sensitive to change. Mitigations that prove effective at reducing impacts to the various salmon life stages should mitigate most impacts to the other species.

G-3-008 E-3-8/3:

(a) Chinook and coho do not have a greater commercial value than chums, although they do have a greater sport fishing value.

(b) The projected change in conditions in the mainstem are not necessarily beneficial to rearing juveniles as suggested in this paragraph. The conditions (parameters) referred to should be identified. Further, mainstream habitat will not necessarily be improved in winter months; higher turbidity is an example. Juveniles are also consistently present in sloughs. There are no data or literature cited to support the last two statements in this paragraph.

Response

(a) The text has been revised. The discussion of commerical value properly belongs in Chapter 5 and has been removed from Chapter 3.

(b) Further discussion on how these conclusions were derived is contained in Sections 3.2.1(b)(ii) and 3.2.1(c)(ii).

G-3-009 E-3-8/4: Arctic grayling also utilize mainstem habitats, not only clearwater tributaries as implied.

Response

The text has been revised to remove the implication that grayling do not utilize the mainstem. Detailed discussions of grayling habitat utilization are included in Section 2.2.1(b)(iii).

G-3-010 E-3-9/1: What are the resident evaluation species below Talkeetna? None are indicated in the listing.

Rainbow and burbot should be included in the list of evaluation species because of their importance to the sport fishery and because of their abundance and adaptation to the turbid conditions. There may be a particular sensitivity to possible changes in the case of burbot.

Response

The four species of salmon listed in the response to question G-3-007 are the evaluation species downstream from Devil Canyon. As previously discussed, these species are considered more sensitive to change than other species within the basin. Rainbow trout and burbot are not considered to be more sensitive to the identified habitat changes than the various salmon life stages; thus, mitigation of impacts to all salmon life stages should mitigate impacts to rainbow trout and burbot. For example, rainbow trout primarily spawn, incubate and rear in tributaries during the summer and overwinter in the mainstem or lower portions of tributaries. A similar pattern is followed by chinook and coho salmon. The available data to not indicate that significant impacts to burbot are likely to occur.

G-3-011 E-3-10/3: Table E.3.3 does not reflect the 1.2 million figure discussed in text.

Response

The table has been appropriately revised.

G-3-012 E-3-10/4: Table E.3.4 reflects different figures than the text with regard to chum salmon escapement. The chum salmon escapement was 20,800 and 49,100 in 1981 and 1982, respectively.

Response

There was a typographical error in the draft table. This has been corrected.

G-3-013 E-3-11/1: Value (ex-vessel) on coho salmon is not presented.

Response

All commercial discussions now occur in Chapter 5.

G-3-014 E-3-11/5: If Mills (1980) data are to be used to indicate significance of recreational use, the 1981 information should be included.

Response

The comparable data from 1978 through 1981 have been incorporated.

G-3-015 E-3-12/1: The harvest figures reported here reflect primarily Susitna River harvest. Additional harvest occurs on some of the anadromous species (chinook for example) outside the Susitna drainage, i.e., in Lower Cook Inlet saltwater fisheries. The statement that the sport fishing harvest is from an area larger than that which may be impacted is incorrect.

Response

The harvest figures solely reflect Susitna Basin harvest. Major impacts are expected in the impoundment zone and between Watana Dam and Talkeetna. Minor impacts are expected downstream from Talkeetna. The harvest figures include data from basin-wide tributaries (such as the Talachulitna) and lake systems (Lake Louise/Susitna Lake) that are not expected to be impacted (see Table E.3.6). Thus the data are from an area larger than that which could be affected by the project.

G-3-016 E-3-12/3: The Tyonek Village subsistence fishery is principally supported by Susitna River chinook salmon stocks, not "at least in part" as stated in the text. The Department not only recognizes the subsistence harvest of fish by Tyonek, but is responsible to ensure the continuation of this stock of fish.

Response

The text has been revised; the subsistence discussion primarily occurs in Chapter 5.

G-3-017 E-3-13/1: Throughout the discussion, the escapement year is unidentified.

Response

The appropriate revision has been made.

G-3-018 E-3-13/4: Types of individuals or species of fish should be identified.

Response

The fact that chinook salmon are being discussed has been re-emphasized.

G-3-019 E-3-16/1: The statement that, "Out-migration in the reach from Talkeetna to Devil Canyon peaks prior to early June and terminates by the end of July throughout the drainage." requires documentation.

Response

As noted at the beginning of the statement, the information came from ADF&G (1981d).

G-3-020 E-3-18/2: There are lakes with sockeye in the Susitna River (Talkeetna to Devil Canyon reach). The potential for sockeye enhancement in the middle Susitna Basin should also be mentioned.

Response

The text has been revised to indicate that Chase Lake contains sockeye. The potential for salmon enhancement in the middle Susitna Basin was the subject of an ADF&G study funded by the state legislature. It is our understanding that the report will be finalized in February 1983. The study apparently concluded that there is a potential for salmon enhancement in the middle Susitna drainage by either construction of a fish passage facility to provide for migration to the middle basin or by establishment of a hatchery. While technically feasible, the fish passage facility is not cost effective.

G-3-021 E-3-19/3-4: Based on the 1982 evaluation of sonar versus tag/recapture Petersen estimates, the latter has been determined to be more representative of escapements than sonar estimates. Therefore, it is recommended that Petersen population estimates be used where available.

Response

The document now uses Petersen population estimates in lieu of sonar estimates, except at Yentna Station, where side-scan sonar counts are considered to be the best estimate of escapement (ADF&G 1983).

G-3-022 E-3-22/1-5: We suggest Petersen population estimates would be more meaningful in lieu of sonar counts for the stations at Sunshine, Talkeetna and Curry. The 1982 evaluation of sonar versus tag/recapture Petersen estimates indicates that the latter are more reliable. Therefore, escapement should be defined on Petersen estimates when available.

Response

See previous response.

G-3-023 E-3-24/1-7: The year the data represent is not stated in the text.

Response

The year of the data has been added.

G-3-024 E-3-26/4: Eulachon are known to extend as far upstream as RM 58 based on 1981 observations by Su Hydro Aquatic Studies staff. The RM 48 figure provided by Trent (1982) was for 1982 observations.

Response

The text has been revised to incorporate this information.

G-3-025 E-3-28/2: Principal study areas were located in the first mile of the tributaries upstream of their confluence with the Susitna. The reference to upper stream reaches in the fourth sentence should be removed.

Response

The text has been appropriately revised.

G-3-026 E-3-29/1: These statements are speculative and cannot be supported by existing data.

Response

The statements have been removed and will be reevaluated as more information becomes available.

G-3-027 E-3-29/2: A much larger number of grayling depend upon the area to be inundated over and above those included in this estimate.

Response

The text has been revised to incorporate 1982 data that were received subsequent to release of the draft Exhibit E and to indicate that this is a minimum estimate.

G-3-028 E-3-29/3:

(a) Grayling fry were captured at Watana Creek area in 1981, indicating spawning in the immediate vicinity.

(b) The final sentence concludes that if other unidentified conditions are suitable, spawning habitat will not be a limiting factor for grayling. This needs proper referencing and evaluation.

Response

(a) The new information pertaining to the grayling spawning area at Watana Creek in 1981 has been incorporated.

(b) The text has been revised to include proper referencing.

G-3-029 E-3-30/1: Burbort also inhabit Susitna River tributaries, not just the mainstem.

Response

The discussion as presented indicates that burbot utilize a wide variety of habitats and does not preclude use of tributary habitat.

G-3-030 E-3-30/2: Areas downstream from Talkeetna of importance to burbot were identified specifically. The four mainstem sites upstream from Talkeetna should also be specifically identified.

Response

The areas of highest burbot catches upstream from Talkeetna have been added.

G-3-031 E-3-31/3: The discussion of whitefish occurrence in the impoundment is not clear.

Response

The text has been revised to clarify the occurrence of round whitefish in the impoundment area.

G-3-032 E-3-32/4: The juvenile longnose sucker collection effort was not sufficiently uniform to conclude changes in distribution from the catch per unit effort data.

Response

The discussion of juvenile longnose sucker has been deleted.

G-3-033 E-3-37/3: Chinook salmon extend to RM 156.8 (Chinook Creek) not RM 158.2.

Response

The correction has been incorporated.

G-3-034 E-3-37/4: Resident species of sculpin also occur in the Susitna mainstem. The text should therefore report 7 species.

Response

The correction has been made.

G-3-035 E-3-40/1: Timing for respective salmon use based on 1981 data would be more accurate if changed to:

Coho - 30 July through mid-September
Pink - 27 July through 20 August.

Response

The new data have been incorporated.

G-3-036 E-3-41/1: The Arctic lamprey also occurs in the Susitna River above the Chulitna confluence.

Response

The text has been revised.

G-3-037 E-3-41/5: Based on set net and electrofishing catches in 1982, pink salmon mill in the Susitna mainstem immediately below Devil Canyon.

Response

The new data have been incorporated.

G-3-038 E-3-43/1: Not all sloughs are overtopped by flows of 20,000 to 24,000 cfs. Examples are Sloughs 10, 11, 14, and 15.

Response

The appropriate revision has been made.

G-3-039 E-3-44/4: Holding areas at the mouth of sloughs are not considered a critical factor any more than "holding areas" at the confluence of many of the chum salmon producing streams. The fact that there are holding areas does not necessarily make the sloughs more productive.

Response

The text has been appropriately revised.

G-3-040 E-3-44/8: In the last sentence, are the authors speaking of a tributary mouth or tributary? In either case, importance of the habitat type for rearing cannot be measured simply by number of fish captured at a site. This is particularly true for tributary mouths because they are part of the downstream and out-migratory pathway where fish may be seasonally concentrated.

Response

The text has been appropriately revised to focus the discussion on slough habitats.

G-3-041 E-3-46/4: These are not static populations. The populations of individuals becomes redistributed to favorable rearing habitat locations, including tributary mouths.

Response

The comment has been incorporated.

G-3-042 E-3-46/7: Chum salmon preference to slough habitat over tributary streams is unsupported. Only index surveys were conducted on tributaries whereas sloughs have been surveyed in total. The 1974 investigations and 1982 ADF&G surveys indicate that tributaries may be equally as important to overall chum salmon spawning in the Talkeetna to Devil Canyon reach as slough habitats.

Response

The text has been revised to indicate the relative importance of tributaries, sloughs and mainstem as chum spawning habitat. A preliminary estimate of the number of chum salmon migrating past Curry that spawned in sloughs indicated that 27 percent in 1981 and 12 percent in 1982 utilized slough spawning habitat.

G-3-043 E-3-47/1/1: Indian River is a major chum salmon spawning stream. Based on 1974, 1981 and 1982 escapement surveys, this stream supported higher numbers of chum salmon than chinook and coho salmon.

Response

The revision has been incorporated.

G-3-044 E-3-49/4: Eulachon were found upstream to RM 58 in 1981, and to RM 48 in 1982.

Response

The new data have been incorporated.

G-3-045 E-3-51/7: Based on 1981 and 1982 ADF&G spawning surveys, sloughs do serve as chum, sockeye and pink spawning habitat.

Response

Available project documents do not identify slough spawning areas downstream from Talkeetna. If the data become available, they will be incorporated into the June 30, 1983, report.

G-3-46 E-3-52/3: Yes, all species of salmon were recorded in tributaries in 1981, but sockeye were not found in notable numbers. We do know that the Chase Creek system supports a "small" sockeye run. ADF&G surveys are conducted in the half mile reach of tributaries upstream from the confluence with the Susitna River. The balance of the tributaries are not surveyed. If the report is to reflect that all species utilized tributaries, then it would be appropriate to modify Page E-3-46, Paragraph 2, which presently excludes sockeye as being present in tributaries.

Response

The section under discussion concerns the reach downstream from Talkeetna. Chase Creek and the ADF&G surveys are in the Devil Canyon to Talkeetna reach. Page E-3-46 has been appropriately revised. Downstream from Talkeetna, sockeye are found in notable numbers in some tributaries.

G-3-047 E-3-55/3: Fish Creek in the Big Lake drainage supports a significant rainbow trout population and also pink salmon.

Response

The information has been incorporated.

G-3-048 E-3-62/4:

(a) Cheechako Creek is a chinook salmon spawning stream. Chinook salmon spawn both in the creek and the mixing area at its confluence with the Susitna River.

Gravel removal/dam construction will destroy this production area, which is a long-term impact. The Cheechako Creek plume area is a spawning site. Will project impacts be mitigated here at least until Devil Canyon is built?

(b) If Tsusena Creek will have the long-term and degree of impacts stated, it seems contradictory and optimistic to say it will or can be rehabilitated.

Response

(a) The reference to the Cheechako Creek material site correctly belongs in the Devil Canyon Dam discussion.

Cheechako Creek will only be mined when Devil Canyon Dam is built, at which time the habitat will be lost to chinook.

(b) Rehabilitation plans for the Tsusena Creek borrow site will be developed during detailed design.

G-3-049 E-3-65/4: Investigations should be conducted to determine the presence or absence of fish in the referenced lake.

Response

The recommendation for further study will be considered during the development of future study programs.

G-3-050 E-3-67/3: This is a mid-summer estimate of only those grayling inhabiting the impoundment area and is not an accurate reflection upon the number of grayling that depend upon that same area for spawning, rearing or wintering.

Response

The number is indicated as a minimum number of grayling residing within the impoundment area and is based on the best available estimate of grayling in the area. The text has been revised with the 1982 estimate, which was obtained subsequent to the previous draft.

G-3-051 E-3-68/3: Data are required to support the suggestion that the reservoir may provide additional wintering habitat.

Response

The increase in reservoir volume is documented in Chapter 2, as are the expected ice cover and the water quality and physical characteristics of the reservoir. These data indicate that the reservoir will be suitable as overwintering habitat.

G-3-052 E-3-71/3: The ADF&G studies document juvenile salmon occurrence in mainstem habitats all summer. Catch rates were relatively low, however, and large numbers of fish could be present in low densities over a large area at any time.

Response

The comment is noted. Analysis of the 1982 data should clarify the role of mainstem habitats as juvenile rearing areas.

G-3-053 E-3-73/4: Water temperatures of 5° to 6°C at Talkeetna during open water period may have major impact on returning adults. If higher flows will reduce temperature, it may be better to reduce flows or find ways to tap warmer layers of water for discharge.

Response

The potential impacts of reduced mainstem temperature during the second year of filling are recognized. The model used to predict these impacts was not able to incorporate the buffering affects of tributary inflow. As the AEIDC habitat modeling evolves, the temperature modeling capabilitites will improve and these results will be used to develop a flow release strategy to minimize the downstream temperature impacts. If flows are reduced to increase the downstream temperature, it will be difficult to extend the filling period which was identified as being desirable in Comment E-2-39/5 and E-2-40.

G-3-054 E-3-74/2: The statements in this paragraph are speculative and reflect the need for further study and analysis.

Response

The discussion has been expanded to include additional information.

G-3-055 E-3-75/2: Same comment as E-3-74, Paragraph 2.

Response

The text has been appropriately revised.

G-3-056 E-3-78/1: The statements here are speculative and not supported by data or references.

Response

It is anticipated that a refined understanding of the habitat requirements of juvenile salmon will be established by the ongoing Aquatic Studies program and the results will verify these statements.

G-3-057 E-3-78/3: Beaver dams in Sloughs 9B and 19 did not inhibit use by adult salmon in August of 1982. Slough 9B had a peak survey count in 1982 of five chum and one sockeye salmon on September 19. Low water condition in mid-August generally precluded adult salmon access to Slough 9 which is the access corridor for salmon using Slough 9B. Slough 19 was essentially void of adult salmon spawning in 1982. Only one pink salmon was observed in this slough and this fish was recorded on August 4, 1982. No beaver dams were present in Slough 19 which would have precluded fish access.

Response

The text has been appropriately revised.

G-3-058 E-3-79/4: Deadhorse Creek (RM 121.0) is not an established anadromous fish stream. Occasionally, one or two adults enter this stream, usually pink salmon. However, no successful spawning has been documented.

Annually, Deadhorse Creek flows go below the surface in the lower one-third mile during the late fall and winter period.

It is questionable whether successful salmon production occurs in Sherman Creek. About 25 pink salmon entered Sherman Creek on or about August 12, 1982, presumably for spawning, it has not been established that the eggs will successfully incubate. The creek flows subsurface in the winter and eggs may be frozen.

Skull Creek (RM 124.7) is another stream which probably will be perched with flow changes in the Susitna mainstem. This creek supports a small chum salmon population.

Response

The text has been revised and additional data incorporated.

G-3-059 E-3-80/1: Devil Creek (RM 161.0) would be equally accessible to salmon as Tsusena or Fog creeks. Devil Creek appears to have potential chinook salmon spawning habitat.

Response

The additional data have been incorporated into the text.

G-3-060 a) E-3-80/2: Data regarding flow characteristics are insufficient to substantiate minimal impacts into Susitna River reaches downstream from Talkeetna. A greater proportion of the Susitna River fishery resources utilize this downstream reach. A small change may affect a proportionately larger resources base.

Response

Available data regarding flow characteristics from Talkeetna certainly indicate minimal impacts. The sufficiency of this data base will be considered in formulating the future study program for FY 1984.

G-3-060 b) E-3-80/3: See comments for E-3-80/2.

Response

See response for E-3-80/2 (G-3-060).

G-3-061 E-3-80/4: In addition to salmon utilization, the Susitna River reach from approximately RM 4.5 to RM 29 is almost entirely eulachon spawning habitat, sustaining a spawning adult population ranging in the millions of fish.

Response

The additional data have been incorporated into the text.

G-3-062 E-3-81/1: All resident species occupy mainstem habitats during ice free months, not "may" occupy.

Response

The text has been appropriately revised.

G-3-063 E-3-82/1: Eulachon spawning limits extend from approximately RM 4.5 to RM 58.

Response

The text has been appropriately revised.

G-3-064 E-3-82/3: Eulachon do not spawn in backwater or semi-placid areas. Principle spawning areas are adjacent to cut banks where the substrate included deposits of unconsolidated sands and gravels, and riffle zones or bars with relatively moderate velocity and unconsolidated sands and gravels.

Response

The text has been revised and the new information on eulachon spawning habitat has been incorporated.

G-3-065 E-3-88/4: The statement on sediment in this paragraph contradicts the statement on Page E-3-90, Paragraph 2, Sentence 3.

Response

The text has been appropriately revised.

G-3-066 E-3-90/1: These statements are not supported by data.

Response

We feel that this is a reasonable interpretation of the available data. The text has been revised to clarify our assessment of this issue.

G-3-067 E-3-90/3: Ice cover would probably form at RM 114 not RM 14 as presented.

Response

The typographical error was corrected to read RM 149.

G-3-068 E-3-90/4: The impacts to fish habitat due to backwater and staging processes caused by increased post-project winter flows are not defined.

The text has been revised to clarify and better define the impacts to fish habitats.

G-3-069 E-3-90/5: These statements are not supported by data and are speculative.

Response

We feel that this is a reasonable interpretation of the available data. The text has been revised to clarify our assessment of this issue.

G-3-070 E-3-95/6: Eulachon do not spawn in backwaters. See comment on E-3-82, Paragraph 3.

Response

The text has been revised and additional data incorporated.

G-3-071 E-3-98/6: Other species are known to be present. A relatively small population of Dolly Varden inhabits the subject areas along with at least one sculpin species.

Response

The new data have been incorporated into the text.

G-3-072 E-3-100/3: Additionally, Jack Long Creek supports adult coho salmon. Portage Creek also has spawning populations of chum and pink salmon.

Response

The additional data have been incorporated into the text.

G-3-073 E-3-103/3: Changes in streamflow during open-water seasons will affect slough habitats depending on the flow released. The potential for destroying these aquatic habitats appears high.

Response

The change in stream flow refers to change in relation to the Watana-only scenario, not change from pre-project conditions. The discussion has been expanded based on newly acquired data.

G-3-074 E-3-122/5: Does restricting unauthorized traffic mean that project personnel will be allowed to fish and the general public will not be allowed access to the fisheries? This may not be an acceptable form of mitigation during a construction phase that may span 20 years. The Board of Fisheries management decisions will also supercede the stated policy of APA on catch and release fisheries by project personnel. It does not seem likely that the public will be barred from the area while project personnel have exclusive access and use of the fisheries.

Response

The Power Authority will be proposing policies as part of their license application. We accept the authority of the Board of Fisheries and, in fact, solicit specific mitigation policies that would be acceptable to them.

G-3-075 E-3-126/4: The lakes for water withdrawal should be identified and their resources inventoried.

Response

The recommendation for conducting a resource inventory of the water bodies used for miscellaneous water withdrawal is acknowledged and will be considered in development of the future study programs.

G-3-076 E-3-127/2: Individual fish will not necessarily be lost by filling of the reservoir. Fish do not have to be moved through the diversion tunnel. Structural protection from passage through the tunnel is a potential mitigative measure.

Response

While it is valid to assume that individual fish will not necessarily be lost by filling the reservoir, the lost tributary and mainstem habitat and low habitat value in the reservoir subsequent to filling is expected to significantly reduce the populations of fish susceptible to passage through the diversion tunnel. The temporary mitigative measure of structural protection from passage through the tunnel will provide only short-lived benefits. It is more appropriate to provide mitigations that provide long-term benefits. Mitigation for these losses is discussed under Mitigation for Inundation Impacts in Section 2.4.4(c).

G-3-077 E-3-130/3: A 10 percent reduction of flows during a critical and stressful period for fish does not constitute a minor reduction. The potential effect of reducing the November flow have on the recharge of groundwater reserves which will be needed throughout winter should be evaluated. Icing may take place much sooner with reduced flows and be much more severe.

Response

The flow schedule for filling Watana has been revised; the flow regime from November 1 through April 30 is now proposed to reflect the inflow to the reservoir. Thus no impacts will occur as a result of flow schedule during these months. If, in the question, icing refers to the ice formation process, then that process will be delayed slightly by the warmer temperatures coming out of the reservoir and the process should be less severe. If the question refers to icings (aufeis), it is anticipated that these will be less severe under reduced fall flows because of decreased hydraulic pressures. November to April are unchanged during filling.

G-3-078 E-3-130/4: There are no data presented to support the statements regarding fisheries impacts at the referenced flows.

Response

See response to comment G-3-066.

G-3-079 E-3-131/5: Pink salmon fry moved out primarily during the ice breakup period. Chums out-migrated primarily following the early runoff period.

Response

The additional data have been incorporated into the text.

G-3-080 E-3-134/2: There are no assurances that responses, i.e., releases of water, will happen quickly enough to keep from losing one year class of fish. By the time the problem appears to be sufficiently severe to warrant correction, it is most probably too late to act. This problem to be further examined.

Response

Response time for water releases is rapid; flows will be monitored at Gold Creek and adjusted immediately at the damsite if it reaches a designated minimum. Minimum flow levels are being investigated during the ongoing mitigation design efforts.

G-3-081 E-3-134/4: We are not aware of testing of this procedure in this area of Alaska, or that the technique is feasible. Additional research needs to be conducted to evaluate the feasibility of the concept of introducing spawning substrate.

Response

Additional documentation has been provided to substantiate the statements. The concept of introducing spawning substrate has proved successful in Washington and as a mitigative measure needs to be evaluated for site specific situations on the Susitna River.

G-3-082 E-3-135/4: Data have not been presented to suggest this procedure will work for chinook salmon. It is as likely that suitably sized gravels placed in side channels, given maintenance flow, may attract chum salmon.

Response

Additional documentation has been provided to substantiate the statements.

G-3-083 E-3-136/3: There is no definition of species to be produced, nor a management scenario. In addition, a suitable location for the proposed hatchery facility has not been identified. To be considered a feasible mitigation alternative, these considerations must be included.

Response

A hatchery siting study has been completed (Kramer, Chin, and Mayo, Inc. 1983). A salmon hatchery is a low priority compensation alternative. It is anticipated that onsite mitigation will be effective at maintaining production of slough and mainstem spawning salmon.

G-3-084 E-3-138/3: There are no data or references presented to document the feasibility of this mitigation approach. Altered thermal regimes in the mainstem and side-channels would cause potential pre-emergence of salmon fry in these areas. However, early emergence of salmon fry spawned in sloughs may not result as a consequence of higher mainstem temperatures.

Therefore, the proposed feeding and rearing of pre-emergent salmon fry would not be resolved by the proposed spawning channel and rearing ponds (E-3-143 and 144) as mainstem fish would have no access to them.

Response

The section on slough mitigations has been substantially revised and the spawning channel/rearing pond alternative has been removed. It is anticipated that full mitigation can be achieved by habitat enhancement techniques rather than compensatory techniques.

G-3-085 E-3-138/4: A much larger number of grayling than included in this estimate depend on the area to be inundated. Also, this is not a wintering population estimate.

Response

Refer to response to Comment E-3-67/3.

On a more general basis, the attitude implicit in the mitigation plan is that losses are inevitable but unquantifiable, and that some mitigation measures will be implemented but may not work. It is also implied that if monitoring demonstrates inadequacy of a mitigation measure other steps will be taken.

Response

With the development of the Susitna project localized losses would be inevitable; however, no net loss or enhancement in many areas is possible. All losses have not been quantified. Although considerable efforts have and continue to be expended for this purpose, as ADF&G has stated, the determination of the degree of impact (loss of habitat and fish) is very difficult to quantify. No guarantee can be provided that any proposed mitigation measure will achieve 100 percent of its goals. Thus, the committment has been made by the Power Authority to monitor the success of its mitigation program and to implement modifications as required. This is considered a rational and responsible approach to mitigation.

How and by whom will the effectiveness of mitigation measures be determined? Under natural conditions small sub-portions of salmon undergo extreme variations in survival. This will confound evaluation of the mitigation measures and could be a source of continuing conflict between the operators and the resource agencies. The frequent references to alternatives and operations which could be implemented if a mitigation measure proves inadequate puts the burden on the wrong parties.

The mitigation aspects of this document are too tentative and too speculative. Substantially more detail and information is required before ADF&G can make a reasonable decision on mitigation methods.

Response

It is assumed that the FERC, who has the responsibility of regulating hydroelectric projects, will be the arbitrator in these matters.

Other additional comments specific to the mitigation section are as follows:

G-3-086 E-3-136 and E-3-140/1: Reference the following statement from the Exhibit E document: "Since the effective mitigation measures to avoid, minimize, rectify or reduce impacts to the grayling population in the impoundment area are not available, it will be necessary to compensate for the loss of these grayling. Compensation is proposed to be in the form of hatchery propatation of grayling...Sufficient grayling will be planted such the number [sic] of catchable grayling will be similar to the number lost."

The FRED Division of ADF&G has been experimenting with grayling culture for several years, first at Fire Lake, then Ft. Richardson, and not at Clear Hatchery. We are continuing to work with grayling and intend to develop techniques that someday will support a grayling production program. At this time and for the foreseeable future, grayling production in Alaska must be considered experimental. In brief, several factors impact hatchery grayling production:

1. It is difficult to find egg sources that are sufficient in number. Whereas salmon egg takes in the tens of millions are common, a one million grayling egg take is a major undertaking.

2. The eggs and fry are extremely small and from a culturist's standpoint, very difficult to work with. Grayling fry hatch at 30,000 per pound as compared with salmon which are ten times that size at emergence. Marking and therefore evaluation of survival after stocking are not possible with existing technology.

3. Survival from green egg to fry have generally been low - 50 percent as compared to 80 to 95 percent for salmon production.

4. Attempts to rear fry in hatcheries have been largely unsuccessful. The obvious survival advantage that could be gained by releasing larger fish cannot be obtained until techniques are developed which will permit holding and feeding of fry. Grayling have been successfully reared in the lower 48. However, those fish hatch at a larger size (20,000 per pound) and behave differently in raceways.

We intend to overcome these problems as we learn more about the performance of grayling in our hatcheries. However, the idea that an irrevocable loss of grayling due to habitat inundation can be compensated by hatchery propagation must be judged speculative at this point.

Response

It is recognized that grayling propagation is not well developed. The mitigation plan provides for a three-year experimental phase to develop grayling propagation technology that will have utilization beyond project needs. Since ADF&G intends to develop grayling propagation techniques and the Power Authority has a need for such technology, a cooperative experimental effort would be desirable.

G-3-087

The development and operation of spawning channels and the modifications of sloughs, that has been proposed as mitigation warrants further discussion.

Reference the following seven excerpts from Chapter 3, of the Draft Exhibit E document:

1. "The slough habitat for the incubating salmon embryos may be enhanced through increased intergravel flow associated with larger flows, or it may be degraded if the higher flows substantially alter the intergravel temperature regime or ice conditions."

2. "The [proposed] flows are of sufficient magnitude, however, to undertake to rectifying (SIC) impacts to salmon spawning activity by modifying existing spawning habitat to maintain natural spawning by salmon."

3. If further impact reduction is required to maintain existing fish populations, additional mitigation measures will be incorporated. Certain target mitigation issues will receive priority in the monitoring program."[E-3-133]

4. "The out-migration of salmon fry will be monitored to evaluate if proper timing of out-migration is achieved.

The basis for such an evaluation will be the baseline out-migration studies and within year comparison to adjacent unregulated systems."[E-3-134]

5. "Success of a multi-level intake depends on the thermal structure of the reservoir, the existence of sufficient water at the desired temperture and location with the reservoir...Temperatures near this (8 to 12°C) range may exist in the top 100 feet...If this layer is present, it can be accessed by the multi-level intake gates...." [E-3-137, 138]

6. "The most significant adverse impact associated with the altered thermal regime would be accelerated incubation and early emergence of salmon fry...The modified sloughs or spawning channels designed to rectify or compensate for lost spawning and incubating habitat will be provided with a rearing pond at their downstream end...Used to collect early emergents and hold them to prevent their downstream migration...Until appropriate conditions, including temperatures are reached in downstream habitats."[E-3-138]

7. The fry will be fed if natural food production is insufficient to support the number of fry present."[E-3-144]

In response to the above: The major problems appear to be flow alteration with resulting affects on slough access, hydraulics and water temperature. As might be expected, the determination of the degree of impact (loss of habitat and fish) is very difficult to quantify and there is not specific information provided. Instead, engineering solutions are proposed for engineering problems. Modified sloughs aslo known as spawning channels are addressed on a conceptual level. Somehow it is proposed, that an unquantifiable loss of fish will be rectified/compensated by a multi-purpose habitat modification program which includes channelization, flow control structures with day-to-day flow alteration, gravel cleaning, gravel introduction, enhancement of upwelling, rering ponds with fry screens on the outlets and artificial feeding of fry.

The engineering, construction and operation of these channels is totally lacking in detail. There are not operational spawning channels for these species in Alaska. Canada has had mixed success, but they are located in environments far more temperate.

The cost of maintenance and operation of these channels should be included in any determination of feasibility. The proposed demonstration project should focus on fish production and survival as well as the physical properties of the modified slough.

The concern about changes in the thermal regime are inadequately addressed. It is apparant that the impoundmant temperatures and hence the utility of a multi-level intake are not known. The rearing ponds at the downstream end of the channels may not be effective in accomplishing the desirec objective. Emergence of fry will not occur within a short time span but over a period of weeks. Therefore, at any given time the fish in the slough or pond will cover a wide range of developmental stages. A schedule of "release" of these fry into the mainstream must be provided. Once emergence timing is upset due to altered temperatures it is uinlikely that survival levels could be maintained by holding them in a pond.

Fry will not automatically feed on an artificial diet, there is an aspect of "training" which is obviously successful in a hatchery raceway. Washington has had some success with pond culture but the fish are generally hatchery lots of similar size.

Assuming that the "operator" of these sloughs and the proposed rearing ponds determines that artificial feeding is required, how will this be accomplished through the ice cover that may develop on the rearing ponds?

Response

These concerns are addressed in more detail in the final Exhibit E and in the responses to the specific questions received from ADF&G and FWS. It should be noted however, that the emphasis of the slough mitigation program is not to create a series of artificial spawning channels but rather to avoid habitat loss and minimize habitat disruption within the sloughs by implementing modifications to compensate for changes in the mainstem flow regime.

SPECIFIC COMMENTS - WILDLIFE AND BOTANICAL RESOURCES

G-3-088 E-3-279: Rationale for considering alteration of habitat less significant than hazards is not supported.

Increased predation is mentioned on page 284, with no indication of its significance to the population, but ignored in the ranking of impacts. The current moose population is highly impacted by predators. The project is likely to increase the vulnerability of the moose population to predation in several ways. Brown bear and wolf populations are likely to be less affected than moose in the early years of the project, causing an alteration in predator/prey ratios. The project could reduce the availability of spring foods for bears and caribou for certain wolf packs, causing a further increase in predation on moose. The drawdown zone and ice conditions are likely to facilitate hunting of moose by wolves. The moose population may have reduced productivity because of poorer habitat quality, especially after severe winters, reducing its ability to sustain predation. These factors could allow predation to drive the moose population to very low levels and maintain it there for long periods. Similar situations have occurred throughout much of Interior Alaska. Ultimately predator populations would suffer and any habitat enhancement attempts could fail.

Response

Rationale for the priorities assigned in this introductory passage are provided in following text. Recruitment in the moose population is currently highly affected by predators. We appreciate the qualitative discussion of cumulative hypothesized impacts. We agree that impacts on middle basin moose inhabiting the impoundment area will be severe.

Mortality to accidents, predation, and hunting will all increase. The modeling approach outlined will allow assessment of all levels of all mortality sources on the population (see Section 4.3.1(a)(iii). The section has been largely rewritten to indicate the above-mentioned impacts (see Section 4.3.1(a)(ii) - Mortality).

G-3-089 E-3-280: Sections relating to impoundment clearing are inconsistent, illustrating poor editing and confusion about the certainty of mitigative actions. Most sections assume the impoundments will be cleared in a stepwise manner, but on page 306 it says, "If portions of the impoundment are cleared..." On page 286 it suggests a brief increase in forage, but on page 287 it predicts a substantial reduction in value.

Moose are sometimes attracted to areas being logged by availability of branches of deciduous trees.

Response

This section has been rewritten to clarify and incorporate these comments.

G-3-090 E-3-283: Overuse of winter range can lead to reduced natality as well as mortality. Moose that never use impoundment areas will be impacted by over utilization of adjacent areas (see page 287 also). This could expand the zone of impact for several decades.

Response

This section has been rewritten to address these issues. See Section 4.3.1(a)(i) - Habitat loss, paragraph 6.

G-3-091 E-3-284: No rationale for concluding that mortality factors will have a negligible effect on the population. Mortality along access routes should be considered along with dam construction activities because they occur together.

Response

No such discussion occurred on page E-3-284. Access corridor impacts are treated in Section 4.3.3. Impacts are summarized in Section 4.3.5.

G-3-092 E-3-288: It should be possible to quantify areas subject to erosion (and other types of habitat alteration) and estimate the proportion that will revegetate. This is an example of an impact that is mentioned with potential negative and positive effects then dropped. The reader has no idea how much area will be affected and whether the net impact on moose will be positive or negative.

Effects of drifted snow on vegetation, availability of vegetation and phenology are not addressed.

Response

This section has been rewritten to address these comments.

G-3-093 E-3-289-290: See general comments on adequacy of assessment of downstream effects on vegetation. Frequency of flooding (290 first paragraph) is probably very important. No rationale is provided for assessment of the effects of ice scouring on vegetation. The potential effects of scouring should be quantified.

Response

This section has been rewritten to address these comments.

G-3-094 E-3-290: The effects of drifted snow on movements of moose are not mentioned here, but are for caribou (page 298).

Response

Text has been revised, see Section 4.3.1(a)(ii) - Blockage of movements.

G-3-095 Increased mortality resulting from increased predation should be considered. Floating ice during latter stages of breakup could have the same effect as floating debris.

Accidental kills will continue during operation of Watana.

Response

Text has been revised, see Section 4.3.1(a)(ii) - Mortality.

G-3-096 E-3-294: The summary of impacts for Watana comes closest to addressing cumulative impacts. However it is not systematic, ignores some impacts mentioned earlier and contains many subjective judgments that are not supported by quantitative rationale. It also does not include impacts of access routes and transmission lines which must accompany Watana. The uninformed reader is likely to be confused and have no real concept of the range of potential changes in moose populations.

Response

Impacts of various project features are treated in separate sections. Where sub-populations have been identified many impacts from different project features will not be cumulative. Those which are cumulative are treated in Section 4.3.5.

G-3-097 E-3-297: There is no basis for the conclusion that the Nelchina caribou herd will not use the area north of the impoundments at its current population size. It is highly likely that this area of high quality range will be used heavily in the future even at moderate population levels.

Large movements of caribou across the impoundment areas have only been observed once since 1973. Movements were not monitored closely in most years.

It is highly likely that the management goal of 20,000 caribou will be modified, perhaps before Watana is constructed. Therefore the conclusions about level of impact are invalid even if the assumptions about range use were correct.

Response

This section had been revised to treat these concerns.

G-3-098 E-3-298: Statements about drifting snow remaining in the impoundment conflict with statements made in the Feasibility Report. This needs to be clarified and documented.

Response

Disagreement represents reanalysis of available data. Portions of the Feasibility Report dealing with environmental matters are superseded by Exhibit E of the FERC license application.

G-3-099 E-3-298: The most significant mortality factor to caribou could be floating ice. In many years the spring migration to the calving grounds would coincide with breakup of the Watana impoundment. During a period of northerly winds, caribou could encounter open water when they reach the north shore. Seeing no obvious barrier they would start to swim across and would encounter a mass of broken floating ice. This would create a problem similar to floating debris. Mortality could be substantial in some years.

Response

This section has been revised to address this comment.

G-3-100 E-3-299: The impression is created that the four possible responses are mutually exclusive. More likely all four responses will be exhibited by varying proportions of the herd.

Response

Text has been revised to clarify this concern.

G-3-101 E-3-300: The statement that the Mount Watana sheep population does not occur near the impoundment is an example of a statement bsed on a brief period of observation. Sheep have been observed near the impoundment in the past.

Response

Sentence has been revised to indicate that the population is not usually found near the impoundment. Considering the traditional nature of seasonal habitat use by sheep (see ADF&G 1982d), several years' data should be adequate to assess use patterns.

G-3-102 E-3-301: All portions of exposed soil at the Jay Creek mineral lick are not used equally. Some of the most heavily used areas are low on the bluff. Therefore the percentage of the lick that would be inundated is misleading. This is also an example of an "operation" impact being discussed under "construction."

Response

Text has been altered to indicate this possibility. However, no data are provided in ADF&G (1982d) to support this statement.

G-3-103 E-3-305: Carrion is not mentioned as a spring brown bear food in the first paragraph.

The assumption that spring foods are not important to bears is incorrect. Food intake during periods of stable weight or even weight loss can be absolutely critical because it reduces a negative energy balance. A prime example is the importance of winter forage for moose.

The suggestion that loss of carrion is more important than loss of green vegetation is questionable. A moderate quality, but abundant, food may be more important to the population than a high quality, but sparse, food.

The assumption that, because lactating female brown bear do not use areas that would be inundated, other bears could do well without those areas is not supportable. Females with cubs probably have overriding reasons to avoid these areas. This includes the cub's ability to travel and the risk of predation on cubs by males. Pregnant females develop heavier fat deposits that probably help sustain them during this period. A female that was not able to coast through this period would probably lose her cubs and move to riparian areas near the river. Spring foods in the impoundments are probably most important to yearlings which emerge from dens in poorer condition, particularly in years following poor berry crops, and suffer the highest rate of mortality. It is unreasonable to conclude that yearlings could survive as well as a lactating female without spring foods.

Response

The text has been altered to address these concerns.

G-3-104 E-3-303-304: Importance of spring foods to brown bears is inconsistent among "construction," "filling" and "operation" sections.

Response

These sections have been rewritten. Population effects on brown bear because of the loss of spring foods will be much less severe because of the short time period (1 or 2 years after clearing) of the loss.

G-3-105 E-3-308: While bears are capable of crossing the impoundments and some will, there still may be a hindrance of movements between seasonal food concentrations that could reduce productivity of the population. This section is inconsistent with a similar section on black bears (page 310). This is another example of where the potential significance of an impact to the population is not discussed in even general terms.

The fact that healthy bear populations exist where salmon are not available is not pertinent. Salmon are one of several seasonal food concentrations. They are probably most important during years when other summer foods, such as berries fail. Bear productivity and survival are probably higher because salmon are present and hence the population is generally higher.

The entire brown bear impacts section is filled with unsubstantiated speculation. Most of it is biased towards minimizing potential impacts. It fails to consider how several impact mechanisms may work in combination and how they might influence the population. The impact section should list important foods of bears by season, indicate how the project might influence the availability of each food to bears, and indicate the possible effects of these changes in availability on bear productivity and survival.

Response

This section has been rewritten to address these comments. Where quantification is provided in ADF&G (1982f) such data are provided. Section 4.2.1(d) describes food habits and identifies potentially sensitive periods.

G-3-106 E-3-310: The consequences of disturbance of denning black bear during clearing are not emphasized. This is likely to cause problems for both bears and crews. A number of bears are likely to be shot. Many of the disturbed bears will not be able to find new dens and mortality is likely to be high. This can result in a more rapid, more violent and more visible adjustment of the bear population to the project.

Response

This section has been rewritten to give greater emphasis to this impact.

G-3-107 E-3-310: There currently is no resident black bear population near the Tyone River confluence and the Fog Lake area supports low densities. Therefore it is unreasonable to expect these areas to support viable populations during operation.

Response

This discussion has been eliminated.

G-3-108 E-3-310: Project facilities may block movements of bears from the Devil Canyon impoundment area to berry areas adjacent to Watana.

Response

This impact has been added to the discussion.

G-3-109 E-3-311-312: The entire wolf impact section is deficient in that it fails to adequately address impacts of reduced prey densities.

Caribou populations may be reduced. Even if changes in caribou numbers are minor the distribution is likely to be altered in a way that reduces availability of caribou to specific packs. There are data from the Susitna basin indicating that moose densities influence wolf territory size, pack size and pack stability. Some current territories may be reduced to the point where social factors would cause loss of a pack.

Response

This section has been rewritten. Impacts to the Watana pack are specifically treated. Anticipated changes in moose density are unlikely to be severe enough to impact most wolf packs at current exploitation rates of wolves. If the wolf population is allowed to increase through better management of harvest levels, prey availability may then become a limiting factor. No reduction in caribou populations are anticipated to result from the Susitna Hydroelectric Project.

G-3-110 E-3-313: The statement that the amount of habitat lost would potentially affect only two wolverines is not completely accurate. The habitat lost will remove portions of territories of a number of wolverines, not all of only two territories.

Response

The text has been altered to clarify this statement.

G-3-111 E-3-314: Impacts of prey loss on belukha whales is inadequately addressed. This section appears to focus on adult salmon only. Outmigrating salmon and eulachon are more likely the foods attracting belukhas to the area. Eulachon in particular may be important. Until effects of the project on the availability of these foods are determined, no conclusions on impacts on belukha can be drawn.

Response

This discussion has been revised slightly to indicate a degree of uncertainty which may be addressed in ongoing research. Our predictions relative to a detectable impact on belukhas remains and we consider it to be a defensible discussion.

G-3-112 E-3-340: Statements of climatic effects should be documented and quantified with regard to magnitude of impact.

Elimination of ice scouring is suggested as a benefit, yet ice scouring may be the most important factor mantaining early successional stages north of Talkeetna (on page 289 reduction in ice scouring is seen as detrimental). Even the potential short-term benefits may be offset by current shrub communities advancing to more mature stages.

Response

Quantification is supplied where data are available. The discussions of downstream vegetation changes have been rewritten.

G-3-113 E-3-341: The flow regime would be used for fisheries management and its affect on vegetation should be identified. It could prevent vegetation of newly exposed substrate and further offset the potential benefits suggested on page 340.

Response

Flow regimes following completion of the Devil Canyon Dam are not expected to differ greatly from flow regimes of the Watana project. Thus, no additional differences to those described in Section 4.3.1(a) (ii) are expected when Devil Canyon becomes operational.

G-3-114 E-3-340-342: The discussion of downstream effects of Devil Canyon Dam are misleading. On page 340 it states "moose may benefit from an increased availability of riparian habitat." Then, on page 341 it points out that much of the habitat will not be available in winter because of open water. (The potential effects of ice fog on use of these areas by moose is ignored.)

Finally on page 342 it pulls the two statements together and states that effects on moose could be "moderate to severe." Then on page 370 it says changes in vegetation will have a "small population-level effect."

This is an example where the combined effects of several impacts have not been clearly thought out. The full range of possible changes in vegetation has not been discussed, only the most optimistic possibilities. When one of several potential overriding factors is identified, the acreage affected is not quantified.

A far more enlightening impact assessment should be possible by building a simple model with existing data. The analysis on page 172 takes a step in the right direction but does not carry it to a useful conclusion. It crudely estimates the maximum acreage that could become available for vegetation. This should be refined to estimate the amount that would enter productive successionaly stages annually during the life of the project. Uncertainties about rates of colonization would produce a broad range of estimates, but the order of magnitude of change and more importantly the chronological patterns of change should become apparent. Similar estimates for currently productive habitat that will advance to mature stages should be subtracted to provide an estimate of net change in acreage of value to moose. The proportions of this acreage that occurs on islands and would be inaccessible to moose during winter should be subtracted to produce a crude estimate of possible changes in available winter range.

A similar systematic approach should be applied to all areas that might be subject to habitat loss or alteration. Impacts that show a potential for serious effects can then be studied in more detail to refine the estimates for mitigation planning.

Response

Downstream impacts have been reassessed, and this section has been largely rewritten. See Mitigation Plan 6.

G-3-115 E-3-342: Devil Canyon impoudment will primarily affect different moose than Watana. Therefore the statement that moose population will have already been greatly reduced is misleading. The summary of impacts uses the word "minimal" five times in reference to impacts on moose in the upper basin, but completely fails to convey any impression of the range of population changes that could occur during the life of the project.

Response

This summary has been deleted and a more comprehensive summary appears in Section 4.3.5(a).

G-3-116 E-3-343: "... small proportion of acceptable black bear habitat ..." What proportion of what area? How important is that proportion?

Response

The correct quote is: "... small portion of acceptable black bear habitat...". The indication is that very little habitat occurs. No measure of "habitat" loss is possible. Vegetation types lost are presented in Table E.3.83 (Devil Canyon); a discussion of use of vegetation types appears in Section 4.2.1(e). Based on information presented in these sections, our analysis of impacts of Devil Canyon development on black bear are considered adequate.

G-3-117 E-3-350: The orientation of access routes in relation to wildlife concentrations and movement patterns should be considered. Some subpopulations will be more heavily impacted than others. Mortality and habitat loss from access routes should be added to other impacts affecting the same subpopulations during the same time periods.

Response

See Section 4.3.3(a) (ii). Data presented in ADF&G (1982a) indicate no special use areas for moose which will be rendered unusable by road access corridors. Section 4.5 summarizes impacts.

G-3-118 E-3-351: Impacts of road and railroad traffic start at tidewater. Increases in unscheduled traffic on existing roads, particularly the Parks and Denali Highways are likely to be substantial. Levels should be estimated and impacts assessed.

Response

Our assessment of impacts on access road and rail traffic are based on the best available forecasts provided by Frank Orth and Associates, Inc. as summarized in Table E.3.167. These are for the peak construction season. Assessment of actual mortality levels is not possible based on currently available information.

G-3-119 E-3-352: The timing of railroad and highway traffic is more important than an average rate. Both seasonal and diurnal pattern should be considered. Scheduling of traffic should be considered as a mitigation measure.

Secondary impacts of access routes, other than hunting, should be considered.

Combined effects of access potential of transmission corridors and access routes should be considered.

Response

No data on seasonal or diurnal traffic patterns have been provided. Mitigation measures are described in Section 4.4. Secondary impacts of development are not treated as we have discussed in response to initial comments above.

G-3-120 E-3-355: Caribou calving north of the Susitna River is sufficiently dispersed that no alignment of the Denali access road will avoid calving areas completely.

Response

We have not indicated that complete avoidance of this impact was accomplished by initial realignment of the access road. We indicate avoidance of the areas where most calving has recently occurred.

G-3-121 E-3-356: Frequency of traffic will be substantially higher during construction unless unscheduled traffic is restricted.

Response

This sentence has been rewritten to clarify this point.

G-3-122 E-3-355-356: It is not always clear which "herd" is being referred to. The Denali access road runs through a central part of the upper Susitna-Nenana subherd's range. It also runs through one of the highest quality portions of the main Nelchina herd's range. Use of the word "peripheral" is highly misleading.

Potential cumulative effects of the access routes and impoundments on caribou range use should be discussed.

Response

The discussion has been clarified. Cumulative impacts are treated in Section 4.3.5.

G-3-123 E-3-359: Potential alterations of prey distribution, especially caribou, on specific wolf packs should be discussed.

Response

It is impossible to predict alterations of caribou range use even without major disturbance. In any particular year, individual wolf packs may suffer from reduced availability of caribou while other packs benefit. No predictions on availability of caribou to individual packs is possible. However, at current harvest levels, availability of prey is unlikely to act as a limiting factor for wolves. (See comment on carrying capacity above.)

G-3-124 E-3-360: The access routes will provide excellent access to tundra habitats. Therefore, human use of areas important to wolverine during summer will increase.

Response

We concur. The text has been altered to reflect this eventuality.

G-3-125 E-3-366-368: Transmission corridors should be considered along with other impacts. For example where they intersect the range of a subpopulation the changes in habitat quality should be added to changes caused by other project features within the range of the same subpopulation.

Placement and management of transmission lines in proximity to roads and railroads can influence animal movements and rates of mortality. For example, moose train collisions could be greatly increased if a transmission corridor attracted moose in a manner that increased crossings of the railroad.

Response

Cumulative impacts are considered in Section 4.3.5. The consequences of increased moose mortality to various subpopulations are being explored through the use of computer modeling.

G-3-126 E-3-370-371: The big game impact summary is completely inadequate. It addresses only impacts on existing populations. It ignores many impacts, including some judged substantial, suggesting that these need not be mitigated. It conveys no impression of the potential magnitude of change, even in current populations. The one effort at quantification uses the smallest possible number of moose that would be impacted by one mechanism. Even those numbers are stated in a misleading way. They are numbers estimated on one survey during a mild winter. There is no basis for the statement that this represents "most years," and it certainly does not represent even a minimum number of moose that would be eliminated by the project.

Response

The section on impacts has been substantially rewritten and the summary reflects this rewriting. Quantification is provided where data are available. A defensible discussion of relative magnitude of impacts is provided where this is possible. See Section 4.4 for mitigation measures proposed. We hope we have clarified any misleading presentation of data which might have occurred inadvertently. The quantification of impacts on moose in the rewrite is based on recently available information and represents an improvement over the previously attempted quantification. Additional information from ongoing ADF&G studies may allow an improvement on analysis of impacts. The modeling approach being developed will greatly increase our ability to predict the effects of many different and cumulative impacts on moose. Any further information which ADF&G can provide on carrying capacity for the Big Game species on which they are conducting project-related research will greatly enhance the ability to quantify project impacts.

DEPARTMENT OF FISH AND GAME

GENERAL COMMENTS - SOCIOECONOMIC

Comment 1

The ADF&G has continuously expressed concern regarding the adequacy of socioeconomic studies relating to the determination and assessment of potential impacts of the Susitna Hydroelectric Project to fish and wildlife. Expression of these concerns dates back to initial meetings with the Alaska Power Authority in 1979. The original study plan developed by the ADF&G in 1979 contained an objective designed to assess these very impacts.

Upon review of this chapter, these concerns remain. In our vew, little substantial progress has been made to define project-related socioeconomic impacts.

Impacts to fish and wildlife users have not been adequately addressed, either in the areas most directly affected by construction or those areas outside the immediate project area. Portions of the fish and wildlife resources produced within the Susitna Project area are harvested or utilized in other more distant regions. There needs to be an assessment of these uses of fish and wildlife with regard to (1) identification of resources used; (2) quantification of use levels; (3) description of use patterns including seasonality, its context within the local communities, etc; and (4) description of geographic areas of use.

Throughout this chapter, reference is made to current and/or planned studies. These studies, however, are not described, objectives are not presented, and time of implementation or completion is not defined.

Response

We agree that fish and wildlife users have been active in the areas most directly affected by construction and in some areas outside of the immediate project area. Both of these areas were considered in Sections 3.5 and 3.7. We also agree that portions of the fish and wildlife resources produced within the Susitna project area are harvested or utilized in other more distant regions. This has also been considered in Sections 3.5 and 3.7.

We have identified which fish, game, and furbearer resources have been used (see Section 3.7), and have described use levels and patterns to the extent allowed by available data. Use patterns within the context of local communities is available in Braund, 1982. Some of Mr. Braund's work has been summarized and is presented in Section 3.7.

Based upon the fish and wildlife impact analyses, it is clear that the biophysical impacts of the project, with mitigation, will be negligible to most users. Changes in the distributions of caribou, moose, and salmon could disrupt the use patterns of local users. This includes guides, transportation services and lodges, as well as local residents who use the resources for food and ther consumptive purposes. A study of the project's effects on the users, through project-induced changes in resource distributions, will be considered in future study plans if significant resource distribution changes are identified.

The largest impact of the project on fish and wildlife users will probably be from easier and, therefore, increased access to fish and wildlife. Exisitng as well as potential users, will have easier access. This will increase competition for fish and wildlife among existing users and among existing and new users. Areas of greatest potential conflict are described in Sections 4.3.1 and 4.3.2 of Chapter 3. Potential conflicts could be reduced through effective management.

Responses to your comment about current and/or planned studies are provided along with responses to your detailed comments.

Comment 2

1. Organizationally, the section of FISH is not comparable to that of GAME which make it deficient in the presentation of vital information.

   a. It makes no mention of guided sport fishing activities which are a major use of the Susitna River and its tributaries.

   b. No mention is made of fishing lodge operations dependent on Susitna River fisheries.

   c. No category comparable to that of "The Hunter", E-5-75, is made for sport or subsistence fishermen.

   d. The category "Resources" on E-5-75 elaborates on game resources, their characteristics, and the users of those resources. Only limited information is currently available pertaining to recreational and subsistence uses in the Susitna River Basin. There is a need for additional data.

e. In the Game section, no "Methodology" is presented as it is for Fish.

Although it may be true that impacts to the fishery resource depend upon loss of habitat and subsequent loss of fish, the issue in this section (3.7) is also the impact upon user groups. In this case, the methodology in this chapter should address both impacts to the respective user groups, and to fish and wildlife resources.

Response

Businesses that depend upon fish and wildlife of the Susitna River and its tributaries are discussed under Displacement of Businesses in Section 3.5. This section has been revised to recognize the dependence of guided sport fishing activities and the partial dependence of lodges on Susitna River fisheries.

The organizational issue raised in comments c-e, have been addressed. Please refer to Section 3.7.

CHAPTER 5 - SPECIFIC COMMENTS

G-5-001 E-5-6/1: Only characteristics of personal monetary income have been described. There should be some description (especially in the Local Impact Area) of relative importance of natural resource harvests as part of the household income. Any income determination need not necessarily be made in monetary terms, but should be done (1) qualitatively by (a) assigning importance values to the harvest and use of each resource; (b) assessing culturally significant practices; (c) describing the type of economic organization of the area; and (2) quantitatively by (a) assessing amounts of time spent harvesting resources; (b) assessing estimated proportions of household food consumption; (c) determining amounts of money spent in pursuit of wild resources; and (d) experessing the overall output or consumption of a household unit.

Response

We agree that nonmonetary income might be more important to residents of the local area than it is elsewhere. An indication of the relative importance of natural resource harvest to the local impact area will be determined during 1983 through interviews with residents of selected communities.

G-5-002 E-6-12/4-6: This section on recreational facilities related to fish and wildlife resources would be more appropriately termed recreational opportunities. This area has an abundance of opportunities but little development like trail systems, shelters, and other man-made facilities. A full assessment of the use of these opportunities and existing facilities would be appropriate. Certainly, there is information available at Mt. McKinley National Partk and the State Park recreation areas.

Response

Baseline recreational use (including information on McKinley National and State Park recreational areas) and the impact of the project on recreation is covered fully in Chapter 7, Recreational Resources. Section 3.1.3 (a) (i) of Chapter 5 has been changed to refer to Chapter 7.

G-5-003 E-5-54/4: The indirect influences affecting commercial businesses dependent upon fish and wildlife resources as discussed are undefined.

Response

Section 3.5.2 contains an amended text that accommodates this concern.

G-5-004 E-5-54/5: The "partial short-term displacement" as discussed is not defined. The statement made that with increased access, business opportunities will increase is purely speculative. One might also expect business opportunities to be reduced as a result of increased access, particularly if the business is associated with the commercial use of the limited fish and wildlife resources.

Response

The text in Section 3.5.2 (a) addresses the concerns raised in this comment. The displacement of businesses due to the project impacts can only be discussed in the context of the estimated direct project impacts on the fish and wildlife resources. If the proposed mitigation measures are successful, there will be little displacement of business. However, in the event that these measures do not achieve the desired results, a different scenario will emerge. For that reason, all discussions of impact estimates including impacts on businesses should not be viewed as precise predictions.

G-5-005 E-5-54/7: This paragraph indicates similar factors are necessary for both successful lodge and guide operations. This statement is incorrect.

Commercial lodges are most successful with improved access and visitation by large numbers of visitors or customers. With construction of new roads, railroads and airstrips, the project area would appear to best fit this category.

A big game guide, on the other hand, appreciates and can tolerate less competition from additional hunters and recreational visitors. This type of business best functions at low levels of human activity and participation.

Response

Clarification has been provided in Section 3.7.2 of Chapter 5. The discussion of impacts on lodge and guide business has also been expanded to reflect the differing concerns of the two types of businesses.

G-5-006 Loss of additional habitat, and the change in location and amount of salmon harvested as stated requires definition. The statement "long-term" impacts to Cook Inlet fishermen and other fish and wildlife users will be small, is speculative. Long term is not defined, nor are "other use groups", or "recent activity levels." No supportive data or study results are presented to support this statement. Types of on-going studies should also be clarified and referenced.

Response

Information on loss of habitat is provided in Chapter 3, Section 2.3. Changes in the numbers of salmon available for commercial harvest are reflected in the figures in Chapter 3, Section 2.2.1(a).

Commercial fishing in Cook Inlet takes place on mixed stocks of salmon. With the partial exception of sockeye, stock separation is not currently feasible. Thus, the location of potential losses to the commercial fishery in Cook Inlet is indeterminate.

From the data presented in the ADF&G Statewide Harvest Survey, much of the recreational salmon fishing effort occurs in the Deshka River, Lake Creek, Alexander River, Willow Creek, Montana Creek, Sheep Creek, and a few other creeks.

The location of the subsistence salmon harvest in Cook Inlet is discussed in Section 3.7.1(c) (ii). Subsistence fishing in the Susitna Basin is not a recognized fishery by ADF&G. Data on location of harvest are unavailable.

Given that the present data indicate little impact, it is reasonable to assume that long-term impacts to the salmon resource will be small.

G-5-007 E-5-68/1-3: This section is labeled "Methodology", but provides no methods appropriate to the evaluation of impacts to user groups. Implicit in this type of evaluation is the need for a measure of existing use. The only statement defining methods is included in Paragraph 2 which described data used to determine impacts of the dam on the fishery resources. It should be noted that pink salmon are more abundant on even years than on odd numbered years. As such, 1981 was a year of low pink salmon occurrence.

Response

Section 3.7.1(a) has been expanded to more fully describe the methodology utilized.

G-5-008 E-5-68: A survey of community usage and wild resources by Cantwell would be useful in assessing levels of use and importance of the salmon, moose, and caribou and other resources.

The Cantwell area is likely to be affected by:

(1) Wildlife population fluctuations due to construction activity;

(2) Population fluctuations because of increased hunting pressure which could result from:

(a) Increased human population, and/or;
(b) Increased access to resources.

While local residents may not appear as a "significant" portion of the overall harvest, those resources may very well be important to the community in many ways.

Response

We concur that more data, which is not now available, should be collected in future studies. A survey of community usage of fish and wildlife will be included as part of an already planned data collection effort in Cantwell and other communities. This data will be collected in 1983.

G-5-009 E-5-68/4: The assumption is made in the first sentence that "... the commercial fishery for salmon produced in the Susitna system occurs only in the Upper Cook Inlet." This assumption is invalid since Susitna River salmon stocks are harvested throughout Cook Inlet, including the lower district. Impacts to Susitna River fish are indeterminable because it is not possible to separate the mixed salmon stocks as they migrate through Cook Inlet.

Response

The text has been revised to emphasize the mixed stock nature of the commercial fishery in Cook Inlet. With the exception of sockeye salmon, stock separation on stream of origin using scale pattern analysis is not presently possible. Therefore, the commercial fishery statistics for Lower Cook Inlet will be included to make the section comprehensive.

G-5-010 E-5-68-69/5: The monetary figures presented here cannot be used to determine the specific financial loss of Susitna fish, because of the mixed stock (see comment E-5-69/4). Many of these fish are Kenai River or Kasilof River fish.

Response

We do not agree with the comment. The section on the commercial fishery in Cook Inlet provides overall information on the magnitude and value of the harvest and provides some information on commercial fishermen as a user group. Specific information on potential monetary loss of Susitna salmon are presented in Section 3.7.1(b).

G-5-011 E-5-69/3: The first sentence states "The specific impacts which would result from construction of the Susitna dams have not been determined in a manner which allows accurate quantification." This statement invalidates comments in E-5-70/1-3 and statements in other Draft Exhibit E report chapters.

The paragraph does not address impacts to Susitna River salmon resources downstream from Talkeetna. Greater salmon occurrence exists in these areas than does the area further upstream from Talkeetna.

Response

The intention of the first statement was to make the point that the impact assessments on salmon are preliminary estimates. These preliminary estimates will be reviewed as further data is collected and additional analyses of these data takes place. The statements have been revised in the text to more clearly reflect this interest.

Impacts to salmon resources downstream from Talkeetna are described as limited (see Section 2.3.1(b) (iii)). The intent in Chapter 5 was to address areas of greatest salmon impact not ares of greatest salmon occurrence.

G-5-012 E-5-70/3: Chinook salmon are harvested incidentally by commercial fishermen in both upper and lower Cook Inlet. Project impacts to these users requires definition as do the criteria for establishing "significant quantities" as stated.

Response

This statement has been changed to indicate that chinook salmon were not included in the potential loss estimates since the project impacts on chinook salmon are projected to be minimal. References are Chapter 3, Sections 2.2.1(a) and 2.3.1(b).

G-5-013 E-5-71/1: Personal communications with sport fish biologists should be properly cited.

Response

The reference has been changed.

G-5-014 E-5-71/2: The discussion indicates the area and level of impacts to resident and migratory fishes is not determined. Chapter 2 and Chapter 3 of the Draft Exhibit E present relatively detailed presentations of these impacts.

The statement, "Data on specific angler use of the Susitna and tributaries above the Talkeetna River confluence are virtually nonexistent." is incorrect. Data are available on angling use in this area from the ADF&G Statewide Harvest Survey.

Impacts are limited not only to areas upstream from the Talkeetna River confluence, as implied. Sport harvest of stocks utilizing the upper Susitna River are thought to occur elsewhere in Cook Inlet, as far south as the Homer area.

Response

We agree with your comment that Chapters 2 and 3 of the Draft Exhibit E presented relatively detailed presentations of the impacts to resident and migratory fishes. However, quantitative estimates of impacts must still be considered preliminary.

Fishing activity from Talkeetna to the proposed damsite are not defined in the ADF&G statewide harvest survey. Angler activity in this area is aggregated into an "other" category. This aggregation does not allow specific analysis of angler use by area.

We agree that impacts to sport harvest are not limited to upstream from the Talkeetna River confluence. The text has been modified accordingly.

G-5-015 E-5-71/4: Table E.5.40 as referenced in the paragraph omits burbot in the list of major species. This paragraph states study is underway to define recreational values of Susitna River fisheries resources which may be impacted by the project. We are unaware of these studies, and they should be referenced.

Response

Burbot will be added to the major species list. Work has been completed on the study mentioned. However, continuation of that research is not currently under contract; therefore, the reference has been removed.

SECTION SUMMARY

G-5-016 The sport fish discussion is not complete nor does it compare with the commercial section in the presentation of figures and numbers. For example, population estimates are available for several species as are data regarding recreational utilization. These data are not presented. The research mentioned as "currently underway" is not referenced.

Response

Recreational utilization data are presented to the extent that these data are available. Population estimates for sport fish are provided in Chapter 3, Section 2.2.

Some research has been completed on the "currently underway" study mentioned. Further research will be considered in future study plans.

G-5-017 E-5-71/5: Generally, the section on Subsistence Fishing is based on the assumption that the harvests which occur in Cook Inlet are from the Susitna River. This assumption is not necessarily true as most of the effort occurred in the Central District where Kenai and Kasilof salmon stocks are taken. Information in Stanek (1980) indicated the residency of subsistence permit holders. Net survey information (Stanek, unpublished data) is available depicting general areas utilized by subsistence fishermen in the Northern District. Similar information is available for the Central District (ADF&G 1980).

Additional assessment of user groups should be made under the category of domestic use of salmon. Salmon for domestic use is obtained from commercial, sport, and subsistence fisheries. Information on use of salmon resources in Tyonek is also available (Stanek and Foster 1980). More recently, data were collected during the spring of 1982 on the specific uses of salmon by Tyonek residents (Foster 1982). It is assumed that most of the chinook salmon caught in the subsistence fishery at Tyonek are Susitna River fish.

Response

The text has been modified to indicate that the subsistence harvest is on mixed stocks with only an indeterminate portion of Susitna Basin fish as one component.

The collection of additional information on user groups will be considered in future study plans.

G-5-018 E-5-71/2: The value of "subsistence" caught fish cannot adequately be determined using a shadow price. Usher (1976) described the difficulty in determining the value of wild foods. The "point of subsistence capture estimate" would not adequately estimate value. A more appropriate value would be the processed cost. In addition, the nutritional value, cultural value, and equipment investment must be added as cost qualifiers.

It is also stated that value might be determined using "...the price of an equally desirable alternative food source." A major question would be how an equally desirable food would be determined when, for many people, there is not a better source in terms of quality, nutritional value, cultural value, social value, and recreational value. Indeed, salmon is the standard by which value is determined.

Response

The actual value of a subsistence-caught fish is a combination of the value of the salmon as food, plus other social, cultural, and perhaps, religious parameters. The food component of this total value can be addressed using a shadow price. Inclusion of the other factors is required, however, to be able to make a complete valuation. The text of this section has been revised.

We disagree with the second part of this comment. The use of the conjunction "or" in the sentence quoted makes this comment inappropriate. In the case where "an equally desirable alternative food source" did not exist, the first part of the sentence would then hold by default.

G-5-019 E-5-73: Under the category of Game, there is not section on methodology as under the Fish section.

In the section on "Guides and Guide Services", there is not quantification of the number of guides operating in the area or their revenue. In addition, quantification of the numbers of people providing outfitting and transporting services that are not guides is required. Information is available from the ADF&G and from the Guide Licensing and Control Board.

Response

Section 3.7.2 has been modified to include introduction that provides the general approach to the discussion of wildlife resources/user interactions.

Section 3.7.2(b) has been modified to reflect the information from the Guide Licensing and Control Board on the number of guides that operate in GMU 13. The other types of information mentioned in the comment are not required by FERC's guidelines for Chapter 5: Report on Socioeconomic Impacts.

G-5-020 E-5-74/3: There is no discussion of available data (Phase 1 of big game reports) that provide estimates of losses of animals, effects of access, new hunting regulations, etc., that would influence "available harvestable animals."

In the category of "Lodge Operators" no indication is made of the amounts of services and relative value of services furnished.

Many additional lodges on the highway system provides services to the individuals who hunt along the highway system or who use the highway system as a point of departure.

Response

Section 3.7.2(b) has been ammended with information on the most recent estimates of project impacts on the animal populations. There is, in the same section, a discussion of the importance of regulations and how regulations may be influenced by the project impacts.

Refer to Section 3.7.2(a)(ii). Information on types of services provided by the lodge operators in the immediate vicinity of the project were listed. Examples of the rates charged by one of the businesses for guided hunting (as part of the services offered) were quoted.

Refer to Section 3.7.2(a)(ii). A list of lodges that are found on the highway system has been provided in response to this comment. However, it should be noted that these lodges cater not only to fish and wildlife users, but also to people who pursue various other activities that may not be affected by the project.

G-5-021 E-5-75/2: Apparently, the intention of the statement "The impact of the proposed project on the lodge operators would be indirect and of the same nature as that of the guiding industry." is that any direct impacts would be upon the resources. However, in the case of the inundation of land areas utilized for hunting, camps and travel, the impact would be direct.

Response

For a discussion of the types of project impacts on lodge operators, see Section 3.7.2(a)(ii). The question of direct and indirect impacts has been addressed.

G-5-022 E-5-76/2: Reference to the figure, 71,000 animals must be put into proper perspective with regard to the present management for the population and range carrying capacity.

Response

The proper context of these estimates is discussed in section 3.7.2(b)(ii). The text has been expanded for this purpose.

G-5-023 E-5-76/3: The information presented deals with the residency of hunters rather than the experiences they seek.

Response

The information deals with both the primary reason for hunting and hunter residences. This is now reflected in the subheading. Refer to Section 3.7.2(b)(ii).

G-5-024 E-5-77/1: A comparison is drawn between hunting pressures or numbers of hunters during the early 1970's and 1980's. Hunting pressure is a function of the number of permits and the number of animals in recent years. This paragraph is misleading and, in fact, the comparisons are invalid.

Response

The importance of permits and other hunting regulations are recognized in Section 3.7.2(b)(ii). In the same section, in the discussion of demand and supply of hunting opportunity, it is recognized that the constaint on demand due to the knowledge that chances of obtaining a permit are limited.

G-5-025 G-5-78/5: The category "Experience Sought" is inappropriate for the informational content of this section. It provides information on characteristics of user groups.

Response

Refer to Section 3.7.2(b)(ii), where the subheading has been expanded to accommodate the two types of information which are contained in the referenced paragraph.

G-5-026 G-5-79/2: Although harvest ticket reports allow for the reporting of multiple means of transportation, analysis of the data allow for only one primary means of transport. The use of highway vehicles is the most common method of transport to the general area. Within the area, however, other forms are more common.

Response

Footnotes to the data obtained from ADF&G clearly indicate that hunters were asked to report the "primary" means of transportation. The data itself then shows the frequency of use as reported by successful hunters and does not contradict the statements made in the draft license application. For these statements, refer to Section 3.7.2(b)(ii).

G-5-027 E-5-80/1: References should be noted with regard to who is doing the studies and their schedules for completion.

Response

Reference to on-going studies was an error. However, future studies will consider the concern expressed.

G-5-028 E-5-80/2: The first sentence is misleading and inaccurate because the implication is that regulations will be of greatest impact to the users. Regulations are a function of resource status and user groups characteristics. Those regulations which may be promulgated due to any reduction in quantities of resources are a reflection of resource status and perhaps increased user access to the area.

The statement, "In such cases, the project would cause little or no additional reduction in hunting opportunity." when referring to already stringent regulations on some species is inaccurate. Indeed, some regulations are more stringent as with caribou, but may become even more stringent if range is inundated and the area of available habitat is reduced. Regulations on increasing numbers of moose in the region may be relaxed in the near future, but if these prove unsatisfactory and mitigation measures do not compensate for moose losses in the impoundment area, further restrictions may be required.

Response

We agree with your comments. We did not mean to imply that regulations would be of the greatest impact to users. The text of this section has been modified accordingly.

G-5-029 E-5-80/3: The statements indicating that regulatory structures will be the major impact on the user is misleading and inappropriately identified as the major impact on the user.

Response

Section 3.7.2(b)(ii) contains a revised text clarifying the references to the importance of regulatory regimes.

G-5-030 E-5-80/4: There is not indication of how the quality of the surrounding environment will be changed thereby affecting the expectations of the user.

Response

For a discussion of guides and guide services, refer to Section 3.7.2(b)(ii). The text has been revised to recognize the possibility of project impacts on quality of hunting. For a discussion of aesthetic values of the resource, refer to Chapter 8 of Exhibit E.

G-5-031 E-5-81/2: Subsistence users in the region have not been identified with regard to the use of game resources, except caribou. In this case, a set of criteria were developed which qualify a certain number of people on a first-come, first-served basis. For other game resources, further work is required to determine resource use patterns. Information provided in the text refers only to caribou.

Although "bringing home food meat may be the 'main goal,'" there are other goals of the user. These include: (1) obtaining high quality goods at a relatively low price; (2) fulfilling certain cultural traditions and obligations to the community and/or family; (3) attaining goals of self-determination and independence of welfare programs; and (4) attaining the knowledge and ability to support one's self.

Response

The text has been revised to take this information into consideration. Please refer to Section 3.7.2(b).

G-5-032 E-5-82/34 and E-5-83/1: Data limitations on trappers do exist; however, a survey of trappers in the local impact area would be appropriate.

Response

We disagree with the usefulness of conducting such a survey. It is believed that many of the people who live in Mat-Su Borough and Cantwell trap in the winter as a means of supplementing their income. However, that is not to say that their trapping occurs in the areas to be affected by the project.

As part of the land use and wildlife studies that were performed for the Susitna project, conversations with trappers and local residents indicated that a low magnitude of trapping activity occurs in the areas in which furbearer habitat is expected to be affected by the Susitna project (the impact area as defined in Chapter 3). This was substantiated by data available from

ADF&G's 1981 south-central trappers survey. As a result of the limited number of individuals that would be affected by the project and the indications that the biological impacts on most species of furbearers will be limited, it was concluded at the time that the benefits of conducting such a survey would not justify its cost. As more is known about the probable biological impacts of the project, a survey of trappers in the local impact area will be reconsidered.

G-5-033 E-5-84/5: The term "on balance" is unclear. There is some question as to whether existing trappers will benefit or if there will just be more numbers of trappers due to access. It is doubtful that increased access to the inundated area will, in fact, benefit trappers since fluctuating water levels will not benefit more aquatic species, especially if draw-downs occur during winter months where food caches and burrows may become inaccessible.

Response

It is true that the benefit of the increased access provided by the access road and transmission lines to the trapper "user group" as a whole does not necessarily mean that existing trappers (trappers who are currently trapping in the Middle Susitna Basin) will benefit. More likely, the additional access, to the extent that it is permitted to be used, will benefit trappers who do not currently trap in that area but will find it to be more feasible than before. A statement has been added to the introduction on users of furbearers to clarify this distinction.

It is true that the fluctuating water levels of the impoundment areas will not benefit aquatic species living in that part of the Susitna River, and this section did not mean to imply that there will be increased use of the inundated areas by aquatic furbearer species after construction of the dam.

G-5-034 E-5-85/2-3: Construction of access roads and transmission lines may provide added access to some areas for trappers. However, the loss of habitat and increased pressure on martens from trapping and human activity generally may reduce the numbers of marten and thereby be a major loss to trappers. Paragraph 3 more accurately portrays likely impacts than does paragraph 2.

Response

There was a typographical error in the section on impacts to pine marten in which part of the paragraph was repeated. This has been corrected.

The possibility that the benefits to trappers associated with increased access to marten in the project area could be limited to the short- and medium-term, and that overtrapping could result, has been added to this section.

G-5-035 E-5-86/3-4: The assessment of trapping activity and its importance to users in the local impact area should be more extensive. There is some confusion as to who an Alaskan trapper is, compared to "recreational" trappers who supplement their income by trapping. Especially when, as stated in paragraph 4, "It is estimated that there are a large number of residents in the local impact area who do some trapping on a part-time basis...", more information is required on how large this group is and the level of importance trapping is to them.

Response

While there is a large number of residents of the local impact area (the socioeconomic impact area, which includes a large geographical area as a result of the rural nature of the area and the dispersed population living in it) who trap on a part-time basis, very few of the individuals trap in the areas in which furbearer habitat or access will be affected by the Susitna project. For this reason, primary data collection on this user group was not conducted.

In addition, secondary information is limited. The information on the activity of residents of the local impact area who trap on a part-time basis was derived from a report on resources in the Mat-Su Borough. This source has now been added as a reference in the text for clarification.

The section now contains no distinction between "commercial" and "noncommercial" trappers, since part-time trappers will often sell the furs they obtain, and since there is no data to support such a distinction.

G-5-036 E-5-88/4-6: There is no mention of what people's attitudes were toward changes in sections other than 3.1 and 3.5. Because natural resource use is important in the area, there should be some indication of local attitudes toward changes in the availability of resources.

It, therefore, follows from E-5-89/3 that only the attitudes presented with regard to Sections 3.1 and 3.5 are addressed.

No further mention is made regarding measures to mitigate impacts to resource users. There should be some indication as to what can be done to resolve the impacts.

Response

People's attitudes toward changes that could result from developing hydropower on the Susitna River are contained in Stephen R. Braund & Associates, March 1982: Susitna Hydroelectric Project Sociocultural Studies (prepared for Acres American Inc. and the Alaska Power Authority). Mr. Braund's main reason for learning about these attitudes was to find out how people felt about the various access corridors that were under consideration at the time. Mr. Braund asked open-ended questions and in the process, something was learned about local attitudes toward changes in the availability of resources. We refer you to this document because it meets your information need and, as important, puts people's attitudes about various potential changes into perspective.

Local users' attitudes will continue to be taken into account as project design work process and mitigation measures are further refined. Through survey work scheduled during 1983 in Cantwell and other communities, additional information on users' attitudes, and the relative importance of fish and wildlife as income will be available to support project design and mitigation efforts.

DEPARTMENT OF FISH AND GAME

GENERAL COMMENTS - RECREATIONAL RESOURCES

Comment 1

This report segment lacks supportive data for many statements related to project impacts. Statements or discussions are often simplistic, based on faulty assumptions and mehtodologies; and lack the necessary definitions to provide adequate project impact analysis.

In general, analysis of current trends in recreational boating and fishing in Upper Cook Inlet, leads to the conclusion that many of the recreational use projections in this report are far too conservative.

Discussion of project impacts in some instances is limited only to statements that anticipated impacts are similar to others discussed, or to other impoundment projects. The specific comments that follow will demonstrate many of these deficiencies.

Response

The final version of Exhibit E addresses these general comments. The recreational use projections as presented are considered reasonable estimates. If the projections do prove to be too conservative, the additional use can be easily accommodated during Phase 5 of our recreation plan development.

SPECIFIC COMMENTS

G-7-001 Fairbanks is not considered to be within the South-Central area of Alaska.

Response

We agree, text has been changed.

G-7-002 E-7-13/3: The paragraph implies members of the Knik Kanoers and Kayakers are representative of the overall increase in recreational boating within the Susitna River basin. They are not, as they comprise only a minor segment of the recreational boating users. Substantially greater increase in boating, and water oriented recreation with other types of watercraft has occurred.

Response

The emphasis has been changed in the text.

G-7-003 E-7-15/3: Lake Susitna, Tyone Lake and Tyone River are already major recreation areas. They are not potential areas for "future development" as stated in the text. Both Lake Susitna and Tyone Lake have numerous recreational cabins located around their perimeters.

Boaters are not able to float down the Susitna River and up to Lake Louise as stated. Powered watercraft are necessary (often equipped with jet of air-drive propulsion) to ascend the Tyone River, to Tyone Lake.

Response

Although already major recreation areas, future development is anticipated in these areas.

We have clarified boater access to these areas.

G-7-004 E-7-20/1: We are not aware of any recreational boaters traveling upstream on the Talkeetna River to Stephen Lake for fishing, due both to the distance and presence of major rapids on the Talkeetna River.

Response

This has been eliminated from the text.

G-7-005 E-7-24/2: Management of lands for public recreation and appreciation as presented in the paragraph requires additional clarification. It is not clear what will be accomplished to achieve these goals.

Response

This comment has been incorporated in changes in the text.

G-7-006 E-7-25/1: This paragraph refers primarily to wildlife related impacts, and little mention is made of potential fisheries impacts. In addition to quarry activities discussed for Tsusena Creek, it can be anticipated that the lower reaches of all Susitna River tributaries within the impoundment may be effected by vegetative clearing, road construction, gravel removal, as well as the stated water quality changes.

Paragraph one also implies the actual construction area is a relatively minor one It in fact will be almost 50 miles in length, and one which does not constitute only a minor inconvenience to recreational users.

Response

Refer to mitigation in Fish Wildlife and Botanical Resource chapter (Chapter 3), Exhibit E.

G-7-007 E-7-25/2: As in the previous paragraph the discussion is directed primarily to wildlife and wildlife related impacts. The discussion fails to address the fact that the lower reaches of all clear water tributaries to the Susitna River, within the impoundment, will be inundated. These areas are the most valued aquatic habitats at present, and are the areas where all recreational use currently occurs.

Response

Refer to Chapter 3, Fish, Wildlife and Botanical Resources, for environmental impacts and conditions of the Susitna project. Not all recreation use is associated with the lower reaches of the clear water tributaries as stated above. Not even all fishing occurs in these zones as exemplified by Stephan Lake, Deadman Lake, Tsusena Lake, Butte Lake, to name a few. Existing recreation use is described in Section 2.1 and 2.2.

G-7-008 E-7-25/5: This paragraph does not clarify why fish populations are not expected to occur in the impoundment. Statements in Chapter 3 (fish, wildlife and botanical resources) indicate the impoundment waters are expected to provide additional fisheries habitat.

The apparent inconsistency in these statements, and report segments, requires clarification.

Response

The text now references the exact situations as described in Chapter 3, Fish, Wildlife and Botanical Resources.

G-7-009 E-7-25/6: This paragraph is unclear as to locations of areas where sport fishing will be disturbed. Dredging reference is to "channel" but does not clarify if it is within the Susitna River or the tributaries where sport fishing currently occurs.

Additionally, dredging may create impacts other than just changes in water quality as stated. Quarry activities, road construction and resultant recreational use restrictions as a result of these activities are not discussed.

Response

This is addressed in Chapter 3, Fish, Wildlife and Botanical Resources. Access to operating construction sites will not be allowed. However, these construction sites are not near current recreation use areas.

G-7-010 E-7-26/1: The flows predicted during the fill period will not only "temporarily diminish" fishing opportunities as stated, but will totally eliminate some of the slough and side channel habitats. The effects of slough dewatering during the fill period may result in the loss of several year classes of some species of fish, creating not a temporary impact, but a "long-term" one.

Response

As mitigation for potential lost fishery resources access to new areas has been provided within the recreation plan. Refer to Chapter 3, Fish, Wildlife and Botanical Resources, for mitigation measures dealing specifically with these issues.

G-7-011 E-7-26/2

There is no information to support the statement of increased fishing opportunities with increased winter turbidity levels as stated.

Response

The comment has been changed in the text.

G-7-012 E-7-28/1: No data exist to support the statement that the presence of construction workers will not have detrimental effects to the recreational resources, nor is there an adequate discussion of what constitutes "proper control."

Response

The recreation plan is intended to provide recreation opportunities for all people. Special recreation facilities are provided for construction workers. There is no evidence to imply they will damage recreational resources. Their presence will be controlled by contract.

G-7-013 E-7-28/2-3: References to the impacts of 550 workers, the loss of 32 miles of river, construction of a 34-mile road, and current uses of the river are treated superficially. Impacts to recreational resources resulting from improved road access alone will affect not only waters within the impoundment but those of adjacent areas as well.

Response

It has been acknowledged (Section 5 for example) that the road will access new areas including water-related sites, which fulfill mitigation of lost recreation resources elsewhere.

G-7-014 E-7-29/3: This paragraph is speculative. No data are presented to support the statement that winter fishing is unaffected by increased turbidity levels. The increase in turbidity levels requires definition.

Response

Refer to Chapter 3, Fish, Wildlife and Botanical Resources.

G-7-015 E-7-30/3: No data are presented to support the assumption that recreational use is non-specific to the area, and can simply be moved to adjoining areas. A definition of subject species and recreational uses discussed is required.

Response

Data does not exist over the major portion of the study area to make the determination more specific in terms of species and their use by hunters or fishermen. It is clear that the use of the area by recreationists is more tied to the potential for access. Refer to Chapter 3, Fish, Wildlife and Botanical Resources, for species descriptions and mitigation measures.

G-7-016 E-7-37/4: Data extracted from the 1970 report should not be used when similar data from the 1976 and 1981 reports are available. Existing ADF&G data suggest that per capita participation days and projected increas es as published in the 1970 plan, and for demand estimation, are inappropriate for 1980 and 2000.

Response

Data developed in the 1976 and 1981 reports are not applicable as base data because participation days per capita statistics were not provided.

G-7-017 E-7-38/1: Quality is not the same for all activities and should not be discussed as though it were. The assumption that travel time and cost totally influences recreational use is faulty.

Response

Refer to Sections 4 and 5 for the discussion on recreation concept, inventory and evaluation. We agree travel time is not the only criteria influencing recreation use. The willingness to drive or fly is only one of several criteria used. Attractiveness, for example, was also used.

G-7-018 E-7-39/4: Data in this paragraph are interpreted incorrectly. A careful review of the evidence cited does not suggest that fishing effort has been decreasing in the impact area, or even that it has decreased relative to statewide trends. Areas used for yearly comparisons do not represent the impact areas. In addition, areas used for comparison were not the same from year to year.

Response

These data have been re-examined to more accurately describe the existing trends in this section.

G-7-019 E-7-40/4: No data presented in this paragraph to support the assumption of a declining recreational demand in the Susitna River area. The discussion does not define the other "attraction values," nor does it address the increasing recreational needs of an increasing human population in the railbelt area.

Response

Data for the assertions are included in Tables E.7.2-E.7.14. Attractiveness of the study area and its inherent recreation potential is discussed in Section 5.

G-7-020 E-7-41/4: The doubling of recreational use as presented is considered conservative. With the addition of a road system into the upper Susitna River area and the expanding human population, greater increases are expected to occur.

Response

The above forces were all considered as well as other criteria (site attractiveness, other recreation site attractions and competition, remoteness) in determining estimated recreation use. In addition Phase 5 recreation plans are intended to provide additional resources if demand is higher than projected.

G-7-021 E-7-41/6: With the decreased flows downstream from Devil Canyon dam, and improved road access to the dam site, we would expect increased days of recreational use by kayakers, canoers, and rafters.

Response

Downstream recreation will be considered during supplemental recreation study prior to June 30, 1983, and included in the Exhibit E supplement.

DEPARTMENT OF FISH AND GAME

GENERAL COMMENTS - LAND USE

This document is written in such a general manner that it is to difficult to comment on. It contains information that contradicts statements made in other chapters, and ignores potential impacts to land use and access downstream from Gold Creek.

Although mitigation of impacts to land use is mentioned, there is no commitment to implementing possible measures. In addition, there is no discussion of which measures will be implemented or when or how. Some impacts to land users are completely glossed over and it is suggested that users will have to accept impacts or move elsewhere.

Response

Revisions have been made to correct any contradictions that occurred in the Draft Exhibit E. The report continues to focus on land use in the project area (i.e., upstream of Gold Creek); however, additional information on floodlands downstream has been added.

Some land use mitigation alternatives have not been committed to, since they are outside the jurisdiction of the Alaska Power Authority (see ADF&G comment on Chapter 3 numbered G-3-074).

SPECIFIC COMMENTS

G-9-001 E-9-2/7: Activities such as consumptive, recreational or subsistence use of fish and wildlife resources are considered as dispersed use and isolated non-site-specific activities which do not involve a commitment of resources at any particular site.

Harvest, and production of harvestable resources, is specifically dependant on a commitment of a specific amount of land (habitat). Participation in the harvest of fish and game (levels of effort) is therefore site-specific. Consequently, the loss of species habitat including the lands and waters used as harvest areas will have a measurable impact both on management of wildlife and on public use.

Response

For the purposes of the land use report, "site-specific activity includes that involving some form of long-term development or other commitment of resources." This definition includes the construction and maintenance of structures or the alteration and maintenance of the terrain. Although hunting, fishing, and trapping requires the use of equipment, that equipment can easily be relocated without mechanical assistance. The abandoned activity site and surrounding terrain would not have been significantly disturbed. The reduction of fish and wildlife is a commitment of resources; however, with the implementation of sound harvest techniques the resource is replenished at a specific activity site within the project area. The loss of species habitat and the management techniques used to minimize the impact of the project are included in Exhibit E, Chapter 3.

G-9-002 E-9-3/5: An assumption is made that because the project is isolated and located in a subarctic environment, extremely low density land use results. However, use of land both by the public and wildlife is seasonal and can be very high for a specific season.

Response

The result of the remote location of the project area is that no roads exist within the project area. The few existing trails are primitive and allow foot or ORV use only. Existing access into the area is predominantly by air and for the purpose of short-term, recreational hunting and fishing. Existing land use is seasonal but it is not high density.

G-9-003 E-9-15/3: Hunting use of Zone 1 is less than in Zones 2 and 3. However, hunting in Zones 2 and 3 is basically associated with the existing lodges and cabins and is more readily quantifiable than identifying independent hunter effort. Use of ADF&G harvest statistics would help quantify independent hunter effort.

Response

The independent hunter effort is quantified for caribou and moose in Section E.5.3.7.2 - Local and Regional Impacts on Fish and Wildlife Groups - Game. These values are called hunter success rates. The project area crosses several ADF&G Game Management Units. Consequently, it is difficult to relate estimates of harvests in particular game units with harvests in the project impact area. Quantifying harvest levels in the project area may be further considered in Phase II of the Susitna Hydroelectric Project.

G-9-004 E-9-5: Reference to rating public use of lands occurs throughout Chapter 9 and is ultimately reflected in Figure E.9.5, a map which identifies 11 use or sample use sites with evaluations of use intensities for each site. The designation of low, medium, and high intensity uses should be defined.

Response

These comments have been addressed in Section E.9.2.2.2-Existing Land Use Activity.

G-9-005 E-9-32/1: Proposed mitigation for the loss of public use of project lands has only addressed the consideration of establishing restrictive access regulations. Other mitigation alternatives should be identified including replacing opportunities lost with lands that provide equal value.

Response

These comments have been addressed in Section E.9.3.4.3-Access - Mitigation.

DEPARTMENT OF

COMMUNITY AND REGIONAL AFFAIRS

ALASKA POWER AUTHORITY

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August 3, 1983

Mr. Mark Lewis
Commissioner
Department of Community and Regional Affairs
Pouch B
Juneau, Alaska 99811

Subject: Your March 16, 1983 Letter Commenting on the Susitna Hydroelectic Project Draft FERC License Application

Dear Commissioner Lewis:

Thank you for reviewing the draft Susitna Hydroelectric Project FERC License Application, Exhibit E and for providing comments related to the Socioeconomic and Land Use chapters. Your comments have been reviewed in detail by appropriate staff and are discussed in Attachment A.

It is important to note the following points prior to examining Attachment A. First, several concerns raised by your Department regarding the draft License Application were addressed in the Socioeconomic and Land Use chapters of the License Application submitted to the Federal Energy Regulatory Commission in February, 1983. Second, a working paper, entitled Project Assumptions, Methodology, and Output Formats (July 1983), has been prepared. The purpose of this paper (Working Paper #1) is to present assumptions and methods that were used to project potential socioeconomic impacts of the proposed project. Additionally, Working Paper #1 describes the format that will be used to report the results of future socioeconomic analyses. This document, which has been enclosed for your use, more fully addresses many of the concerns raised in your letter. Third, in direct reponse to your letter, an interagency workshop was organized and held in Palmer on July 19, 1983. (Dave Tremont of your staff attended this workshop.) Follow-up meetings were held on July 19 and 20 in Trapper Creek and Talkeetna. The purpose of the workshop and follow-up meetings was to provide your Department, and other agencies and organizations, with an opportunity to more fully understand and to contribute to the socio-economic impact projection process. The workshop focused on detailed methodological discussions of information presented in Working Paper #1, as well as additional concerns raised by participants.

We look forward to continuing our working relationship with your staff on issues of concern related to the Susitna Project.

Sincerely,

Eric P. Yould
Executive Director

TA/ljc

Enclosures as stated

cc: Dave Tremont, DCRA, Anchorage, Alaska
William Wakefield II, FERC, Washington, D.C.
Dwight L. Glasscock, H.E., Anchorage, Alaska
Jane Drennan, PMS, Washington, D.C.

ATTACHMENT A

The following discussion provides a point-by-point response to the issues of concern raised by the Alaska Department of Community and Regional Affairs' March 16, 1983 letter.

Comment #1 (Page 1)

The assumptions underlying the socioeconomic analysis imply significant and yet uncommitted policy positions on the part of the State. For example, Exhibit E contains assumptions regarding the origins of the labor force, housing opportunities for that labor force, and mobility of the work force during construction. Implicit in these assumptions are policies addressing local hire and job training, worker residence at the project site, mode(s) of access to and from the construction site, and the use of construction camps as opposed to transporting workers. Should any of these implicit policies fail to materialize as presumed, the nature of the impacts described in Exhibit E could change drastically.

In order to clarify the relationship between assumptions of the socioeconomic impact model and State policy, the Department's recommendation is that the Alaska Power Authority provide a process for key State agencies to become actively involved in the methodology and use of the model. This would, in our opinion, serve two useful purposes. One, it would enable the State to constructively critique the assumptions of the model, particularly in light of existing State policies. Secondly, a better understanding and practical use of the model by State agencies could help form the basis for establishment of new State policies for the project. In the same manner, involvement of the Matanuska-Susitna Borough in the critique and application of the model should be provided for, should the Borough choose to participate.

Response

It is recognized that several assumptions underlying the socioeconomic analysis are based on uncommitted policy positions on the part of the Alaska Power Authority, and that the results of the impact analysis could change if the implicit policy positions and corresponding assumptions do not occur. As described in Working Paper #1, the impact model is designed to analyze multiple scenarios and to provide sensitivity analyses of changes in key assumptions, including the assumptions and policies delineated in Comment #1 (such as local hire, construction camp, and worker transportation issues). These model attributes were discussed at the socioeconomic workshop and are described on pages 10, 16-18, 37, 39, and 41-52 of Working Paper #1.

As described in the cover letter, in response to the second part of Comment #1, an interagency workshop was held July 19, 1983 in order to actively involve key State agencies and the Matanuska-Susitna Borough in the methodology and use of the socioeconomic model. The workshop and subsequent meetings in Trapper Creek and Talkeetna gave the agencies and communities an opportunity not only to understand and critique assumptions and methods used in the model, but also to guide the model's use.

Comment #2 (Page 2)

It is the Department's opinion that the socioeconomic impacts identified in Exhibit E as resulting from the Susitna project are significantly understated.

As was described in the Department's review comments for the Susitna Project Feasibility Study, we feel that the proposed impacts from the Susitna project will far exceed those expressed in Exhibit E. We base our predictions on the impact historically caused from other large construction projects in Alaska, most notably the Trans-Alaska Pipeline project (TAPS).

In order to account for a larger impact than described in Exhibit E, the Department recommends that an alternate socioeconomic impact model scenario(s) be established to represent, as closely as possible, appropriate factors of the TAPS experience for the Susitna project. At a minimum, this alternative analysis should assess those impacts due to induced population growth and increased numbers of people seeking employment. For example, Exhibit E (on page E-5-20) describes that within the period 1983-1991, the latter date representing the peak year of the Watana construction phase, the population of the Matanuska-Susitna Borough is proposed to increase by approxiamtely 22,355 persons. Of this total, only 4,700 persons are proposed to be connected to the project, including direct and indirect/induced workers and their dependents. This estimate appears to be low, particularly in light of the experience gained from the TAPS project, when a far larger than anticipated influx of people was attracted to the area. As a result, this in-migrant population competed with local residents for both direct and indirect/induced jobs and greatly strained the capabilities of public services and facilities. The Department feels that the types of impacts found with the TAPS project could likely reoccur with the Susitna project. We recommend, therefore, that a model scenario be developed which utilizes information gained from the TAPS experience in calculating population influx and resultant impacts. Even with the difficutly in predicting precise numbers of secondary or induced workers and families, the model can at least be used to generate likely or alternative scenarios to guide decision makers in assessing potental impacts and preparing mitigation measures.

Response

The socioeconomic impacts identified in Exhibit E of the License Application projected to result from the construction and operation of the proposed Susitna Project are based on a specific set of assumptions outlined in Chapter 5. As discussed at the workshop and in Working Paper #1, the projected impacts may change if different assumptions and project scenarios are used. Thus, the model selected for use in the socioeconomic analysis is capable of providing impact projections for a wide variety of scenarios and assumptions, including a limited analysis of speculative in-migration by job seekers.

Based on characteristics of the Susitna Project in contrast to the TAPS, the analysts responsible for conducting the socioeconomic analysis for the Susitna Project do not anticipate that the Railbelt Region will face the same magnitude of demand for housing, facilities, and services due to the Susitna Project as was experienced by the City of Fairbanks during the construction of TAPS. For example, the work force requirements for TAPS rose to 22,000 workers within two years. The lower-48 was experiencing a moderate to severe recession and wages associated with the pipeline work were very high. In contrast, for the Susitna Project the peak construction work force is estimated to increase steadily over five years, peaking at approximately 3,500 workers; the lower-48 may or may not be in a recession; and the real wage differential, which has decreased significantly, will most likely continue to close. As a result, potential impacts due to speculative in-migration of job seekers are likely to be considerably smaller for the Susitna Project than they were for TAPS. Thus, due to differences in the size of the construction work force, length of the construction period, and to changing economic and wage conditions, there is little basis for anticipating that the socioeconomic impacts related to TAPS and the Susitna Project would be comparable.

Comment #3 (Page 2)

Responsibilities for provision of services and facilities within the local project area (Matanuska-Susitna Borough) should be more clearly defined for the State, Borough, and the Contractor.

Exhibit E does present a discussion regarding projected public service and facility needs for the Matanuska-Susitna Borough (and selected cities within) both in base-case and project-induced scenarios. More specific data, however, could have been provided regarding the costs and revenues anticipated for the State, Borough, and Contractor for specific services and facilities required under both scenarios. Such information, for example, would clearly illustrate the levels of State support anticipated both with and without the Susitna project.

Response

An analysis of State, Borough, and Contractor responsibility for the provision of services and facilities within the local impact area (e.g., the Matanuska-Susitna Borough, and communities therein and nearby) will become more clearly defined during the mitigation planning process scheduled for the Fall of 1983. An Impact Mitigation Plan is also scheduled to be developed by March 1984. This plan will be updated, as necessary, due to changes in the local project area, prior to project construction. Final responsibilities will be defined prior to the initiation of construction.

Comment #4 (Page 3)

Legal responsibilities for access to the project site both during and after construction need to be clearly defined.

Exhibit E (Chapter 9) briefly discusses the location of the proposed access road and its potential future use. It is also discussed that during the construction phase, only project personnel will be allowed passage on the road. Land management planning for the access road area is proposed to also take place during the construction phase.

The Department recommends that legal responsibilities should be clearly identified prior to opening of the road for any purpose. This action would clarify, for example, maintenance responsibilities and liable parties in the event of unauthorized use of the road. Secondly, the Department recommends that land use planning take place before the original road is constucted in order to incorporate future land use considerations within the original road design and layout. Similar considerations (as described above) should be given to the proposed rail access route to the Devil Canyon site.

Response

Legal responsibility for access to the project site (both road and rail) will be identified prior to the opening of the road for any use. The legal issues to be resolved will include the reponsibilities for winter plowing and maintenance as well as enforcement and the establishment of liable parties in the event of unauthorized use of the road. Furthermore, prior to construction of the access route, potential land use conflicts will be identified and future land use considerations will be assessed.

Comment #5 (Page 3)

The possibility of dam failure should be taken into consideration for the Susitna project, particularly for areas downstream of the dam. This is a critical issue given the size of the dam, and impoundments, and the proven seismicity of the project area. The Department has stressed in our previous comments that the downstream flood hazard due to catastrophic dam failure should be mapped and appropriate stipulations should be placed on downstream development in order to prevent potential loss of life and property.

B/L/1

Exhibit E (Chapter 6) gives attention to seismicity, however, it is simply stated on Page E-6-36 that the main structures (dams) have been analyzed to accommodate the ground motions induced by the maximum credible earthquake. The Department stresses, however, that our above concerns be addressed within the land use planning for the project area.

Response

The Susitna Dams will be designed and constructed so that downstream areas are protected from the consequences of a failure or untimely release of water from the reservoir. The dam foundations will be designed to be stable under all conditions and capable of carrying the weight of the structures. The design criteria will be such that the strains on the dams resulting from external, static, and dynamic forces such as earthquakes, will be maintained within acceptable limits. The selected dam types, earth-rockfill and concrete arch, have proven records of safety. Operation and maintenance procedures will be developed to assure that the dams and their appurtenant facilities will be properly maintained throughout the life of the project. Structures and foundatins will be monitored so that any physical change can be detected and any necessary corrections can be promptly made.

Flood discharges on the Susitna River will be controlled by operation of the powerhouse, the valved outlet facilities, and the service and emergency spillways. The powerhouse and gate outlet facilities will be operated so that the peak outflow from all floods will be less than the peak inflow to the reservoirs. In the case of the 50-year return period flood where the inflow peak is about 65,000 cfs, the outflow will be about 31,000 cfs. Therefore, with these project releases, no changes in the land use downstream of the project area is anticipated.

The operations manual for the Susitna Project will include appropriate public safety coverage. This document will include a specified procedure should a catastrophic dam failure occur.

During the final design and construction phases of the Susitna Project, the Power Authority will map areas downstream of the dams for potential flood hazard associated with any catastrophic dam failure. This mapping will be carried out according to the procedures recently established by the U.S. Bureau of Reclamation and the Corps of Engineers for their major water retaining structures.

Comment #6 (Page 3)

More information needs to be provided about the proposed permanent townsite.

B/L/1

Exhibit E presents in various chapters the concept of a permanent townsite to be established at Watana. Chapter 8 (Aesthetic Resources) for example, presents a conceptual layout of the proposed townsite. The Department is concerned that if a permanent townsite is to be established near the project, much more information needs to be provided regarding: physical site suitability, liveability factors, community expansion areas, government, and opportunities for economic diversification. Additionally, the costs and providers (State, Matanuska-Susitna Borough, community) of facilities and services for the community should be specifically identified.

Response

Information on the location of the proposed permanent townsite and the expected services and facilities is being developed as part of the on-going studies to support the licensing process. The design and layout of the permanent townsite will be developed in cooperation with the Department of Community and Regional Affairs, Native Corporations, the Matanuska-Susitna Borough, and other responsible state and federal agencies.

Comment #1, Socioeconomic Impacts (Page 4)

It would be helpful to summarize in one section of Chapter 5 all the assumptions, standards, and input variables that were used within the impact model. Data sources of each should be cited.

Response

Assumptions, standards, and input variables are summarized for the economic-demographic, public facilities and services, and fiscal modules of the impact model in Sections V, VI, and VII of Working Paper #1. Additionally, relevant assumptions, standards, and input variables were discussed at the socioeconomic workshop.

Comment #2, Socioeconomic Impacts (Page 4)

Chapter 5 does not identify if, and when, sensitivity analysis will be done for key variables used in the socioeconomic impact model.

Response

Refer to the response to Comment #1, page 1.

Comment #3, Socioeconomic Impacts (Page 4)

It would be useful in Chapter 5 to portray in graphic format the data regarding baseline and project-induced costs versus revenues. The percentage of costs and revenues per contractor, State, and Matanuska-Susitna Borough should also be shown in graphic format. Additionally, if various scenarios are to be eventually portrayed by the model, graphic representations of costs versus revenues per scenario would be useful.

Response

The percentage of costs and revenues per contractor, the State, and the Mat-Su Borough will be estimated in the Fall of 1983. Graphic formats will be considered as one of several alternative presentation tools.

Comment #4, Socioeconomic Impacts (Page 4)

On page E-5-23, reference is made to the absence of impact on the Matanuska-Susitna Borough School District because a contractor provided school at the construction site will serve the residents. As specified in previous Department comments, under Alaska Statutes, the Matanuska-Susitna Borough is mandated to exercise areawide education powers. Therefore, the District would be responsible, by law, for the provision of educational facilities and services to all residents of the Borough. This does not prohibit the project contractor and the School District from formally agreeing to share costs or take other steps to lessen impacts; however, any educational facilities, programs, and faculty will have to comply with School District standards and guidelines. Therefore, there will be an impact on the School District.

Response

The potential impacts on the Matanuska-Susitna School District will be re-evaluated and analyzed in more detail in the Fall of 1983 as part of the overall revisions to the socioeconomic impact analyses. Revised socioeconomic projections are scheduled to be available on computer print-outs in November 1983.

Comment #5, Socioeconomic Impacts (Page 4)

Page E-5-47: The 1981 vacancy rate for housing (outside of incorporated communities) within the Matanuska-Susitna Borough is given as 25%. Does this figure include secondary homes?

Response

The 1981 vacancy rate for housing outside of incorporated communities but within the Matanuska-Susitna Borough (25 percent), excluded secondary homes where houses were easily identified as secondary dwelling units. Nonetheless, the Matanuska-Susitna Borough Planning Department population and housing survey inadvertently included some secondary dwelling units.

Comment #6, Socioeconomic Impacts (Page 4)

Page E-5-137; Table E.5.35: A more detailed breakout of costs and revenues for each service or facility per year would be useful to include somewhere in Chapter 5 as back-up data to Table E.5.35.

Response

Additional back-up data, including cost and revenue information, will be developed in the Fall of 1983. Revsied socioeconomic projections are scheduled to be available on computer print-outs in November 1983.

Comment #1, Land Use (Page 5)

Pages E-9-20 through E-9-22, Section 23 - Description of Existing Land Use Management Plans for the Project Area: Among management plans listed in this section, the Denali Scenic Highway Study [pursuant to the Alaska National Interest Lands Conservation Act, Section 1311 (b)] should also be included.

Response

Paragraph six on page E-9-27 of the February, 1983 License Application identifies and briefly describes the Denali Scenic Highway Feasibility Study. The study recommendation was that the Denali Highway not be designated a scenic highway.

Comment #2, Land Use (Page 5)

Page E-9-59; Figure E.9.8: The biophysical coastal boundary for the Matanuska-Susitna Borough Coastal Management Program has been amended from that shown on Fig. E.9.8.

Response

Consultation with the Mat-Su Borough Planning Department indicates that Figure E.9.15 of the February, 1983 License Application reasonably reflects the biophysical coastal boundary for the Matanuska-Susitna Borough Coastal Management Program.

SUSITNA HYDROELECTRIC PROJECT
SUBTASK 4.5: SOCIOECONOMIC STUDIES

Draft Final

PROJECTION ASSUMPTIONS, METHODOLOGY AND OUTPUT FORMATS

For: HARZA-EBASCO and the

ALASKA POWER AUTHORITY

By: FRANK ORTH &

ASSOCIATES, INC.

July 1983

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I. INTRODUCTION

The main purpose of this paper is to present the assumptions and methods that have been used to project potential socioeconomic impacts of the proposed Susitna Hydroelectric Project. Another purpose is to describe the formats that will be used to report results of future analyses.

Many of the assumptions and methods described in later sections of this paper are the same as those used in the preparation of Chapter 5 of Exhibit E (February, 1983). Because of the current need to determine potential impacts that could result from alternative management and design scenarios, some methods were refined, and some new assumptions and methods were developed.

Most of the changes from earlier methods occurred in the portion of the economic-demographic module that involves origin and settlement of workers. A gravity allocation element was created in response to the need to model the effects of alternative camp/village sizes and other attributes, work force characteristics, transportation options for workers, access corridors, and scheduling. Other changes, which primarily increased the ease with which assumptions may be changed, occurred in most elements of all of the modules of the model.

This paper is organized in seven sections. Section II presents the Federal Energy Regulatory Commission's (FERC's) requirements and needs, while Section III describes the near- and long-term objectives of the socioeconomic studies. Section IV provides an overview of the impact projection methods, and the structure of the model used to project impacts. The paper concludes with detailed presentations of each of the three parts (modules) of the model.

II. FERC REQUIREMENTS AND NEEDS

The Report on Socioeconomic Impacts, a required section of the Susitna Hydroelectric Project license application Exhibit E, must identify and quantify the impacts of constructing and operating the Susitna Hydroelectric Project, including impacts on employment, population, housing, personal income, local government services and tax revenues, and socioeconomic conditions in the communities and other jurisdictions in the vicinity of the project.

The Report is to include, among other things:

1. An evaluation of the impact of any substantial project-induced in-migration of people on the impact area's governmental facilities and services, such as police, fire, health, and educational facilities and programs;

2. Estimation of the numbers of project construction personnel who:

   - currently reside within the impact area;

   - Would commute daily to the construction site from places situated outside the impact area; and

   - Would relocate on a temporary basis within the impact area.

3. A determination of whether the existing supply of available housing within the impact area is sufficient to meet the needs of the additional project-induced population; and

4. A fiscal impact analysis evaluating the incremental local government expenditures in relation to the incremental local government revenues that would result from the construction of the proposed project. (Federal Register, November 13, 1981).

FERC regulations do not explicitly define mitigation policy nor goals for socioeconomic impacts. However, mitigation measures for addressing significant and adverse potential effects of the project must be developed to satisfy the mitigation and other requirements of the National Environmental Policy Act. Hence, it is necessary for the Report to also address mitigation issues.

The Report on Socioeconomic Impacts, as part of the Susitna Project license application, was submitted to FERC in February, 1983. The Report was accepted by the FERC, although FERC requested supplemental information primarily concerning the methods utilized in analyzing impacts and the formulation of an impact mitigation plan. The Report presents alternative mitigation measures, and a definite mitigation plan will be prepared as project management and design plans evolve.

III. OBJECTIVES OF THE SOCIOECONOMIC STUDIES

The main objective of the socioeconomic studies is to satisfy FERC's requirements and needs. Secondary objectives include:

- o Providing information that will help the Alaska Power Authority make decisions on measures to mitigate potential adverse socioeconomic impacts and on interdisciplinary issues, such as the selection of an access corridor or camp/village sizes and quality.

- o Providing planning information to communities, the Mat-Su Borough and state agencies so that they can anticipate and cooperatively plan for avoiding and mitigating potential adverse project-induced socioeconomic impacts.

IV. OVERVIEW OF THE MODEL

To meet the above objectives, it was necessary to develop impact projections and assessments, and alternative mitigation measures, that would help in designing the project, assessing environmental impacts, and determining project feasibility. Additionally, it was desirable to develop impact projection methods and procedures that would allow projections to be easily and periodically revised before and during project construction.

A. Conceptual Foundation, Choice of Method and Techniques

1. Conceptual Foundation

Any of several alternative theoretical concepts can be used as the foundation of an impact projection and assessment model. These alternatives include location, central place, and economic base theories.

Location theory has limited usefulness for this socioeconomic assessment. It's strengths are in estimating the potential for the development of interrelated industries, and for assessing the growth potential of direct industries and industry sectors. This information was not required as part of this study.

Like location theory, central place theory has limited usefulness for this study. It's strength lies in providing a means to estimate the geographic distribution of impacts. Although it was not the main conceptual foundation for the projections, it provided part of the conceptual basis for predicting workers' settlement patterns. This is discussed further in Section V-B-2.

Economic base theory was relied upon heavily for this study because its strength lies in estimating how secondary industry sectors will change in reponse to a change in direct industry sectors. This is relevant for this project because one of the most significant sources of impacts will be employment and population growth that is stimulated by the project's direct employment. As a result, the quantifying approach is deterministic (causal)-- relationships between the variable(s) to be forecast and influencing variables/factors are identified and determined, and then incorporated into the forecasting process.

In economic base theory, there are two key concepts. First, it assumes that the economy may be split into two sectors: direct and secondary. Businesses and other economic entities that sell goods and services at places outside of the local economy comprise the direct sector, and those that sell goods and services within the local economy comprise the secondary sector. Second, it assumes that the amount of secondary activity is determined by the amount of direct activity. Thus, an increase in direct activity (e.g., employment) is accompanied by a corresponding, and roughly predictable, increase in secondary activity.

Aggregate employment multipliers are commonly used to estimate employment effects that are likely to result from changes in direct employment. Other multipliers may be used to estimate population effects that result from the increases in direct and secondary employment. Aggregate employment and other multipliers are discussed further in later sections of this paper.

2. Choice of Method

Methods that were considered for implementing an economic base model included aggregate employment multiplier, intersectoral flows, and input-output. Several criteria were developed to evaluate these methodological alternatives. There were also several constraints that influenced the choice of methodology. The criteria and constraints may be grouped as follows:

a. Criteria:

- Must quantify impacts at the local (community) level, and to a lesser extent, regional and statewide levels.

- Must use best possible techniques to estimate secondary employment impacts.

- Must have consistent methodology for "with project" and "without project" projections.

- Must be easy to update results.

- Must provide information that is useful to decision makers (FERC, APA, local jurisdictions).

b. Constraints:

- Must be able to develop and use the model within the budget and other resources available.

- Availability of data.

- Must be consistent with the Institute of Social and Economic Research's (ISER's) projections of employment and population at the statewide and regional (railbelt and subareas) levels.

Each of the three alternative methods differ substantially in their data requirements, cost and time for development, and the level of detail provided in the results. The input-output method can be the best method to use from a results perspective (e.g., it is capable of providing detailed projections of impacts on industry sectors). For this analysis, however, this method could not have provided detailed projections because the local economies (boroughs/census divisions) of Alaska are not large enough for an input-output method to be functional. Further, the cost of development and implementation of this method would have been prohibitive even if it were potentially functional. The intersectoral flows method would have also been preferred from a results perspective, but it too would have resulted in excessive development and implementation costs.

Part of the reason for the high costs associated with these methods is that large amount of primary data would have been required on a continuing basis. For the input-output method, it would have been necessary to collect primary data to support the development of technical coefficients (direct requirements coefficients or input-output table) at the borough/census division level. Besides the budget and time constraints, it is very doubtful that a meaningful input-output table could have been developed. This is because the Mat-Su Borough's economy is not yet well-developed, among other factors.

Similarly, the intersectoral flows method would have required a table showing requirements coefficients. Because it focuses solely on exports, data requirements are less than those reqired for the input-output method. Nevertheless, these data requirements would have been quite substantial, and it is doubtful that a meaningful table could have been developed due to the limited size and breadth of the Mat-Su Borough's export economy. Moreover, the level of detail of the regional economy produced by this type of method would exceed the requirements of this project.

The aggregate employment multiplier method was chosen because techniques were available to provide more detail to the impact projections, and it did not share the shortcomings of the methods discussed above. Further, ISER's MAP model, being an economic base-econometric model, fit well with this decision. Accordingly, it was decided that the ISER employment and population projections would serve as baseline projections for the statewide, railbelt region, and subarea (multi-borough/census division) levels, and that baseline projections for borough/census divisions and smaller areas would be derived by disaggregating the ISER projections. The techniques used to disaggregate these projections are discussed in Section V-B-2.

The method used to project impacts of the project follows economic base theory in that secondary (support sector) impacts of the project are estimated using employment multipliers. It is assumed that the level of secondary activity is uniquely determined by the level of direct (basic sector) activity, and that a given change in the level of direct activity will bring about a predictable change in secondary activity (Leistritz and Murdock, 1981). Thus, the creation of a given number of construction jobs will create a predictable number of secondary jobs in related industries and the service sector. The techniques used to estimate secondary employment effects are discussed further in Section V-C-1.

It would have been preferable to use income instead of employment as the indicator to measure economic change if adequate data had been available. Employment may not be an accurate indicator of economic activity in sectors that experience technological change, and if different direct industries have significantly different wage rates and/or input purchasing patterns). However, it was not possible to use income because adequate income data was not available.

3. Techniques

Several techniques were used in conjunction with the aggregate employment multiplier method to project impacts. Some of the more important techniques are:

- o Gravity allocation model (used to allocate inmigrating workers to communities)
- o Trend analysis (used to allocate ISER's MAP model's baseline employment and population projections to smaller geographic areas)
- o Person per household trend multipliers (used to project numbers of households)
- o Per capita planning standards (used to project demands for public facilities and services)
- o Per capita fiscal multipliers (used to project local jurisdictions' revenues and expenditures, with and without the project

Each of these techniques is discussed in Sections V - VII.

B. Model Structure

1. Overview

Having established aggregate employment multiplier as the method, the next step was to design a model that could use this method to produce appropriate projections. Several needs were considered during the design process. These were:

- o Ability to meet the information requirements of FERC, NEPA, APA, and local officials (e.g., employment, population, housing, public facilities and services, and fiscal impacts).
- o Ability to produce annual projections for up to 25 years.
- o Ability to efficiently handle multiple scenarios.
- o Amenable to sensitivity analysis.
- o Ability to quantify potential impacts in detail, and for small geographic areas.
- o Ability to efficiently interact with monitoring and mitigation activities.
- o Ability to produce results that are useful: (1) in identifying potential problems, (2) to decisionmakers, and (3) to the mitigation activity.
- o Capable of being updated quickly, efficiently, and at low cost.
- o Capable of being manipulated at low cost.
- o Relatively short processing (run) time.
- o Ability to create many diverse reports (output formats).
- o Ability to have results validated and the model calibrated.

With these considerations in mind, the structure for the model was developed. The general structure is shown in Figure 1. Here it can be seen that the model is composed of three main modules, each containing equations that compute baseline and "with-project" (construction and operations) projections. Comparisons of these projections yield impact projections.

This general structure mirrors economic base theory, as the source of impacts rests in the economic-demographic module (creation of direct jobs), and these impacts are reflected in the public facilities and services, and fiscal modules. New populations associated with construction workers, secondary workers, and dependents create demands on housing and public facilities and services. The budgets of local jurisdictions are impacted by these new demands.

Each of the modules are discussed further in Sections V, VI, and VII, and each of the considerations presented above are addressed at appropriate places in these sections. Before proceeding on to the detailed discussions, however, it is appropriate to discuss in more detail several key considerations, including the need for computerization. These are discussed below.

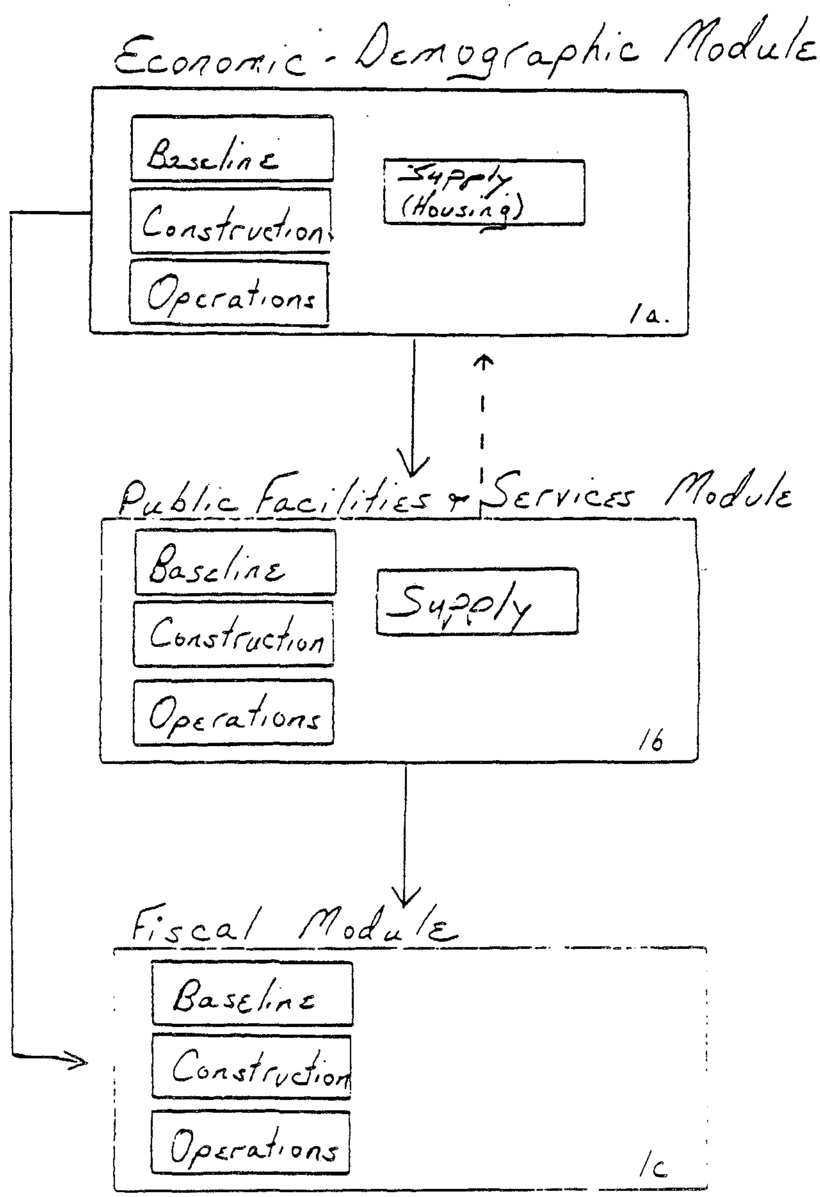
2. Key Considerations

a. Ability to Quantify Impacts in Detail, and for Small Geographic Areas

As the nearest communities to the construction sites are quite small, and any settlement by workers would create measurable impacts, it was necessary to consider developing the capability to quantify potential impacts for small geographic areas. Based upon a review of the attributes of these communities, it became apparent that some workers, under certain conditions, would probably be attracted to, and settle in these small communities. As a result, a rather large number of small impact areas were delineated. These are shown in Table 1. A map showing the impact Areas is shown in Figure 2.

Figure 1

STRUCTURE OF SUSITNA MODEL



The Module is composed of 3 main modules,
each containing information/projections on the baseline
and "with project" impacts.

Organized By Functional Area.

Table 1
POTENTIAL IMPACT AREAS, AND/OR WORKER TRACKING POINTS

LOCAL

Work sites:

- Work camp 1 (At Watana)
- Village 1 (At Watana)
- Work camp 2 (At Devil Canyon)
- Village 2(?)

Cantwell

- Cantwell railroad camp
- Cantwell community

Cantwell area (Cantwell, Denali and other areas of Western Denali Highway)
(not to be used at this time due to lack of baseline data)

Healy area (not to be used at this time due to lack of baseline data)

McKinley (not to be used at this time due to lack of baseline data)

Nenana area (not to be used at this time due to lack of baseline data)

Paxson (not to be used at this time due to lack of baseline data)

Trapper Creek

Talkeetna

Gold Creek (not to be used at this time due to lack of baseline data)

Railroad communities: (not to be used at this time due to lack of baseline data)

- Sherman
- Curry
- Chase
- Chulitna
- Canyon
- Lane

Hurricane/Indian River subdivision
(not to be used at this time due to lack of baseline data)

Palmer

Wasilla

Houston

Other Mat-Su Borough

- Surburban
- Rural and Remote

Table 1
(continued)

REGIONAL (census divisions)

Anchorage

Fairbanks-North Star Borough

SE Fairbanks

Seward

Kenai-Cook Inlet

Yukon-Koyukuk

Mat-Su Borough	(Trapper Creek, Talkeetna, Palmer, Wasilla, Houston, Hurricane-Indian River, Gold Creek, Railroad commnities)

Valdez-Chitina-Whittier

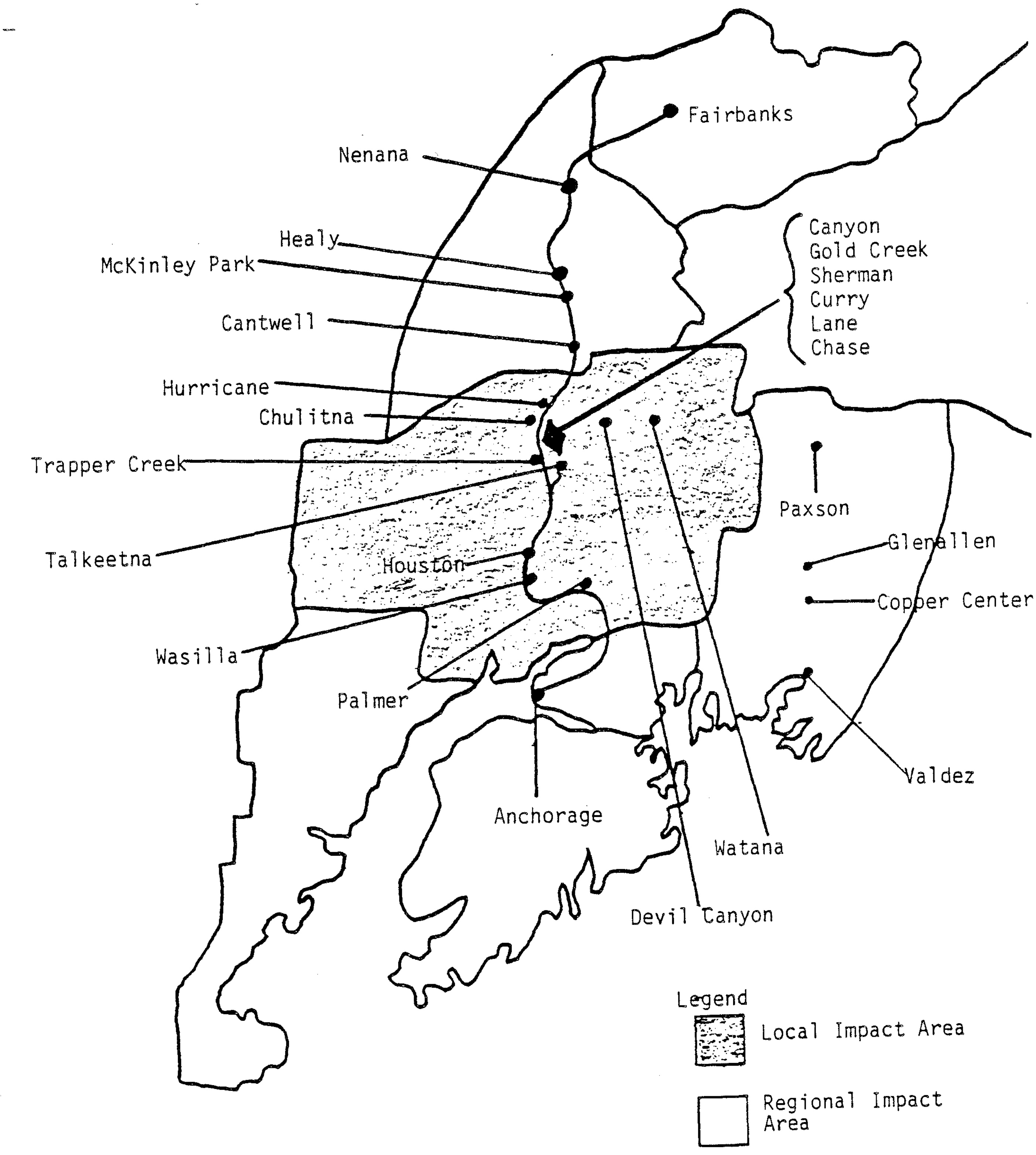
Glennallen
Valdez
Copper Center
Gulkana

Note: The model is structured to include these communities should it become necessary to conduct impact analyses for these communities. Baseline data would be required for these analyses.

Note: The region will be expanded from the original ISER Railbelt region to include a portion of the Yukon-Koyukuk census division as Cantwell and other potentially impacted communities are in this census division.

Figure 2

POTENTIAL IMPACT LOCATIONS IN THE LOCAL IMPACT AREA



b. Ability to Efficiently Handle Multiple Scenarios

There are several aspects of project design and management that will affect the level, distribution, and composition of socioeconomic effects that are currently uncertain. These include:

- o Choice of access corridor
- o Transportation mode(s) and frequency for workers
- o Size and quality of construction camp/village
- o Work schedules
- o Local hire and training programs

Additional project characteristics possibly subject to revision during detailed project design are:

- o Manpower requirements and timing of same
- o Timing of construction for Watana and Devil Canyon dams

Analysis of alternative scenarios will help decisionmakers select policies, with substantial knowledge of the range of possible impacts. The model is designed to project with-project socioeconomic variables using these scenarios, and to accommodate and produce different baseline projections. Hence, ranges of potential impacts can be provided.

c. Amenable to Sensitivity Analysis

The model must be able to accommodate alternative assumptions concerning various economic and demographic relationships in the impact areas, and to determine the sensitivity of projections to variations in these assumptions. Some examples of assumptions are:

- Percent of total work force that will relocate (settle) in communities

- Possible deviations from derived employment multipliers

- Local supply of skilled and unskilled labor

- Number of dependents per accompanied worker

- Number of school-age children per accompanied worker

- Attractiveness indicators for communities

Determining how sensitive the results are to changes in these and other assumptions helps decisionmakers and planners prepare for a possible range of impacts. As actual data for these assumptions are obtained from monitoring local community conditions prior to and after construction begins, the assumptions can be revised. This will result in more accurate projections, and permit formulation of responsive mitigation measures.

The model is designed to easily accommodate changes in assumptions in the pre-construction, construction, and post-construction phases.

d. Computer Software

It was appropriate to computerize the model in view of the following needs:

- Ability to efficiently handle multiple scenarios.

- Amenable to sensitivity analysis.

- Ability to efficiently utilize results from and provide input to the monitoring and mitigation activities.

- o Ability to produce results that are useful: (1) in identifying problems, (2) to decisionmakers, and (3) to the mitigation activity.

- o Capable of being updated quickly, efficiently, and at low cost.

- o Capable of being manipulated at low cost.

- o Relatively short processing (run) time.

- o Ability to create many useful and diverse reports (output formats).

The model was computerized using the Data*Model economic and financial modeling software package. It is operated on a Wang Virtual Memory computer system. It takes between two and three hours to run the Susitna impact model and generate the 50 standardized reports that were developed for it (print-out of all the results takes considerably longer). The model has been structured so that assumptions and data are easily changed and the set of alternatives can be performed efficiently.

The planning of a computerized economic impact model needs to take into account both hardware and software considerations. The major criteria that were used to determine the way the model would be computerized included:

1. Ability of the computer system (hardware) to handle a very large model, in terms of both on-line computer memory and storage capacity;

2. Cost of development of the model;

3. Operation and storage cost;

4. Flexibility of reporting (a software consideration);

5. Operation speed (related to both hardware and software);

A modeling software package was chosen over the alternatives of custom programming of a model or using a timeshare statistical package for several reasons. Use of modeling software results in a lower set-up cost than the first alternative by avoiding the development time of programming, and has a lower operating cost than timeshare systems. The advanced report-writing capability of the system means that any combination of variables in the various parts of the model can be displayed in a report, and that the model and equations can be defined before all the report formats are developed. In addition, this software allows non-programmers to create and modify the model. Finally, use of in-house software and computer equipment will allow integration of the model with custom programming or statistical analysis software, as appropriate. Some speed in running the model was given up as result of the choice of using a minicomputer rather than timesharing options on a mainframe.

. Description of the Software

Data*Model is a computerized spreadsheet program in which the data, calculations and reports are independent modules. The model can handle up to 500 time periods and 30,000 rows. Data*Model is available for approximately 12 different mini- and micro-computer systems. The major components of a model using this software are:

1. A Row Definition, which defines all names of data inputs, parameters and variables that are used in the model.

2. Model definition files, which store data and equations. The interrelationships of data input, parameters, and variables are defined here.

3. A Spreadsheet, the data file in which the results of the model's calculations are stored.

4. <u>Report formats</u>, which store instructions for the presentation of any combination of projections (results)and assumptions. A variety of reports are generated from each spreadsheet model.

   - <u>Vertical report formats</u> store instructions for the variables that are to be displayed, and the order in which they will appear.

   - <u>Horizontal report formats</u> define the horizontal dimension of the reports: the time periods that are to be shown and the order in which they will appear.

As Figure 3 shows, the rowname file and model definition files combine to produce a spreadsheet of all data and calculations in the model. A report is generated by specifying the spreadsheet to be reported on and the vertical and horizontal definitions to be combined. This modular structure allows an efficient way of handling multi-scenario models, in that the data or assumptions can change without affecting the rest of the model or the structure of the reports.

Data*Model contains a number of built-in features that increase the efficiency and ease of model building and manipulation. These include (1) linking statements, which allow various modules to run automatically, in sequence, without further input from the user; (2) automatic percent change calculations over time; (3) goal-seeking routine (in which a result is requested and the model calculates a component of the equation); (4) lead and lag equations, (5) routines for inflation, sums and means, accumulation of values over time, and financial routines such as depreciation, amortization, present value, etc. The equations in the model are functionally linked.

A limitation of Data*Model is its lack of sophisticated matrix handling functions, which increases its set-up cost relative to other spreadsheet programs. An equation needs to be written out for each variable and each impact area. This facet of the software was accepted as a cost that is compensated for by the speed of operation (compared

Figure 3

DESIGN OVERVIEW OF DATA*MODEL

ECONOMIC MODELING SOFTWARE

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                                        ---------------------
                                        |   MODEL DEFN.     |
                                        |-------------------|
                                        |       DATA        |
                                        |        &          |
                                        |   COMPUTATIONS    |
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                                                 |
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|                 |     |                                   |
| ROW DEFINITIONS |---->|           SPREADSHEET             |
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               | E E E |     |                                  |
               | R P F |     |                                  |
               | T O I |---->|          R E P O R T             |
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               |     O |     |                                  |
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to other modeling programs), the flexible reporting options, and the ability of the system to handle the large number of equations and impact areas. Its effects were mitigated by use of a custom program which facilitated the copying and editing of groups of row definitions and equations.

e. Ability to Create Many Useful and Diverse Reports (output formats)

As discussed above, the reporting flexibility of the model is substantial. The reports now being generated by the model are intended to meet most of the decisionmakers' needs. However, it is probable that additional reports will be required or desired. Because of the reporting flexibility, these reports will be available quickly and at low cost.

The model currently produces reports that compare conditions with the project during the projection period (1985-2005) to projected conditions without the project, rather than to current conditions. This is an important distinction for two reasons. First, the magnitude of population influx and other effects related to the project need to be evaluated in light of the size of population (and other variables) that would be in the impact area in the absence of the project. Second, because many of the impact areas are expected to grow and change rapidly over the next 20 years, whether the project occurs or not, comparison of the "with project" scenario to current conditions would be misleading.

In the areas of housing and public facilities and services, the model also compares total demands with the project to the capacity of the communities to fulfill these demands.

V. ECONOMIC-DEMOGRAPHIC MODEL

The economic-demographic (E-D) module calculates the impacts of the project on population, employment, and housing, by impact area and year, and provides detailed population influx and efflux information to the public facilities and services, and fiscal modules. This information is used in these modules to determine impacts on public facilities and services, and local jurisdictions' expenditures and revenues. Input information, and information concerning impacts, is provided by year and by impact area to help local jurisdictions with mitigation planning.

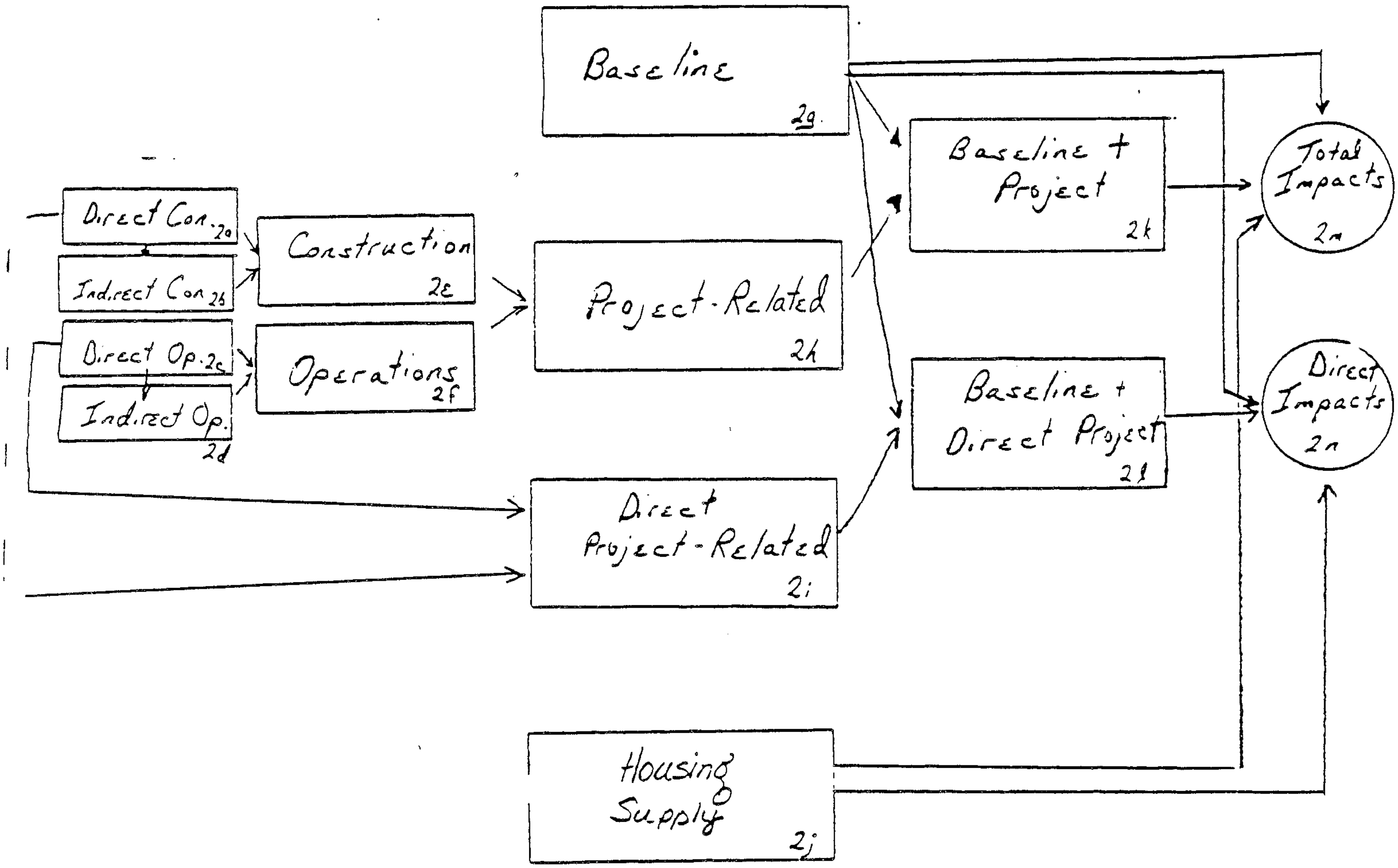
In response to FERC's requirements and needs, and the needs of the APA and local jurisdictions, the module also provides detailed information on employment, payroll, spending, and settlement patterns of the direct construction work force. For example, this information includes employment by residence and by year, payroll by labor category and year, spending patterns of construction workers by year for selected impact areas, and demand for housing, by impact area and by year.

The general structure of this module is shown in Figure 4. Here it can be seen that the module produces both total and direct impacts. Another important feature, implicit in Figure 4, is that direct construction employment is separate from indirect construction-induced employment (i.e., secondary employment generated by direct construction activity and employment), and that contruction employment is separate from the operations employment. This allows for more detailed impact projections and assessments, and is methodologically superior to a more aggregated treatment of the work forces.

The general method for projecting total project-related employment, and total in-migrant workers and population, is shown in Figure 5. Here it can be seen that the number of direct and secondary jobs created is a function of (1) direct manpower requirements and (2) the number of secondary jobs created by the direct construction jobs. Employment multipliers were used to estimate these secondary jobs (see Section V-C-1).

Figure 4

STRUCTURE OF ECONOMIC/DEMOGRAPHIC MODULE



(Contents of 2a - 2l)

Types of Information Contained

Population

Employment

Housing

Income

(Contents of 2m & 2n)

Quantitative Expression of Impacts

% Increase Over Baseline

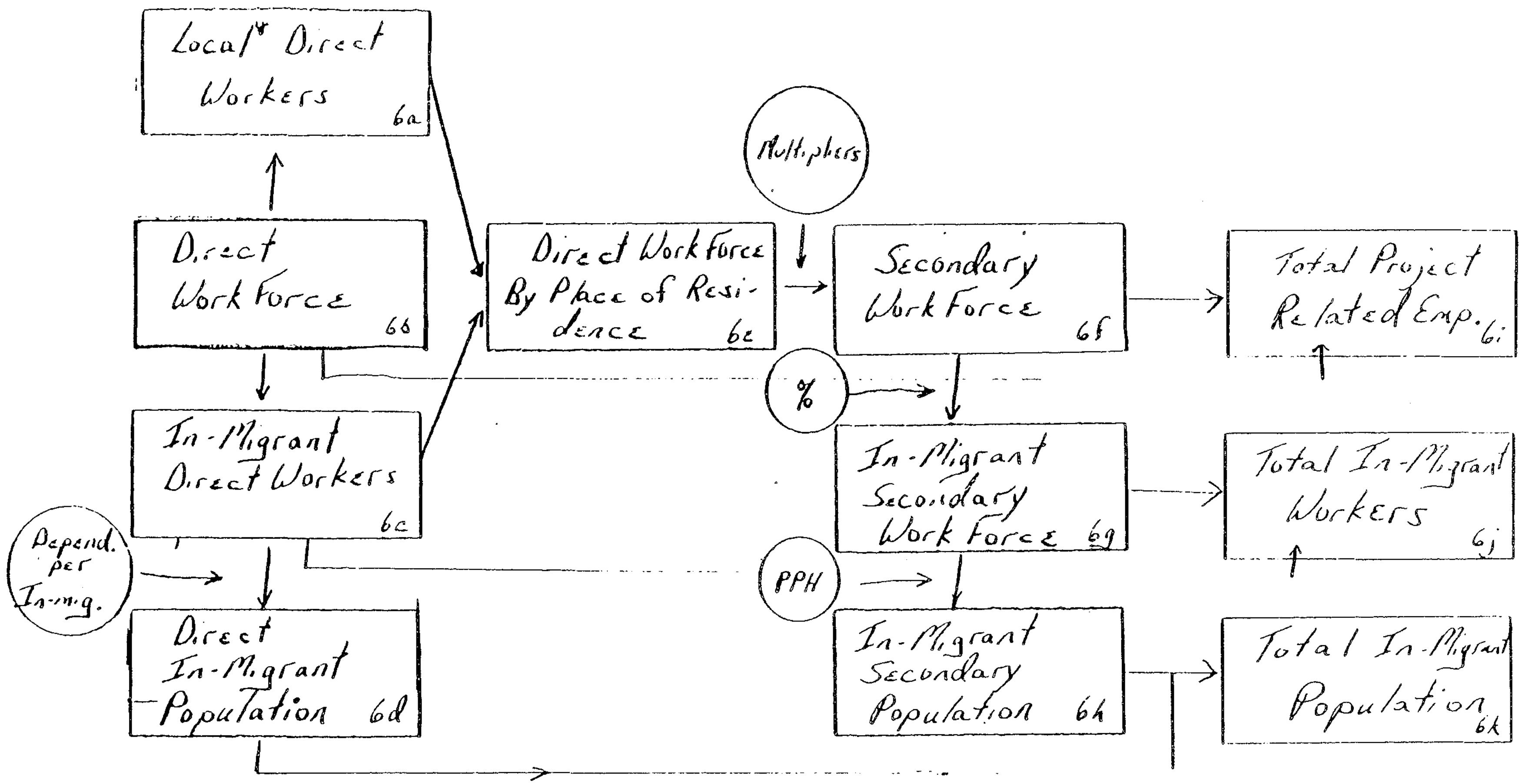
Increase Over Baseline in Nos.

Capacity Utilization

Distribution of Increase Over Geographic [illegible]

Figure 5

RESIDENT AND NON-RESIDENT PROJECT AND RELATED EMPLOYMENT AND POPULATION



The Logic in this diagram holds for each "impact area."
*Local = people who lived there previously.

The total number of in-migrant workers is simply total direct manpower requirements less the number of jobs filled by local residents, plus the number of secondary jobs that are not filled by local residents. Total in-migrant population is calculated by applying a dependents per in-migrant worker value to the direct in-migrant workers, and adding this to the in-migrant secondary population. This population is calculated by applying a persons per household value to the in-migrant secondary work force.

Total in-migrant population is compared to baseline population projections to arrive at total impacts, as indicated in Figure 5. Similarly, direct project-related population is compared to baseline population projections to arrive at direct impacts of the project.

The techniques used to make baseline projections are discussed in the next section. This discussion is followed in subsequent sections by presentations of techniques used to make "with project" projections.

A. Baseline Projections

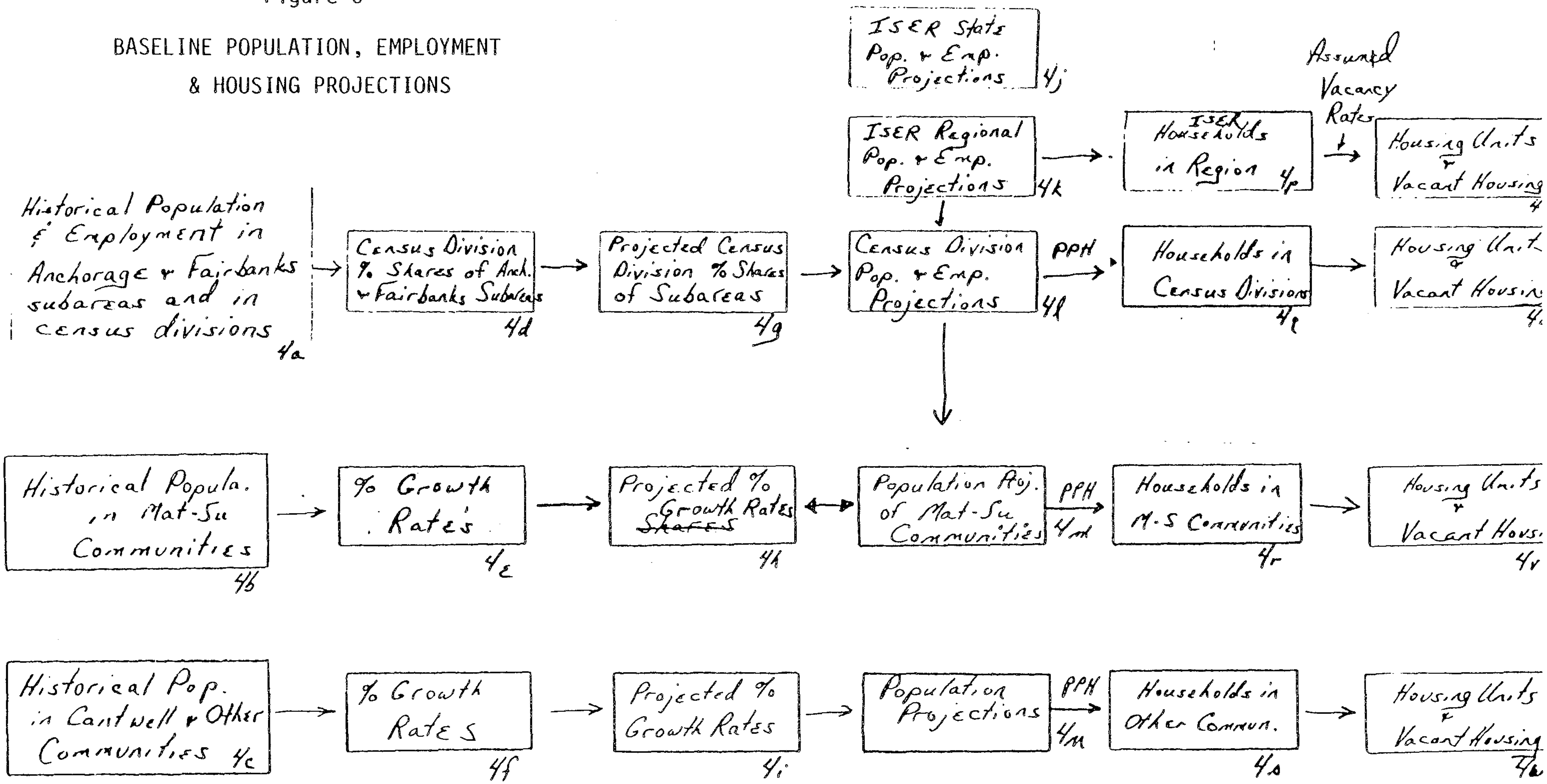
Figure 6 displays the structure of the baseline projection portion of the economic-demographic module. The approaches and projection techniques used are discussed below.

1. Employment

Baseline projections for employment in the Railbelt region and its three subareas, Anchorage, Fairbanks and the Valdez-Chitina-Whittier census division (see Figure 2), were generated by the Institute of Social and Economic Research's (ISER's) Man-in-the-Arctic-Program (MAP) econometric model (September 1981). This model was also used for the determination of the need for energy during the projection period. As additional data from the MAP model is made available, baseline projections can be updated.

Figure 6

BASELINE POPULATION, EMPLOYMENT
& HOUSING PROJECTIONS



Notes
1. Employment not projected at community level
2. Income not projected in baseline.

Frank Orth & Associates, Inc. used ISER's projections as the basis for the employment projections for the various census divisions that comprise the Anchorage and Fairbanks subareas (Anchorage/ Kenai-Cook Inlet/ Seward/ Mat-Su Borough, and Fairbanks-North Star/ Southeast Fairbanks, respectively). These were calculated from ISER's subarea employment projections using several steps:

1. A time series of employment in each census division was collected for 1964-1980). These data were derived from unemployment insurance records collected by the Alaska Department of Labor. They are considered to be the most consistent and accurate series of statistics on employment in Alaska. The major limitations of the series are that (1) employment is listed by place of work rather than place of residence; and (2) the figures do not include workers who are not covered by unemployment insurance.

2. The percentage that each census division in the Anchorage subarea and Fairbanks subarea represented of total employment in that subarea was calculated annually. In general, the trends in employment were relatively stable, with the Mat-Su and Kenai census divisions increasing their percent shares of the Anchorage subarea slightly during the 1970's.

   From these numbers, percent change in the percent shares was also calculated. For each census division, a trend analysis of the increase in percent share over time was performed, which yielded the average increase or decrease in percent share for that census division.

3. Based upon the assumption that these historical trends will continue, the average increase in percent share was applied to the 1980 figure to obtain a set of projections of percent share of employment for each census division for the years 1981 through 2005 (see Table 2).

Table 2

PROJECTED PERCENT SHARE THAT CENSUS DIVISIONS WILL REPRESENT OF EMPLOYMENT IN THE ANCHORAGE AND FAIRBANKS SUBAREAS*

	Percent of Employment In Anchorage Subarea				Percent of Employment In Fairbanks Subarea	
	Anchorage	Kenai-Cook Inlet	Seward	Mat-Su Borough	Fairbanks North Star	Southeast Fairbanks
1981	87.0	7.7	1.5	3.6	95.4	4.6
1982	86.8	7.8	1.5	3.7	95.4	4.6
1983	86.7	7.9	1.5	3.8	95.4	4.6
1984	86.5	7.9	1.5	3.9	95.4	4.6
1985	86.3	8.0	1.5	4.0	95.4	4.6
1986	86.2	8.1	1.5	4.1	95.4	4.6
1987	86.0	8.2	1.5	4.2	95.4	4.6
1988	85.8	8.3	1.5	4.3	95.4	4.6
1989	85.6	8.3	1.5	4.4	95.4	4.6
1990	85.5	8.4	1.5	4.4	95.4	4.6
1991	85.3	8.5	1.5	4.5	95.4	4.6
1992	85.1	8.6	1.5	4.6	95.4	4.6
1993	85.0	8.7	1.5	4.7	95.4	4.6
1994	84.8	8.7	1.5	4.8	95.4	4.6
1995	84.6	8.8	1.5	4.9	95.4	4.6
1996	84.5	8.9	1.5	5.0	95.4	4.6
1997	84.3	9.0	1.5	5.1	95.4	4.6
1998	84.1	9.1	1.5	5.2	95.4	4.6
1999	83.9	9.1	1.5	5.3	95.4	4.6
2000	83.8	9.2	1.5	5.3	95.4	4.6
2001	83.6	9.3	1.5	5.4	95.4	4.6
2002	83.4	9.4	1.5	5.5	95.4	4.6
2003	83.3	9.5	1.5	5.6	95.4	4.6
2004	83.1	9.5	1.5	5.7	95.4	4.6
2005	82.9	9.6	1.5	5.8	95.4	4.6

* As defined in the Institute of Social and Economic Research's Man-In-the-Arctic economic model.

4. These percent share projections were then multiplied by ISER's employment projections for the Anchorage and Fairbanks subareas to obtain projections of employment, by place of employment, for each census division.

Employment data for the communities of the Mat-Su Borough are not reliable, due to data collection and reporting problems. Thus, employment was not projected at the community level.

2. Population

The methodology used to project population in the various impact areas, without the project, is similar to the employment methodology listed above. Baseline population was projected independently of the employment projections as a result of the need to disaggregate the regional trends to smaller areas. In these census divisions and communities, population and employment trends differ significantly.

Baseline projections of population in the Railbelt region and the three subareas of Anchorage, Fairbanks and the Valdez-Chitina-Whittier census division were generated by the MAP model (September 1981). As additional data from the MAP model is made available, these projections can be updated.

Population projections for the various census divisions that comprise the Anchorage and Fairbanks subareas (Anchorage/ Kenai-Cook Inlet/ Seward/ Mat-Su Borough, and Fairbanks-North Star/ Southeast Fairbanks, respectively) were calculated from the population projections for the subareas using these steps:

1. A time series of population in each census division was collected for 1964-1980. These data are mostly derived from U.S. Bureau of the Census data. The Mat-Su Borough data included data collected in annual surveys conducted by the Mat-Su Borough Planning Department. As a result of the rural and rapidly increasing population in the Borough, it was believed that the Planning Department's surveys were more accurate than U.S. census data.

2. The percentage that each census division in the Anchorage subarea and Fairbanks subarea represented of total population in that subarea was calculated annually. In the Anchorage subarea, the figures showed that the percent shares of population accounted for by Mat-Su Borough and the Kenai-Cook Inlet areas have increased rapidly, while the percent share of the Municipality of Anchorge has declined.

   From these numbers, percent change in the percent shares was also calculated. For each census division, a linear regression of the increase in percent share over time was performed, which yielded the average increase or decrease in percent share for that census division.

3. Based upon the assumption that these historical trends will continue, the average increase in percent share was applied to the 1980 figure (or 1981 for the Mat-Su Borough) to obtain a set of projections of percent share of population for each census division for the years 1981 through 2005. These are displayed in Table 3.

4. These percent share projections were then multiplied by ISER's population projections for the Anchorage and Fairbanks subareas to obtain projections of population, by place of population, for each census division.

5. Population projections for several of the communities of the Mat-Su Borough were caculated separately. Annual growth rates were projected for the future based on historical growth rates and the changing population distribution patterns in the Borough. These growth rates are displayed in Table 4.

   As a result of this methodology, both (1) the population increase based on historical trends and (2) the population increase related to economic development are taken into account. ISER's regional and subarea projections explicitly

Table 3

PROJECTED PERCENT SHARE THAT CENSUS DIVISIONS WILL REPRESENT OF POPULATION IN THE ANCHORAGE AND FAIRBANKS SUBAREAS*

	Percent of Population In Anchorage Subarea				Percent of Population In Fairbanks Subarea	
	Anchorage	Kenai-Cook Inlet	Seward	Mat-Su Borough	Fairbanks North Star	Southeast Fairbanks
1981	78.4	10.3	1.3	10.0	91.2	8.8
1982	77.8	10.4	1.3	10.4	91.2	8.8
1983	77.2	10.6	1.3	10.9	91.2	8.8
1984	76.6	10.7	1.3	11.3	91.2	8.8
1985	76.0	10.8	1.3	11.8	91.2	8.8
1986	75.4	11.0	1.3	12.2	91.2	8.8
1987	74.8	11.1	1.3	12.7	91.2	8.8
1988	74.2	11.3	1.3	13.1	91.2	8.8
1989	73.6	11.4	1.3	13.5	91.2	8.8
1990	73.0	11.6	1.3	14.0	91.2	8.8
1991	72.4	11.7	1.3	14.4	91.2	8.8
1992	71.7	11.9	1.3	14.9	91.2	8.8
1993	71.1	12.0	1.3	15.3	91.2	8.8
1994	70.5	12.2	1.3	15.8	91.2	8.8
1995	69.9	12.3	1.3	16.2	91.2	8.8
1996	69.3	12.5	1.3	16.7	91.2	8.8
1997	68.7	12.6	1.3	17.1	91.2	8.8
1998	68.1	12.8	1.3	17.6	91.2	8.8
1999	67.5	12.9	1.3	18.0	91.2	8.8
2000	66.9	13.1	1.3	18.5	91.2	8.8
2001	66.3	13.2	1.3	18.9	91.2	8.8
2002	65.7	13.4	1.3	19.4	91.2	8.8
2003	65.1	13.5	1.3	19.8	91.2	8.8
2004	64.5	13.7	1.3	20.3	91.2	8.8
2005	63.9	13.8	1.3	20.7	91.2	8.8

* As defined in the Institute of Social and Economic Research's Man-In-the-Arctic economic model.

Table 4

ASSUMPTIONS FOR BASELINE POPULATION GROWTH RATES
FOR SELECTED COMMUNITIES LOCATED NEAR THE PROJECT SITE

Community	1981-1990	1991-2005
Palmer	6.5%	3.5%
Wasilla	7.5%	7.5%
Houston	10.0%	10.0%
Trapper Creek	4.0%	4.0%
Talkeetna	5.0%	5.0%
Cantwell	2.0%	2.0%

included assumptions on economic development scenarios and the percent share methodology reflects the trends in the distribution of growth within the region.

3. Housing

Projections of housing demand were calculated for each of the communities likely to be affected by the project and for the Railbelt region as a whole. Housing demand was calcuated by applying population-per-household projections (see Table 5) to the projected populations of each community and census division. The population-per-household measures were assumed to decline gradually over time to converge with the national and state averages. These measures were dervied from the ISER study of the need for power in the Railbelt (Goldsmith and Huskey, 1980). In the ISER model, average population per household is estimated to decline by 20 percent over the next twenty years, and is consistent with the projected decline in the national level.

Current housing supply estimates were obtained from the U.S. Census Bureau (1980) and community surveys where available. Housing stock was assumed to increase in direct proportion to the growth in the number of households. Baseline housing supply was projected by multiplying the number of households by an assumed average vacancy rate of five percent. The exception was the area of the Mat-Su Borough outside the incorporated communities, for which it was assumed that the vacancy rate (25 percent in 1981) would fall over time.

No differentiation among types of housing was made, and the timing of housing construction was not estimated. These simplifications were appropriate for the following reasons. The Mat-Su Borough is increasingly becoming a bedroom community in which single family dwellings on plots of an acre or more predominate. As a result of the large population increase expected in the Mat-Su Borough in the next twenty years, with or without the project, it is likely that there will be a continuous need for new housing, fueled by increasing demand. In many of the communities closest to the project, there is currently very

TABLE 5

POPULATION-PER-HOUSEHOLD ASSUMPTIONS

	State	Mat-Su Borough	Trapper Creek	Talkeetna	Cantwell	Palmer	Wasilla	Houston
1981[a]	3.073	3.270	3.300	3.300	2.750	3.153	3.127	2.900
1982	3.064	3.240	3.269	3.269	2.741	3.128	3.103	2.885
1983	3.053	3.210	3.238	3.238	2.733	3.103	3.079	2.871
1984	3.040	3.180	3.207	3.207	2.725	3.078	3.055	2.856
1985	3.041	3.150	3.176	3.176	2.717	3.053	3.027	2.842
1986	3.031	3.121	3.144	3.144	2.709	3.028	3.008	2.828
1987	2.998	3.091	3.113	3.113	2.701	3.003	2.984	2.813
1988	2.960	3.061	3.082	3.082	2.693	2.978	2.960	2.799
1989	2.932	3.031	3.051	3.051	2.685	2.953	2.936	2.785
1990	2.900	3.002	3.020	3.020	2.677	2.929	2.912	2.770
1991	2.876	2.972	2.989	2.989	2.669	2.904	2.889	2.756
1992	2.849	2.942	2.958	2.958	2.661	2.879	2.865	2.742
1993	2.824	2.912	2.927	2.927	2.652	2.854	2.841	2.727
1994	2.801	2.883	2.896	2.896	2.644	2.829	2.817	2.713
1995	2.777	2.853	2.865	2.865	2.636	2.804	2.793	2.699
1996	2.754	2.823	2.834	2.834	2.628	2.779	2.770	2.684
1997	2.731	2.793	2.803	2.803	2.620	2.754	2.746	2.670
1998	2.707	2.764	2.772	2.772	2.612	2.730	2.722	2.656
1999	2.682	2.734	2.741	2.741	2.604	2.705	2.698	2.641
2000	2.657	2.704	2.710	2.710	2.596	2.680	2.674	2.627
2001	2.637	2.674	2.679	2.679	2.588	2.655	2.651	2.613
2002	2.617	2.645	2.648	2.648	2.580	2.630	2.627	2.598
2003	2.597	2.615	2.617	2.617	2.572	2.605	2.603	2.584
2004	2.577	2.585	2.586	2.586	2.564	2.580	2.579	2.570
2005	2.556	2.556	2.556	2.556	2.556	2.556	2.556	2.556

a. Matanuska-Susitna Borough Planning Department, 1981.

little vacant housing available to support a sizable increase in population. Housing distribution within communities, the types of housing that will be constructed, and the speed with which the supply of housing will respond to or anticipate the demand can only be guessed at, and this was complicated by the long time frame for the project and the impact model.

Thus, it was felt that detailed projections of housing supply would be of limited usefulness due to the expected large changes in the housing market in the local impact area and the uncertainty surrounding any set of assumptions. In this model, the emphasis of the determination of project-related effects on housing is placed on the effects that the project will have on the demand for housing. Housing supply will be addressed by the community and household monitoring program.

B. Direct Work Force

1. Work Force Requirements

a. Annual Work Force.

Estimates of work force requirements for the project, by trade and by year, were obtained from the project engineers (Acres American, 1981). The estimates include all manpower required for the construction of the access road and camp/village; power facilities and transmission facilities; and all management, adminstrative, and operations personnel. Manpower for off-site activities such as procurement, manufacturing, shipping and a portion of the engineering staff are not included in these estimates. The different types of workers are added up into three labor categories - laborers, semi-skilled/skilled and administrative/engineering, and total work force by year is also calculated.

Construction of the first phase of the Watana dam will require a significantly greater number of workers than both the second phase of Watana and construction of the Devil Canyon dam. This difference can be attributed to the additional labor requirements in the initial years for construction of the work camp and village, the access road and to the more labor-intensive nature of a gravel-fill dam (Watana) than a concrete arch dam (Devil Canyon).

b. Accommodation of Changes in Manpower Requirements and Construction Schedules.

In the model, the construction and operations work force requirements, by trade (such as carpenter, millwright, ironworker, plumber, etc.) for each dam, are entered separately. This will facilitate adjustment of the model if the size of the work force changes, if the trade mix is altered, or if the schedule for either or both of the dams is changed.

c. Seasonality.

The demand for construction manpower will vary during any given year. Monthly manpower requirements are calculated by the model using the following steps:

1. The percentages of the total yearly work force that will work in each month were projected. These percentages are displayed in Table 6. The model was designed to accommodate different seasonality assumptions for the major labor categories, if appropriate.

2. For each labor category, the number of workers in each year are multiplied by the percentages for each month to yield the numbers of workers in that labor category needed in each month.

3. For each month, the number of laborers, semi-skilled/skilled and adminstrative/engineering personnel are added to obtain the total construction work force needed per month.

Table 6

SEASONALITY OF PROJECT EMPLOYMENT:
PERCENTAGES OF PEAK ANNUAL CONSTRUCTION WORK FORCE
THAT WILL BE EMPLOYED IN EACH MONTH

January	30 %
February	31 %
March	43 %
April	66 %
May	72 %
June	87 %
July	99 %
August	100 %
September	90 %
October	69 %
November	51 %
December	35 %

2. Origin and Settlement Patterns

a. Overview

This portion of the module addresses four basic questions:

- o From where do the direct workers originate?
- o Which direct workers settle in the local communities?
- o Where do the in-migrant direct workers settle?
- o How many in-migrant workers leave when they are no longer employed on the project, and when do they leave?

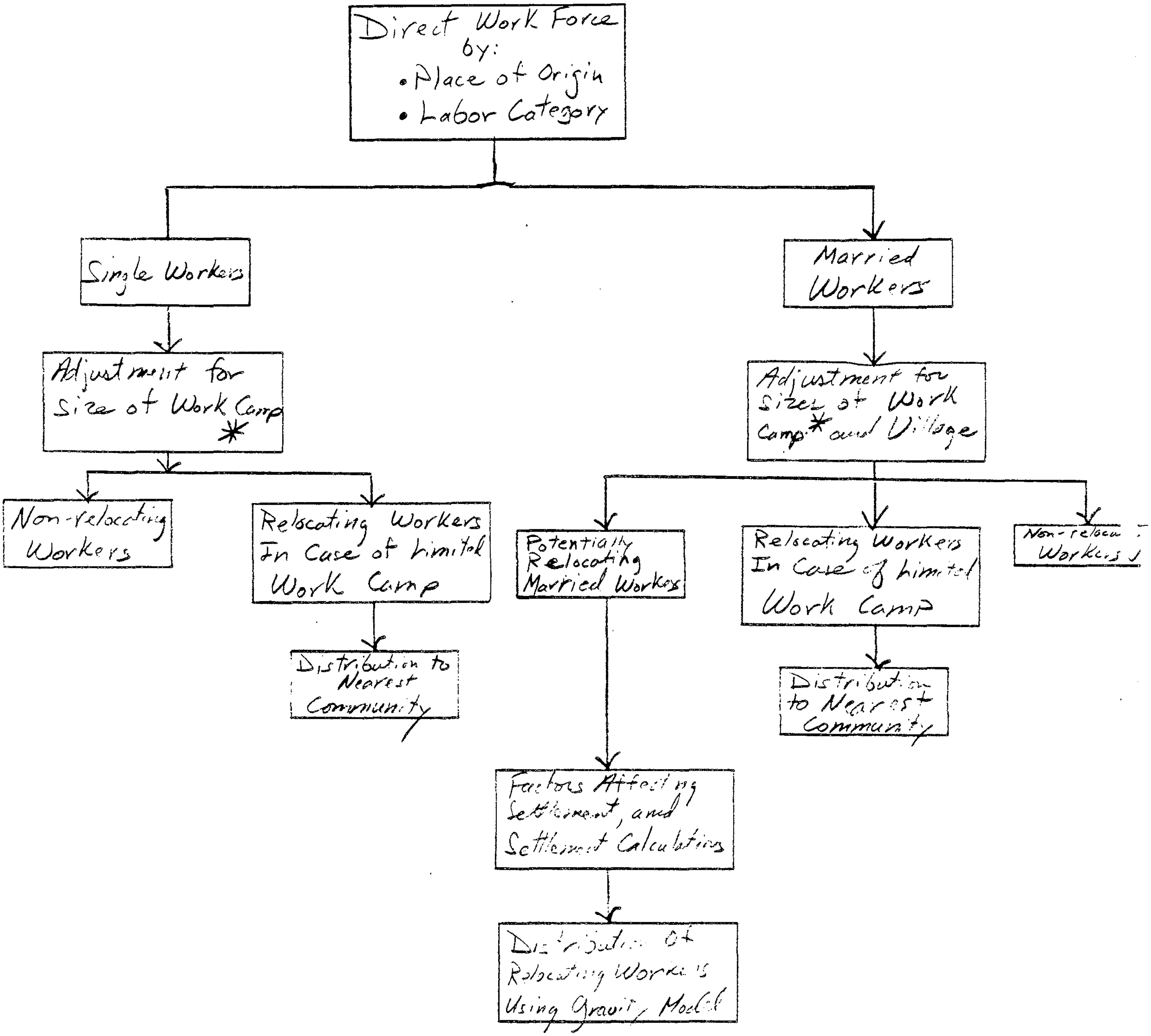
This portion of the module is a critical part of the model because it largely determines the magnitude and geographic distribution of the project's impacts. For this reason, special care has been taken to structure this portion to allow for quick and efficient analysis of multiple scenarios, and sensitivity analysis of key assumptions.

The methodology used to project settlement patterns for the work force is diagrammed in Figure 7. Here it can be seen that, in general, only married workers are expected to relocate their permanent residences (The model has been structured to also account for single workers who may relocate their residences). It can also be seen that the magnitude of in-migration by married workers is expected to be influenced by several major factors. These include:

- o place of origin
- o labor category
- o attractiveness of the work camp
- o leave schedules (days on and days off-work)
- o access corridor/mode of transportation

Figure 7

METHODOLOGY USED TO PROJECT SETTLEMENT PATTERNS OF DIRECT WORK FORCE



* The work camps are currently planned to accommodate all workers. Single and married workers will have a strong incentive to relocate if the camps are not large enough to accommodate all 40 workers.

Assumptions concerning the last three of these factors can be varied to provide socioeconomic input to the work force and project access analyses that will be conducted by the Power Authority.

Further, it can be seen in Figure 7 that the distribution of inmigrant workers to impact areas is projected using a gravity model. Travel time or cost of travel to the work sites, relative attractiveness of communities as places to live, and other factors are incorporated into this model. This model is designed to address several of the work force and project area access issues that will be considered by the Power Authority, including the transportation and access corridor/mode of transportation options.

In reviewing Figure 7, it should be noted that workers will relocate to local communities temporarily or permanently if the work camp is not large enough to accommodate all single and married workers. In this case, single as well as married workers that cannot be accommodated will relocate to the community located nearest to the work camp that can accommodate additional residents.

The following sections provide more detailed descriptions of the methodology outlined in Figure 7. Assumptions and methods concerning outmigration of workers are provided at the end of Section V-B-2.

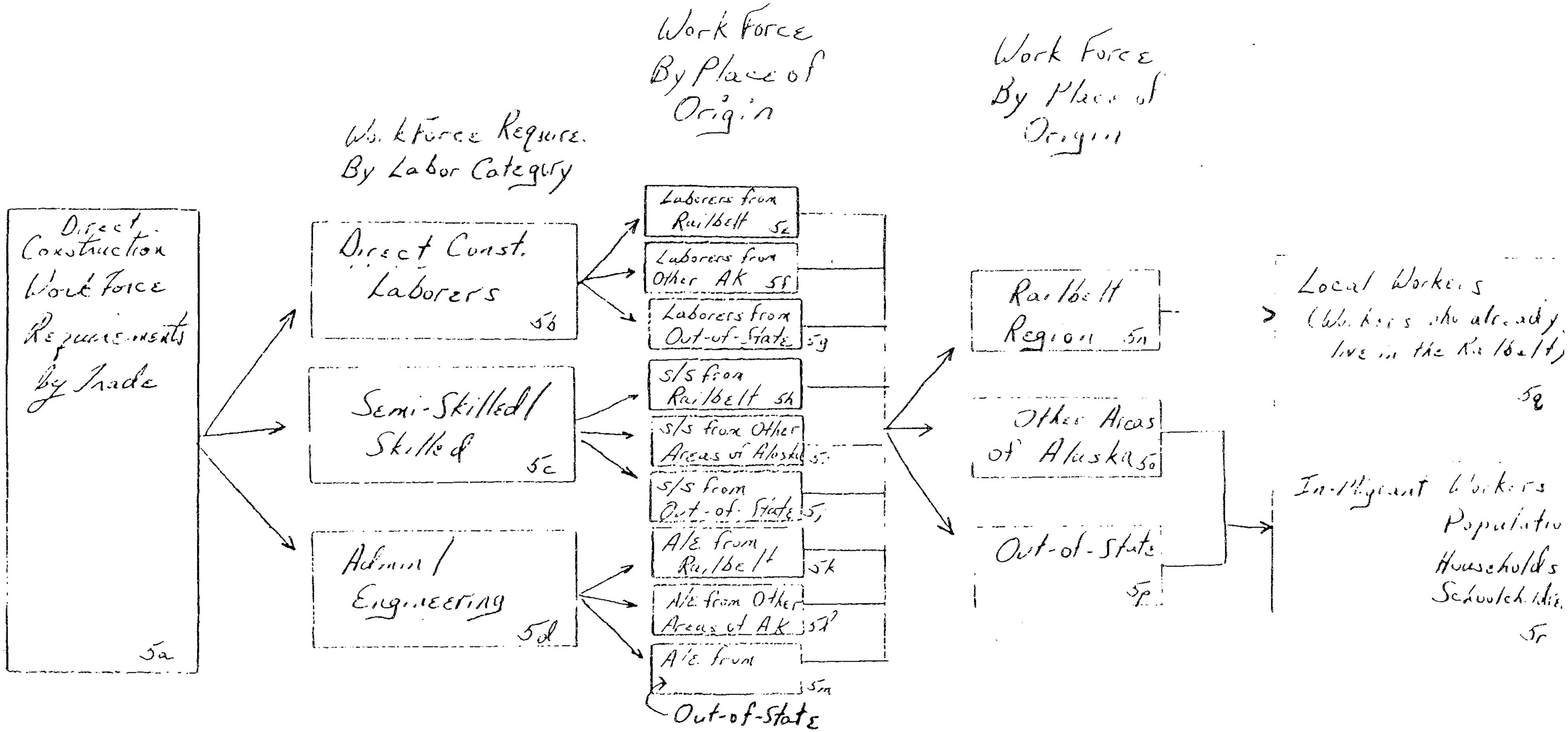
b. Origin of the Direct Workforce

The technique for estimating the origin of the direct work force is shown in Figure 8. Here it can be seen that the direct work force trades data was aggregated over trades into labor categories (Laborers, Semi-skilled/Skilled and Administrative/Engineering). Next, assumptions regarding the percentage of workers in each labor category that would originate from the Railbelt Region, other parts of Alaska excluding the Railbelt Region, or outside of Alaska were developed.

Assumptions for the proportion of workers that will originate from (a) the Railbelt Region, and (b) other parts of Alaska excluding the Railbelt Region, were based upon analysis of unemployment data for the

Figure 8

DIRECT CONSTRUCTION WORK FORCE



trades, and discussions with labor union business managers, Alaska Department of Labor economists, and construction contractors. Current and probable future availabilities for workers were approximated, and compared to direct work force requirements. Based upon these comparisons, the amount of labor, by labor category, that would be supplied from each of the three areas was estimated. These estimates (origin assumptions) are as follows:

Work Force Origin Assumptions

	Railbelt Region	Other AK	Outside AK
Laborers	85%	5%	10%
Semi-skilled/skilled	80	5	15
Administrative/Engineering	65	5	30

The model is structured to allow for sensitivity testing of these assumptions.

The amounts of labor that will originate from the census divisions of the Railbelt Region and selected communities/cities of the Mat-Su Borough and Cantwell were also estimated. These estimations were made by assuming that project employment will be distributed among census divisions based, in part, upon each census division's average share of total construction employment in the Railbelt Region during 1979 - 1981. These shares were adjusted to reflect the census division's proximity to the construction sites relative to other census divisions. The shares (origin assumptions) are as follows:

Assumptions on Work Force Origin Within the Railbelt:

Anchorage:	55.9%
Mat-Su	6.7
Kenai-Cook Inlet	11.1
Seward:	0.2
Fairbanks	23.8
S.E. Fairbanks	0.2
Valdez-Chitina-Whittier	2.1
Yukon-Koyukuk	(to be determined in coordination with the above shares)

Direct employment was estimated for residents of selected Mat-Su Borough cities/communities based upon each city/community's recent average share of total population in the Borough. Trends in population shares were also taken into account in making initial estimations of city/community shares of the Borough's direct project employment. Population data were used in lieu of employment data because employment data are not available for most cities/communities.

As with the census divisions, these shares were adjusted to reflect a city/community's proximity to the construction sites relative to other cities/communities. The shares (origin assumptions) that were used are as follows:

Assumptions on Work Force Origin Within the Mat-Su Borough:

Palmer	10%
Wasilla	8
Houston	5
Trapper Creek	1
Talkeetna	4
Other Mat-Su Borough	72
Suburban	
Rural and remote	

Both Mat-Su city/community share assumptions and census division share assumptions can be easily altered for sensitivity testing.

c. Residency and Movement of Direct Workers

The direct construction work force will be composed of single and married workers (the latter category includes cohabitants that are not married). It is assumed that none of the single workers will choose to relocate their permanent residence closer to the construction sites. Instead, the single workers will reside at the camp/village while at work, and maintain their original permanent residences. The only exception to this pattern will occur if the camp is not large enough to accommodate all single workers that need housing. In this case, it is assumed that some of the single workers will seek temporary housing, or establish permanent residence, in nearby communities. Because single workers will generally not relocate, they are handled separately in this part of the model.

In contrast, it is assumed that some of the married workers will choose to relocate their permanent residences closer to the construction sites (though they themselves will remain at the work camp during the week). Married workers will also have an additional incentive to relocate if the camp cannot accommodate all married workers.

i. Relocation of Married Direct Workers

Numbers of Workers That Will Face the Relocation Decision

The first step to estimating the number of married workers who will relocate to cities/communities is to determine the total number of married workers. This is done using single:married data from other projects (U.S. Army Corps of Engineers, 1981). Next, married workers are allocated to the three labor categories using the labor category multipliers discussed above. It should be noted that the single: married ratio, and the labor category multipliers can be adjusted to provide for sensitivity testing.

Workers who will be confronted with the relocation decision will be those for whom there is no room at the village. It was assumed that housing would be available at the village for the engineering/administrative (E/A) and semi-skilled/skilled (S-S/S) workers and their families. The available housing will be split unequally between these labor categories, with more of the housing available to the E/A workers. The model is structured to allow for adjustment of the shares of housing available at the village for each of these labor categories.

Once these E/A and S-S/S workers are subtracted from total married workers, the number of workers who are confronted with the decision to relocate to cities/communities, remains. The next step is to apply the origin multipliers discussed above to each labor category. This calculation provides the number of married workers, by place of origin (Railbelt Region, other parts of Alaska outside of the Railbelt Region, and outside of Alaska), that face the relocation decision.

Number of Workers That Will Relocate

The number of workers that will relocate is estimated according to workers' place of origin and labor category. It is assumed that both these factors will influence the relocation decision. Place of origin is important because it affects travelling time; labor category may also affect the magnitude of inmigration because the number of workers who have dependents and the average duration of employment may vary by labor category.

In addition, the attractiveness of the camp and village, leave schedules, and access corridor/mode of transportation may influence workers' incentives to relocate. As the attractiveness of the camp and village increases, the incentive to relocate should decrease. As leaves become more frequent, or the time/cost of travel increases, the incentive to relocate (or obtain temporary housing) will become greater.

Accordingly, unique relocation multipliers can be assigned to workers from each place of origin and labor category. The model is structured to allow for adjustments in camp and village attractiveness, and leave schedules.

The projected number of relocating workers, by place of origin and labor category, is calculated by applying the relocation multipliers to the number of workers who face the relocation decision. These workers have the option to relocate to the Railbelt Region, and census divisions and cities/communities therein.

Geographic Places of Relocation

It is difficult to accurately predict where workers will settle. They will consider a myriad of things when they make their decisions.

Recognizing that it is not possible nor appropriate to try to account for all factors that workers may consider, the approach is to focus upon the most likely factors. After reviewing the socioeconomic literature, and analyzing the situation in the Railbelt Region, the attractiveness indicators listed below were determined to be the most relevant for that segment of the Susitna work force that will consider relocating.

Community Attractiveness Indicators

Housing
Schools
Public Facilities and Services
Wholesale/Retail/Finance, Insurance, Real Estate/Services (number of establishments or employment)
Land available for development

The previous version of the model considered the above indicators in an informal way. Workers were allocated to communities based upon judgement. With a growing need to take into account alternative assumptions, it was decided to allocate workers in a more systematic and explicit manner.

To systematically apply these indicators (decision criteria), incorporate other important factors, and to be able to perform sensitivity analysis, it was decided to create an equation whose parameters and variables could be easily manipulated. The attraction-constrained version of the gravity model was chosen over more complex formulations, such as capacity-constrained and linear programming (LP) models, for two reasons: (1) considerably more data would be required for the more complex formulations, particularly for the LP model (these data are not now available, and would only be available at substantial cost); and (2) the simpler formulation can predict quite well magnitudes and locations of demand that are important for planning.

The equation that incorporates the indicators is:

$T_{ij} = B_j \; D_j \; W_i \; d_{ij}^{\;-a}$ (Stenehjem and Metzger, 1980), where:

T_{ij} = Number of workers that are predicted to settle in place i and commute to work site j (j = Watana or Devil Canyon).

B_j = A constant scaling factor that constrains the total number of workers commuting from alternative communities to the number of jobs that these workers fill at the work site ($\sum_i T_{ij} = D_j$). $B_j = (\sum_i W_i \; d_{ij}^{\;-a} \; D_j)^{-1}$.

D_j = Number of workers that are predicted to relocate.

W_i = Measure of the attractiveness of a community as a place to settle; this measure is, itself, the result of a calculation in which the community's rating on each attractiveness indicator is weighted and tallied. The following weights are used:

Community Atractiveness Indicator	Weight
Housing	3
Schools	2
Public facilities and Services	2
Wholesale/Retail/FIRE/Services	2
Land available for development	1

Each indicator is weighted according to its perceived importance relative to another indicator. These weights will remain constant in all applications of the model. An ordinal scale of 1 - 5 will be used to rate the attractiveness of an indicator in one place relative to that same indicator in another place.

d_{ij} = Mean transit time from community to work site (an average of the winter and summer transit times). Note: Mean transit time could be replaced by out-of-pocket travel expenses, where d_{ij} could become $e^{-aC_{ij}}$ (C = out-of-pocket travel expenses).

a = Weighting factor attached to the mean transit time measure. Note: "a" becomes larger as the worker gains more opportunities to leave the camp (e.g., more frequent leaves, or more liberal camp rules). Also, as cross-sectional data for T_{ij}, W_i, and d_{ij} become available, the parameter "a" can be more accurately calibrated through the use of regression analysis. It will also be possible to assess the statistical significance for alternative values for a.

The following assumptions will be used in the implementation of the model:

Travel time to the work site: workers will prefer to minimize travel time from their residence to the work site. Places with lower transit times to the work site will be preferred over those with higher transit times.

Cost of travel to the work site: workers will prefer to minimize the cost of travel from their residences to the work site. Places with lower costs of travel to the work site will be preferred over those with higher costs of travel.

Leave schedule: as leaves become more frequent, places located closer to the work site will be preferred over those located farther away.

As data on project-related population change in the various communities becomes available (through the monitoring program), the above equation may be modified with the intent of improving the accuracy of settlement projections.

The gravity model will be used to project settlement for:

- Workers who originate from other parts of Alaska, and outside of Alaska. These workers may relocate to Anchorage, Fairbanks, Mat-Su (and cities/communities therein), Yukon-Koyukuk (and cities/communities therein), and Valdez-Chitina-Whittier (and cities/communities therein) census divisions.

- Workers who originate from Anchorage, Kenai-Cook Inlet, and Fairbanks census divisions. These workers may relocate to the cities/communities of the Mat-Su and Yukon-Koyukuk census divisions.

ii. Relocation of Single and Married Workers (Special Case)

As discussed earlier, single and married workers may live in nearby communities if the camp does not have enough capacity to accommodate all workers. In this case, the single-to-married ratio is applied to the number of workers that cannot be accommodated at the camp, to obtain numbers of single and married workers that must find accommodations elsewhere. It is assumed that these workers seek housing in the nearest community.

The origin and labor category multipliers are applied to these temporarily or permanently relocating workers to obtain information that is necessary for worker tracking purposes. In addition, an estimate is made for the percent of married workers who will choose to have their dependents accompany them to their place of relocation. This information is used in the population influx calculations discussed in Section V-B-3.

The total number of married workers, used as the starting point for projections in the general case (discussed in section i. above), is diminished by the number of married workers that cannot be accommodated at the camp. This is done to avoid double-counting.

d. <u>Outmigration of Workers</u>

It is assumed that a percentage of the inmigrant workers that are no longer employed on the project will choose to move due to lack of employment opportunities or other factors. The model has the flexiblity to move these inmigrant workers from their places of relocation in any given year, and at any given rate.

Currently, it is assumed that 50% of the workers who in-migrated from outside of Alaska, or from other parts of Alaska outside of the Railbelt Region, and lose their employment on the project, will out-migrate. They will leave their places of relocation and return to their original place of residence or go elsewhere in search of employment.

On large projects in the lower 48 states, an average of about 30-40 percent of the workers who completed their employment on projects chose to remain at their places of relocation. The percentage is assumed to be higher for this project because it is expected that workers will stay in the area after construction on Watana ends, hoping to obtain employment on the Devil Canyon Dam during 1994-2002. After 2002, it is expected that a large number of these workers will choose to remain in the area because by that time they will know about job opportunities in the area and will have an attachment to the area.

It is assumed that workers who relocated from areas of the Railbelt Region to places closer to the work sites, do not outmigrate when their employment of the project ends. Instead, these workers remain at their places of relocation and search for new employment.

3. Population Calculations

The cumulative population influx into each impact area is calculated in the model as a function of : (1) the cumulative number of in-migrating direct workers; (2) the percentage of those workers that are assumed to be accompanied by dependents; and (3) the average number of dependents per accompanied worker.

It was assumed that 100 percent of the direct workers who relocate to the Railbelt region will be accompanied by dependents (The model is now structured to allow this percentage to vary). Since housing will be provided on-site, there will be little incentive for most single workers who come from outside the Railbelt region to establish residences in a nearby community. On the other hand, in-migrating direct workers with families who cannot obtain family housing on-site will be more likely to desire housing for their dependents in the region. It should also be noted that a large percentage of the work force for this project will be skilled tradesmen, and such workers are more likely to have families than unskilled construction laborers. This assumption can be easily changed in the computerized model, for sensitivity analysis purposes.

An assumption of 2.11 dependents per accompanied construction worker was used to calculate the population influx associated with the direct work force. This figure is an average derived from a survey of construction projects throughout the United States that was performed for the U.S. Corps of Engineers (U.S. Army Corps of Engineers, June 1981). Comparable data on Alaskan projects are not available. The resultant population per household figures differ from the household size projected for the state. The specific construction worker measure was used because construction workers have been observed to have characteristics slightly different from the population as a whole.

4. Payroll

Payroll is calculated by multiplying the number of workers of a given trade by the number of hours worked in an average month by the hourly pay rate. The payroll figures are projected in constant 1981 dollars.

Numbers of Hours. The assumptions on numbers of hours varied by type of worker:

Laborers -	232 hours	(54 hours per week, 4.3 weeks per month)
Semi-skilled/skilled -	232 hours	(54 hours per week, 4.3 weeks per month)
Administrative/Engineering -	208 hours	(48 hours per week, 4.3 weeks per month)
Operations Work Force -	208 hours	(48 hours per week, 4.3 weeks per month)

Wage Rates. Wage rates for laborers and semi-skilled/skilled workers were obtained from the Alaska Department of Labor (ADOL) and are displayed in Table 7. These wage rates are routinely collected by ADOL through industry surveys, and are the workers' base rate of pay exclusive of any fringe benefits and prior to standard deductions. Wage rates for engineering/adminstrative and operations/maintenance personnel were obtained from Acres American, Inc. and are the workers' Alaskan base rate of pay exclusive of any fringe benfits and prior to standard deductions. These wage rates do not include travel allowances, housing allowances, or other other highly variable types of compensation.

Table 7

1981 HOURLY WAGE RATES USED TO CALCULATE PAYROLL

TRADE	HOURLY WAGE	TRADE	HOURLY WAGE
LABORERS			
Drilling	$18.30	Blasting	$11.36
Cement	17.13	Laborers	16.62
Pumping	16.16	Excavating	18.30
Material Handling	15.66	Moving Storage	7.17
Security	6.10	Fire	7.55
Police	10.10	Janitor	10.00
Waste Disposal	14.43		
SEMI-SKILLED/SKILLED			
Stationary Engineer	$15.00	Electric Powere Gen.	$14.37
Machanic - Machine	13.21	Mechanic - Auto	14.81
Mechanic - Engine	17.48	Truck Driver (Heavy)	15.80
Truck Driver (Light)	15.80	Air	9.50
Bus Driver	6.00	Nurses	9.14
Radio/T.V.	5.75	Telephone Operator	6.09
Medical Assistant	7.63	Purchasing Agent	12.45
Structural Steel	16.93	Sheetmetal	20.93
Boilermakers	20.97	Welders	17.46
Electronics	17.57	Electricians	21.31
Rail Transport	9.50	Painters	18.65
Carpenters	18.51	Bricklayers	18.93
Roofers	18.82	Pipefitters	20.73
Plumbers	20.73	Bartenders	8.25
Chefs	13.13	Cooks	8.12
Kitchen Workers	5.71	Laundering	5.94
Electrical Transmission	19.45	Recreation	6.46
Photography	10.24	Nursery	4.61
Airplane Pilots	18.29	Secretarial	7.24
Bookkeeping	7.21	Data Processing	7.63
Accommodation	6.41	Teachers	7.87
Writers	4.67	Commercial Artists	7.45
Office Managers	9.49	Landscapers	9.25
ADMINISTRATIVE/ENGINEERING			
Electrical Engineer	14.37	Electrical Eng. Draft	11.10
Civil Engineer	14.17	Civil Engineer Draft	9.21
Mechanical Engineer	11.38	Mechanical Eng. Draft	9.21
Mining Engineer	22.00	Surveyers	12.92
Geologist	12.92	Geotech	10.10
Hydrology	12.00	Environment	8.92
Managers	9.49	Misc. Professionals	10.00

C. Secondary Work Force

1. Multipliers

Secondary employment was estimated by applying location and time-specific secondary employment multipliers to the on-site construction work force and any operations workers that maintain permanent residences in the region outside of the villages and construction camps. These work forces include both the single and married workers discussed in the previous section. The following multipliers were applied to these work forces:

Census Division	Multiplier (Time Period)
Anchorage	1.1 (1983-84); 1.2 (1985-87); 1.3 (1988-96); 1.4 (1997-2005)
Mat-Su	0.8 (1983-87); 0.9 (1988-2005)
Kenai-Cook Inlet	0.4 (1983-89); 0.5 (1990-99); 0.6 (2000-2005)
Seward	0.3 (1983-99); 0.4 (2000-2005)
Fairbanks	0.5 (1983-89); 0.6 (1990-99); 0.7 (2000-2005)
SE Fairbanks	0.2 (1983-99); 0.3 (2000-2005)
Valdez-Chitina-Whittier	0.3 (1983-99); 0.4 (2000-2005)

The value of each location-specific multiplier was assumed to increase with time due to import substitution and other factors that reflect a maturing and growing economy.

It is implicitly assumed that the secondary employment multiplier associated with workers housed on-site is zero. This multiplier is expected to be very low or insignificant in all areas except, perhaps, Cantwell and the Mat-Su Borough. Accordingly, the multipliers for these areas have been raised slightly.

The secondary employment multiplier for Anchorage was developed as part of an in-depth theoretical and empirical analysis of the Anchorage economy (Tuck, 1980), and the multiplier for Fairbanks was taken from an industrial development projects impact assessment model developed by Dr. Bradford Tuck and Environmental Services Ltd. for the Fairbanks Northstar Borough.

The secondary employment multiplier for the Mat-Su Borough is based upon research conducted jointly by Dr. Tuck and Frank Orth & Associates, Inc. The multiplier was initially estimated to be 0.76, and was raised to 0.80 to account for the expected effect of expenditures made by workers who reside at the camp or village and take occasional excursions in the Railbelt Region and/or travel to their residences outside of the Railbelt Region.

Multipliers for the remaining census divisions are based upon work conducted by Dr. David Reaume (Reaume, 1980). Dr. Reaume estimated regional multipliers as follows:

Gulf (Cordova-McCarthy, Kenai-Cook Inlet, Kodiak, Seward, and Valdez-Chitina-Whittier census divisions): 0.2

Interior (Fairbanks, S.E. Fairbanks, Upper Yukon, and Yukon-Koyukuk census divisions): 0.4

The multipliers used for the Kenai-Cook Inlet, Seward, and Valdez-Chitina-Whittier census divisions are slightly higher than Dr. Reaume's estimate for the Gulf Region. This is because it was assumed that the secondary sectors of these census divisions' economies would grow relative to the basic (direct) sectors of their economies during 1980 - 1983.

The multiplier used for the S.E. Fairbanks census division is lower than that for the Interior Region because it was known that the multiplier for the Fairbanks census division was about 1.5. Given that the economy of S.E. Fairbanks is far less developed than that of Fairbanks, a multiplier of 0.2 was assumed for S.E. Fairbanks.

The model is structured to allow for adjustment of these multipliers. This flexibility is especially appropriate because several of these multipliers may change more or less quickly than the rates of change assumed above.

Flexibility is also important because it may be appropriate to lower the multipliers associated with the direct construction work force. Recent research (Denver Research Institute, 1982) has shown that these multipliers are frequently over stated. Accordingly, the model will be run using several values for the multipliers.

2. Origin and In-migration

Since the employment multipliers were applied to the on-site construction workers according to their places of residence, the distribution of secondary sector jobs within the region was simultaneously determined. Thus, it was assumed that secondary sector jobs will be created where construction workers maintain their permanent residences.

Some of these jobs will be filled by local residents while the remainder will be filled by in-migrant workers from other areas. The number of in-migrating secondary workers was determined by estimating the percent of total secondary jobs, created in each census division and community, that is likely to be filled by in-migrants. The following percentages were used:

Anchorage:	25%
Kenai-Cook Inlet:	15
Seward: 0	
Fairbanks:	15
S.E. Fairbanks:	20
Valdez-Chitina-Whittier:	30
Yukon-Koyukuk:	90

Mat-Su Borough:

Palmer:	10%
Wasilla:	10
Houston:	10
Trapper Creek:	70
Talkeetna:	25
Other Areas:	10

These percentages resulted from an analysis of the amount of labor potentially available at each location. Unemployment data, labor force participation rates, and underemployment information were utilized in this analysis. These percentages were then applied to the total secondary employment estimates, by location, to obtain the number of in-migrating secondary workers in each location.

It should be noted that this represented an extension of the economic base method, as this method usually ignores underemployment of labor and often results in overestimation of the in-migration of secondary workers and related population. This extension serves to provide for a more realistic (lower) estimate of in-migrant secondary workers. It should also be noted that the percentages discussed above will be estimated for other locations (impact areas) at a future time.

3. Population Calculations

Cumulative population influx associated with the secondary work force is calculated for each impact area by multiplying the population-per-household measures that were projected for the state under the Base Case by the estimated number of in-migrating secondary workers. It was assumed that these workers would have the same general demographic characteristics as present residents.

D. Housing Impacts

The impacts of the project on housing are quantified using the following steps:

1. The number of cumulative project-related in-migrant households is calculated as equalling the number of direct and secondary workers that in-migrate into a community or area by a given year.

2. The percent increase that this number of households represents of the total projected number of households in the impact area is calculated.

3. The projected project-related influx is compared to the number of vacant houses that is expected under "without project" conditions.

VI. PUBLIC FACILITIES AND SERVICES

A. Overview of Methodology

The general approach to forecasting public facility and service requirements during 1985-2005 was:

1. to develop appropriate standards, for each service category and for each relevant community, that relate service and facility requirements to the size of population;

2. to assess the adequacy of existing facilities and services and to quantify any over- or under-capacity using these standards;

3. to estimate future needs based on the application of these standards to the population growth forecasts with and without the Susitna project;

4. to indicate the significance of the impact on local jurisdictions; and

5. to provide indicators of need for project-impact mitigation measures.

B. Geographic Scope

Projections of impacts of the project on public facilities and services are calculated only for communities and other jurisdictions in the Local Impact Area. The flexibility to project facility and service requirements of other communities and jurisdictions in the Railbelt region has been built into the computerized model. At this time, however, no further work has been done to develop appropriate per capita service standards for these jurisdictions.

C. The Computerized Module

The public facility and service model utilizes three types of data input. First, the module reads in the population and household projections from a data file that is created as an output of the economic-demographic module. Second, assumptions on service standards and data on capacity are accepted. Third, information on present and planned capacity is entered.

A schematic of the structure of the facilities and services module is presented in Figure 9. Per capita service standards are multiplied by the projected population of each community, under the "with project" and "without project" scenarios, and the results are stored as service requirements for that community. The effects of the direct population influx and the total project-related population influx are calculated independently, so that direct and total impacts can be separated for mitigation planning purposes.

Impacts of the project are displayed quantitatively in various ways. Project-related requirements are compared to the requirements without the project as a percent increase, and to 1981 capacity in both absolute and percent capacity utilization terms.

The results of the model are presented for each community or impact area, by variable, on a yearly basis. Table 8 is an example of the report format that is produced by this module.

D. Types of Service Standards

Service standards can be divided into two categories--average and prescriptive. Average standards are based on recent data on existing service levels on a per capita basis for a given area. Average standards may be based on national, regional, state or local averages, or on averages for a given type or size of community; their distinguishing feature is that they are based on an average of what currently exists. As such, they reflect the realities of funding and staff limitations that local governments face.

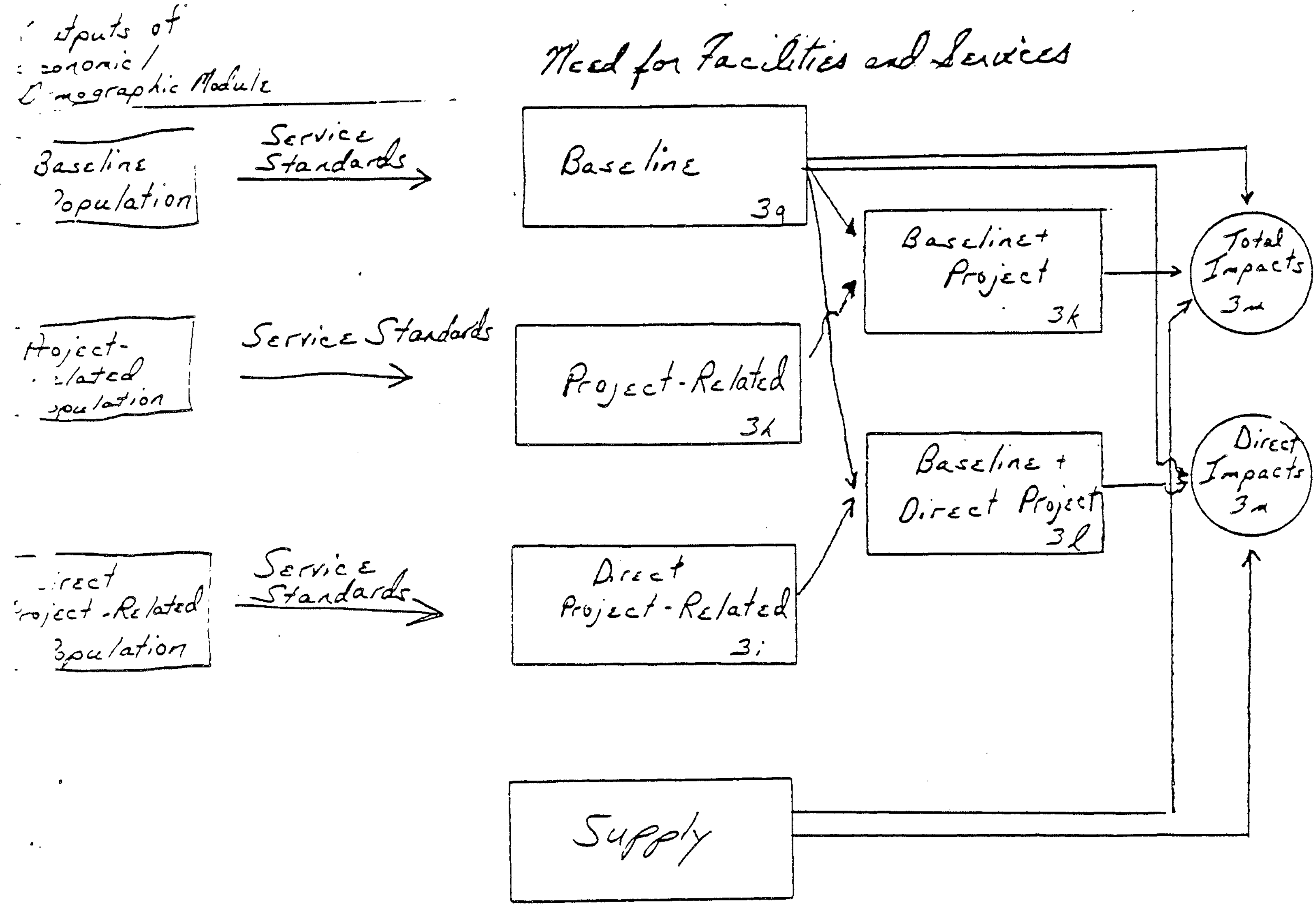
Table 8

IMPACT OF THE PROJECT ON POLICE PROTECTION
IN THE MATANUSKA-SUSITNA BOROUGH
(NUMBERS OF OFFICERS)

YEARS	1985	1986	1987	1988	1989	1990	1991	1992	1993
PROJECT-RELATED REQUIREMENTS									
Direct Project	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Project	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BASELINE (Cum.)	28.0	31.0	33.0	35.0	37.0	39.0	41.0	42.0	45.0
TOTAL REQUIREMENTS	28.0	31.0	33.0	35.0	37.0	39.0	41.0	42.0	45.0
Direct Require. As % Increase Over Basel.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Require. As % Increase Over Basel.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1981 Capacity	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
Excess (Under) Cap.	(8.0)	(11.0)	(13.0)	(15.0)	(17.0)	(19.0)	(21.0)	(22.0)	(25.0)
% Capacity Utiliz.	140.0	155.0	165.0	175.0	185.0	195.0	205.0	210.0	225.0

Figure 9

STRUCTURE OF PUBLIC FACILITIES AND SERVICE MODULE



(Contents of 3g - 3l)

Types of Information Contained

Water } gallons per day
Sewage – gallons per day
Solid Waste - acres per year
Police - number of police
Hospitals - Bed Need, Doctors
Schools - classrooms, teachers
Not quantified: Fire · Transportation

Playgrounds
Neighborhood Pks
Community Parks

(3m + 3n)

Quantitative Expression of Impacts

% Increase Over Baseline
Increase Over Baseline in Nos.
Capacity Utilization
Distribution of Increase Over Geographic

For some service types, prescriptive standards are set by relevant agencies or associations. For instance, a state government may require certain standards for health care and education; standards for fire protection based on insurance tables may be used widely. These standards often vary by size, type and community, and may be voluntary or mandatory.

A mix of average and prescriptive standards have been used in this analysis. The objective has been to provide detailed measures of adequate service levels, for those services which the local governments now provide, while keeping under consideration the resource constraints that communities face. Local preferences, based upon conversations with local, state and borough officials, have been taken into account.

For some facilities and services, the required level of service varies among communities, depending on factors such as the size of the community and the type of community (urban, suburban or rural).

In some cases, relevant standards may be based on variables other than population per se -- for example, the number of dwellings or the number of school-age children. These variables are related to population levels, but the actual ratios may change over time. Service categories such as education and health care are especially sensitive to demographic changes. Where possible, predictors of demographic changes have been incorporated into the model.

Due to the many factors that influence the needs for public facilities and services, the uniqueness of each community, and the subjectivity in deciding adequate service levels, the standards used in the model should not be considered absolutes, but rather as general indicators of changing requirements with and without the Susitna project. A summary of the standards used is displayed in Table 9. In the sections below, specific considerations relating to the choice of standards are discussed.

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Table 9

SUMMARY OF PUBLIC FACILITY AND SERVICE STANDARDS FOR SELECTED COMMUNITIES IN THE LOCAL IMPACT AREA

	Palmer	Wasilla	Houston	Trapper Creek	Talkeetna	Mat-Su Borough	Cantwell
Water Supply							
Average Water Supply (gpd per capita)	120-150[a]	120-150[a]	-	-	-	-	-
Sewage Treatment							
Sewage Treatment (average gpd per capita)	150	-	-	-	-	-	-
Solid Waste Disposal							
Landfill Requirements (acres per 1,000 population)	.11-.21[b]	.11-.21[b]	.11-.21[b]	.11-.21[b]	.11-.21[b]	.11-.21[b]	.11-.21[b]
Education							
Average Primary School-Age Children To Teacher Ratio	25	25	-	25	25	25	15
Average Secondary School-Age Children To Teacher Ratio	21	21	-	-	-	21	15
Teacher to Support Staff Ratio	8:1	8:1	8:1	8:1	8:1	-	-
Health Care							
Desired Hospital Bed Occupancy Rate	-	-	-	-	-	55%	-
Law Enforcement							
Police Officers (officers per thousand population)	1.5	-	-	-	-	1.0-1.5	1.0
Parks and Recreation							
Playgrounds (acres per 1000 dwelling units)	3.9	3.9	3.9	-	-	-	-
Neighborhood Parks (acres per thousand dwelling units)	3.3	3.3	3.3	-	-	-	-
Community Park (acres per thousand dwelling units)	-	-	-	-	-	4.8	-

[a] Assumed to increase from 120 gallons per day per capita in 1981 to 150 gallons per day in 2000.

[b] Assumed to increase from .11 acres per year per thousand population in 1981 to .21 acres per year in 2000.

E. Assumptions and Service Standard Used

1. Water Supply

Water systems are comprised of three components -- the supply source, the treatment facility and the distribution system. The most widely used standards for water service are the average and peak water consumption per capita, in terms of gallons per day (gpd). Facility standards sometimes include pipe length per thousand dwellings, and treatment capacity.

The standards are relevant only for communities that have or are expected to develop water systems. Only two communities in the Local Impact Area, Palmer and Wasilla, have city-wide water supply systems. Other residents, including inhabitants of the communities that will be most affected by the project, rely on individual wells or "community" systems that serve a particular subdivision, trailer park or other small area.

An average per capita water consumption standard of 120 gallons per day in 1981 rising to 150 gpd by the year 2000 was used. The city of Palmer currently has an average per capita water use rate of 120 gpd, and this relatively low usage may be attributed to the relatively small amount of industry in the area. It is expected that future growth will include an increase in business activity and hence a rise in per capita water consumption.

2. Sewage Treatment

The amount of sewage generated is a function of the amount of water that is used daily. In the literature on national standards, it has been estimated that an average of 65 percent of total water supplied becomes sewage, or 100 gpd per capita, with the remainder used for miscellaneous purposes such as watering lawns and gardens, firefighting and generating steam (Stenehjem & Metzger, 1980). This standard is not appropriate for application to many Alaska communities. In the winter in parts of Alaska, more water than required for use flows through the distribution system, in order to keep the water from freezing within the pipes. This water is then returned as sewage, resulting in sewage flows representing close to 100 percent of water use. This is the case in Palmer, where sewage requirements equal 100 percent of average water usage, or 120 gallons per day per capita. For the purposes of projections of impacts, a constant standard of 120 gpd has been used for Palmer, the only community with a sewage treatment system in the Mat-Su Borough, and for Wasilla, which is planning a sewage system at this time.

3. Solid Waste Disposal

Solid waste can be disposed through incineration or sanitary landfill disposal; sanitary landfill has become the prevalent mode. Facility requirements for solid waste disposal can be measured in terms of the amount of land needed per capita on an annual basis. Published standards range from 0.2 to 0.3 acres per thousand people, depending on assumptions of pounds of waste per capita, depth of the site and the rate of compression of the waste.

A lower standard of .11 acres per thousand population has been assumed initially for communities in the Mat-Su Borough and other communities in the Local Impact Area, based on the premises that waste production per capita is much lower and the fill depth of the central landfills is twice as high as national averages. This standard is calculated to rise to 0.21 acres by 2000 and held constant at this level between 2001 and 2005.

4. Education

The major determinant of the requirement for educational facil- ities and services is the ratio of school-age children to population, modified to take into account private school attendance. Two different methodologies were used to estimate the number of school-age children associated with the (1) Base Case population and (2) in-migrant population associated with the Susitna project.

Under the Base Case, for the Mat-Su Borough, the standards that the school district uses for planning were used in this study as well. Short-term planning through 1987 uses an estimate of 22.8 percent (school-age children : total population). For long-range planning purposes, an estimate of 25 percent is used. For the purposes of this study, the ratio is assumed to rise gradually from 22.8 percent in 1987 to 25 percent in 2000 and then held constant at that level through 2005. In Cantwell, the present 18 percent level was assumed to remain constant over time in the Base Case.

The number of school-age children accompanying workers on the project has been estimated using a ratio that was calculated, through surveys of other large projects, of .89 schoolchildren per in-migrant worker accompanied by dependents (U.S. Army Corps of Engineers, 1981). The number of school-age children associated with the in-migrant secondary population was calculated on the same basis as Base Case school-age children.

A major service standard for education relates the number of school-age children to the number of classes and teachers. Local preferences have been used as standards in this case. In the Mat-Su Borough school district, planning standards include an optimum of 25 students per class for primary schools and 20-22 for secondary schools. In addition, Mat-Su Borough statistics show that teachers comprise about 50 percent of total school district personnel requirements. In Cantwell, the Railbelt School District's planning standard teacher-student ratio of 15:1 was used.

Requirements for classroom space can be measured in terms of number of classrooms or alternatively, the number of square feet per pupil (90 square feet for primary school students and 150 square feet for secondary school students). The square feet calculations are useful to the estimation of the cost of constructing new facilities. The model is able to provide both sets of calculations.

It is assumed that the present ratios of primary school students (54 percent of total) and secondary school students (46 percent of total) will remain constant. It is beyond the scope of this analysis to forecast changes in distribution by school and by grade.

5. Health Care

Standards for acute public health care focus on the capability of hospital facilities and staff to accommodate the expected number of patients without building overcapacity that will then add to hospital costs. While rule-of-thumb bed multipliers of between 2.1 and 5.8 beds per 1000 population are often used, it has become customary to base the number of beds required on a measure of the long-term daily average daily census of patients using the hospital divided by the desirable occupancy rate. In Alaska, the recommended occupancy rates are 80 percent for urban hospitals and 55 percent for rural hospitals. The formulas used are:

Acute Care Patient Days at Valley Hospital plus Days at Alaska and Providence Hospitals for Borough Residents	/	Borough Population	=	Hospital Use Rate for Borough Residents

Hospital Use Rate for Borough Residents	X	Estimated Borough Population	/	365 days in year	=	Projected Average Daily Census (PADC)

Projected Average Daily Census	X	Proportion of Bed Need Met at Valley Hospital	/	Minimum Occupancy for Rural Hospital (55%)	=	Valley Hospital Acute Care Bed Need

A significant aspect of the hospital system in Alaska deserves note. The Municipality of Anchorage has developed a comprehensive acute and long-term health care system that provides the main medical care for the residents of Southcentral Alaska, as well as other areas of the state. A large percentage of people living in areas such as the Mat-Su Borough, as well as Cantwell, presently elect to use hospitals in Anchorage over the local hospital due to the larger number of doctors (especially specialists) and the more modern facilities. However, the percentage of patients that use the Valley Hospital in Palmer has been rising rapidly in recent years, and this trend is expected to be accelerated by the planned addition to and renovation of this hospital, as well as the possible addition of certain medical specialists to the staff. It is assumed that the usage of Valley Hospital as a percentage of total Alaskan hospital use by Mat-Su Borough residents will rise from 38 percent in 1980 to 75 percent in 2000 and remain constant at that level through 2005.

Age and sex distributions of the population are important determinants of hospital use. Due to data limitations, these and other demographic factors have been assumed to remain constant. As data become available from communities and workers through the monitoring program, the model may be restructured to project age and sex distributions.

6. Law Enforcement

Police service standards range from one officer per thousand population in unincorporated rural areas to 1.5 officers per thousand population in small communities and 2 officers per thousand in moderately large cities. For rural parts of the Local Impact Area, a standard of 1.0 officers per thousand was applied to the population projections. For the southern part of the Mat-Su Borough (outside Palmer, which has its own police force), a standard of 1.5 officers per thousand population was used; it is anticipated that the growing suburbanization of the borough will soon justify use of the increased standard.

Alaska State Troopers judge the relative adequacy of their staffs in terms of the average case load (i.e. number of crimes) that each officer is charged with investigating. Six cases per Trooper is considered average, and eight is considered the level at which additional staff is needed. In the Mat-Su Borough, in 1981, there was approximately one Trooper per thousand population, and the average case load was about six per officer. This indicated that the rural standard discussed above was appropriate for this area.

7. Recreation

Projected requirements for recreation facilities, in terms of acreage for playgrounds, neighborhood parks and community parks, were calculated by applying national standards for rural areas. Standards for playgrounds and neighborhood parks are most applicable to the cities of Palmer, Wasilla, and Houston, whereas community parks are planned for larger areas, and the standard pertaining to this category is most relevant to Mat-Su Borough as a whole.

8. Other Facilities and Services

Some categories of public services did not lend themselves to this type of quantitative approach. The method of analysis used for these categories are discussed below.

9. Fire Protection

The major criteria that can used to evaluate the adequacy of fire protection are (1) the available water flow rate (gallons per minute), (2) response time, and (3) manpower availability. There are several standards that relate these variables to population size in the socioeconomic impact literature. Water flow, response time or service radii, and the equipment capacity are commonly used. It is common in communities of less than 7,000 to rely on volunteer firefighters; as this is not a cost item, requirements for manpower have not been projected for communities of the local impact area.

However, fire protection planning in Alaska, as in many other states, often takes the form of trying to achieve a certain fire rating as measured by the Insurance Service Organization (ISO). The ISO is a national organization that rates fire protection on a scale from one (best) to ten (worst); fire insurance rates closely reflect these ratings.

Communities without a community water system can at best achieve an ISO rating of 8 (which is the objective that the Mat-Su Borough presently hopes to achieve for its most populous fire districts). Requirements to achieve a rating of 8 are: that dwelling class property be within five road miles of a fire station (on roads that are in good condition) and that the fire department has demonstrated its ability to deliver 200 gallons per minute (gpm) for a period of twenty minutes without interruption. The latter requirement implies a need for a capacity of 4,000 gallons of water "on wheels." The ISO rating does not relate service availability to the size of population.

10. Transportation

The impacts of the project on transportation were analyzed with the consultation of public officials who have responsibility for transportation infrastructure in the region.

The capacity of the Parks Highway, the main highway in the project area, was discussed with the Alaska Department of Transportation and Public Facilities, and specific areas which could be transportation bottlenecks were determined. Officials at the Alaska Railroad confirmed that the rail line is underutilized, and could easily handle the additional freight that the project would generate.

The Mat-Su Borough has a skeletal road framework which will need to be expanded significantly to handle the population growth that is expected in the next twenty years. Discussions with Mat-Su Borough officials yielded estimates of the threshold borough population sizes that are expected to trigger the need for additional roads. For instance, as the population of the borough exceeds 30,000, there will be a need to build a collector road ring with a radius of four or five miles from Wasilla. Using these threshold levels, it was possible to estimate by how much the population influx related to the Susitna project would accelerate the need for these infrastructure additions.

Possible future enhancements to the impact model would entail (1) projecting the increase in traffic counts on major roads in the impact area related to the project and (2) relating the project-related population influx to the demand for airport facilities.

VII. FISCAL MODULE

A. Overview of the Fiscal Impacts Module

1. Purpose

The purpose of fiscal impact analysis of resource development projects, such as the Susitna Hydroelectric Project, is three-fold:

- To identify the types and magnitude of project-induced changes in the expenditures and revenues of local governments;
- To identify or estimate the timing of project-related expenditures and revenues; and
- To make the above information available to the mitigation planning process.

2. General Approach

The general approach taken in the analysis of the fiscal impacts of the Susitna Hydroelectric project was to consider two futures. First, baseline conditions were analyzed and projected, for each local jurisdiction, to provide a basis for comparison. Second, conditions with the project were projected, using data inputs from the economic-demographic and the public facilities and services modules.

In the analysis of baseline conditions, emphasis was placed on identifying the most important sources of revenue and expenditure items. Past and current trends in both revenues and expenditures were examined and analyzed, and these trends were used as the basis for the projections of future fiscal conditions in the project area.

In the projection of fiscal impacts related to the project, the effects of the direct population influx and the total project-related population influx are calculated independently, so that direct and total impacts can be separated for mitigation planning purposes.

B. Impact Areas and Local Jurisdictions

Within the project impact area, there are a number of jurisdictions that hold a variety of powers to collect taxes or otherwise receive revenues and to provide certain public services. The fiscal powers vested in these jurisdictions, to a large extent, determine likely sources of future revenue and future needs for expenditures for public facilities and services. The distribution of fiscal responsibilities among jurisdictions also will affect the extent to which any given jurisdiction is impacted by the project. In the following section a brief description of the government organization and fiscal responsibilities of jurisdictions in the project area is given. For additional information on government organization in the project area, refer to Frank Orth & Associates, Inc., 1982.

1. The Municipality of Anchorage and the City of Fairbanks

These centers comprise by far the largest population centers in the project area. The Municipality of Anchorage is a first class home rule municipality while Fairbanks is a first class city. This first class status provides both population centers powers to levy taxes on real and personal property as needed in order to provide services to their residents. Each one of these centers provides a wide range of public facilities and services.

2. Mat-Su Borough.

The powers and responsibilities of the Borough are comprised of four general functions: general fund administration, provision of fire protection and road services to service areas, land management functions, and responsibilities for the school district. General fund administration and responsibility for the school district are part of the Borough's area-wide duties to serve all areas in the Borough; provision of fire protection and road maintenance to service areas are non area-wide functions whereby only selected areas are served.

3. Incorporated cities

The incorporated cities in the Mat-Su Borough are Palmer, Wasilla, and Houston. Palmer is a first class home rule city, while both Wasilla and Houston are second class cities.

4. Palmer

As a home-rule city, Palmer has certain certain powers of taxation. Home rule and general law municipalities may levy tax on all real and personal property located in the municipality to support services provided throughout the municipality. The maximum rate of taxation is three percent (thirty mills) of the full and true value of taxable property.

5. Wasilla and Houston

As second class cities, Wasilla and Houston require a majority vote to exercise the power of taxation. In addition, there is a tax ceiling of five mills. For additional discussion of the tax powers of local authorities in the State of Alaska, refer to Frank Orth & Associates, Inc., 1982.

C. Projection of Revenues and Expenditures

1. Revenues

Sources of revenue are, in the main, determined by the taxation powers of a given jurisdiction together with its eligibility for intergovernment transfers. For each jurisdiction, the major traditional sources of revenue were determined and its tax powers were examined.

The next step was to determine appropriate methods of projecting future revenues. The discussion that follows presents a list of alternative methods including the ones chosen for this analysis.

a. "Own Source" Revenues

"Own source" revenues include all source of revenue that the local jursidiction raises for itself, such as property, sales and income taxes. These are a function of the size of the tax base and the tax rates used.

Property values are influenced by many factors, including the level of demand as population increases. To estimate changes in the property tax base, a real rate of growth of four percent was assumed for the Mat-Su Borough baseline assessed value. This rate is based on recent observed growth rates in the Borough's total assessed value. For the "with project" scenario, baseline per capita assessed valuation was applied to the population influx to estimate additional growth in the property tax base. Certain tax rates were assumed for the analysis period.

Sales tax revenues were assumed to grow in direct proportion to population. The sales tax rates were assumed to be constant.

b. Intergovernmental Transfers

In estimating intergovernment revenues, it is important to understand the criteria used by the state and federal government in allocating transfer funds to local jurisdictions. Allocations are usually made on the basis of local population size. Therefore, per capita based projections are good approximations of this form of revenue and were used in this analysis. In some cases, both population size and geographic location are considered when allocating transfer funds. Whenever appropriate, the per capita based projections in the model were adjusted to account for location specific factors.

c. Bonding

The Borough has in the past utilized school revenue bonds primarily for school capital projects. The authority to do this is always sought from the local taxpayers, as, in principal, they are responsible for repaying this form of obligation. However, the state legislature has in the past provided varying levels of reimbursement to the borough. Current law allows up to 90 percent reimbursement of both principal and interest payments. In this analysis, maximum bonded indeptedness is projected as a ratio of assessed valuation.

d. Political Factors

It is important to note that political factors, such as the form of government of a jurisdiction and changes in state statutes, can heavily influence the amount of revenue that may be available to a local jurisdiction. For example, a local decision to incorporate or upgrade the level of incorporation from a second class to a first class city, can lead to increased taxation powers and potential revenues. Similarly, a decision at the state level to change the criteria for providing revenue sharing assistance to local jurisdictions can have far reaching effects.

2. Expenditures

A first step to projection of expenditures is to identify the types of public facilities and services provided by a jurisdiction. This initial step provides a listing of the expenditure items for which projections must be made. Suitable methods can then be identified for making the projections. In the following section, alternative methods are discussed as is the rationale for selecting the method which was used in this study.

Generally, there are two groups of methodologies for projecting public expenditures: (1) the average cost approaches and (2) the marginal cost approaches. Methodologies in both groups were examined for advantages and disadvantages and for applicability to the project area. The following is a brief review of these methods.

a. Average Cost Methodologies

Average cost methodologies include the per capita cost, service standards, and cross-sectional regression analysis approaches. The per capita cost method is based upon the assumption that, in real terms, present per capita costs are reasonable estimates of future cost. It is a relatively inexpensive methodology to apply, as it readily utilizes available historic data. Its major weakness lies in its lack of direct accounting for threshold effects (i.e. predicting the large amount of new investment that is needed when a community reaches a certain "size threshold"), existence of excess capacity in public facilities, and economies of scale in providing new services.

The service standards method would multiply the results of the service requirements calculated in the facilities and services module by unit costs to project total facilities costs. The cross-sectional regression analysis approach estimates average service requirements based on data from several communities in the region. Both the service standards and regression methods require considerably more data than the per capita method. Additionally, because the regression method must draw on regional data to have enough data points, it is sometimes regarded as being too regionally based to constitute an appropriate local impact projection method.

b. Marginal Cost Methods

These include the case study approach, the comparable city method, and the economic engineering method. An important advantage of these methods is that they are able to explicitly account for the threshold effects, excess capacity and economies of scale. However, marginal cost approaches require great amounts of data, may not be accurate if there is uncertainty surrounding assessment of excess capacity in public facilities and services, and in addition require great amounts of effort to update the estimates. In general, these methods are more expensive to apply.

c. Criteria for Methodology Selection

The following criteria were used to make a selection of expenditure projections methodology:

- Simplicity of application while providing reasonably accurate results;

- Availability of data;

- Ease of update and therefore usefulness in mitigation planning and mitigation measure revisions; and

- Applicability to impact area fiscal conditions.

The first criterion demands a method that, although simple, would meet current standards of acceptability. The per capita cost method meets these requirements and is the most commonly applied fiscal impact methodology.

With the exception of the cross-section regression method, the average cost methods tend to require historical data that is readily available. The marginal cost methods require great amounts of data that may not be available and can be complex in application.

Cost projections for this project will need to be revised repeatedly to reflect the most current information on the project and its schedule. It is, therefore, necessary to have a method of projection that can be updated easily. Although the marginal cost methods (and in particular the case study method) can have a great deal of accuracy, their application demands a correspondingly higher data collection effort. As a result, marginal cost methods are more suited to a one-time application.

Using the above criteria, the per capita cost method was selected for use in this study. It was recognized, however, that the method's weaknesses could be minimized by incorporating some features of the Case Study approach. Thus, interviews with local officials were conducted in order to gain perspectives on trends in public facilities usage. Furthermore, public facilities thresholds and public preferences concerning the extent of public facilities and services will be monitored during the project period so that adjustments can be made during a dynamic mitigation planning process. During that process, the per capita multipliers used and assumptions that underlie them will be compared to actual costs to better facilitate mitigation. If revised cost estimates are required, they can be made easily and quickly. This is one advantage of the per capita method - it facilitates a continuous mitigation process.

D. Link of the Fiscal Module to other Modules

1. Input Data

As discussed above, many of the revenue items and most of the cost items are projected applying per capita multipliers to the projections of population and school-age children. Per capita multipliers were obtained or computed from current and historic budgets. Interviews with local officials supplemented this information. These multipliers are contained within the fiscal module. The rest of the data are derived from the other modules of the model.

2. Link to the Economic-Demographic Module

The fiscal module obtains population data from the Economic-Demographic module. The data extracted corresponds to the type of cost projections to be made (baseline projections, impact of the direct project-related population influx, and impact of the total project-related population influx) and the appropriate phase of the project. Accordingly, changes in the economic and demographic scenarios affect the revenue and cost estimates in the fiscal calculations.

3. Link to the Public Facilities Module

A significant portion of the Mat-Su Borough budget goes to education. In fact, the school district budget constitutes about 58 percent of the borough revenues. Consequently, one of the important variables in projecting fiscal conditions is the number of children in the borough. These estimates are provided by the public facilities module.

A possible future enhancement of the fiscal calculations will introduce a link to the public facilities module to specifically extract indicators of threshold effects. This linkage would then be used together with monitoring information to adjust cost estimates, as more data become available regarding supply shortfalls.

E. Baseline Projections

This section discusses the estimation of baseline projections. A detailed analysis is given regarding component revenue and cost items, some of the assumptions made, and specific methods of estimation for each jurisdiction. The jurisdictions covered are Mat-Su Borough, the cities of Palmer, Wasilla, and Houston within the borough, the Municipality of Anchorage and the City of Fairbanks. Within the Mat-Su Borough, special attention is given to the general fund, the school operating fund, the service area fund, and the land management fund.

For jurisdictions in the local impact area including Mat-Su Borough and Palmer, Wasilla, and Houston, considerable effort was devoted to projection of both the revenues and expenditures. Major sources of revenue and important expenditure items were identified. The Municipality of Anchorage and the City of Fairbanks are outside of the local impact area. Consequently, only expenditure projections were made. Major expenditure items were emphasized. The following is a discussion of the module structure for calculations.

1. Mat-Su Borough

Revenues: Two types of revenues are projected. They are "own source" revenues and intergovernmental revenues. The only source of own revenues is the property tax. Intergovernmental transfers received by the borough include such categories as state shared revenues, municipal assistance revenues, and federal revenue sharing. All intergovernment revenues were estimated using per capita multipliers. Property taxes were projected based on an assumed real growth in the tax base of four percent. The applicable tax rates are of two kinds: (1) the area-wide tax rate and (2) the non area-wide rate. The first is applied to the total Borough assessed valuation while the second is applied to the non area-wide assessed value. Residents of those selected areas where the Borough provides fire protection and road services pay a non area-wide tax in addition to the area-wide tax that is paid by all residents of the Borough. The general equations used for the two types of revenues are given below:

$$IGR_{it} = IGH_{it}*POP_t$$

$$PT_t = AV_t*MR_t$$

IGR_{it} = the ith item intergovernment revenue in the year (t)
IGH_{it} = the ith item per capita revenue ,,
POP_t = population in the Mat-Su Borough ,,
PT_t = property tax ,,
AV_t = assessed valuation ,,
MR_t = the mill rate (tax rate) ,,

Expenditure items for the borough, such as area-wide general fund administration, service area cost items, and land management fund, are projected based on per capita expenditure estimates using the following general equation:

$$COST_{it} = PCC_{it}*POP_{it}$$

PPC = the per capita cost multiplier
POP = the population size
Subscripts: (i) identifies the ith cost item, and
(t) identifies the year.

2. The School District Budget

Revenues: The school district revenues come primarily from the state government, area-wide local taxes, and the federal government. All government contributions, with the exception of those from the state's foundation program, are based on school-age population. Foundation program monies are granted on a per instruction unit basis and take into account area specific cost adjustment factors. This revenue item, however, can also be said to be based on population since instructional units are determined by the number of students. Estimation of property taxes was discussed above; the state and federal government contributions are projected using per capita school child revenues and the total school-age children. The general form of the equation used is as follows:

$$SR_{it} = PR_{it} * TSC_{it}$$

SR_{it} = nonlocal school revenue from the ith source in year (t)

PR_{it} = revenue from the ith source per school child in year (t)

TSC_t = total school age children in year (t)

3. The City of Palmer Budget

Revenues: The City of Palmer derives revenues from own sources, intergovernment transfers, and miscellaneous sources. Own sources include the local property taxes, sales taxes, and service charges. Own sources constitute close to 60 percent of all revenues while intergovernment sources contribute some 25 percent. Miscellaneous sources are responsible for the balance. Own source revenues are projected using per capita multipliers; intergovernment revenues are projected based on historic percentage contributions.

Other revenue sources are the special fund charges for water and sewer services. The projections in this category were based on per capita charges.

Expenditures: The city of Palmer provides a number of standard services. Cost projections for all the various services listed below were based on per capita cost multipliers.

Services provided include:

- o General administration
- o Police
- o Fire service
- o Ambulance
- o Parks and recreation
- o Health services
- o Library
- o Public works
- o Water supply
- o Sewer

Thus, the general formula for projecting the total outlay for each item is as follows:

$$COST_{it} = PCC_{it}*POP_t$$

The various terms in the equation are explained above.

4. City Of Wasilla

Revenues: There are two categories of revenues that the city of Wasilla receives. They include intergovernment transfers, and own-sources. Unlike the City of Palmer, Wasilla receives by far the greatest amount of its revenue from intergovernment funds, which include state-shared taxes, state and federal revenue sharing, state grants for capital projects, various transfers from Mat-Su Borough and elsewhere for the library, and other miscellaneous intergovernment transfers. All the revenue items were projected using per capita revenue multipliers.

Expenditures: Expenditure items for the City of Wasilla include:

- o General administration;
- o Parks and recreation;
- o Library;
- o Fire service;
- o Capital projects.

All these were projected based on per capita expenditure multipliers with a general formula of the form:

$$COST_{it} = PCC_{it} * POP_t$$

5. City of Houston

Revenues: Although the composition of revenue items and purposes is quite varied, there are only two important sources of revenue for the City of Houston. These are the state and Mat-Su Borough. To project baseline revenues for Houston, per capita revenues estimates were obtained for each important revenue item and applied to the projected population of the city.

Expenditures: To project expenditures, per capita expenditure multipliers for the various cost items were obtained and used with the projected population of the city. The applicable expenditure items include:

- o Local government administration;
- o Fire service;
- o Parks and recreation;
- o Road maintenence;
- o Solid waste.

6. Municipality of Anchorage

For the Municipality of Anchorage, expenditure projections were made using the per capita cost method. Per capita expenditures for major expenditure items were applied to the population projections; the total expenditure was then obtained by summing over the individual items. The most important components of expenditures are as listed below:

- Police;
- Fire service;
- Ambulance;
- Parks and recreation;
- Library;
- Health services;
- Transportation;
- Sewage service;
- Solid waste disposal;
- Water supply.

7. City of Fairbanks

As with the Municipality of Anchorage, only the expenditures were projected for the City of Fairbanks. The per capita cost approach was used. The items included in the expenditure projections are:

- Police;
- Fire sevice;
- Ambulance;
- Parks and recreation;
- Library;
- Health services;
- Transportation;
- Sewage service;
- Solid waste disposal;
- Water supply.

F. Impact Projections

Project impacts were projected using the same formulas as were used in the baseline projections. One difference in methodology concerns estimation of property tax revenues associated with the population influx. The approach was to use the baseline derived per capita assessed valuation together with the total population (including population influx) to estimate total assessed valuation. Tax revenues are then derived, as in the baseline projections, using the same mill rate multipliers.

Incremental revenues and costs were projected for various aspects of the project. The aspects considered in the fiscal calculations include the direct increment associated with the direct project populations, and the increment associated with the total population influx. Project scenario total revenues and expenditures (Baseline+Project - direct and secondary) are also projected.

G. Reports

Reports are organized by jurisdiction. The revenues and expenditures are reported as well as indications of deficits. The revenue projections reported include baseline revenues, incremental revenues due to direct population influx, increments due to total project-related population influx, and overall revenues in the "with project" scenario. Similar information is reported for expenditures. The reports display total revenues and total expenditures for each jurisdiction, rather than individual revenue/cost items. However, back-up tables that report on the detailed computations can be designed and produced to facilitate local plannning.

For the jurisdictions where both revenues and expenditures are projected, baseline deficits and "with project" scenario deficits are reported. In addition, the percent increase (decrease) in the jursidiction's deficit as a result of the project is reported. Two sample reports are included as Table 10 and 11. These two reports are similar, but differ in the time period of reporting. Table 10 covers the period from 1985 to 1993 while Table 11 reports on the remainder of the project development and beyond to the year 2005.

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Table 10

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FISCAL MODULE REPORTS
REVENUES AND EXPENDITURES
IMPACTS ON BUDGETS
(Thousands)

Mat-Su Borough General Fund

Year	1985	1986	1987	1988	1989	1990	1991	1992	1993
REVENUES									
PROJECT RELATED									
Direct Portion									
Project Total									
BASELINE PROJECTION									
TOTAL REVENUES									
EXPENDITURES									
PROJECT RELATED									
Direct Portion									
Project Total									
BASELINE PROJECTION									
TOTAL EXPENDITURES									
Baseline Deficits									
Total Deficts									
% Increase in deflct									

Table 11

FISCAL MODULE REPORTS
REVENUES AND EXPENDITURES
IMPACTS ON BUDGETS
(Thousands)

Mat-Su Borough General Fund

Year	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	200
REVENUES												
PROJECT RELATED												
Direct Portion												
Project Total												
BASELINE PROJECTION												
TOTAL REVENUES												
EXPENDITURES												
PROJECT RELATED												
Direct Portion												
Project Total												
BASELINE PROJECTION												
TOTAL EXPENDITURES												
Baseline Deficits												
Total Deficts												
% Increase In Deficit												

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FISHERIES SERVICE

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August 3, 1983

Mr. Robert W. McVey
Director, Alaska Region
National Marine Fisheries Service
P.O. Box 1668
Juneau, Alaska 99802

Subject: NMFS January 25, 1983 Letter of Comment on the November 15, 1982 Draft Exhibit E of the Draft FERC License Application for the Susitna Hydroelectric Project.

Dear Mr. McVey:

National Marine Fisheries Service's January 25, 1983 comments regarding the November 15, 1982 Draft FERC Exhibit E for the Susitna Hydroelectric Project, and Alaska Power Authority responses to those comments, were inadvertently omitted from Chapter 11, Exhibit E, of the February 28, 1983 formal License Application submittal to the Federal Energy Regulatory Commission.

In order to rectify this omission, this letter transmits our point-by-point responses to your agency's comments. Your letter and these responses will be incorporated into the License Application document authorized by the FERC for distribution to the resource agencies and the public.

General Comments

1. Comment: It appears that many of the basic economic premises upon which this project was planned have now changed. We believe the License Application should fully consider the impact of these events and discuss their effect or impact on overall project feasibility, the need for Watana to be operational by 1993, and the economics associated with providing sufficient downstream flows to minimize fishery impacts.

   Response: Following submittal of the License Application on February 28, 1983, the FERC requested similar information concerning project economics and downstream flows. Portions of Exhibits B and D were revised (as of July 11, 1983) and information added that specifically addresses the economic issues as they apply to instream flows. For example, in the revised application three new flow regimes, which consider project economics and instream flows, were considered in addition to the seven flow regimes originally described in the February 1983 License Application. The revised License Application will be available to the resource agencies in the near future.

2. Comment:...we recommend that Exhibit E of the License Application include a presentation and analysis of the 1982 data.

Response:

Data from the 1982 field season were incorporated throughout Chapters 2 and 3 of the February 28, 1983 submittal, to the extent possible. Additional information from the 1982 field season was provided in Appendix E.2.A of the July 11, 1983 submission.

3. Comment: We recommend that the License Application detail ongoing and proposed studies.

Response: An interagency meeting (including NMFS) was held by the Power Authority on July 18, 1983 to describe the 1983 aquatic studies progam. Details of the proposed 1984 fiscal year (FY) field program (July 1, 1983 to June 30, 1984) were also submitted (on July 11, 1983) to the FERC as part of the supplemental information requests. The Power Authority will provide additional details to the study plans when study scopes for FY 1984 are finalized.

4. Comment: We recommend the License Application be expanded to include a more precise description of impacts and present the following design/operating concerns:

A. Flow releases - based upon weekly rather than monthly averages.
B. Quantification of "normal" spillages, below the 1 in 50 year event, passed through the outlet/cone valve facility.
C. Potential peaking operations at Watana without the Devil Canyon Dam. ACRES has identified this as a possiblity. What circumstances would dictate such operation? What daily and hourly fluctuations would result? How would such fluctuations be attenuated by tributary input and the river distance between Watana and Devil Canyon?
D. Compensation flow pumps at the Devil Canyon facility. What flows will they provide? How were these flows established? Are these pumps still planned for this facility?

Response: A and B - The November 15, 1982 draft License Application has been expanded to include weekly analyses in addition to the monthly analyses. This has resulted in a quantification of "normal" spillages, below the 1 in 50 year event, passed through the outlet/cone facility as described on p. E-2-111.

C - The potential for peaking operations at Watana without the Devil Canyon dam has been defined in the February 28, 1983 license submittal (p. E-2-104). A daily variation of not more than 2000 cfs is anticipated and would be attenuated through natural storage in the river channel prior to reaching Portage Creek. A flow routing study has not been performed for determining river stage variation between Watana and Portage Creek. However, the daily flow variability of no more than 2,000 cfs is not expected to cause significant changes in water surface elevation downstream from Devil Canyon. A 2,000 cfs change in flow from 20,000 cfs would cause approximatley a one-quarter foot change in mainstem stage neglecting the natural attenuation. It is our judgement that this change will not adversely affect the downstream fisheries. However, this will be confirmed by future studies.

D - The compensation flow pumps at the Devil Canyon facility have been eliminated as they were not considered cost effective. The value of the dewatered reach to the fisheries resource was not considered significant.

5. Comment: We continue to be concerned about development of a release schedule which would mitigate impacts to fisheries. The draft Exhibit E states that reduced flows could impair fish migration, de-water spawning and rearing habitat, prevent access to slough and side channel habitats, and lower or eliminate intergravel flows to slough and side channel spawning grounds. The minimum flows proposed in Exhibit E, however, were not developed using any recognized in-stream flow predictive methodologies, and may not constitute the preferred flow regime for minimizing such effects. The license exhibits do not explain how the 12,000 cfs minimum operational flows for August and September were determined.

Response: A section entitled Project Operation and Flow Section has been added to Chapter 2, Exhibit E of the License Application. The section explains how the minimum operational flows for August and September were determined. Although Exhibit E states that these impacts could occur, specific mitigation measures to avoid or minimize these impacts have been added to Chapter 3 of the Exhibit E.

Potential impacts to fisheries are being refined. As this process continues, the operational flows and the specific mitigation measures will also be refined in consultation with appropriate resources agencies. The present schedule and plan calls for completion of many of the instream flow related studies during the 1983 field season. The results of these studies will be incorporated into aquatic habitat modeling efforts being performed by the Arctic Environmental Information and Data Center (AEIDC). Initial results of these modeling efforts are anticipated to be available in late 1983 followed by final results in mid-1984.

6. Comment: We believe that maximum winter flow limits should be required as well, particularly in light of potential staging should ice cover develop below Devil Canyon.

   Response: We concur that maximum winter flow limits should be established. The ice modeling studies will be used to predict the mainstem stage increases during ice cover conditions. This information will be used to predict fishery impact and potential flood conditions for the town of Talkeetna. Mitigation measures including setting maximum winter flow limits will then be established. This will be done during the continuing studies and will assist in the interagency negotiations concerning instream flow.

7. Comment: We recommend that the License Application contain a specific, detailed flow release schedule, developed through a quantifiable in-stream flow analysis and coordinated with NMFS, U.S. Fish and Wildlife Service and the Alaska Department of Fish and Game (ADF&G), which would minimize impacts and/or enhance conditions for spawning, feeding, passsage, out-migration, and overwintering in the Susitna River.

   Response: An expanded discussion of one flow selection procedure is presented in the revised Chapter 2, p. E-2-56. Also, Exhibit B has been revised to examine three additional flow regimes (Cases E, F, and G) that consider a wider range of flow alternatives. These flow regimes are being assessed through a quantifiable instream flow analysis that will be coordinated with NMFS, USFWS, ADF&G, Alaska Department of Natural Resources, Alaska Department of Environmental Conservation, Alaska Department of Transportation and Public Facilities, the Alaska Railroad, and the Corps of Engineers. This analysis will be performed on an incremental basis whereby the effects of flow alteration can be examined on a continuous basis over a range of flows rather than on just a discrete individual flow basis. The final flow regimes will be negotiated during interagency discussions and negotiations.

8. Comment: The Watana and Devil Canyon dams will cause changes to the existing water temperature regime of the Susitna River, generally releasing cooler water during summer months and warmer water in winter. Temperature variations affect the ability of fish to migrate, spawn, feed, and develop in the Susitna system. Ice formation will be delayed or possibly not occur. Exhibit E discusses this matter at length but does not present an accurate description of post-project temperature alterations. A model was developed to project temperatures, uet it has been operated with only one year of data (1981). Further, this model was run only for the months of June through October.

Response: Additional temperature modeling results were presented in the February 28, 1983 license submittal (p. E-2-118 to E-2-120 for Watana operation and p. E-2-164 to E-2-167 for Watana/Devil Canyon operation). These model results cover the period of June through December. A criterion was established to match outflow temperatures to inflow temperatures as closely as possible. It is our judgement that for the year modeled (1981), the model reasonably describes post-project temperature alterations. At Watana, it was possible to match summer outflow temperatures to inflow temperatures although the outflow temperature does not exhibit as high or as low an extreme as the inflow temperature. For a period in the spring and a period in the fall, it was not possible to match temperatures. At Devil Canyon, it was not possible to match natural water temperatures until late in the summer.

The APA does appreciate the concern of NMFS that the model was run with only one year of data. The APA is currently carrying out studies to examine the effect of various hydrological and meteorological conditions on outflow temperatures including low flow and average flow years to complement the high flow year (1981).

9. Comment: Realizing the importance of an accurate understanding of the thermal structure within the reservoirs and of outflow temperatures, we believe additional information is warranted. We recommend that modeling be done for both reservoirs throughout the year, and the resultant data be incorporated into the riverine temperature model calibrated with at least two seasons data.

   Response: As discussed in the response to Comment 8, additional modeling is currently being undertaken. This modeling effort will include both reservoirs and all seasons. As per the NMFS suggestion, the resultant data will be incorporated into the riverine temperature modeling with at least two years data.

   It is our judgement that one year of modeling has demonstrated that summer temperature control is possible.

10. Comment: NMFS recommends that the final License Application contain the results and analysis of the 1982 field data base being gathered by the Alaska Department of Fish and Game, et al., and results of an expanded study of sloughs in the Devil Canyon to Talkeetna reach which would provide a larger and more representative sample than currently available.

    Response: To the extent possible, additional 1982 field data collected by the Alaska Department of Fish and Game were included in the February 28, 1983 License Application submittal.

In addition, detailed information on these sloughs in the Devil Canyon to Talkeetna reach was provided in Appendix E.2.a in the July 12, 1983 submission. The 1982 field data will also be incorporated in future analyses.

The sloughs which were selected for study contain the greatest percentage of spawning salmon in the sloughs upstream of Talkeetna.

11. Comment: Exhibit E discusses the impact of project construction and operations on river ice formation. Apparently, post-project ice formation will be delayed due to higher release temperatures from Devil Canyon. Currently, ice originating from the upper Susitna contributes 75 to 85 percent of the ice load to the lower river. With this input reduced or delayed by the project, ice formation on the lower river will be affected. This impact is not adequately discussed in the Exhibit.

    Response: As stated in the February 1983 license submittal, the reduced ice contributions to the lower Susitna River will result in about a four-week delay in the formation of ice downstream from Talkeetna. Future ice studies will review this information and provide more detail concerning ice development and staging.

12. Comment: Ice formation above Talkeetna will also be delayed by the project. The location of the ice front in this reach has important implications to fisheries habitat within the mainstem, side channels, and sloughs. In areas with ice cover, staging is expected to occur which would increase water surface elevations, possibly increasing upwelling, overtopping the upstream berms of sloughs, and causing high velocities and scour to occur.

    In those areas where ice formation does not occur, water elevations would drop below naturally occuring levels, leading to potential de-watering of spawning gravels and reductions in upwelling areas. Exhibit E predicts that the ice front should occur at some location between Talkeetna, RM 100 and Sherman, RM 130 and will depend upon the upstream temperature, i.e., the Devil Canyon outflow. As no model was completed for winter riverine or reservoir temperatures, the full scope and measure of these effects cannot be assessed.

    Response: Although no winter reservoir temperature modeling was completed for the November 15 draft, the location of the downstream ice front was bracketed based on preliminary information. Since the November 15 draft, the results of the reservoir temperature and instream ice modeling were completed and included in the February 1983 license document. Discussions on the ice-related impacts during Watana and Watana/Devil Canyon operation were expanded (p. E.2.89, E.2.124 - E.2.127, and E.2.169 - E.2.170). Reservoir temperature modeling results for both Watana and Devil Canyon reservoirs were used as input to riverine temperature modeling. Additionally, maximum and minimum expected reservoir outlet temperatures, for both Watana and Devil Canyon reservoirs, were used as input boundary conditions for riverine temperature modeling to bracket the maximum upstream and downstream locations of the ice front.

To futher refine and expand these ice modeling results, further instream ice studies are currently being undertaken. These studies will define the ice front location for various inputs, the time of ice formation, the ice staging, and the ice breakup.

13. Comment: Measures to mitigate unavoidable impacts to fisheries resources are presented in the Exhibit. Many of those measures designed to mitigate construction impacts effectively address this concern. Development of a flow regime that minimizes loss of habitat and maintains normal timing of flow related biological stimuli is also proposed. We recommend that such a release schedule be included in the final License Application.

    Response: In the License Application submitted on February 28, 1983, seven alternate flow regimes were considered (see Exhibit B). These regimes ranged from those which optimize project economics (Case A) to those which consider flows that minimize or eliminate impacts to fish (Case D). In order to expand the range of possible flow regimes which would encompass any plausible flow regime, three additional flows (Cases E, F, and G) were added to Exhibit B in July 1983, including one (Case G) that reflects average pre-project or run-of-river conditions. Final flow regime selection will be made following interagency review and negotiations.

    At present, there is no indication that flow provides stimuli for outmigration. Instead, it may be related to other factors such as photoperiod.

14. Comment: The Exhibit proposes to mitigate fishery losses by physical modification of side sloughs and creation of mainstem and side channel spawning areas. This vague commitment to an approach that is only a paper concept dependent upon the results of ongoing or proposed studies does not allow us to fully evaluate the feasibility of the proposed project nor to assess the effectiveness with which project impacts can be mitigated.

    Response: The revised mitigation plan in the License Application submitted February 28, 1983 has further developed the details associated with the various habitat enhancement measures.

A detailed comprehensive mitigation planning effort will be completed through consultation with the various resource agencies. This effort will be based, to a large extent, on already completed field studies and on the aquatic habitat modeling studies by the AEIDC which will be compelted in FY84. The modeling studies are necessary to determine the level and extent of mitigation measures needed.

15. Comment: We support the concept of retaining the habitat value of side sloughs through physical alteration. Further, we recommend that Exhibit E incorporate a slough mitigation plan which identifies the sloughs to be modified, the design criteria, and the operational plan and target fish species specific to each slough. Details for the mitigation goals and operational monitoring efforts for this plan should be included. The applicant should note, however, that we feel the release schedule proposed in Exhibit E should be refined based upon an accepted instream flow predictive methodology and the specific requirements of the selected species. We believe this is essential to serious consideration of a slough modification program.

    Response: An expanded slough mitigation plan is incorporated into Chapter 3, Exhibit E of the February 28, 1983 License Application submittal. As mentioned in the response to Comment 14, a stepwise approach to mitigation is currently underway. This approach first involves completion of modeling studies to quantitatively assess any positive or negative impacts. The second step will be to complete the detailed plan, in consultation with the various resource agencies, to mitigate these impacts.

16. Comment: Exhibit E states that if alternative mitigation schemes prove infeasible, a hatchery could be developed. While we regard such artificial methods to be the least desirable form of addressing fishery losses, we realize that slough modification is largely untried in Alaska and that these mitigative efforts may indeed fail. Therefore, we recommend that Exhibit E should advance this discussion beyond the statement that "a hatchery could be developed." Information should be included within license Exhibit E which describes the number of hatcheries needed, locations, sizes, what the production target for each species would be, and cost estimates.

    Response: The salmon hatchery alternative is a low-priority alternative that is not anticipated to be needed. The Power Authority believes that full mitigation can be achieved by an adequate flow regime and/or employing the habitat enhancement techniques described in revised Section 2.4.4, Chapter 3, Exhibit E. A report[1/] on the assessment of hatchery potential and siting has been prepared for the Power Authority and will be considered in future mitigation planning efforts.

17. Comment: None of the mitigative measures presented comply with FERC rules and regulations under Section 4.41 (F)(3)(iii); i.e., costs for these features are not presented, nor are design plans for mitigation features included.

    Response: Cost of mitigation is discussed in Chapter 3, Section 2.7 of the February 28, 1983 License Application. Cost estimates are shown in Tables E.3.39, E.3.41, E.3.45, and E.3.47; design drawings are presented in Figures E.3.26 through E.3.31.

    Additional details and refinement to the mitigation facilities will result from on-going mitigation planning efforts. This will include extensive consultation with the resource agencies.

[1/] Kramer, Chin and Mayo, Inc. 1983. Susitna hatchery siting study. Prepared for the Alaska Power Authority and Acres American Incorporated.

Specific Comments - Chapter Two

1. Comment: Page 15, para. 4, Breakup. The section should describe when breakup normally occurs, specifically the dates of the earliest, mean, and latest recorded events.

   Response: Breakup information for the Susitna River at Talkeetna is contained in Table 4.6 in the Ice Observations 1980-81 report by R&M Consultants.

2. Comment: Page 38, para. 3. This section should consider that at least eight sloughs exist above Gold Creek, several of which support large numbers of spawning salmon, e.g., Slough 21. While Gold Creek may be a logical point at which to gauge flow, it does not necessarily guarantee that upstream flow will be sufficient to maintain habitat value in these sloughs. Exhibit E should discuss this concern and recommend necessary measures to guarantee adequate flow to these sloughs.

   Response: Flows at Gold Creek are used as an index of flows throughout the Susitna basin above Talkeetna. By targeting flows to be accommodated at Gold Creek, flows throughout the basin can be apportioned on a drainage area ratio basis. Since the drainage area between Watana or Devil Canyon and Gold Creek will not be altered, reduction or increase of flow at Gold Creek is indexed to changes at any point in the river above Talkeetna. The rationale is discussed at p. E-2-110.

   The sloughs upstream from Gold Creek that support fish are downstream from Portage Creek. Since the drainage area between Watana and Gold Creek is approximately 980 square miles and the drainage area between Portage Creek and Gold Creek is approximately 176 square miles, the discharge at the most upstream slough will be about 17.7 percent less than the total discharge contributed from the drainage area between Watana and Gold Creek if it is assumed that the runoff per square mile does not vary over this drainage area. For example, if the Gold Creek flow is 12,000 cfs, of which 8,000 cfs is released at Watana and the remaining 4,000 cfs is contributed from the drainage area downstream from Watana, the flow at the slough immediately downstream from Portage Creek would be approximately 11,300 cfs. (Under natural conditions, a flow of 4,000 cfs from the drainage area between Watana and Gold Creek would imply a Gold Creek discharge of 20,000 cfs.) This flow, in conjunction with proposed mitigation measures, would be used to maintain the productivity of the sloughs. With distance downstream, the flow would increase such that the flow adjacent to sloughs just upstream from Gold Creek would be close to the 12,000 cfs flow at Gold Creek.

   It must also be remembered that the water level at sloughs upstream of Gold Creek are being indexed to Gold Creek for future analysis.

3. <u>Comment</u>: Page 47, Section (v) <u>Impacts on Sloughs</u>. The section notes that data to confirm the areal extent of upwelling at low flows are unavailable at this time. Currently only one slough has been investigated sufficiently to predict project influences on groundwater and upwelling. This slough is not representative of all such sloughs in the Devil Canyon to Talkeetna reach.

   Under existing winter flows, ice formation causes staging equivalent to an open water flow elevation exceeding 20,000 cfs. Filling flows of 1,000 cfs, for which ice formation may be delayed or fail to occur, could significantly impact sloughs through dewatering gravel spawning areas and overwintering habitat.

   <u>Response</u>: While it is true that groundwater studies have focused on slough 9, studies have also been conducted at slough 8A. These studies have been useful in understanding the mainstem-groundwater-slough upwelling interaction. Although there certainly are differences among sloughs in the Devil Canyon to Talkeetna reach (path length, groundwater gradient, soil properties, tributary inflow etc.), the groundwater processes are similar.

   Because of the potential for adversely affecting groundwater upwelling rates and area during the filling of Watana Reservoir, filling flows have been revised in the February 1983 License Application submittal. Natural flows will be provided from November through April during the filling period.

4. <u>Comment</u>: Page 49, para. 2. As the temperature of groundwater is considered a function of the average annual temperature of the mainstem Susitna what will be the impacts of the second filling year release temperatures to the groundwater? How long would any change persist? No data are presented to support the statement that groundwater temperatures will not change.

   <u>Response</u>: The impacts of the second filling year release temperatures on the groundwater would depend on the location downstream. Immediately downstream of the damsite, the mainstem water temperature would be a constant 4 degress C from the first winter of filling through the second summer of filling until the outlet facilities can be operated. This would tend to cause an increase in groundwater upwelling temperature just downstream from the dam, assuming existing conditions approximate 3 degrees C. Farther downstream climatic conditions will have an effect on mainstem water temperatures. For example, at Gold Creek, water temperatures will be cooled in October to less than 4 degrees C, but will be above natural conditions. Winter temperatures (i.e., November to March) will be 0 degrees C. April temperatures are likely to be above existing conditions, but will be close to 0 degrees C. Temperatures will continue to be above natural conditions

until natural temperatures begin to rise above 0 degrees C in early May, when the ice is flushed out. At that time, natural temperatures will be greater than filling temperatures and will remain so for the summer or until the outlet facility can be operated. Thus, although the warmer fall temperatures and April temperatures during filling will tend to compensate for the cooler summer water temperature at Gold Creek, the net effect will be a cooler average for the approximate one year period. However, the lower average water temperature for this period will only be short term. Although this dynamic process has not been modeled, the temperature differences during this period would be dampened by the buffering capability of the soil and groundwater, as it is now. Hence upwelling temperatures during the filling process would likely be within 0.5 degrees C of existing temperatures.

5. Comment: Page 51, para. 3. Monthly Energy Simulations. The referenced program utilized load forecasts developed by ISER, Woodward-Clyde, and Battelle. These forecasts are now seriously questioned in light of recent developments (see General Comments). We recommend these simulation studies be updated and run with the most recent load forecasts available.

   Response: Simulation studies were updated and run with the most recent load forecasts available. The results were included in the License Application revisions submitted to FERC on July 11, 1983, and will appear in the Application distributed for agency and public review.

6. Comment: Page 58, para. 1. Reservoir and Outlet Water Temperatures. This suggests that winter outflow between 1 degree and 4 degrees C can be selectively withdrawn through a multiple intake structure. This control would be dependent upon the thermal profile of the reservoir during winter, a set of conditions which has not been modeled. Therefore, we question the validity of the statement which suggests one degree water temperatures would be available upon request. Information presented by Acres during the Nov. 29 - Dec. 3 workshop showed winter temperatures in Eklutna Lake to be between 0 and 3.6 degrees in the upper 2 meters, while isothermal conditions exist below this level.

   Response: We concur that temperature control of the outflow would be dependent upon the thermal profile of the reservoir. We also agree that 1 degree C water may not necessarily be available upon request. The analysis was meant to bracket the range of outflow temperatures expected. Experience at the W. A. C. Bennett dam in British Columbia, Canada has shown that winter outlet temperatures from an intake 150 feet and 250 feet below water surface have been as low as 1 degree C or less. With a deeper intake, it would also be theoretically possible to maintain an outlet temperature of 4 degrees C. Winter thermal modeling results of Watana and Devil

Canyon is included in the February 28, 1983 License Application submittal.

7. Comment: Page 59, para. 2. Ice. It is not clear what impact will occur to the lower River from reduction of ice flow from the upper Susitna. How far downriver would ice formation occur? When does freeze-up normally occur?

Response: The reduction of ice from the upper Susitna will cause a delay in the ice formation process downstream of Talkeetna. Since the reach below Talkeetna has not been modeled, a quantification of the delay has not been made. However, it is anticipated that the lower river will be ice covered with both Watana and Watana/Devil Canyon in operation. Discussions of the ice formation processes are presented in the February 1983 License Application submittal (p. E.2.90, E.2.127, and E.2.170). As discussed in the response to your General Comment No. 12, further instream ice modeling for the Devil Canyon to Talkeetna reach will be conducted during FY84. In addition, the need for ice modeling studies downstream of Talkeetna is presently being examined, but a decision regarding the necessity for detailed ice modeling below Talkeetna must await the results of field studies to be conducted this coming winter.

8. Comment: Page 91, para. 2. Mitigation of Watana Impoundment Impacts. This section states that a proposed 12,000 cfs flow at Gold Creek would provide salmon access to most of the sloughs and would assist in maintaining adequate groundwater levels and upwelling rates. There are no studies which would support these conclusions, as only one of approximately thirty-six sloughs has received detailed study. Similarly, current information does not permit the development of mitigation measures within the sloughs, as stated in the last paragraph of this page.

Response: The statement that a proposed flow of 12,000 cfs would provide salmon access to most of the sloughs was deleted from the February 1983 License Application final submittal. The statement that a flow of 12,000 cfs would assist in maintaining adequate groundwater levels and upwelling rates remains relevant. Under natural conditions, in September and early October, when Gold Creek flows drop below 12,000 cfs, upwelling continues to exist. The water table is necessarily lowered to maintain a balance with the mainstem water level. This is further discussed in Section 4.1.2(f) and 4.1.3(d) of the February 28, 1983 License Application document. However, as discussed in Appendix E.2.A of Chapter 2 of the License Application to be distributed to the resource agencies for review, this reduction in water table depth is of a magnitude which may not be significant. It is our judgement that a flow of 12,000 cfs in conjunction with mitigation measures, will provide salmon access to most sloughs.

9. Comment: Page 93, para. 2. Nitrogen Supersaturation. While we support the concept of installing cone valves at the outlet works of both dams, the subject requires further discussion. These valves will only operate (and afford gas supersaturation benefits) during spillages below the 1 in 50 year high flow event. According to the discussion presented on pages 79 through 81, such spillages would be a relatively uncommon event (for the 32 year period simulated, there were 4 years during which spillages occurred). The discussion on these valves should present data on their frequency of use and explain the criteria by which they are planned and installed. This should include the following:

   1. Potential temperature impacts resulting from withdrawal from these outlet structures.

   2. Potential impacts to river ice formation attributed to operation of these valves during winter.

   Response: The discussion on Nitrogen Supersaturation in the February 28, 1983 submittal was expanded to include frequency of use, volumes discharged and maximum annual discharge of the fixed cone valves (Sections 4.1.3(a)(v), pp. E-2-111 through E-2-112 and 4.2.3(a)(v), pp. E-2-163 through E-2-164). The rationale for the use of these valves is presented on pp. E-2-87 to E-2-188. The valves have been proposed as one means in which to decrease the potential for gas supersaturation.

   Potential temperature impacts resulting from withdrawal from these outlet structures can be found in Sections 4.1.3(c)(i) and 4.2.3(c)(i) of the license document. Operation of the Watana fixed-cone valves will not be a problem. However, operation of the fixed-cone valves at Devil Canyon could have an adverse impact on the downstream fishery. As stated in Section 4.2.3(c)(i), this effect will be minimized by releasing flow at Watana and generating power at Devil Canyon to the extent possible. During project operation, the fixed-cone valves will not normally be operated during winter. Only in the event of a power outage would their operation become necessary.

10. Comment: Page 95, para. 1. Temperature. The discussion of Devil Canyon post-project temperature mitigation is inadequate. What advantages are gained by the multiple release structure? Will Devil Canyon reservoir stratify during summer and winter?

   Response: The advantages of the multiple release structure at Devil Canyon are discussed in Section 4.2.3(c)(i) of the February 1983 license document. Results of the Devil Canyon modeling are presented in Chapter 2 of Exhibit E the February 28, 1983 license document. Based on the results of the thermal modeling of Devil

Canyon Reservoir, thermal stratification will occur between May and December. See Figures E.2.213 and E.2.214.

Specific Comments - Chapter Three

1. Comment: Page 8, para. 2. "Since the greatest changes in physical habitats are expected in the reach between Talkeetna and Devil Canyon, fishery resources using that portion of the river were considered to be the most sensitive to project effects." Transforming the mainstem Susitna River into a reservoir is also a considerable change. Later in this paragraph is the statement "The mitigations proposed to maintain chum salmon should allow sockeye and pink salmon to be maintained as well." We are unable to locate specific mitigation plans for chum salmon. Those conceptual plans presented for slough modification and mainstem spawning bed construction deal principally with one life history stage. The statements made here that improved mainstem conditions will replace loss of slough rearing habitat and that juvenile overwintering areas are not expected to be adversely affected by the project are not supported. In fact, preliminary data presented elsewhere in the Exhibit indicate that overwintering habitat will be impacted and that sloughs may provide important rearing habitat.

   Response: The Power Authority concurs that changes of physical habitat in the impoundment zone are also considerable. The referenced paragraph should refer to changes that affect anadromous species. In that case, the Talkeetna to Devil Canyon reach is where the greatest changes in physical habitat associated with these species are expected to occur.

   The mitigation plans for the sloughs are primarily focused on chum salmon because of their proportionally greater use of the sloughs. However, other species of salmon that utilize the sloughs such as sockeye and pink salmon are also being considered in the plans. Additional studies to support impact assessment and mitigation planning are continuing, as detailed in an interagency meeting held July 18, 1983 to describe the 1983 field season studies. These include studies on all life stages. The revised mitigation plan has further developed the details associated with the various habitat enhancement measures and addresses the overwintering and rearing habitat concerns. See Section 2.4.4(a) of the revised Chapter 3.

2. Comment: Page 12. Species Biology and Habitat Utilization in the Susitna River Drainage. Estimates of adult salmon presented in this section depict only escapement. A more meaningful estimate should be made using catch to escapement ratios, as done in chapter five. For instance, in 1982 77,000 pink salmon migrated above Talkeetna. However only one fish in every 3.8 escaped the commer-

cial fishery. Using the 3.8 to 1 ratio, this reach of the Susitna accounted for over 350,000 pink salmon of which over 277,000 were available to the commercial fishery. Escapement estimates alone fail to indicate the high values associated with anadromous fishery resources.

Response: These computations have been provided (Chapter 3, Section 2.1.5(a)).

3. Comment: Page 76. Slough Habitat. This section does not describe impacts associated with lowered winter river stage during filling. Should upwelling and backwater effects during winter prove critical to developing eggs or juvenile salmonids, any reduction in these areas could create significant damage.

   We question the figure presented as the number of sloughs in which salmon spawn within the Chulitna to Devil Canyon reach. Using information supplied by the ADF&G and from Exhibit E, adult salmon have been observed in 26 of these sloughs. Exhibit E should clearly present the total numbers of sloughs in this reach and the 1981 and 1982 data on spawning adults.

   Response: There will be no reduction of flow during winter filling periods (see revised Chapter 2 as well as revised Chapter 3, Table E.3.26). The number of sloughs utilized by salmon is based on data from ADF&G's 1981 and 1982 field studies. For both years, 20 of the 34 surveyed sloughs between Devil Canyon and Talkeetna have supported spawning salmon (p. E-3-95 of revised document and individual species discussions in Section 2.2.1).

4. Comment: Page 77. The discussion presented on impacts to slough habitat is not clear. As Exhibit E states that groundwater upwelling in the sloughs is probably driven by the mainstem stage, which would cause a decreased flow in the sloughs (post-project), why does this section state that under post-project conditions only the backwater areas (of the sloughs) would be affected?

   The second paragraph of this page states, "With mainstem flows above 14,000 cfs, a backwater forms at the mouth of the slough." How is this known? Which slough is being discussed? Is this true for each slough? The same paragraph explains that, during the 1982 field season, flows in the 12,000 to 14,000 cfs range occurred and afforded opportunity to observe fish passage at flows below normal August levels. These flows appeared to hamper or restrict fish passage into sloughs. Backwater effects were not seen at flows of approximately 12,000 cfs, yet project low flow limits for August have been established at 12,000 cfs. This section underscores the problems associated with such proposed flows. It is apparent that some significant changes occur to the slough habitat within a relatively narrow range of flows; changes which may have important biological implications.

Response: The discussion has been expanded to address these concerns, see pages E-3-95 to E-3-97 of the revised document. Additional analyses of the backwater effect are provided in Appendix E.2.A of the July 11, 1983 revised License Application.

5. Comment: Page 87, para. 5. While the described floods may transport sediment and scour the river bed, reduction or elimination through flow regulation may not necessarily be beneficial. The Exhibit presents no data to support the comment that high mainstem velocities limit fish usage (page 87, para. 2). Further, such high flow events may be critical to maintaining side channel and slough habitat through flushing and replenishment of gravels and by removing vegetation and beaver dams which may reduce habitat value. This point is not discussed in the following sections of slough or side channel habitats.

   Response: The data to support the statement that high streamflows appear to inhibit upstream salmon migration occurs in the referenced ADF&G documents (see page E-3-109 of the February 1983 License Application). As discussed in the revised Section 2.2.2(b)(ii), these high flows are beneficial in flushing fines from spawning gravels. The mitigation plan (Section 2.4.4, p. E-3-168) provides a means for mitigating this loss of a flushing flow.

6. Comment: Page 103, para. 3. Slough Habitat. We disagree that changes in streamflow during the open-water season are not expected to affect slough habitats.

   Response: The statement referred to the additional impacts to sloughs caused by the Devil Canyon dam above those already imposed by the Watana dam. This has been clarified (see p. E-3-132).

7. Comment: Page 116. Aquatic Studies Program. We believe this discussion suffers from omission of the majority of the 1982 field study results. We strongly believe that two years of study are the minimum required as a basis to discuss the impact of hydroelectric development on the Susitna River.

   Response: Additional 1982 data have been incorporated throughout the document.

8. Comment: Page 130. Measures to Minimize Impacts. It is stated that "A flow release schedule will be used that minimizes the loss of downstream habitat and maintains normal timing of flow- related biological stimuli." The flow schedule presented in Exhibit E, Chapter 2 does not minimize habitat loss, nor does it maintain

normal flow related biological stimuli. This section should also discuss installation of compensation flow pumps at Devil Canyon which would provide flow between the dam and tailrace channel.

Response: An expanded discussion of the flow selection procedure is presented in the revised Chapter 2, p. E-2-56 (July 1983 update). The compensation flow pumps below Devil Canyon have been removed from the project. In addition, see response to General Comment 13. This response describes how the Exhibit B has been revised to examine three additional flow regimes (Cases E, F, and G).

9. Comment: Page 130, para. 2. Measures to Minimize Impacts. The section states that "Instream flow requirements are being determined for each species/life stage/time unit combination." Who is performing these studies? How will they be determined? Again, it is impossible to understand what flow regime, if any, is actually being suggested within Exhibit E. Is the release schedule presented in Table 2.17 just a "first cut?" This is apparently the case. Considering that the final release schedule is to be based on future studies as suggested here and may be modified to accommodate outmigration (page 3-132, para. 1) and will need to consider temperature and volume (page 3-143, para. 1); why is a flow regime proposed in the absence of such information?

Response: ADF&G and AEIDC are continuing to evaluate the effects of the flow regime and develop, in consultation with the resource agencies, a release schedule to minimize impacts. These efforts will be relying on the AEIDC hydraulic modeling efforts to evaluate various mitigation flow alternatives.

10. Comment: Page 131, para. 1. This states, in effect, that slough habitat will either be enhanced or degraded by the project, and that actual impacts to habitat are the subject of ongoing studies. These ongoing studies should be described. What will be investigated? Which sloughs will be studied?

Response: The referenced text properly belongs in the impacts section. The discussion has been revised to focus on mitigation (p. E-3-162). The on-going studies were presented in detail to NMFS and other resource agencies during a meeting on July 18, 1983 at the APA. The APA plans to continue to inform and consult with the resource agencies concerning any existing future aquatic studies.

Extensive field and modelling efforts that address impacts to sloughs (and other habitats) are continuing. These efforts are being conducted by the ADF&G and the Arctic Environmental Information and Data Center. Intensive efforts are focused on sloughs

8A, 9, 11, and 21 with additional studies on other sloughs. The primary relationships being investigated are:

1. flow in mainstem versus flow and groundwater in the sloughs;

2. habitat (as measured by velocity, depth, and substrate) changes with flow;

3. species abundance and distribution;

4. incubation and emergence of salmonids;

5. overtopping of the head end of the slough; and

6. timing of outmigration and rearing.

11. Comment: Page 132, para. 4. This states that flows of 12,000 cfs are sufficient to undertake rectifying impacts by modifying habitat. How is this known? The paragraph should discuss the studies upon which this is based or qualify any such conclusions as preliminary and subject to further study.

    Response: The text has been revised to indicate the preliminary nature of the discussion, although considerable field observations are available to substantiate the statement (see Trihey 1982d reference in revised Chapter 3).

12. Comment: Page 133, para. 1. Winter Flows. The statement is made that "Since minimal impacts are expected during both filling and operational winter flow, rectifying measures are not needed." This is not supported. On page 131, para. 1, we learn slough habitat may be degraded by winter flows and that these impacts are the subject of ongoing studies. Page 94 presents a lengthy discussion of impacts attributed to altered winter flows.

    Response: The referenced sentence has been changed in the February 28, 1983 submittal. It should only have been in reference to filling flows. Since the filling flow regime from November 1 to April 30 is proposed to reflect the inflow to the reservoir, only minor impacts are expected and no mitigations are proposed.

13. Comment: Page 133, para. 5. Reduction of Impacts Over Time. "Post-operational monitoring will be conducted to evaluate the effectiveness of mitigation measures (see Section 2.6)." The license application should detail what monitoring will occur and how the effectiveness of mitigation efforts will be evaluated.

Response: The expanded discussion on monitoring starts on p. E-3-180 of revised Chapter 3.

14. Comment: Page 136, para. 3. The discussion of hatchery development is inadequate. In the event that other mitigation alternatives fail, it will be important to present a clear picture of what measures would be taken to compensate for fisheries losses.

    Response: The salmon hatchery alternative is a low-priority alternative that is not anticipated to be needed. The Power Authority feels that full mitigation can be achieved by an adequate flow and/or employing the habitat enhancement techniques described in revised Section 2.4.4. If necessary the hatchery alternative will be investigated in more detail in the future. Recent efforts in consideration of a hatchery include a siting study for such a facility[1/].

15. Comment: Page 137, para. 3. We believe that the water temperature of 5° to 6°C during the second filling year will present significant adverse impacts to salmon. Addition of a low level portal could apparently avoid much of these effects. We recommend such a device be incorporated into the final design.

    Response: This option is being evaluated in light of the temperatures anticipated during the second year of filling. This evaluation includes field studies by the ADF&G on egg incubation temperatures, laboratory studies by the USFWS on incubation temperatures, and a literature review. Results of the field and laboratory studies are expected to be completed in FY84. If indicated by these studies, provision of a lower level intake would be considered in the detailed design phase of the project.

16. Comment: Page 143, para. 1. "Continuing reservoir thermal modeling will allow an evaluation of available water temperatures throughout the year so that a detailed release plan can be developed. The release plan will need to consider both water temperatures and volume in order to minimize impacts." We strongly agree with this, and recommend that the license application contain just such a release plan which would most effectively minimize impact.

    Response: This evaluation is continuing through hydrologic modeling efforts. In fact, the importance of this effort was given high priority by the Power Authority. This has resulted in an expansion of efforts to complete this evaluation.

[1/] Kramer, Chin, and Mayo. 1983. Susitna hatchery siting study. Prepared for the Alaska Power Authority and Acres American, Inc.

Specific Comments - Chapter Ten

1. Comment: Page 28, para. 6. Diversional Emergency Release Facilities. The release levels referred to do not avoid adverse effects on the salmon fishery downstream.

   Response: We concur that release levels referred to do not completely avoid adverse effects on the salmon fishery downstream. However, these flow releases permit the development of mitigation measures to these effects.

2. Comment: Page 30, para. 3. Figure E.2.90 indicates that three, rather than four portals would be constructed at Watana. We question which is correct and how the numbers and position of the portal were considered in minimizing impact. Also we cannot concur that temperatures will be controlled within acceptable limits.

   Response: Figure E.2.90 actually shows that four portals would be constructed at Watana. Thus, Figure E.2.90 is in agreement with Chapter 10. Since water nearer the surface of the reservoir will be closer to natural temperatures it is desirable to draw water from the surface. However, because the reservoir will be drawn down in late spring it will be necessary to have an intake portal at an elevation near the surface. As the reservoir fills, the water surface elevation will increase. Therefore, in order to continue to draw water from close to the surface an intake portal at a higher elevation must be provided. As the filling process continues, additional intakes must be provided to take advantage of the warmer surface waters. The elevation of the top intake is near the maximum reservoir operating elevation. As the reservoir elevation is drawn down in the fall and winter the process is reversed. Water is drawn from near the surface to take advantage of the cooler surface waters. The selection of four portals is based on engineering considerations (i.c. the number of portals that could be technically and economically constructed) and the thermal profile of the reservoir at various times of the year.

   The degree of temperature control is discussed in our response to General Comment No. 8. It is our judgement that temperatures within the natural range can be provided during the summer period. However, this judgement is being confirmed through on-going studies.

3. Comment: Page 30, para. 4. We are not aware of studies which have occurred to mitigate project impacts through provision of streamflow at Gold Creek. These should be described.

Response: A discussion of the project operational flow selection process has been added in Chapter 2 of Exhibit E. Although specific studies addressing flow selection have not been completed at this time, the studies being funded by the Power Authority are directed towards ultimately providing a basis for flow selection.

4. Comment: Page 31, para. 5. According to presentation by ACRES American at an APA-sponsored workshop in Anchorage during the week November 29 to December 3, 1982, no temperature model has been run for Devil Canyon reservoir. How, then, can the utility of a multi-level draw-off at Devil Canyon be known? This again underscores the lack of understanding of project temperature impacts.

Response: As of the November 15, 1982 draft, no temperature model had been run for the Devil Canyon reservoir. However, preliminary modeling of Watana reservoir indicated a multi-level intake at Watana was beneficial. Hence, it was assumed that a multi-level intake at Devil Canyon would also be beneficial until this could be verified by modeling Devil Canyon reservoir. The results of the Devil Canyon reservoir modeling are presented in the February 28, 1983 License Application document.

The Alaska Power Authority appreciates the effort expended by NMFS personnel in formulating comments on the Draft Exhibit E. If you have any questions regarding our responses, please do not hesitate to contact Mr. Thomas J. Arminski, Deputy Project Manager, Permitting, Alaska Power Authority.

Sincerely,

Eric P. Yould
Executive Director

TA/dlc

cc: Brad Smith, NMFS, Anchorage, Alaska
William Wakefield II, FERC, Washington, D.C.
Dwight L. Glasscock, H-E, Anchorage, Alaska
Jane Drennan, PMS, Washington, D.C.

NATIONAL PARKS SERVICE

COMMENTS CONTAINED IN THE NATIONAL PARK SERVICE LETTER OF JANUARY 14, 1983

We have reviewed the proposed Susitna Project recreation plan as presented in the draft license application Exhibit E and have the following comments. Cultural resource management issue comments were addressed previously in the December 3, 1982, letter from our archeologist, Dr. Floyd Sharrock.

The recreation plan appears to be well-conceived. A diversity of recreation resource opportunities are planned with facility development in stages which will permit future modification where it is appropriate. The plan also reflects excellent coordination between its authors and appropriate public agencies and the private sector.

We support the following recommendations, many of which were shared with the EDAW, Inc., representatives at the December 1, 1982, workshops for recreation and aesthetics.

Comment 1

Before construction begins, existing river conditions from upstream of the project (perhaps the confluence of the Tyone and Susitna Rivers) to Gold Creek should be recorded on film. A high quality motion picture with narrative describing preconstruction resource conditions could be an effective interpretive tool for the visitor center(s). A permanent film record of the Devil Canyon whitewater is especially important. A film record of the project construction process and the project in operation, including a description of the recreation opportunities, should also be made and perhaps combined with the preconstruction film for use at the visitor center(s).

Response

A high quality movie as described will be considered as part of the visitor interpretation program. The detailed programming, functional design, and final engineering for the visitor center(s) will occur during Phase II design development.

Comment 2

If normal operation of the Watana Dam will minimize the danger now associated with kayaking the unregulated Devil Canyon whitewater, consideration should be given to providing public access to the Susitna River below the dam prior to the completion and operation of the Devil Canyon Dam.

Response

This suggestion will be considered.

Comment 3

Consideration should be given to providing public access from the project transportation corridor to Portage Creek for fishing and/or kayaking.

Response

Access to Portage Creek was examined in Exhibit E as a recreation opportunity. Because of fragile salmon spawning grounds and localized wetland conditions at the creek, trail access was determined to be undesirable.

Comment 4

Appropriate day use and/or overnight facilities should be considered for Gold Creek. These facilities could accommodate: river users coming out of the project, backpackers who enter the project area via the Devil Canyon Dam construction right-of-way, and other recreationists using the Alaska Railroad who wish to lay over in the Gold Creek area.

Response

Recreation use of the Susitna River below the Devil Canyon damsite and within the transmission intertie will be considered as part of supplemental transmission corridor recreation planning. This will occur prior to June 30, 1983.

Comment 5

The status of the Stephan Lake-Prairie Creek corridor is presented on pages E-7-83, 84 as a lower priority resource area. The priority should be elevated to Phase One implementation as negotiations with Cook Inlet Region, Incorporated, and/or the village corporations could be lengthy. Public access to the Talkeetna River (a potential State Recreation River) via the Stephan Lake-Prairie Creek corridor is an important issue that needs to be resolved early so that public use may continue during project construction.

Response

Access to the Stephan Lake-Prairie Creek corridor by air will continue at Stephan Lake. Current recreation use on the Prairie Creek-Talkeetna River run typically means a fly-in to Stephan Lake and rafting or kayaking out; this usually takes three days. Other recreation use of Stephan Lake includes sportsmen's lodges, a commercial lodge, and private cabins from which people enjoy hunting and fishing. Public use will continue as currently defined. The potential for public camping will be dependent upon the above-mentioned agreements and if Phase Five provides the necessary time to negotiate and design any public facilities as needed without restricting existing use.

Comment 6

There is an incorrect statement in paragraph 6, page E-7-15, that should be revised. The text incorrectly states that the Susitna River has been studied for potential inclusion in the National Wild and Scenic Rivers System. A study and evaluation under the authority of the Wild and Scenic Rivers Act has never been undertaken.

Response

Text has been revised.

Comment 7

Recently it came to our attention that the electrical transmission corridor between the Watana Dam and Gold Creek will now be relocated closer to the transportation corridor to facilitate maintenance. We trust that careful attention will be given to the development of appropriate mitigation measures to safeguard, as much as possible, the scenic values associated with the corridor.

Response

All project facility relocation and/or design refinements will be studied and visual mitigation measures applied to protect scenic values. An aesthetic mitigation measure applied to the new transmission corridor was locating the corridor out of primary viewsheds toward the Talkeetna Mountains. This was accomplished by placing the transmission corridor along the north side of the road.

FISH AND WILDLIFE SERVICE

COMMENTS CONTAINED IN THE U.S. FISH AND WILDLIFE SERVICE LETTER OF JANUARY 14, 1983

GENERAL COMMENTS

Comment 1

The Fish and Wildlife Service (FWS) has been requested by letter dated 15 November 1982, from Acres American Incorporated, to formally review and comment on the Federal Energy Regulatory Commission (FERC) draft license application Exhibit E for the Susitna Hydroelectric Project. This response is being provided as partial fulfillment of your request and is intended to be a constructive evaluation in regard to fish and wildlife resources. We hope that our comments will be of value in drafting the final license application.

Response

The receipt of the FWS comments within the regulated minimum 60 day review period was appreciated.

Comment 2

The following FWS letters were also provided in response to formal pre-application requests on this project:

1. June 23, 1980, letter to Eric Yould.
2. December 17, 1981, letter to Eric Yould.
3. December 30, 1981, letter to Eric Yould.
4. January 5, 1982, letter to Eric Yould. Response April 4/82.

Since these letters were formally requested as part of the FERC pre-application coordination process we consider it appropriate that our responses be specifically addressed as part of the Exhibit E.

Response

The four letters cited are included in section of Chapter 11. Letters previously forwarded to FWS in response to letters 1, 3 and 4 are also included. As requested, a specific response to letter 2 has been included in Exhibit E, Chapter 11.

Comment 3

The following letters were provided as informal consultation to facilitate the Susitna Project planning process:

1. November 15, 1979, letter to Eric Yould.
2. April 16, 1982, testimony presented to the Alaska Power Authority (APA) Board.

3. August 17, 1982, letter to Eric Yould.
4. October 5, 1982, lester to Eric Yould.

We anticipated seeing in the draft Exhibit E specific responses to the concerns and recommendations raised in the letters and testimony provided. This is consistent with advice provided by the FERC[1]. In that this did not occur, we recommend that the APA respond in the Exhibit E to the specific comments and recommendations which are contained in these letters and testimony.

Response

The FWS letter of October 5, 1982 and testimony of April 16, 1982 are considered as formal consultation since this input was provided in response to requests from APA. This letter and corresponding response is included in Appendix 11.E of Chapter 11. All specific comments and recommendations received from the Fish and Wildlife Services to date are responded to in Exhibit E.

Comment 4

The response provided by this letter, our previous letters (both those formally and informally requested), the testimony presented to the APA Board, and the letter recently provided to you on 19 November 1982, constitute the official position of the FWS on this project.

Response

This correspondence is noted as the official position of the U.S. Department of the Interior, Fish and Wildlife Service.

Comment 5

The principal authority of the FWS to provide comments and recommendations rests in the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.)[2]. The Coordination Act requires that fish and wildlife conservation be given equal consideration with other project features throughout the Federal lead agencies' planning and decision-making processes . The Act also requires consultation with State and Federal fish and wildlife resource agencies to ascertain what project facilities, operations, or measures may be considered necessary by those agencies to mitigate and compensate for project-related losses to fish and wildlife resources, as well as to enhance those resources. The reports and recommendations of the fish and wildlife resource agencies on the fish and wildlife aspects of such projects must be presented to action agency decision-makers and (where applicable) to Congress. The Coordination Act requires more than a consultative responsibility; it is an affirmative mandate to action agencies . Like the National Environmental Policy Act (NEPA) (42 U.S.C. 4321 et seq.), it requires early planning and post-construction coordination and full consideration of recommendations made by resource agencies.

Our recommendations, under the Coordination Act, must be, "as specific as is practicable with respect to features recommended for wildlife conservation and development, lands to be utilized or acquired for such purposes, the results expected, and shall describe the damage to wildlife attributable to the project and the measures proposed for mitigating or compensating for these damages."

Similar language is found in NEPA's Section 102(2)(B) that agencies identify and develop methods and procedures which will insure that presently unquantified environmental amenities and values may be given appropriate consideration in decision-making, along with economic and technical considerations.

Both the Coordination Act and NEPA, necessitate, commsurate with the scope of a project:

1. A description and quantification of the existing fish and wildlife and their habitat within the area of project impacts;

2. A description and quantification of anticipated project impacts on these resources; and

3. Specific mitigation measures necessary to avoid, minimize, or compensate for these impacts.

Response

The authority of the FWS under the Fish and Wildlife Coordination Act is recognized. The APA has made considerable effort to actively solicit input from State and Federal fish and wildlife resource agencies. The APA has especially encouraged any specific recommendations regarding project features, operations or measures the resource agencies may consider necessary to mitigate or compensate for project-related losses to fish and wildlife resources.

Comment 6

We have reviewed the draft Exhibit E in consideration of these statutes. The adequacy of the review documents has been examined in respect to whether or not the information, analysis, and mitigation plan provided would allow the FERC to be in compliance with the requirements of these environmental madates if they issued a license to the applicant.

Response

A number of reviewers question the adequacy of the studies to date and the sufficiency of the Application. The Alaska Power Authority perceives a sequential process, each step requiring progressively more refined study, analysis and design.

Step 1 - Feasibility

Initially, engineering and environmental studies are undertaken to determine the feasibility of the Project. Studies identify major Project characteristics, critical resource and design issues, and economic feasibility of the Project. The Feasibility Report of March, 1982, represented the culmination of this step.

Step 2 - Prelicensing

Prelicensing studies continue, expand and refine the analysis in sufficient detail to allow rigorous analysis of the Project with respect to technical detail of design concepts, economic feasibility, impact assessment, and mitigation planning. These studies provide the basis for: The Application for License; formal agency consultation; and Federal Energy Regulatory Commission (FERC's) preparation of an Environmental Impact Statement (EIS). The contents of the Application for License are specified in FERC regulations. The Power Authority's interpretation of the general intent of the prelicensing studies and these regulations is that studies have to be of sufficient detail to identify all of the major impacts of the Project and to allow effective mitigation planning, but not in the detail that is required to support final design prior to construction. The studies should be sufficient to provide a basis for the development of realistic mitigation plans for construction and operation.

Studies performed to this standard rely on existing information and a rigorous sampling program, and estimates and predictions such as can be appropriately drawn, based upon professional judgment. The FERC regulations, themselves, speak in terms of "expected impacts ...," "anticipated impacts...," "possible changes...."

Inherent in the decision to proceed with licensing is that studies have sufficient quantification to support the Application. What constitutes sufficient quantification is a judgmental decision. FERC's regulations state only that the information should be "... commensurate with the scope of the project ..." While the level and sophistication of quantification varies from study to study, in sum, the current studies allow impacts to be determined and mitigation activities planned with a resolution more precise than the range of variations that naturally occur, both temporarily and spatially.

One of the objectives of the studies is to support mitigation planning to the point of "... proposing mitigation measures or facilities including functional design drawings, proposed operation and maintenance procedures, costs, etc." Functional design drawings reflect preliminary engineering and environmental analysis necessary to prove the practicality of the proposed facility and drawings that demonstrate the concepts, spatial and structural characteristics of the proposed facilities. These drawings are not design drawings from which construction could proceed.

The Power Authority feels that the studies on the Project to date adequately meet the objectives of prelicensing studies. Ongoing studies will expand and support the current analysis and be provided to FERC (and resource agencies) in time for FERC's development of their Draft EIS (DEIS). Ongoing and proposed studies will support the refinement of the proposed Project flow regime and of the other mitigation measures during the design phase of the Project. The Design Phase will be concurrent with the development of the actual license and its attendant stipulations.

Comment 7

Our review has been undertaken in light of our former correspondence, including the 16 April 1982, testimony presented to the APA Board by Deputy Regional Director LeRoy Sowl. Except for item (8) we find the testimony as valid today as it was at that time. It is apparent that the consultation process has failed in so far as the intent of the FERC regulations[3]. We have written numerous letters on this project to assist APA in planning measures to protect and enhance fish and wildlife resources. Responses to our letters have been non-existent, or too late to deal with the problem of concern(e.g., FWS letters dated October 5, 1982, and November 19, 1982). An illustration of what we have found to be an inadequate level of consultation can be found in the December 15, 1982, response to our November 19, 1982, letter. We considered our requests to be fully within the intent of the FERC regulations[4].

Response

A review of comments by resource agencies on the draft of Exhibit E for the Application for License indicates that the preponderance of comments address adequacy of study plans and the result. A smaller number of comments address the nature of the licensing process and the Alaska Power Authority's performance to date. Only a few agency comments convey statements of policy or recommendations with respect to Project design, and mitigations of construction or operation. Chapter 11 of Exhibit E contains the formal consultations with agencies and includes point by point responses to their comments on the November 15, 1982, draft of Exhibit E.

Subsection (d) Section 4.40 states that appropriate State, Federal and local resource agencies must be given the opportunity to comment on the proposed project prior to filing of the Application for License. Further definition on consultation requirements is spelled out in Section 4.41 (f), which outlines the components of the Environmental Report, Exhibit E. While procedural requirements are outlined, the objectives of the consultation process are not. The objectives of the consultation process are discussed in Application Procedures for Hydropower Licensing, Exemptions, and Preliminary Permits, Federal Energy Regulatory Commission (FERC), April, 1982. Objectives include:

First Step - Predraft Consultation

- Provide a basis for analysis of the environmental and natural resource management aspects of proposed projects;

- Identify problems that should be considered;

- Meet the FERC's requirements under Fish and Wildlife Coordination Act, Endangered Species Act, National Historic Preservation Act, and other Federal statutes;

- Agencies must understand the project and its effects; and

- Provide an opportunity for agencies to comment on and define any studies needed to identify potential impacts and recommend adequate protective and mitigative measures.

Second Step - Formal Consultation

- Formal request for review of draft application (in writing to document); and

- Results of studies (if possible, a copy of the application).

Third Step - Response to Agency Comments

- Applicant's responses to agency review comments

Step 1 - Predraft Consultation

A long history of interaction with State, Federal and local resource agencies dates back to Bureau of Reclamation and Corps of Engineer's (COE), studies of the Susitna River potential. Initially, resource agencies encouraged the investigation of the Susitna River as a more benign alternative to the Rampart Project on the Yukon River.

Several configurations were studied before the current arrangment was identified by the COE as representing the best accommodation between power development and environmental protection (see Exhibit B, Chapter 1). COE studies culminated in a final Environmental Impact Statement issued in July of 1979. Agency consultation during COE studies extends back into the early 1970s. The concerns raised by agencies during the review of the COE EIS have been further studied during the studies for the license application.

Because of the existing COE studies when the Power Authority assumed the project in 1979, there existed a well defined Project and general familiarity on the part of resource agencies with its attributes. As the Power Authority planned environmental and engineering studies to support the more demanding FERC license application, resource agencies were again invited to comment on important resource issues, study design and recomment mitigative activities. The subsequent study program incorporated many of the comments received from agencies.

To coordinate interactions between resource agencies and the Power Authority, the Susitna Hydro Steering Committee evolved. This informal interagency Committee proveded a mechanism for exchanges between the Power Authority and resource agencies. Design developments, study plans and Phase I master contracts were reviewed by the Steering Committee and their comments were incorporated, in part, into Project studies.

The first two years of Project studies culminated in a Feasibility Report and many attendant reports. Volume 7 of this Report outlines public review and comments on the Project, and Volume 12 documents agency consultation to March 1982. The Feasibility Report was widely disseminated and received conspicuous agency and public review. In response to these comments on the Feasibility Report, the Power Authority rescheduled the proposed date for submitting the application for license from June of 1982 to the 1st Quarter of 1983 (February 28, 1983). Major refinement of study programs was undertaken to address issues raised during the review. In part, the postponement of submittal was to allow for the inclusion of additional environmental data.

As part of the refinement and redirection of environmental study programs, a series of workshop meetings occurred in May and June of 1982. In these meetings, the Power Authority and the resource agencies redefined the study programs. Terrestrial studies were reviewed again during an extensive weeklong workshop during August 23-27, 1982. Agency personnel, topical experts and project personnel participated in this workshop (see Appendix 11.6 in Chapter 11).

On September 2, 1982, the Power Authority, by way of letter, informed the resource agencies of the intended schedule for preparing and filing the application and requested any guidance an agency could offer with respect to the project configuration and mitigation planning.

In summary, during Step 1 of the three-step consultation process, resource agencies and the public were presented with extensive, informal and formal opportunites to familiarize themselves with the proposed Project and Project studies. The evolving nature of the project and studies have been extensively reported and reflects accommodation to agency and public preferences.

Step 2 - Formal Consultation

Formal preapplication consultation was initiated with the dissemination of the draft Exhibit E on November 15, 1982. The draft Exhibit was sent to resource agencies with the request that they review and comment on the draft by January 15, 1983. A review of the Project (essentially unchanged since the Feasibility Report in March 1982) took place on the first day. Topical sessions followed in which Project personnel reviewed baseline conditions, impact analysis and mitigation planning. Sessions included:

1 - Project description, 1/2 day
2 - Hydrology/Hydraulics/Temperature/Channel Norphology, 1-1/2 days
3 - Aquatic Ecosystems, 1-1/2 days
4 - Terrestrial Wildlife and Habitat, 1 day
5 - Wetlands, 1/2 day
6 - Archaeology/history, 1/2 day
7 - Socioeconomic, 1/2 day
8 - Recreation, 1/2 day
9 - Aesthetics, 1/2 day
10 - Land Use, 1/2 day

Step 3 - Applicant's Response to Review Comments

The Exhibit E of the Application for license reflects substantial modifications in response to the informal comments that occurred during the workshop of November 29 through December 2, 1982. Specific responses, and often redrafting of the text of the Exhibit E, have followed receipt of formal agency comments. Chapter 11 of Exhibit E contains all agency responses to the request for review of the draft Exhibit E. Each comment by an agency has received a response.

Comment 8

Attached to this letter are our formal comments on the FERC draft license application Exhibit E for the Susitna Project. Comments are provided on Chapters 2, 3, 5, 7, 8, 9, and 10. We have also reviewed Chapters 1, 4 and 6. However, we do not at this time have any comments to offer on these chapters.

The comments provided are organized into general comments and specific comments for each chapter. In our attempt to be as responsive as possible within the limited time frame APA has established for our review and comments we have not been able to organize our comments into a comprehensive listing of deficiencies, clarifications, information needs, and recommendations. Many of these comments have been left within the context of the section within which they are raise. We feel by commenting in this way it will assist you in consistently correcting the deficiencies identified.

Response

The FWS complete letter of January 14, 1983 with attached comments is contained in Appendix I, Chapter 11 of Exhibit E. In Appendix J of Chapter 11 are responses to these comments.

Comment 9

The following comments are generally applicable to several chapters and, in some cases, are applicable to all of the chapters: It is our understanding that the projections of future power needs used in the license application are generally agreed to be high[5] and are being reevaluated for submittal to the FERC after the license application is submitted (Acres American Deputy Project Manager John Hayden, personal communication). The changes in the load forecasts are dramatic. In the Acres American report evaluating economic tradeoffs of flow regimes[6] the asumed moderate load forecast for the year 2010 is 7,791 gegawatt-hours (GWh). In the latest Battelle Newsletter[7] the moderate forecast is 4,986 GWh and the low forecast is 3,844 GWh. The significant decline in projected power demands has large implications to many of the project assumptions which have constrained mitigation planning, for example: available water for downstream flows; mode, timing, and routing of construction access; and scheduling of work. The license application should fully discuss the implications of the latest load forecasts.

Response

There is no single projection of future power needs used in the license application. Instead, there is a range of forecasts sufficiently wide to cover most perceptions about the Railbelt region's future. Battelle has indicated, based on a limited review of their earlier work, that a more current outlook for state oil revenues would tend to appreciably lower their base case set of forecasts. Battelle's limited review did not address the influence of Susitna power costs on power demand, nor did it take account of recent actual Railbelt power generating growth rates approximately three times greater than the forcasted average annual mid-range growth rate of 3.5 percent. Thus, we disagree with the contention that the projections used in the license application are generally agreed to be high.

The license application contains an explanation of the analytical tools used for power demand forecasting, presents a set of forecasts based on wide ranging sets of assumptions, and includes a thorough sensitivity and multivariate analysis addressing alternative futures. It is readily acknowledged that the pace of future load growth cannot be predicted with precision, especially in Alaska. Further, the outlook will change from year to year. It is important that decision makers are kept abreast of the most current outlook, and this will be done. At the same time, this variability and uncertainty cannot be used as an excuse to indefinitely postpone decisions, nor to annually alter the project configuration to conform to that year's outlook.

With the respect to the Watana Project in particular, it is important to note that the Project's timing is insensitive to forecasts of future load growth. Since it is designed to be fully utilized in displacing existing generation, the need for the Watana phase is dependent on the cost and availability of alternative generation, but not on load growth.

The combination of Watana and Devil Canyon will provide power to first displace fossil fuel-fired generation, and subsequently to accommodate any growth in demand over the next several decades. The two project phases are of approximate equal output, thereby allowing phased development to match the growth in demand.

The financing approach to Susitna is designed to insure that the cost of Susitna power, even in the early years of operation, is equal to, or less than, the variable generation costs facing Railbelt utilities.

Assuming that such a finance plan is implemented, Railbelt utilities should be willing to shut down their fossil fuel-fired plants and purchase Susitna power. In the Railbelt today, total annual generation, excluding self-supplied industrial demand, exceeds 3,500 GWh. Netting out the generation potential from existing hydroelectric facilities (which would not be displaced), leaves a present-day market of 3,300 GWh. The most pessimistic Battelle forecast calls for another 450 GWh before 1990, giving a total potential market of at least 3,750 GWh when the Watana Project is completed. Watana will be able to provide 3,450 GWh, and therefore, be fully utilized immediately upon its completion.

The Devil Canyon phase of the Project would then be added sometime later, as Railbelt demand increased and the need dictated. Devil Canyon's additional 3,330 GWh would be available to accommodate demand growth whether that resulted from population increases, increased per capita use, conversion from fossil fuels to electricity, or industrial demands.

With respect to the specific planning decisions mentioned by the Fish and Wildlife Service, several comments can be made. The scheduling of work on Watana and choice of construction access mode, timing, and routing were, and remain, independent of changes in the outlook for future load growth. Irrespective of when the Project is needed, a primary concern of the Power Authority is to minimize the duration of construction and, therefore, interest during construction and the Project cost. Further, introducing any increased risk of Project delay, once construction has begun, has serious implications for the ultimate cost of this capital intensive Project. The scheduling of work and the choice of access have been significantly influenced by these concerns; the decisions have not been driven by the load forecast.

Comment 10

The intent of the Coordination Act and NEPA is that environmental resources be given equal consideration with project features. Consistent with NEPA, as well as the APA Mitigation Policy, avoidance of adverse impacts should have been given priority as a mitigation measure. We have found this generally not to be the case, for example: mode, timing, and routing of construction access; scheduling of work; type and siting of the construction camp/village; recreation development; instream flow regime; and filling schedule. Other examples can be found in our Specific Comments.

Response

It is the Power Authority's intention to build the optimal power producing Project commensurate with environmental, cost, and other considerations. Needless to say, decisions about Project design and operation require the balancing of these several considerations.

As major design decisions are made, environmental information pertaining to that decision is developed and fed into the decision-making process. For example:

Avoidance of adverse impact has been an important factor from the earliest stages of Project formulation.

The middle Susitna Basin was originally considered as a preferred location for hydroelectric development, not only because of the relative economics, but also because of its compatibility with the natural environment. Compared to other potential large hydroelectric development sites (e.g. Wood Canyon on the Copper River), the middle Susitna location has less potential environmental impact. Within the Basin itself, consideration of environmental impact resulted in the early elimination of the Gold Creek, Tyone, and Olson projects, three of the twelve damsites identified in the middle portion of the Susitna Basin. Lesser environmental impact was one of two primary reasons why the Watana-Devil Canyon combination was selected as the basin development plan over the High Devil Canyon-Vee scheme.

Extensive analysis of the access route was accomplished. This analysis incorporated many facets of analysis: construction cost; logistic costs of the construction period; risks to Project schedule; impacts on fish, wildlife, and habitat; and impacts on adjacent communities. Balancing all of these considerations, an access route was selected which was identified as not being the environmentally preferred route. Nevertheless, environmental attributes were given more than equal consideration during the decision process; other considerations simply dominated, as was documented during the analysis.

Comparably, the type and location of the construction village reflects the balancing of several considerations, primary among them: impact of work force on adjacent communities; safety and productivity of the work force; Project costs; and environmental impacts. Factors other than proximate environmental impacts governed the selection of the proposed camp configuration.

Most features of design and operation reflect a multidisciplinary assessment of benefits and liabilities of several options. The Environmental Report (Exhibit E) of the license application provides the analysis of the proposed Project and reasonable alternatives which permit the Power Authority, FERC, Agencies, and the public to determine the benefits and liabilities of decisions about design and operation of the Project and its mitigation program.

Comment 11

Engineering and environmental studies do not seem to be interactive. It appears that the findings of environmental studies have not been integrated into the engineering design. This may be due in part to the short time frame established for project planning. An examination of the sequencing of the studies illustrates this problem. It is our understanding that the Aquatic Studies Program, designed to be the basis for determination of impacts to the aquatic system and associated mitigation measures, was established as a five year study. We are now two years into this program. The analysis of the data to allow an assessment of impacts and formulation of mitigation proposals may add another year to this process. APA expects to obtain a license, and begin construction in late 1984, or early 1985[8]. Obviously, this does not allow for an impact analysis and mitigation planning based on these studies prior to licensing. Mitigation planning, and an assessment of the impacts of different mitigation options needs to be undertaken in regard to project costs, viability, socioeconomic considerations, and mitigation proposed for potentially competing interests. This should all be considered throug the development of the environmental impact statement, and certainly prior to license issuance.

Response

The Power Authority seeks to effectively incorporate into the decision-making process of the Project the findings and recommendations of the environmental studies' program. Numerous design and operation aspects reflect tempering the optimum power development/minimum Project cost criteria with environmental protection and its attendant costs. Proposed spawning season flows are 12,000 cubic feet per second (cfs) instead of the 6,000 cfs that optimum power operation would suggest. Fixed-cone valves have been incorporated for the release of excess flows without the entrainment of dissolved gases, even though the problem would be only occasional (and, at Watana, substantially upstream from any existing anadromous fish populations). The number and location of borrow sites has been reduced to minimize habitat impacts. Vegetation in the reservoir will be cleared to avoid potential impacts from floating debris to animals swimming across the reservoir. Multilevel intakes have been incorporated to permit temperature regulation of downstream releases.

A large construction camp is planned and a number of transportation options for workers have been planned in order to reduce impacts to the small adjacent communities.

In response to agency comments at the time of their review of the Feasibility Report, additional environmental scientists were assigned to the Project, and the Power Authority staff was augmented with two environmental scientists.

Interaction between the engineering and environmental disciplines has occurred throughout the project development studies. This has included significant input into important development decisions including dam location, basic project configuration, access plans, construction camps, and project operation.

The sequencing of studies identified, has not presented a significant problem. During the preliminary design and feasibility assessment of most projects, all study disciplines have less quantified data than would be ideal. Rather than identify this as an insurmountable problem and thus failing to incorporate environmental criteria into early planning, the approach has been to integrate sound professional engineering, economic, and environmental judgment, as well as quantified knowns, into the planning decisions. As additional data become available, decisions are reassessed, impact predictions further quantified, and design specifications and operation modes finalized.

Substantially before the point of finalization, however, preliminary assessments of Project impacts will be available and functional design drawings can be produced for mitigation measures. Thus, for example, a five-year plan for studying impacts of aquatic ecosystems may be needed to permit the final design for construction of facilities, although an adequate assessment of impacts and mitigation plans can be made after two years of studies to support a license application. The ongoing study programs will permit refinement in design and operations of the Project and its mitigation facilities. The Power Authority believes it is not necessary for these studies to be completed prior to any license application.

Comment 12

Numerous examples of lack of coordination and/or communication between the groups responsible for the different study elements are evident. Examples can be found by comparing discussions concerning minimum downstream flow releases in Chapters 4 and 10 to what is found in Chapters 2 and 3. Reservoir temperature modeling discussions in Chapter 10 are not consistent with what is stated in Chapters 2 and 3. Another example is found in the minimal level of concern expressed in Chapter 10 for socioeconomic (Chapter 5) considerations, such as impacts of license denial. More specific comments are included in the attached document. Other Exhibits were not provided to us for review although we requested them by letter dated November 19, 1982.

Response

Although it is recognized that some inconsistencies existed in the Draft Exhibit E submitted for review in November 15, 1982, this draft document and our final license application provide numerous examples where extensive coordination among the various study disciplines occurred.

Comment 13

Research of background information is frequently inadequate and incomplete. An example would be the discussions concerning subsistence (Chapters 3 and 5). More adequate research of this very important area appears justified. We have listed several readily available references which would be of value in improving this discussion.

In Chapters 2 and 3 minimal information is brought into the discussions concerning physical changes which have been observed at similar hydropower projects. We are sure that many of the potential impacts that are discussed for Susitna (e.g., temperature concerns) are not unique to this project. The State's experience with the Trans-Alaska Pipeline System (TAPS) project could have been drawn upon more fully as an example, particularly in regard to socioeconomic (Chapter 5) discussions. Another example is the discussion concerning natural gas and geothermal electric generation as alternatives to Susitna (Chapter 10). Very little use was made of existing information bases.

Response

Extensive use was made of existing information. A review of the reference section of each chapter should serve to confirm this. Additional references identified under specific comments have been reviewed.

Comment 14

Speculation is not always clearly distinguished from data-based conclusions. This problem is most apparent in Chapters 2 and 3 and should be corrected.

Response

Although even most data-based conclusions have a judgmental component associated with them, a special effort has been made to identify, for the reader, those conclusions based more on professional judgment than quantitative assessment. The inclusion of these statements is evidenced by the following comment.

Comment 15

Lack of quantification is a recurrent problem in the Exhibit. Neither base line data nor impacts are appropriately quantified (e.g., Chapters 2, 3, 5, and 10). Statements in the document let us know what, "Much of the discussion is based on professional judgment," (page E-3-3), and, "Many of the statements are speculative ... and ... unsupported," (page E-3-56). Other statements let us know that ongoing, or planned studies, will fill these numerous data gaps to allow a quantification of the resources and impacts which would let us go beyond, "the conceptual mitigation plan," (page E-3-116). Recognizing a problem does not, in and of itself, correct it. We were particularly concerned with this in our review of Chapter 3. In the Exhibit E, the existing resources should be quantified. The potential impacts to these resources should be quantified and then evaluated over the line of the project. Only at that point can specific, effective mitigation measures emerge. We consider quantification of existing resources and impacts and a specific, effective mitigation plan essential to the development of an acceptable environmental impact statement.

Response

See response to general comment 6 above.

Comment 16

The ongoing, and planned studies, which are frequently noted (particularly in Chapters 2 and 3) should be fully identified so we can examine them in regard to their scope. We cannot, otherwise, determine what needs to be done and the time frame for accomplishment. Further discussion is provided in our Chapters 2 and 3 general comments, and throughout our specific comments sections.

Response

The FWS determination as to what they perceive needs to be done should be based upon a review of the data and assessments contained within Exhibit E. Any suggestions for specific studies will be considered in planning future studies.

Comment 17

In several of the chapters (e.g., Chapters 2, 3, and 5) we are faced with mitigation options to contend with identified (although frequently unquantified) adverse impacts. For example, in Chapter 3 there are discussions on the potential value of spiking spring flows for salmon out-migration and the installation of a fifth portal on the multi-level intake structure to provide warmer downstream temperatures during filling. If these mitigation proposals have validity, they should have been incorporated into the project design and operational plan. The document does not provide an adequate mitigation plan as required.

In addition, mitigation measures which are presented should have proven successful in Alaska, or in a similar environment. If the proposals are not proven, then they would need to be demonstrated effective in the project area. Further discussion is provided in our Chapter 3 general comments sections.

Response

The mitigation plans have been revised to state a preferred mitigation program. Additional options in some areas are discussed and the procedures that would be followed to add these options or substitute these options for the presently proposed program element.

Comment 18

The need for an effective monitoring program through construction and the operation phase is discussed in many of the chapters. However, the program is not adequately described. We fully support the establishment of a monitoring program. We believe the program should provide for participation by representatives of appropriate State, Federal, and local agencies and be financed by the project. This panel should have the authority to recommend modification of how activities are conducted to assure that mitigation is effective. Recommended changes in the mitigation program should be adopted through a mechanism established in the license, mutually acceptable to all concerned bodies.

Response

It is the intention of the Power Authority to establish a monitoring program that responds to and implements the Articles of any forthcoming FERC license for the Project.

With respect to formulation of the specifics of the program, we invite and also expect your agency, as well as other regulatory entities, to play a major role in this effort. With respect to monitoring the effectiveness of mitigation measures and compliance with stipulations of the license application, we see that as the licensee's responsibility.

We expect that no matter who does the monitoring, their observations will establish whether the mitigation programs are achieving their goals. If they are not, the mitigation programs will be modified as will undoubtedly be required by the license.

Comment 19

Unfortunately the rush to meet the schedule for the license application has resulted in poor quality control, i.e., countless typographical errors, missing lines, misreferenced tables and figures, unclear sentences, internal inconsistencies, inadequate documentation, missing references in bibliographies, etc. This should have been eliminated in a thorough editing prior to release for agency pre-license application review. Our review for biological completeness was somewhat hampered by this problem.

Response

It is recognized that the draft Exhibit E submitted for review and comment was indeed a draft document. Considerable effort has been made to improve the quality of our final license application.

Comment 20

In the previously referenced FWS letters and testimony, many of the same concerns discussed above and in the attached comments were raised. It is our view that unless the issues raised in this letter are satisfactorily resolved, we do not believe the application could provide the basis of an acceptable environmental impact statement. In this respect we consider the license application to be deficient.

Response

The Power Authority acknowledges the concerns expressed in this and previous letters submitted by the FWS. The Power Authority contends that the license application satisfactorily addresses these concerns. The final resolution of these concerns is expected to occur during the FERC license review process.

Comment 21

We recommend that you strengthen the license application by including information resulting from a thorough evaluation of the biological data collected during the 1982 field season. This would enable an assessment of the adequacy with the data base to support a sufficiently quantified impact analysis and, in turn, a specific, effective mitigation plan. We believe a realistic appraisal could then be made as to when any remaining deficiencies could be satisfied.

Response

1982 biological data and the accompanying analysis will be submitted to FERC when available. It is recognized this information will improve the data base and allow for refinement of impact predictions and mitigation plans.

COMMENTS CONTAINED IN THE U.S. FISH & WILDLIFE SERVICE LETTER OF JANUARY 14, 1983

CHAPTER 2 - WATER USE AND QUALITY

GENERAL COMMENTS

Comment 1

In examining Chapter 2, we were concerned that sufficient scope and quantifications are not provided to allow a quantified impact evaluation of the fisheries and other biological resources. The information provided should allow for the development of specific and effective measures which would fully mitigate for all adverse impacts. We are left with the definite impression that the project would, through changes in streamflow, water quality, temperatures, ice conditions, vegetation, and slough habitats, have significant effects upon the resources of concern to use, particularly the fisheries. However, quantification of the potential impacts is generally lacking as are specific effective mitigation measures. Of course, the latter cannot be accomplished prior to the former, despite the attempts found in this chapter.

A significant portion of the lack of specificity found in Chapter 2 is due to the fact that, although two years of data have been gathered (1981 and 1982), the Exhibit E reflects only the 1981 data. We have consistently stated that the 1982 data be analyzed and included in the Exhibit E (see Deputy Regional Director LeRoy Sowl's April 16, 1982, statement to the APA Board, and out letter dated October 5, 1982, to Eric Yould). Our position remains the same.

Response

Substantial additional quantification has been incorporated in Chapter 2 since the original draft was distributed in November 15, 1982. The sections on streamflow, water quality, water temperature, ice conditions, vegetation, and slough habitats have been expanded. Whenever possible, information collected in 1982 has been incorporated in the document.

Comment 2

This chapter does not identify what studies have been completed, what studies were ongoing in 1982, and what studies are proposed. Until this is provided, we cannot determine what studies we would like to see modified, and what we see as being missed. Without this type of information, the resource agencies are placed in a reactive mode, i.e., we can only comment on what should have been examined in completed studies. However, in so doing, we can better facilitate the applicant's efforts to plan a project we can support. An example of a proposed study which is not addressed in this chapter is the Arctic Environmental Information and Data Center (AEIDC) study. The following is a summary of this proposed study:

The AEIDC proposal is designed to (1) accurately and comprehensively predict system-wide streamflow and temperature effects of the dam(s), and (2) interpret effects of such changes in terms of aquatic habitats and fish populations.

To accomplish these general objectives, AEIDC proposes using a linked system of simulation models which requires data from other project studies, available literature sources, and professional judgment.

The study is a result of the need to consider the special aquatic habitat relationships in the Susitna River basin and the need to account for the interrelated effects of ice, sediment, streamflow, and temperature changes which will accompany construction, filling, and operation of the selected dam or dams.

Most assessments of hydroelectric projects are based upon impacts associated with changes in mean monthly streamflows and temperatures. However, the actual impacts of the project may not be caused by the mean events but through changes in the natural pattern of streamflow or temperature variation. Further, a single set of mean monthly flows does not actually reflect instantaneous flows in the river; the actual predicted mean monthly discharge will probably not occur during a given month because of expected anomalies in hydrologic statistics. Therefore, it is necessary to predict the range of mean monthly flows expected, based on reservoir inflow, power generation requirements, and downstream demands.

The AEIDC model system would depend heavily upon a reservoir operation model to generate an exhaustive range of feasible weekly or monthly flow regimes and the expected variation over a 30-yr forecast period.

The model system would include provisions for ice and sediment modeling to account for changes in substrate distribution, bed elevation or channel configuration which might result from project operation. At a minimum, ice and substrate modeling would support the assumptions that hydraulic boundary conditions either remain stable or change within predictable limits with project operation.

The array of predicted weekly or monthly flows and temperatures may be biologically interpreted in several ways. The available habitat data base is heavily weighted at this time toward known chum and sockeye salmon spawning areas in sloughs and side channels in the Susitna River between Talkeetna and Devil Canyon. Access and spawning dynamics with respect to mainstem discharge are the major simulation goals of several ongoing field studies. The AEIDC modeling system could provide a time-series approach to determine effects upon critical life history stages of these species. It is possible that the entire riverine life cycle of chum salmon might be simulated under various flow regimes to predict long-term population trends. A similar analysis of sockeye salmon might be possible.

The primary concept, again, is first to credibly and comprehensively predict all project operations and their effect upon the habitat-related physical parameters within the system; secondly, those effects will be interpreted, through long-term forecasting, in terms of their influences upon affected salmon populations.

We support the proposed AEIDC study. It should provide the basis for determining project instream flow impacts and a reasonable assessment of mitigative alternatives.

Response

The ongoing 1982 and 1983 studies are reflected in the Power Authority study contracted to the AEIDC, as summarized in the US Fish and Wildlife general comments on Chapter 2.

Comment 3

It is apparent that the proposed instream flow releases are designed for maximum power production and do not reflect biological needs. The 12,000-cfs figure for August reflects the maximum amount of water that can be discharged without significant economic effects. It is our understanding that the project releases would be 10,000 to 12,000 cfs year round. No consideration was given to the potential impact of the project during winter when flows of this magnitude might prove highly detrimental to the fishery. The potential value of spiking flows during the spring to facilitate smolt out-migration and flush the sloughs of ice and debris is discussed. However, these flows are not reflected in the proposed releases.

We consider it very important that the license application contain a specific, detailed flow release schedule, which is designed to mitigate project impacts, protect or enhance conditions for fish spawning, feeding, unrestricted fish passage, out-migration, and provide overwintering habitat for fish in the Susitna River. This schedule should be developed through a quantified instream flow analysis which has been coordinated with the FWS, National Marine Fisheries Service, and the Alaska Department of Fish and Game (ADF&G).

Response

The proposed instream flow releases are not designed for maximum power production and do reflect biological needs. If instream flow releases were solely to maximize power production benefit, Case A (8,000 cfs) would have been selected. This selection process is described in Section 3 of Chapter 2.

The potential impact of the project during winter was considered. Temperatures, ice front location, the delay in ice cover, and the potential impact on sloughs have been discussed. Appropriate mitigation measures have been incorporated to ensure that productive salmon sloughs will not be overtopped during the freezeup process (Chapter 3). The impact of these flows on the fishery is discussed in Chapter 3.

The potential value of spiking to facilitate smolt out-mitigation is being examined. However, because the desired timing and magnitude is not known at this time, a spring release was not included in the minimum flows specified.

With the five-year slough maintenance program and the increased upstream berms included in the mitigation plan, there will be no need to flush the sloughs of debris and ice.

Comment 4

In response to the APA request of September 2, 1982, the FWS, by letter dated October 5, 1982, provided input specific to the draft Exhibit E. This is in compliance with the FERC recommendation that information included at the initiation of formal consultation, "...responds to the preliminary comments and recommendations of the agencies."[9] Since this was not done, our October 5, 1982, letter should be made part of our formal response on the draft Exhibit E. As such, the points raised in that letter should be specifically addressed in the Exhibit E submitted as part of the license application. Many of the points raised would be most appropriately responded to in Chapter 2.

Avoidance of adverse impacts should, in compliance with the APA Mitigation Policy document and NEPA guidelines, be given top priority in the license application. In particular, our concerns as to the decisions which led to such project features as the camp/village, transmission line routing, construction access routing, turbine configuration, filling regime, flow regime, etc, with regard to avoidance of impacts, should be addressed.

Response

All correspondence received from FWS has been specifically addressed in Chapter 11 of Exhibit E. The text in other appropriate chapters has also been modified to address their comments.

Avoidance has been given top priority as an environmental mitigation measure. However, in compliance with NEPA and the Power Authority mitigation policy, our decision-making process has only given environmental considerations equal status with economics, not priority status.

SPECIFIC COMMENTS

2 - BASELINE DESCRIPTIONS

2.3 - Susitna River Water Quality
(a) Physical Parameters
(1) Water Temperature

W-2-001 - Mainstem: Paragraphs 1 and 2: Those months which are being referred to by winter and summer should be indicated.

Response

The winter months normally include the months of October through April when the flow is predominantly base flow and water temperatures are approximately 0°C, whereas the summer months include the period after breakup through the high runoff period (September). Paragraphs 2 and 3 have been clarified to reflect the intended meaning.

W-2-002 - Sloughs: Paragraph 1: The first step in understanding the temperature relationship between the mainstem and the sloughs is to measure the temperatures of both sites. This has been done. The relationship between the mainstem and the sloughs regarding temperatures (as well as other water quality parameters) then must be established. This process, apparently, is just beginning. To this end, one slough (#9) has been examined. This examination has focused, correctly, on the ground water relationship. According to Tony Burgess (Acres American), in his Susitna Hydro Exhibit E Workshop presentation (12/1/82) on ground water upwelling and water temperature in sloughs, the ground water regime can be modeled, but locally the match is not very good: The ground water temperatures near the surface do not match the predicted temperatures. Continued study is obviously indicated for Slough 9. After an understanding is achieved for that slough, the program would need to be expanded to other sloughs, possibly Sloughs 8A, 11, 19, 20 and 21. These sloughs have been more intensively examined than other sloughs in this reach of the Susitna River. We recommend that this general program be undertaken.

Response

The comment that the ground water relationships for only one slough (#9) have been examined and that the program would need to be expanded to other sloughs, possibly Sloughs 8A, 11, 19, 20 and 21 is well taken and will be considered for future studies. However, the Slough 9 studies have provided an overall understanding of the ground water processes within the sloughs. Given the similarities of the sloughs, i.e., similar soil conditions and hence permeability, similar flow path lengths, and similar upwelling temperatures, we expect similar ground water processes in all the sloughs between Portage Creek and Talkeetna. For example, ground water measurements conducted on both Slough 9 and Slough 8A demonstrate that ground water flow is in a downstream direction and locally laterally toward the sloughs.

The ground water flow pattern as deduced from the model compares reasonably well with measured field data. The FWS comment, "locally the match is not very good" applies to the ground water conditions in the vicinity of well 9-11. The poor match may be due to a number of reasons.

- A surface stream exists in that area, probably due to runoff from the upland areas. This could locally recharge the alluvial aquifer;

- Ponding of surface water behind the railway embankment has also been observed, and would lead to elevated ground water levels; and

- Soil stratigraphy adjacent to the valley wall may be much more variable than in the center of the valley. It may contain silty layers which would result in perched water table conditions. The wells in this area may therefore not be measuring the main alluvial water surface.

To address the question of why ground water temperatures near the surface do not match the predicted temperatures, deep wells have been drilled near Slough 9. These wells are being monitored for temperature and piezometric head. These data along with continued ground water temperature measurements near the surface should provide the information necessary to address this question. Results will be available in the June 30, 1983 supplemental report.

W-2-003 - Tributaries: Paragraph 4: The difference in temperatures of the Chulitna and Talkeetna Rivers should be referenced at least by month. It would appear that the cooler temperatures displayed by these rivers would be useful in an assessment of post-project temperatures effects at the confluence and further downstream. We recommend this be examined.

Response

We concur that the temperatures of the Chulitna and Talkeetna Rivers would be useful in an assessment of post-project temperature effects at the confluence. Monthly data for June 1982 through September 1982 have been included in Section 2.3.1(c). From approximately mid-October through April, water temperatures in both the Chulitna and Talkeetna Rivers are near 0°C.

W-2-004 - Freezeup: Paragraph 3: The impact of this process should be fully explained in regard to river morphology and maintenance of the present riparian zone.

Response

The discussion on freezeup has been expanded to provide a more detailed explanation on the freezeup process in Section 2.3.2(a). The impacts to river morphology and riparian vegetation are discussed in Section 4.1.3 (c)(ii).

W-2-005 - Winter Ice Conditions: Paragraph 2: Please refer to our comments on Section 2.3 (a)(i) - Sloughs. The sloughs should be identified by number, and percentage to which the statements apply.

Response

The sloughs which were observed to have open leads during mid-winter 1982 have been identified in Table E.2.18.

W-2-006 (iii) Suspended Sediments: The percent contribution, by season, from the major suspended sediment sources should be indicated. An analysis of the anticipated changes, by season, due to the project operation should be made.

Response

Sediment sources and the contribution of suspended sediment by season have been included in Section 2.3.3(b). Project effects are discussed in Sections 4.1.3(c)(iii) and 4.2.3(c)(iii).

W-2-007 (ix) pH: The pH range, from 6.6 to 8.1, is broad and should continue to be monitored. The potential exists for a lethal pH shock to occur to aquatic life with a change of 1.0 pH. A change of this magnitude might be possible from a reservoir water release. A pH below 6.6 may be harmful to fish depending on the amount of free carbon dioxide present in excess of 100 parts per million. Egg hatchability and growth of alevins could be adversely effected at a pH range between 6.5 and 6.0. The need for a predictive water quality model is apparent given the toxic heavy metals that occur in the drainage. We recommend that one be utilized.

Response

Continued monitoring of pH levels will be taken into consideration. No large pH variations are expected as a result of a reservoir water release. Releases from Watana will be withdrawn from the same four upper level intakes as powerhouse flows. Adverse pH and free carbon dioxide concentrations will not occur in this portion of the reservoir. At Devil Canyon, the intakes for the seven fixed-cone valves will be at elevations of 1050 and 930 feet. The lower of these intakes will be approximately 100 feet above the reservoir floor. Consequently, the acidic waters which will exist immediately adjacent to the reservoir floor, due to the leaching process, will not be withdrawn and passed downstream. Acceptable pH values are expected throughout the balance of the reservoir. The utilization of a predictive water quality model will be considered.

(d) Other Parameters

W-2-008 (iii) Others: The railroad right-of-way that parallels the Susitna River has been sprayed with various herbicides for vegetation control for a period of years. Herbicides used include amitrole, 2-4D, bromicil, and Garlon (tordon). Streams of primary concern are Chase, Indian, Lane, and Gold Creeks. A spill of Garlon occurred in Lane Creek in 1977. Sloughs located along the railroad right-of-way could also be recipients of some of the herbicide spray. No fish and/or wildlife tissues have been analyzed for food chain herbicide impacts in the area. Due to the type of herbicide used, we are certain that detectable amounts will occur over a long period of time. Please incorporate this information into your discussion.

Response

The use of herbicides along the railroad right-of-way has been incorporated into Section 2.3.8(m). Although it is true that no tissue analysis was undertaken, the presence of these contaminants is not a project related impact. Water samples at Cantwell and Gold Creek were analyzed for endrin, lindane, methoxychlor, toxaphene, 2, 4-D, and 2, 4, 5-TP silvex. All concentrations were below detection limits (R&M 1982). Water samples analyzed for herbicides by USGS at Susitna station in 1982 were also below detectable limits.

Project regulation of the Susitna River will serve to reduce the dilution of existing herbicides in the mainstem by approximately one-half during the months of

May through September and increase the dilution effect by a factor of approximately 6 from November through April.

Herbicides will not be used for vegetation control on the Susitna Hydroelectric Project.

2.4 - Baseline Ground Water Conditions

W-2-009 (d) Hydraulic Connection of Mainstem and Sloughs: It should be noted that the sloughs provide valuable rearing habitat for anadromous and resident fish. Additional comments concerning the ground water connection and current studies are provided under Section 2.3(a)(i) - Sloughs.

Response

The statement that sloughs provide valuable rearing habitat for anadromous and resident fish has been added to Section 2.2.4. Additional information can be found in Chapter 3.

2.5 - Existing Lakes, Reservoirs, and Streams

W-2-010 (a) Lakes and Reservoirs: Paragraph 1: Project features include transmission lines, access roads, transmission line maintenance roads, railroad staging areas, etc, and should be examined within the context of this section. The proposed Recreation Plan would lead to the encouragement of impacts to numerous lakes throughout the upper Susitna basin. Secondary impacts resulting from the project would expand impacts to additional systems.

Response

We concur that impacts to the water quality of existing lakes and streams could occur due to project features. Additional discussion has been provided in Section 2.5. A listing of the lakes which could be subject to secondary impacts from the access roads and transmission lines is also provided. Further information is also provided regarding the proposed recreation plan.

2.6 - Existing Instream Flow Uses

W-2-11 (b) Fishery Resources: Reference should be made to burbot and Dolly Varden as important resident species.

Response

The importance of burbot and Dolly Varden as important resident species has been noted in Section 2.6.2.

W-2-012 (g) Freshwater Recruitment to Estuaries: Paragraph 2: It should be noted that salt water intrusion and mixing would be related to tidal action.

Response

Salt water intrusion is related to tidal action. The larger the tide range, the greater the mixing and the less the salinity intrusion. At the time of the August 18 and 19, 1982 salinity measurements, spring tides (i.e., large tide range) were occurring in Cook Inlet. This would have the effect of reducing the salt water intrusion. However, even with neap tides (i.e., small tide range) and the 90,000 cfs discharge at the mouth of the Susitna River, sufficient mixing would exist to prevent salinity intrusion upstream of the mouth. This information has been incorporated into Section 2.6.7 of Chapter 2.

2.7 - Access Plan

W-2-013 (a) Flows: Paragraph 2: The use of regression equations in calculations of peak and low flows in lieu of actual discharge data should not be a substitute for the collection of data, when sizing culverts for engineering integrity or fish passage. Washouts due to undersized culverts resulted on the north slope haul road and, more recently, at the Terror Lake Hydro construction site.

Response

During final design of the access road, culverts will be sized to maintain fish passage according to the criteria established by the Alaska Department of Fish and Game. The recommendation that actual discharge data be collected will be taken into consideration in the development of future field studies. However, the value of regression equations should not be underestimated.

W-2-014 2.8 - Transmission Corridor: Base line information on the transmission corridor from the damsites to the Intertie has been acknowledged as lacking within the Exhibit. As with other project features, the Exhibit E should provide base line data, impact assessment, and mitigative planning. We recommend that this be done for this project feature. For further comments, please refer to our letter dated January 5, 1982, on the Transmission Corridor Report. We provided this letter as formal pre-license consultation and continue to view it as such.

Response

The transmission corridor from the damsites to the intertie has been rerouted subsequent to the draft application. Both the transmission line and access road now share a common corridor. Further information can be found in Chapter 2, Sections 2.8, 3.6 and 6.2; Chapter-3; Chapter 10, Section 2.4; Exhibit A, Sections 4 and 10; and Exhibit B, Section 2.7.

3 - PROJECT IMPACT ON WATER QUALITY AND QUANTITY

W-2-015 3.2 - Watana Development: Reference is made to Exhibit A. By letter dated November 19, 1982, we requested a complete copy of all the Exhibits. This information has not been received.

Response

Watana development explained in feasibility report.

(a) Watana Construction

W-2-016 (i) Flows: Paragraph 1: The significance of the loss of the one-mile reach due to construction would more appropriately be assessed in Chapter 3, under Fishery Resources, 2.3.1(a)(i).

Response

The significance of the loss of the one mile reach due to construction is assessed in Chapter 3 Section 2.3.1 (a)(i).

(ii) Effects on Water Quality

W-2-017 - Suspended Sediments/Turbidity/Vertical Illumination: Paragraph 2: Anticipated suspended sediment and turbidity levels should be compared, by month, to the ambient conditions. This would allow an evaluation and understanding of potential project impacts. The amount of spoil which would be generated and the extent to which grading and washing of materials would be needed is not addressed. This has obvious implications in regard to water quality and spoil disposal. We do not at this time have sufficient data or maps with which to provide specific input. We would recommend to the extent possible, borrow material be obtained from within the future impoundment area. It is stated that, "downstream, turbidity and suspended sediment levels should remain essentially the same as baseline conditions." This would not appear to be the case during the winter, when the ambient conditions are crystal-clear.

Response

Seasonal assessments of anticipated suspended sediments and turbidity levels for the construction period are provided in Section 4.1.1(c)(iii). Disposal methods and the extent of grading and washing have also been addressed in Sections 4.1.1(c)(iii) and 6.2. The stockpiling of gravel is expected to alleviate the need for excavation during winter. Therefore, downstream turbidity and suspended sediment levels during winter should be close to ambient conditions.

W-2-018 - Contamination by Petroleum Products: Spillage of petroleum products into the local grayling stream would have significant impacts on this fishery. An oil spill contingency plan should be presented in the mitigation plan which is in compliance with state and federal regulations.

Response

Federal law requires that as part of the management procedures there will be an oil spill contingency plan (40 CFR 102.7). This is discussed in Chapter 3, Section 2.4.3(c)(ii).

W-2-019 - Concrete Contamination: The types of potential problems associated with this activity should be identified and a pollution control contingency plan should be developed as a component of the proposed mitigation plans. Such a plan must be in compliance with state and federal regulations. The Wastewater Treatment section (Page E-2-37) is a much more appropriate level of analysis.

Response

Refer to Section 4.1.1(c)(vi) for the potential impacts associated with concrete work. The Power Authority concurs with the need for a pollution control contingency plan. A plan, in compliance with state and federal regulations, will be developed. Please refer to Section 6.2 for proposed mitigative measures.

W-2-020 (iv) Impact on Lakes and Streams in Impoundment Area: Discussions regarding borrow and spoil materials are extremely general. The potential sites, quantity of material to be removed, or deposited, extent of cleaning that would be necessary, and biological description of the sites to be disturbed, should all be described. Mitigative analysis should address such issues as timing constraints on various operations and measures required to reestablish pre-project conditions for those sites which would not be permanently lost.

Response

As previously noted, refer to Section 4.1.1(c)(iii) for a discussion of the proposed borrow sites, cleaning processes, and spoil disposal. Biological descriptions of these areas are provided in Chapter 3.

W-2-021 (v) Instream Flow Uses: Anticipated impacts for flows greater than the one in 50-year event should be described.

Response

The anticipated impacts for flows greater than 1:50-year event are discussed in Section 4.1.1(f).

W-2-022 - Fisheries: Paragraph 2: The desirability of avoiding this fishery loss by gating the diversion tunnel should be discussed.

Response

An expanded discussion of the impacts of the diversion tunnels on fish is contained in Chapter 3, Sections 2.3.1(a)(i) and 2.4.3(h). While it is valid to assume that individual fish will not necessarily be lost by filling the reservoir, the lost tributary and mainstem habitat and the low habitat value in the reservoir subsequent to filling is expected to significantly reduce the populations of fish susceptible to passage through the diversion tunnels. The temporary mitigative measure of structural protection from passage through the tunnel will provide only short-lived benefits. It would be more appropriate to provide mitigations that will provide long-term benefits.

W-2-023 (vi) Facilities: General input is provided in our comments on Chapters 5 and 10. The decisions regarding the type, administration, and siting of the construction camp/village were made without input from resource agencies. In addition, the timing constraints placed upon the construction of this project are no longer supported by economic studies (Chapter 10, General Comments). The Exhibit should be revised to reflect updated forecasts. Reference is made to Exhibit F. Although we have requested this Exhibit, it has not been provided.

Response

These comments are addressed under the appropriate chapters.

W-2-024 - Water Supply: It should be noted whether or not the features described in this section were coordinated with the Alaska Department of Environmental Conservation.

Response

The detailed design of support facilities, including water supply development, will afford an opportunity for agency input. Water rights appropriations will be pursued as required by law. Please refer to Section 4.1 (g)(i) for additional discussions.

(b) Impoundment of Watana Reservoir

(i) Reservoir Filling Criteria

W-2-025 - Minimum Downstream Target Flows: Paragraph 1: The factors that went into this fishery vs economics tradeoff analysis for determining the appropriate downstream flows should be discussed in detail. At the Susitna Hydro Exhibit E Workshop (conducted on November 29 through December 2), it was indicated that the analysis consisted of determining at what summer flows economic benefits drop off. Given that the economic analysis upon which this is based is generally considered out of date (Battelle Newsletter #4, Railbelt Electric Power Alternatives Study), confidence in this analysis from an economic perspective must be low. From a fishery perspective, it is unacceptable.

Response

Section 3, Project Operation and Flow Selection, has been added to the license document. This section discusses the factors considered in the selection of downstream flows. Alternative operation scenarios are discussed in Chapter 10.

W-2-026 Paragraph 2: Once we have an acceptable instream flow regime, several gauging stations will be necessary to assure proper flows. It should be recognized that at least eight sloughs are located above Gold Creek and that several of these currently support fish. Flows to maintain or, if possible, enhance the productivity of these sloughs should be provided.

Response

The sloughs upstream from Gold Creek that support fish are downstream from Portage Creek. Since the drainage area between Watana and Gold Creek is 980 square miles and the drainage area between Portage Creek and Gold Creek is approximately 176 square miles, the discharge at the most upstream slough will be about 17.7 percent less than the total discharge contributed from the drainage area between Watana and Gold Creek if it is assumed that the runoff per square miles does not vary over this drainage area. For example, if the Gold Creek flow is 12,000 cfs, of which 8000 cfs is released at Watana and the remaining 4000 is contributed from the drainage area downstream from Watana, the flow at the slough immediately downstream from Portage Creek would approximate 11,300 cfs. (Under natural conditions, a flow of 4000 cfs from the drainage area between Watana and Gold Creek would imply a Gold Creek discharge of 20,000 cfs.) This flow, in conjunction with proposed mitigation measures, would be used to maintain the productivity of the sloughs. With distance downstream, the flow would increase such that the flow adjacent to sloughs just upstream from Gold Creek would be close to the 12,000 cfs flow at Gold Creek.

W-2-027 Paragraph 4: The out-migration of salmon in the spring is as likely related to photo-period and development as the other factors listed. Very low flows in the spring could cause many of the juveniles to remain trapped in backwater pools that are normally flooded under pre-project conditions.

Response

During Watana reservoir filling, very low flows in the spring may occur; however, this will not cause juveniles to remain trapped in backwater pools that are normally flooded under pre-project conditions. Local runoff from the spring melt and/or rainfall in combination with ground water inflow will provide sufficient flow for out-migration.

W-2-028 Paragraph 6: The proposed flows of 12,000 cfs have not been demonstrated to maintain the integrity of slough morphology and provide the flushing flows needed to clean fines out of gravel. Also, the potential problem of beavers colonizing many of the sloughs, not being naturally controlled by flooding, and therefore interfering with fish usage of the sloughs should be addressed. Competing interests of aquatic and terrestrial project components such as salmon vs beaver conflicts have been given minimal attention in the exhibit.

Response

While the proposed flows of 12,000 cfs will not provide the flushing flows to clean fines out of the gravel or maintain the integrity of the slough morphology, during wet years flows often will be sufficiently high to overtop many of the upstream berms of those sloughs which have not been increased in elevation for fishery mitigation. (In sloughs where the upstream berm elevation will be increased, the sloughs will be maintained on a 5-year rotating schedule.) If, during filling the flood volume storage, criteria are exceeded, Watana flows will be increased up to 30,000 cfs (Section 4.1.2(b)(ii)). During project operation, once the Watana reservoir is filled to the normal maximum operating level, outflow will be increased to equal inflow up to the operating capacity of the release facilities. From the annual flood frequency curves (Figures E.2.147 and E.2.199), flushing flows of 20,000 cfs will occur once every 7 years on the average with Watana only. When Devil

Canyon comes online, there is a 50 percent chance annually that a flushing flow of at least 20,000 cfs will occur. As energy demand increases, flushing flows of 20,000 cfs will occur about once every five years.

The salmon vs beaver component of this question is addressed in responses to comments in Chapter 3.

W-2-029 Paragraph 7: Adequate instream flows for the winter period should be established according to fish requirements. This is a critical period for fish and even minor dewatering may have significant deleterious effects.

Response

We agree with the importance of ensuring adequate flows for fisheries in the mainstem during the winter months. Adequate mainstem flows are most critical during this period when climatic conditions are harsh and the mainstem is being utilized for overwinter rearing. Hence, during Watana reservoir filling, instream flows will be increased to natural levels for the period November through April. Section 4.1.2 has been modified accordingly.

W-2-030 (ii) Reservoir Filling Schedule and Impact on Flows: Once an acceptable instream flow study has allowed an evaluation of various flow regimes, an acceptable filling regime for the project which would minimize impacts to aquatic resources can be developed. The proposed filling regime has been established upon an inadequate biological information base.

Response

The summer (i.e., May through September) filling regime is based on the minimum operation flows (See Sections 3.2 to 3.7). With average filling conditions, the reservoir level is high enough by August of the second year of filling to permit the release facilities to operate. Hence, the adverse temperature impacts from 4°C water being released through the low level outlet can be avoided.

W-2-031 (iii) River Morphology: Paragraph 3: The potential negative impacts on slough areas downstream of Talkeetna due to decreasing the recurrence intervals of what are now mean annual bank-full floods are not addressed.

Response

The discussion has been expanded.

(iv) Effects on Water Quality

W-2-032 - Water Temperature: The timing and consequences of the filling regime on downstream temperatures should be better defined. Just as modeling needs to define operational thermal changes, the thermal processes should be modeled for the filling period. From this we may be able to consider mitigative measures.

Response

After the initial summer of filling, the Watana reservoir will necessarily cool to 4°C. From this point until water can be passed through the release facilities, the Watana outlet temperature will be 4°C. This is because the outlet will be approximately 400 feet below the water surface at the end of the first summer of the filling and there is no mechanism for any significant heat transfer to the water at this depth. The volume of water stored in the reservoir after October of the first summer of filling will be about 2.2 million acre-feet . From November through April, 0.5 million acre-feet of 4°C water will be evacuated from the reservoir and be replaced by 0°C water which was contributed as inflow during this time. The 0°C water, because it is less dense than 4°C water, will tend to float on top of the 4°C water, although there will be some mixing of 0°C and 4°C water; however, this will be confined to the upper layers. Even with cooling before the ice cover forms, only insignificant cooling will occur at a depth of 175 feet. It is the 0.5 million acre-feet stored below this depth which will be discharged during winter. In spring, the ice on the reservoir surface will melt and the reservoir will warm to 4°C, probably by about the end of May. Then the surface will continue to warm above 4°C and slowly this warmer water will penetrate deeper. Also, warm Susitna River water will be contributed to the reservoir. Although there will be some mixing, the warmer surface water, because it is less dense, will float on the denser 4°C water. Through mid-September, approximately 1.8 million acre-feet of 4°C bottom water would be released from the reservoir if the low level outlet was continuously used. This would still leave a reserve of 4°C water. However, it is anticipated that sometime in late July or August the reservoir will be sufficiently full to allow discharge through the release facility.

- Suspended Sediments/Turbidity/Vertical Illumination

W-2-033 . Watana Reservoir: Paragraph 3: Discussion should be provided on the impact of water quality changes on the photosynthetic process downstream of the reservoir.

Response

Vertical illumination in the reservoir will be limited by absorption and scattering of light by suspended particulate matter. Data from glacially-fed Eklutna Lake reveal a close correlation between the rate of exponential decay of illumination with depth and surface turbidity levels, (R&M Consultants, 1983). Quiescent settling of particulate matter in winter allows relatively low turbidities in early summer and a corresponding maximum depth of vertical illumination. If the depth of the euphotic zone is taken as the depth of penetration of 1% of illumination available at the surface, photosynthetic activity in the reservoir may extend from the surface to as much as 17 meters depth. Suspended sediment introduced by summer streamflow will quickly increase surface turbidity levels and reduce the depth of the euphotic zone accordingly. Mid to late summer euphotic zone depths may be as low as 2 meters (Fig. E.2.147). With reduced surface turbidities in the fall, an increase in vertical illumination is expected. However during the breakdown of density stratification in the fall, turbulent mixing of turbid strata in the water column will increase turbidities once again, reducing illumination somewhat until inverse temperature stratification and ice cover formation occur.

The nature and concentration of suspended sediment at the powerhouse intake will control turbidity and vertical illumination in the river downstream between Watana and Talkeetna. The reduction in summer turbidity levels from pre-project conditions will cause an increase in vertical illumination and hence photosynthesis. In fall and winter, relative post-project increases in downstream turbidities will reduce illumination intensity, although 1 percent light penetration depths are likely to be greater than 2.4 meters in open water areas with a gradual increase in light penetration through the winter.

W-2-034 Paragraph 4: It is stated that, "...the river will be clearer than under natural conditions." This may be true during the summer; however, it is our understanding that this will not be the case during the winter.

Response

The statement that the river will be clearer than under natural conditions was meant to reflect summer conditions only. Section 4.1.2(e)(iii) has been amended accordingly.

W-2-035 . Watana to Talkeetna: We believe the increase in winter turbidity might be more important in terms of potential fishery impacts. Quantification of potential changes should be provided. The methodology by which the summer turbidity levels were established and why it is not applicable to predicting winter conditions needs to be explained.

Response

See response to ADF&G comment G-2-042.

W-2-036 . Talkeetna to Cook Inlet: Anticipated changes during the winter should be discussed.

Response

The anticipated changes in suspended sediment and turbidity in the Talkeetna to Cook Inlet reach during the winter have been incorporated in Section 4.1.2(e)(iii).

(v) Effects on Groundwater Conditions

W-2-037 - Impacts on Sloughs: Paragraph 1: The potential impacts on slough habitats are not clearly described. The discussion provides the impression that there is a greater understanding of the groundwater relationship between the sloughs and mainstem than is warranted by studies to date. Please refer to our comments under Section 2.3(a)(i) - Sloughs.

Response

The potential impacts on slough habitats have been revised in Section 4.1.2(f)(ii). Further information on slough hydrogeology can be found in the Ground Water Studies Report (Acres, 1983).

W-2-038 Paragraph 4: It is indicated that reduced staging would result from the decreased winter flows. The potential impact should be addressed in regard to the potential to dewater spawning and rearing habitats.

Response

As discussed in the response to comment W-2-029 above, natural flows will be released from November through April. Since ice staging occurs in November and December, reduced staging should not occur. However, a delay in ice cover formation and, hence, staging will occur.

W-2-039 Paragraph 5: Although the temperature relationship of the mainstem and sloughs does not appear to be well understood, discussion should be included on this potential impact, particularly during the second year of filling when the differences from pre-project conditions are greatest.

Response

The temperature relationship of the mainstem and sloughs is fairly well, although not totally, understood. As discussed in Section 4.1.3(c)(i), the slough water temperatures are related to the long-term average mainstem temperature which is approximately 3°C. For about eight months during filling, the low level release will be passing water which is near 4°C. Therefore, near the Watana reservoir outlet and for some distance downstream, temperatures will be warmer than the natural winter conditions, but cooler from May to August, the time at which the release facilities will be operable. The net effect will be an increase in temperature above natural conditions for this time period of about 1°C.

Further downstream, temperatures at Gold Creek from November through April will have cooled to an ambient 0°C and from May to "August will average 5 to 6°C (see Figures E.2.141 to E.2.146). Hence, at this location there will be a net decrease in average temperature for this period. However, the difference is less than 1°C. When these temperature changes are considered in conjunction with the buffering effect of the soil skeleton, the impact on ground water upwelling temperatures of this eight-month period should not be significant. Prior to and after this period, temperatures will be close to ambient except for a period in the fall when they will be warmer and a period in spring when they will be cooler.

W-2-040 (vii) Effects on Instream Flow Uses: Please refer to our comments on Section 2.3(a)(i) - Sloughs, and 3.2(b)(v) - Impact on Sloughs. The statements of no temperature effects are not supported by data or citation. The reduction of flows through these sloughs is not quantitatively defined. The loss of scouring flows to clean fines, remove beaver dams, and clear ice could result in significant loss or degradation of slough habitat for fish.

Response

For a discussion of the temperature effects in sloughs, refer to Section 4.1.3(c)(i). Flow rates through sloughs contributed by upwelling will not change significantly. However, without mitigation, there will be a dewatering of the upper areas in some sloughs during summer because of a lowering the mainstem water level and, hence, ground water table. Refer to Section 4.1.2(f)(ii) for a complete discussion. The comment on a loss of scouring flows is discussed in the response to comment W-2-028.

(c) Watana Operation

W-2-041 - Minimum Downstream Target Flows: The criteria are not provided which led to the development of the "target" flows. Apparently, no consideration is provided concerning maximum flows, which may be a more important consideration during winter than establishing a minimum flow level.

Response

Criteria considered in the development of the "target" flows are provided in Sections 3.4 to 3.6. We concur that consideration should be given to maximum flows during winter. At present the maximum winter powerhouse discharge as determined by the weekly energy simulation program is 16,000 cfs. This maximum will be examined in future project operation simulations.

W-2-042 . Monthly Energy Simulations: Paragraph 1: The potential impacts of the water year 1969 extreme drought should be fully addressed. The effect of this naturally occurring event should be described in regard to Watana operations, how downstream flows would be maintained, and how it would effect the biological resources. For example, we suspect that higher downstreams flows would be necessary to allow entrance to sloughs during this period.

Response

The potential impact of a drought year such as water year 1969 is discussed in Section 3.2.8. Downstream flows would be maintained during the summer of the drought occurrence. By the end of September, the reservoir elevation would be well below the normal level at approximately El 2125. The available energy would be distributed over the October to May time period. Discharge from water taken out of storage would average 4000 cfs. With the natural flow averaging 1000 cfs during this time period, total flow from Watana would be 5000 cfs. Thus, the minimum flow of 5000 cfs would be maintained throughout the winter. Only with a late spring breakup would there be a problem of maintaining a flow of 5000 cfs. If this occurred Watana would become a run of the river power plant until natural flows exceeded downstream flow requirements.

W-2-043 . Daily Operation: In that the Devil Canyon development may not come online for many years, if ever, consideration should be given to operations without the Devil Canyon dam. A greater level of concern and discussion should be forthcoming on avoidance of potential impacts to the sloughs above Gold Creek.

Response

The operation of Watana before Devil Canyon comes online is discussed in Section 4.1.3(a)(i). Discussion of the avoidance of potential impacts to the sloughs above Gold Creek can be found in the response to comment W-2-026.

- Floods

W-2-044 . Spring Floods: Paragraph 2: In that spring floods are part of the pre-project regime, discussion should be provided as to the importance of this phenomenon and whether or not post-project simulated spring floods should be included in the post-project flow regime.

Response

During spring floods, there can be a substantial supplement to in Watana discharges contributed by the drainage area between Watana and Gold Creek. Examples of this for daily simulations of years 1964, 1967, and 1970 are illustrated in Figures E.2.156, E.2.157 and E.2.158. In the 1964 simulation, the spring flood flow is 24,000 cfs at Gold Creek.

The spring floods are of paramount importance to the project. This flow provides the necessary annual storage which is subsequently released for winter power generation. Hence, at this time, no simulated spring floods have been included in the post-project flow regime. Further information on the consideration of simulated spring floods can be found in Section 3.6.3(d).

W-2-045 (ii) River Morphology: Paragraph 2: The discussion on ice process should be expanded.

Response

The discussion on ice processes has been expanded and is contained in Section 4.1.3(b).

W-2-046 Paragraph 3: The discussion leads to a view that eventual loss of the slough habitats is inevitable. The flow regime proposed does not counteract this potential problem. Avoidance of this impact through flow modifications is consistent with the APA Mitigation Policy document and NEPA. It illustrates a low level of biological consideration in the formulation of the proposed instream flow regime.

Response

The loss of slough habitats is not inevitable (see Chapter 3, Section 2.2.2(b)(ii), Fisheries.

The flow regime proposed does not avoid habitat impacts. It does, however, minimize certain impacts while improving the technical feasibility of other mitigation options.

Avoidance of fisheries impacts strictly through flow modifications is not consistent with the Power Authority Mitigation Policy since the passage of avoidance flows would be in severe conflict with other project objectives (i.e., economics and power production), and alternative mitigation measures are available (i.e., slough modification and enhancement).

(iii) Water Quality

- Water Temperature

W-2-047 . Reservoir and Outlet Water Temperature: Paragraph 2: 1982 data from Eklutna Lake, which Watana Reservoir is expected to mimic, was presented at the Susitna Hydro Exhibit E Workshop. During the winter, Eklutna Lake showed temperatures ranging from 0° to 3.6°C in the upper 2 meters, dropping to isothermal conditions below this depth. If Watana Reservoir exhibits a similar shallow winter stratification, it would appear that Watana could not be operated to, "...take advantage of the temperature stratification within the reservoir."

Response

See response to comment W-2-049.

W-2-048 Paragraphs 5 through 7: Given that the temperature model has only been run for five months and has only one year of data for that period (1981), this discussion must be considered speculative. It is our understanding that input for this model is lacking because previous data was tailored to an earlier temperature model which is no longer considered applicable to this project. It would seem premature to place much faith in the new model based on the minimal level of testing to date. We recommend that data from two full years be inputted to the model and the results be provided in the Exhibit E.

Response

Your recommendation that data from two full years be inputted to the DYRESM temperature model will be considered during the planning of future studies.

W-2-049 Paragraph 8: This suggests that winter outflow temperatures between 1° and 4°C can be selectively withdrawn through a multi-level intake structure. This would be dependent upon the thermal profile of the reservoir during the winter, a period which has so far not been modeled. The statement suggesting that one degree water temperatures can be selectively obtained is speculative. It is also in conflict with the information provided at the Susitna Hydro Exhibit E Workshop where Eklutna Lake was presented as a model for Watana Reservoir. Eklutna Lake showed winter temperatures between 0°C and 3.6°C within the upper two meters of the surface. If Watana Reservoir shows a similar winter stratification, one should not expect to be able to tap temperatures other than 4°C with the proposed multi-level intake structure. It would have been appropriate to reference the Eklutna study findings here as is done on Page E-2-61.

Response

We concur that winter outflow temperatures would be dependent upon the thermal profile of the reservoir. The results of the winter temperature modeling are discussed in Section 4.1.3(c)(i). Eklutna Lake temperature modeling was underaken to determine the suitability of the temperature model DYRESM in predicting temperatures in a glacially fed reservoir. Watana would not necessarily exemplify the same temperature structure. There is good agreement with actual Eklutna Lake measurements and model predictions from October through December.

It is possible that a period of calm, cold weather could have caused an ice cover to form on Eklutna Lake in the fall of 1981 shortly after the lake reached an isothermal temperature of 4°C, with the result that the ice cover could have acted as a thermal insulator preventing further heat loss. This could have caused the Eklutna Lake profile measured on April 16, 1982, which showed winter temperatures between 0°C and 3.6°C within the upper two meters of the surface. However, we do have suspicions on the validity of the measurements. Recent temperature measurements taken on January 10, 1983, showed the temperature varying from 0°C at the surface to 1.6°C at 2 meters, to 2.6°C at 10 meters, to 3.0°C at 15 meters, to 3.2°C at 20 meters, and to 3.4°C at 25 meters.

At Williston Reservoir in British Columbia, Canada, winter temeprature profiles were measured on April 14 and 15, 1982 (Figure E.1.168). These profiles indicate a gradual increase in temperature with depth. Outlet temperatures from the G.M. Shrum powerhouse were 1.8°C at this time.

In 1977, recorded water temperatures at the G.M. Shrum tailrace indicated a gradual temperature decrease from 3°C in early January to approximately 1.3°C at the end of January. February temperatures varied between 0.4°C and 1.9°C, averaging about 1.2°C. In March, tailrace temperatures warmed up to about 2°C. Therefore, based on the temperature modeling and experience elsewhere, temperature regulation during winter is possible. However, to state that a temperature of 1°C can be maintained may have been optimistic.

W-2-050 . Slough Water Temperatures: Paragraph 1: Please refer to our comments on Section 2.3(a)(i) - Sloughs.

Response

Refer to the response to comment W-2-002.

W-2-051 - Ice: Paragraph 1: It should be clarified as to what would be the impact of the reduced contribution from the upper Susitna River. Estimations of post-project ice staging should be compared to pre-project conditions and the methodology by which the predictions were made should be explained, and/or referenced.

Response

Comment noted.

W-2-052 Paragraph 2: How ice is lost to the system post-project, would dramatically change from pre-project conditions. The impact of this major change in this riverine system should be thoroughly explored, not merely noted.

Response

The post-project changes in ice conditions have been expanded in Section 4.1.3(c)(ii).

W-2-053 - Turbidity: Paragraph 1: Please provide an explanation as to why, "Turbidity in the top 100 feet of the reservoir is of primary interest.

Response

Turbidity in the top 100 feet of the reservoir is of primary interest because this is the layer in which photosynthesis would occur.

W-2-054 - Nitrogen Supersaturation: Discussion should be provided specific to the fixed-cone valves. It is stated that the valves would discharge spills up to a one in 50-year event, but we have no indication of the anticipated extent of their use. Withdrawing water from the hypolimnion; they would often be counterproductive to what is intended to be achieved through use of the multi-level intake. The potential for thermal shock in fishes, or shock due to rapid shifts in other water quality parameters, should be evaluated. Rapid water level changes would also be an obvious result of their use, particularly between the dam face and the powerhouse.

Response

The anticipated usage of the fixed-cone valves has been incorporated in Section 4.1.3(a). The release facilities at Watana will be drawing water from between El 2025 and El 2085. This corresponds to an average depth of 130 feet when the reservoir water surface is at El 2185. Since flow releases occur only after the reservoir is full and since this occurs in August or September, then if it is assumed that the temperature profiles are appropriate and water is drawn uniformly over the intake, the water temperature through the release facilities will be about 8°C. Hence, thermal shock will not occur and most water will be withdrawn from the epilimnion where no adverse water quality conditions are expected to exist.

3.3 - Devil Canyon Development

W-2-055 (a) Watana Operation/Devil Canyon Construction: Paragraph 1: The referenced Exhibit A has not been provided, although we requested it.

Response

See the response to comment W-2-015.

(ii) Water Quality

W-2-056 - Concrete Contamination: Please refer to our comments on Section 3.2(a)(ii) - Contrete Contamination.

Response

Refer to Section 4.1.1(c)(vi) for a discussion of the potential impacts associated with concrete construction activities. A detailed pollution control contingency plan will be developed in compliance with appropriate regulations. Refer to Section 6.2 for proposed mitigation measures.

W-2-057 (vi) Facilities: Decisions regarding the Devil Canyon support facilities were made without input from resource agencies.

Response

Resource agencies will have an additional opportunity to provide input on decisions regarding the Devil Canyon support facilities during the detail design.

W-2-058 - Construction, Operation and Maintenance: The, "...appropriate preventative techniques..." should be described and incorporated into the mitigation plan.

Response

Mitigative techniques are described in Chapter 3, Section 2.4.3. and Chapter 2, Section 6.2.

(b) Watana Operation/Devil Canyon Impoundment

(iii) Effects on Water Quality

W-2-059 - Water Temperature: The ability to continue to selectively remove very narrow temperature bands would depend upon numerous unknowns, assuming the ability exists with operation of Watana alone. Removal of such a sizable quantity of water in so short a period of time certainly would have implications for one's ability to select temperature bands during certain times of the year. It should be stated that the temperature model upon which this all rests only has input from five months of one year.

Response

Devil Canyon Reservoir will be filled either during the fall or winter. The outlet temperature from Watana will be close to 4°C. Hence, it will not be necessary to, nor will it be possible to, select temperature bands during filling.

The statement that the summer temperature modeling is based upon five months of input from one year is correct. The value of the five months of summer reservoir modeling is that it demonstrates that downstream temperature control is possible with the proposed design of the intake structures.

W-2-060 - Support Facilities: Please refer to our comments on Section 3.3 (a)(v8) - Construction, Operation, and Maintenance.

Response

See the response to comment W-2-058.

W-2-061 (vi) Instream Flow Uses: It is our understanding that significant losses to the existing fisheries would result. The basis for the statement that, "...additional fishery habitat will become available..." with Devil Canyon Reservoir should be explained in detail.

Response

Refer to Chapter 3, Section 2.3.2(c)(i).

(c) Watana/Devil Canyon Operation

(i) Flows

W-2-062 - Project Operation: It is indicated in the Feasibility Report Vol. 1, page 13-32, that compensation flow pumps would be installed. An explanation as to the function of these devices, their purpose, the flows which they would provide, whether or not they are to be installed in one dam or both, how water from this source would affect the water quality parameters of the water released from the powerhouse, and the basis for the flows which would be provided from this source should be provided. We would also like to see an explanation of the fixed-cone valves regarding their expected periodicity of use (at least by month) and impacts on water quality parameters and flow levels.

Response

The compensation flow pumps have been eliminated. It is our opinion that the cost of the compensation flow pumps does not warrant providing a fishery flow in the 3300 feet that would be dewatered downstream from Devil Canyon. The operation of the fixed-cone valves is discussed in Section 4.2.3(a).

(ii) Effects on Water Quality

W-2-063 - Water Temperatures: Since Devil Canyon Reservoir has not yet been modeled, the rationale for this discussion should be presented. The thermal models for Watana and Devil Canyon should provide information on the following:

(1) The temperature profile, depth to isothermal conditions, and timing of mixing:

(2) The timing of winter stratification;

(3) The extent of turbulence that would be generated at the reservoir intake; and

(4) The capability of the intake structure to select from one temperature layer in a stratified reservoir.

This should be included in the Exhibit E.

Response

Results of Devil Canyon Reservoir modeling have been incorporated into Chapter 2, Section 4.2.3(c)(i).

W-2-064 - Ice: Please refer to our comments on Section 3.2(c)(iii) - Ice. Information should be provided on the extent of scour in the sloughs under winter and spring breakup conditions. Discussion should address where the ice front would develop under "worst case" conditions for post-project Watana and Watana/Devil Canyon operations. Fluctuating high power demand in a record cold year and a record warm year should be discussed. Scenarios which would produce over-topping of river ice and multiple breakups which may scour the river channel should be described.

Response

Information on the extent of scour in the sloughs under winter and spring breakup conditions is discussed in Section 4.2.3(c)(ii). Worse case conditions are also described.

W-2-065 - Nitrogen Supersaturation: Please refer to our comments under Section 3.3(c)(i) - Project Operation.

Response

The operation of the fixed-cone valves is explained in Section 4.2.3(a). The expected frequency of use for various energy demands is illustrated. Except for temperature, water quality is not expected to be significantly different than powerhouse outflow water quality conditions.

W-2-066 - Facilities: Erosion control measures should be described and incorporated into the mitigation plan.

Response

Erosion control measures have been described and incorporated into the mitigation plan in Chapter 3, Section 2.4.3(c). A detailed erosion control plan will be prepared subsequen to FERC licensing.

W-2-067 3.4 - Access Plan Impacts: Paragraph 2: Reference is made to Exhibit A. By letter dated November 19, 1982, we requested a complete copy of the license application. We have not yet received this Exhibit.

Response

See the response to comment W-2-015.

W-2-068 (a) Flows: Accurate discharge information on the creeks is needed to insure proper culvert sizing for fish passage. Utilization of culverts rather than bridges could result in more blockages to grayling migration due to beaver activity.

Response

We concur that accurate discharge information on the creeks is needed to insure proper culvert sizing for fish passage. During final design of the access route, appropriate information will be collected to insure proper culvert sizing.

W-2-069 3.5 - Transmission Corridor Impacts: Please refer to our letter dated January 5, 1982, regarding the Transmission Corridor Report.

Response

Our response to this letter is contained in Chapter 11.

5 - MITIGATION, ENHANCEMENT, AND PROTECTIVE MEASURES

W-2-070 5.1 - Introduction: Paragraph 2: It is stated that, "... mitigative measures," were incorporated, "...in the preconstruction planning, design, and scheduling," yet we see construction camps/villages which were planned with no outside coordination with resource agencies, or even consideration of alternatives. The transmission corridor from the Watana dam was also planned with essentially no resource agencies input. We see scheduling (based on an out-of-date economic analysis), determining access routing, timing of construction activities, and reservoir filling with no input from resource agencies. This has precluded an objective examination of alternative mitigation measures.

Response

As detailed in Chapters 10 and 11, considerable effort has been directed toward coordination with resource agencies and examination of alternatives.

W-2-071 Minimum flows are proposed with the impression that they were arrived at through an as yet undisclosed fisheries vs. economic tradeoff. In the draft Exhibit E, we have an evaluation of economically determined flow releases, the basis for which are not longer accepted by the economists that developed them (Battelle Newsletter #4 (Final), Railbelt Electric Power

Alternatives Study, December 1982), competing against flow releases. The 12,000 cfs flow release is apparently the maximum discharge for August without significant economic effects.

Response

Refer to Sections 3.2 to 3.7 for the discussion on the selection of minimum flows.

W-2-072 We suspect that the flexibility for providing instream flows, once this issue has been resolved, is highly dependent upon the hydraulic turbines which are selected for the project. We recommend that a tradeoff analysis be presented to display the relationship of different hydraulic turbine configurations with both a one dam and two dam configuration related to maximizing flow release options vs. more flexible turbine system alternatives. If the proposed turbines, in either dam, would adversely effect future instream flow options than the decision as to the preferred turbine configuration should be deferred until a specific, detailed flow release schedule, developed through a quantified instream flow analysis, is agreed upon which would mitigate impacts or enhance conditions for spawning, feeding, passage, out-migration, and overwintering in ths Susitna River.

Response

Premature turbine sizing is recognized as a generic F&W concern since it can result in reduced discharge flexibility.

As designed, however, the Susitna project is capable of efficiently operating at any flow above 1500 cfs up to the maximum of the powerhouse.

W-2-073 The proposed multi-level intake structure would provide the flexibility to select a desirable temperature regime only if the temperature bands exists in the reservoir of sufficient size and of sufficient depth. It has not been established that the multi-level intake would provide sufficient temperature control. At present, Watana Reservoir has been thermally modeled for five months of one year. It is our understanding that this is insufficient to even test the model for the five months for which it was run. Devil Canyon Reservoir has not been modeled, yet the recent incorporation of a multi-level intake here leads one to believe the applicant expects this reservoir might stratify. We recommend that modeling be carried out for both reservoirs, throughout the year, and the resultant data be incorporated into a river temperature model. This should be based upon two years of data (e.g., 1981 and 1982) and presented in the license application.

Response

We agree that the proposed multi-level intake structure would provide the flexibility to select a desirable temperature regime only if a temperature band of sufficient size and of sufficient depth exists in the reservoir. Based on the modeling effort to date, in our judgment, temperature control is provided through the multi-level intake. As with any modeling effort, additional modeling would provide added confidence in the ability of the multi-level intake to control outlet temperatures. The Devil Canyon reservoir modeling is contained in Section 4.2.3(c)i).

W-2-074 Reference is made to the incorporation of fixed-cone valves to prevent nitrogen supersaturation. The frequency, periodicity, and anticipated volume of use is not addressed. Since they would be drawing upon water very low in the dam and then dumping an unknown volume of this water into an essentially dry riverbed, we would expect potential adverse impacts to the mitigation flow and temperature regimes. The potential effects upon icing conditions and, depending upon the time of year, salmon movements needs to be assessed. We recommend that these potential impacts be discussed in the Exhibit E.

Response

Information on operation of the fixed-cone valves including frequency of operation and anticipated volume are contained in Section 4.1.3 and Section 4.2.3. At Devil Canyon, the release facilities would be discharging onto bedrock. Hence, adverse impacts on suspended sediments or turbidity are not anticipated. The release facilities at either dam would be operated during winter months only during a power outage to maintain minimum flows. If an outage occurred, outlet temperatures would be warm enough to prevent icing conditions from occurring.

W-2-075 Paragraph 3: The importance of monitoring construction practices, operation and maintenance and monitoring of mitigation is recognized in the APA Mitigation Policy document. How this will occur needs to be examined in the Exhibit E. We recommend that a panel of appropriate state, federal, and local agency personnel be established, at project expense to monitor project construction, operation, and maintenance. The monitoring panel, mandate, and operational mechanisms should be discussed in the license application.

Response

See the response to comments in FWS covering letter.

W-2-076 5.2 - Construction: Please refer to our comments above, Section 5.1: Paragraphs 2 and 3.

Response

See the response to comments W-2-070 and W-2-075.

W-2-077 Paragraph 2: Please refer to our discussion of instream flows under Sections 5.1: Paragraph 2, 3.2(b)(i) - Minimum Downstream Target Flows, and 3.2(c) - Minimum Downstream Target Flows. Additional pertinent comments can be found throughout. The statements contained in Section 5.3 can only be considered speculative; to date, there are no studies to support them. Only one slough, identified as #9, has received detailed study. In the November 1982 draft report provided at the Susitna Hydro Exhibit E Workshop, Preliminary Assessment of Access by Spawning Salmon to Side Slough Habitat above Talkeetna, the author noted that until the 1982 field data are analyzed, any statements regarding streamflows necessary for chum salmon access to the side sloughs are provisional. It should also be recognized that the examination of slough access flows is not only without support, but one dimensional. No analysis is put forth to examine other life phases of fish, or project related changes in water quality parameters.

Response

As discussed in Chapter 3, Sections 2.3.1(a)(ii), 2.3.1(a)(iii), and 2.4.4(a)(i), the analysis did consider other life phases. As has been discussed in other comments and in Chapter 3, Section 2.4.2, mitigations focused on chum salmon as the evaluation species. Although provisional, statements regarding slough access flows are not without support.

W-2-078 Paragraph 5: Changes in downstream river morphology have not been fully assessed. It is premature to conclude that no mitigation would be necessary. The lack of ice scour and flood flows may cause sloughs to silt in and may reduce natural cleaning processes necessary to maintain productive spawning substrate and rearing areas.

Response

The discussions on changes in downstream river morphology have been expanded in Section 4.1.2(d). As discussed in the fishery mitigation section in Chapter 3, sloughs that will be adjacent to ice covered sections of the mainstem and have berms constructed at their upstream ends will be maintained on a five-year rotating basis. At sloughs located upstream from the ice front, during wet years, excess flow will be released from the damsites, providing flushing flows.

W-2-079 Paragraph 6: It would seem appropriate to examine, in the Exhibit E, methods of mitigating the potential thermal effects anticipated during the filling period, to include extending the filling period.

Response

Methods of mitigating the potential thermal effects anticipated during the second year of filling will continue to be investigated during the detailed design process. One potential mitigation is a shorter filling regime. This would enable a flow release through the outlet facilities early in the second summer of filling.

5.4 - Mitigation of Watana Operation Impacts

W-2-080 (a) Flows: Paragraph 2: Please refer to our comments under Section 5.1: Paragraph 2 and Section 5.3: Paragraph 2.

Response

Refer to responses above.

W-2-081 Paragraph 3: It is stated that, "Watana, when it is operating alone, will be operated primarily as a base load plant." Please discuss the extent to which it is intended to be operated as a peaking facility. Of particular concern would be how it might operate under worst case conditions, such as fluctuating high power demand during a record cold year. The implications of scenarios like this should be explored in the Exhibit E if Watana is being proposed for periodic peaking use.

Response

It is intended that from October through April, there will not be more than a 2000 cfs spread between maximum and minimum powerhouse discharges within a 24-hour period during Watana operation.

W-2-082 (b) Temperature and D.O.: Please refer to our comments addressing the multi-level intake structure and reservoir temperature modeling in Sections 5.1: Paragraph 2, and 3.3(b)(iii) - Water Temperature. We have provided additional comments on these subjects throughout.

Response

Refer to previous comments.

W-2-083 (c) Nitrogen Supersaturation: Please refer to our discussion of the fixed-cone valves under Sections 3.2(c)(iii) - Nitrogen Supersaturation and 5.1: Paragraph 2.

Response

Refer to previous comments.

5.6 - Mitigation of Devil Canyon/Watana Operation

W-2-084 (b) Temperature: Discussion should be provided as to why multi-level intake ports are proposed at Devil Canyon. It would appear that it has been concluded, without benefit of a thermal reservoir model, that Devil Canyon would stratify.

Response

Refer to Section 4.2.3(c)(i) wherein a discussion on the results of the Devil Canyon thermal reservoir modeling has been presented.

COMMENTS CONTAINED IN THE U.S. FISH AND WILDLIFE SERVICE (FWS) LETTER OF JANUARY 14, 1983

CHAPTER 3 - FISH, WILDLIFE, AND BOTANICAL RESOURCES

GENERAL COMMENTS - FISHERIES

Comment 1

Periodically in the Fishery Section are disclaimers such as, "Much of the discussion is based on professional judgment," (Section 1.2, Page E-3-3), or "Many of the statements are speculative...and... unsupported," (Section 2.3, Page E-3-56). Other statements let us know that ongoing, or planned studies, will fill these numerous data gaps to allow a quantification of the resources and impacts (Sections 2.2(b)(ii), 2.4(b)(ii), 2.5, 2.5(c)(ii), etc.) and let us go beyond, "The conceptual mitigation plan," (Section 2.5, Page E-3-116) which is provided in this chapter. Recognizing a problem does not, in and of itself, correct it. We are concerned that the Fishery Section generally fails to quantify the existing resources, fails to quantify the potential impacts, and fails to provide specific mitigation measures to deal with identified, quantified, adverse impacts. Once we have potential mitigation measures, these proposals would need to be evaluated, for example, in regard to potential impacts on: project costs, design, and feasibility; socioeconomic considerations; and fish and wildlife resources other than those for which the mitigation is targeted. This type of evaluation would form the basis of an acceptable environmental impact statement and should be provided as part of the license application.

Response

At the request of resource agencies, efforts were made to distinguish between highly speculative comments and those of a more quantifiable nature. The inclusion of this information was meant to assist the reader, not to disclaim the logic or validity of the assessments presented.

Comment 2

The ongoing and planned studies which are frequently cited (Sections 2.2(b)(ii), 2.4, 2.4(b)(ii), 2.5, 2.5(c)(ii), etc.) should be fully identified so we can examine them in regard to their scope. We cannot, otherwise, determine what needs to be done and what is being done (with assurances that it will be done).

Response

Agencies' determination of what they consider needs to be done should be based upon their review of the information contained in the FERC license application. The supply of this review to FERC and the Power Authority will have a major influence upon what will be done.

Comment 3

Potential impacts are frequently identified in the Fishery Section, such as loss of the apparently important high spring flows for out-migrations (Section 2.3[a][ii]). Potential mitigation to contend with these anticipated adverse impacts are suggested, such as spiking spring flows (Section 2.4[b][ii][SIC,iii]). If these mitigation proposals have validity, then they should be incorporated into the design and operations proposal.

Response

The mitigation proposals identified have merit. However, they will not be incorporated until their environmental benefit vs. cost is more fully evaluated.

Comment 4

Mitigation measures which are proposed should have proven success in Alaska, or in a similar environment. If the proposals are not proven, then they would need to be demonstrated effective in the project area. For example, hatchery propagation of grayling may need to be demonstrated as an effective alternative since grayling hatcheries have not been particularly successful in Alaska. Likewise, the proposed slough modifications are unproven and, thus, should also be demonstrated in the Susitna system before project operation.

Response

This suggestion is compatible with our approach as indicated by our proposed evaluation of slough habitat enhancement.

Comment 5

We support the establishment of a monitoring program funded by the project, containing a board of representatives from appropriate state, federal, and local agencies. The board should have the authority to recommend project modification measures to assure that mitigation is effective. The procedure by which this would occur should be incorporated into the license as an article. This type of monitoring program should be discussed in the mitigation plan.

Response

The Power Authority mitigation policy contains a provision for program monitoring. If a board of representatives from appropriate state, federal, and local agencies is established, it will be necessary to determine the authority, funding, and composition of such a board.

COMMENTS CONTAINED IN THE U.S. FISH AND WILDLIFE SERVICE
LETTER OF JANUARY 14, 1983

GENERAL COMMENTS - BOTANICAL RESOURCES

Comment 1

At the recent Susitna Hydro Exhibit E Workshop, November 29 to December 2, we were pleased to learn of the recent efforts to coordinate botanical and wildlife data needs. Vegetation types within the project area are apparently now being subcategorized and remapped on the basis of more recent, larger scale photography and additional field work. Analyzing the value of vegetation as part of wildlife habitat, an information need we have consistently cited (e.g., FWS letter to Eric Yould, APA, October 5, 1982), will better allow quantification of project impacts and the development of mitigative measures. However, these efforts render the current Botanical Resources Section at least partially obsolete.

Response

Paragraph 1: We concur that as the mitigation planning process proceeds, the impact assessments and planning documented in Exhibit E will become "at least partially obsolete." This is as it should be. The Susitna project approach to mitigation is one of iterative refinement based on continuing data analysis and close cooperation between project engineers, environmental specialists, and agency representatives. Exhibit E is based only on preliminary design commensurate with completed feasibility studies. As the project enters the detailed design stage, impact assessment and mitigation planning will not only influence ongoing design, but change with it as well.

Comment 2

Because there is no explanation of ongoing studies, the reader is left with the perception that vegetation studies have been completed. We recommend that descriptions of the following be provided in the Exhibit E: (1) current remapping efforts for both overall vegetation and wetlands; (2) plans for summer 1983 ground truthing of this data; (3) 1984 field work which may be necessary for verifying wetlands; (4) proposed productivity studies relative to project moose studies (see Section 4.2[a][i], Page E-3-204, Paragraph 2 and Section 4.3[a][i], Page E-3-281, Paragraph 3); and (5) schedules for completing these investigations and analyses in conjunction with overall mitigation and project planning. Such information is provided, to some extent, relative to the Aquatic Studies Program, Section 2.5.

Response

Paragraph 2: All of the requested information has been incorporated into the mitigation plan for botanical resources (Section 3.4).

Comment 3

In general, the description of vegetation types and potential project impacts is thorough. Still, a major problem with this section involves incomplete coverage of wetlands. Minor problems involve the need for some additional maps and tables, conflicting citations of figures and tables (e.g., referring to Figure W1 and Table W3 as Figure E.3.W1 and Table E.3.W3 in the text).

Response

Paragraph 3: We appreciate your statement that "In general, the description of vegetation types and potential project impacts is thorough." We have recognized the need for greater documentation of wetland areas, potential impacts to wetlands, and how these impacts will be mitigated. All previous wetland mapping is incorporated in the revised Exhibit E, and quantification of wetland impact areas is provided to the extent justified by the mapping detail. Our technical meeting of December 2, 1982, on wetlands was held to find ways to improve the project analysis of wetlands, and a new mapping program described in the text (Sections 3.2.3 and 3.4.2) is in its early stages as a result of that meeting.

GENERAL COMMENTS - WILDLIFE

Comment 1

We found the Wildlife Section both too general and incomplete. Judgmental statements are rarely referenced (e.g. page E-3-376, last paragraph) qualitative terms are seldom defined (e.g. page E-3-315, last paragraph; page E-3-310). Perhaps most critical is the minimal detail and coverage of the mitigation plan.

Response

The comment concerning judgmental statements apparently refers to the prioritization of species. The utilization of a prioritization scheme is inescapable. A discussion of its advantages and drawbacks can be found in Section 4.1 Introduction. The actual priorities assigned are justified in Sections 4.1.2 and 4.1.3 and specific values of each species are referenced throughout the text. The assessment of the importance of a species is obviously dependent on the opinion and background of the assessor. While an ecologist might not agree with an assessment based on socioeconomic considerations, these priorities are legislatively mandated. Even from a sociopolitical viewpoint, differences in priorities are arguable. In actual fact, the method is far from biologically meaningful and the exact order in which species are treated matters very little from that standpoint. See specifically Section 4.1 paragraph 2, sentence 4.

Most of your comments relative to definitions of qualitative evaluation lacking a succinct definition are premature. Where quantification is available data are provided. Where we have relied on relative, but unquantifiable analysis, the qualitative terms used are justified as thoroughly as possible in the ensuing text. The mitigation plan has been largely rewritten.

Comment 2

Lack of quantification is a serious problem throughout this section. While baseline populations are occasionally estimated, impacts are typically qualified only as major or minor, and no values are provided for those mitigation measures which are recommended.

Response

Where data are available quantification is provided. Estimation of populations is rarely possible in wildlife investigations. Where a defensible estimate can be made it is provided. Obviously if no population estimate can be made, other data may be used to predict the proportions of the population affected by various impacts. Your remarks regarding our consistent use of current populations rather than potential populations seem somewhat inconsistent with this comment.

Comment 3

We are highly concerned with the lack of attention to habitat values, although we have repeatedly cited the need for project evaluations to consider habitat values as well as populations (please refer to FWS letters to Eric Yould, 5 October 1982, 5 January 1982, 23 June 1980, and 15 November 1979; and testimony of LeRoy Sowl, FWS, before the APA Board, 16 April 1982). We appreciate the initial efforts to evaluate habitats for furbearers and birds, and the reported plans to model carrying capacity for moose. Yet we see no evidence of how such evaluations will be continued, expanded to other species, and most importantly, used in developing timely, comprehensive mitigation measures, which are an integral part of project plans.

Response

Where habitats can be evaluated and it is deemed appropriate, we have attempted to do so. In general, habitat is a poorly defined concept which attempts to define where animals are found.

The reasons for not utilizing the USFWS Habitat Evaluation Procedure (HEP) are both utilitarian and philosophical. Measures similar in concept to HEP may be the appropriate tool for assessing impacts for some species. Species which utilize their habitats in a simple, easily defined and measured way lend themselves well to such evaluation. Other, more opportunistic, complex or poorly understood species do not (see Mule 1982). Some species will never lend themselves to this approach and other techniques are more likely to prove efficient and effective. In its particulars, HEP is neither effective nor objective for most Alaskan species. There is no reason to assume that measures of vegetation characteristics alone will accurately predict the value of a particular area to every species, or that the biologist armed with such knowledge will be able to accurately predict the number of individuals of each species the area supports now or potentially under further idealized (but for whatever reason not presently attained) conditions. The development of a technique for evaluating impacts to various species is necessary and HEP is an admirable first attempt. However, the enforced use of this technique can only lead to poor management decisions and a confused, inaccurate assessment of impacts.

We would reiterate here that habitat value must first be based on an understanding on the nuances and intricacies of habitat use and will be useful only as a hypothetical construct for comparing general patterns of habitat use among species. Other methods of evaluating impacts are equally useful and often may be more efficient.

Comment 4

Where population information is provided, it is for the current situation. No accounting is given for long-term habitat potentials, for example, (1) habitats may be able to support greater populations over the long-term (e.g. pine marten near Watana Creek): (2) habitat values may decline as, through succession, vegatation proceeds to more mature stages which are less productive for moose; or (3) harvest management goals may be modified and caribou populations allowed to increase to where available habitats are more completely stocked.

Response

Many sections have been rewritten to address the likelihood of alteration of management goals and the carrying capacity of habitats. The range of possible changes in habitat values for moose is infinite. Where the project itself will affect such changes they have been well addressed. Moose in any area are dependent upon the periodic occurrence of vegetative recession and we consider the natural occurrence of this phenomenon before and after project construction to be treated as thoroughly as is presently possible.

Comment 5

We recommend providing information on continuing studies (including habitat modeling) and how data gaps identified here, in previous agency comments, and the August 1982 Adaptive Environmental Assessment (AEA) Workshop will be answered. Our Specific Comments below, further address this need. Another major problem is that the Wildlife Section is not integrated, nor is it consistent relative to impact potentials and mitigation options with other sections in Chapter 3 or with other chapters in the Exhibit E. For example, in Chapter 3 the impacts discussions are based on no access along the transmission corridor; in Chapter 5, such access is assumed (Section 3.7[c][i], page E-5-84).

Not only do we recommend that this problem be corrected, but that evidence be provided as to this section has been integrated into project designs and scheduling. That integration is most critical with regard to the mitigation plan. Information should be provided on the mechanism for notifying project engineers of key wildlife areas and at the same time for the engineers to notify the environmental consultants and resource agencies of design changes or mitigation measures they believe are unfeasible. Additional information should be provided on the process to be followed for finalizing and then implementing mitigation requirements.

Integration of the various report sections would be aided through an overview discussion of overall project objectives for wildlife, fisheries, vegetation, recreation, land use, and socioeconomics.

Response

Projects for which the APA has guaranteed support are described in as much detail as possible. No expansion of the studies mentioned to include other species is indicated. For several hypothesized impacts for which no production of occurrence or relative seriousness can be provided, monitoring programs are proposed. Appropriate levels and forms of mitigation must, in those instances, be relegated to future assessment. The mitigation section has been rewritten.

Comment 6

Presently we find apparent objectives of the Wildlife Section often contrary to recreation or socioeconomics; within the Wildlife Section, objectives for one species may conflict with those for another species.

Because of the voluminous nature and complexity of material involved, it is difficult to assess population status, habitat values, impacts, and mitigation for each species relative to all other species. This is particularly important where mitigation for one species may be at the expense of another, as above. Thus we suggest some type of summary chart which would show, by species: (1) populations; (2) habitat types and values; (3) status (i.e. increasing/decreasing, upper/lower basin, etc.); (4) values (commercial, recreational, and or subsistence with monetary figures where possible); (5) past and present harvest effort, success, and management restrictions; (6) impacts; and (7) mitigation alternatives. Please refer to our suggestions under Section 3.4 for evaluating mitigation alternatives as prioritized under NEPA guidelines. The schedule for filling resultant data gaps could then be outlined; additional mitigation needs or tradeoffs in benefits/impacts would also be obvious.

Response

Objectives of proponents of recreation, wildlife and socioeconomics are different by definition. Conflicts in mitigation plans for project features proposed by recreation, socioconomic and fisheries consultants have been identified and altered to avoid such inconsistencies. We are aware of no internal inconsistencies in the wildlife sections.

Comment 7

We recommend quantifying the level of mitigation to be achieved by different measures. This is particularly important where management policies are unclear (e.g. housing and transportation of workers, harvest regulations, and prohibitions on use of the access road pre- and post-construction will determine the magnitude of project impacts.)

Response

The mitigation section has been rewritten.

Comment 8

Finally, we are concerned that although the fragmentation of project impacts by project feature allows for a more comprehensible analysis, the report lacks a broad overview. Cumulative impacts are generally ignored. We recommend that such impacts be compiled in conjunction with a list of unavoidable adverse impacts.

Response

Cumulative impacts are treated in Section 4.3.6.

Comment 9

Lack of key data has made it essentially impossible to more than outline the types of measures which should be included in the mitigation plan. In many cases, no evidence is provided for the proven success of recommended measures in Alaska or similar environments. For such unproven measure, demonstration projects should now be established or backup mitigation measures outlined for implementation if unproven measures fail (e.g. blasting to enlarge the Jay Creek mineral lick, provision of artificial raptor nests).

The monitoring program we recommended under the Fishery Section should also be extended to wildlife resources in the project area.

Response

Unproven measures: Any hope of mitigation within the actual project area will depend on the willingness to allow an adaptive, experimental approach. However, all the measures proposed here are based on an understanding of known processes and biology and all are deemed entirely feasible with a high probability of success. The Susitna Hydroelectric Project Fish and Wildlife Policy includes provision for monitoring of wildlife populations.

SPECIFIC COMMENTS

1 - INTRODUCTION

1.2 - Impact Assessments

W-3-001 Paragraph 1: Please refer to our Fishery Section - General Comments regarding quantification and the status of the project studies.

Response

Refer to general responses.

W-3-002 Paragraph 4: Several of these references do not appear in the bibliography.

Response

This has been corrected.

1.3 - Mitigation Plans

W-3-003 Paragraph 8: Avoidance of adverse impacts rarely appears to occur, particularly in regard to project features. For example, missed opportunities to avoid adverse fish and wildlife resources impacts exist in: project scheduling; mode and routing of construction access; recreation planning; siting, administration, and type of construction camp/village; and instream flow regime.

Response

Avoiding impacts through design features or scheduling activities to avoid loss of resources has received highest priority, and this approach has been applied whenever possible. Environmental values have been given, and will continue to be given, equivalent consideration with other project parameters such as cost, schedule, etc. However, plannning based solely on environmental considerations would be contrary to NEPA and the Power Authority mitigation policy.

As identified in Chapter 10 and in our Development Selection Report, significant environmental impacts were avoided by selecting the middle Susitna basin. Impacts were further avoided by rejecting damsites downstream from Devil Canyon or upstream from Vee Canyon. As a consequence, in a number of subsequent planning decisions, the magnitude of the impacts being mitigated did not justify the cost, schedule, or energy differential between avoidance and other acceptable forms of mitigation.

W-3-004 The monitoring program, which has been supported in several chapters, should be fleshed out. The program should provide for participation by appropriate representatives of state, federal, and local agencies, be supported by the project, and be able to recommend changes in the mitigation program to be adopted through a mechanism established in the license, mutually acceptable to all concerned bodies.

Response

See response to General Fisheries Comment No. 5.

2 - FISHERY RESOURCES OF THE SUSITNA RIVER DRAINAGE

2.1 Overview of the Resources

W-3-005 (d) Selection of Project Evaluation Species: Paragraph 4: Improving habitat conditions for an evaluation species would be helpful to other species with similar habitat requisites. However, we would expect other species, with habitat requirements that conflict with evaluation species, to be adversely affected. In addition, we recommend Dolly Varden and burbot be included as evaluation species for the Susitna River downstream of Devil Canyon.

Response

It is true that some species with a lower evaluation priority may be more sensitive to change. In the Susitna River, however, the four Pacific salmon selected as evaluation species (chum, chinook, coho, and pink) utilize almost all available habitats at some point in their life cycle and are considered to be highly sensitive to change. Mitigations that prove effective at reducing impacts to the various salmon life stages should mitigate most impacts to the other species. These four species of salmon were selected as the evaluation species downstream from Devil Canyon. Dolly Varden and burbot are not considered to be more sensitive to the identified habitat changes than the various salmon life stages, thus mitigation of impacts to all salmon life stages should mitigate impacts to Dolly Varden and burbot. For example, Dolly Varden primarily spawn, incubate and rear in tributaries during the summer and overwinter in the mainstem or lower portions of tributaries. A similar pattern is followed by chinook, coho, and salmon.

W-3-006 Paragraph 6: It is stated that, "Improved conditions in the mainstem are expected to provide replacement habitat... Juvenile overwintering habitats are not expected to be adversely affected." We are unaware of specific data to support these statements.

Response

The discussion has been expanded to clarify and support the statement.

W-3-007 Paragraph 8: Evaluation species and life stages should be listed for the Cook Inlet to Talkeetna reach.

Response

The fish evaluation species that were selected for the Devil Canyon to Talkeetna reach also apply downstream from Talkeetna. The text has been revised to indicate this.

W-3-008 (i) Commercial: Species specific comparisons are made of commercial harvest to escapement. Perhaps a better gauge would be to provide estimated contribution to the commercial harvest, as is assessed in Chapter 5 (page E-5-70), or estimated contribution to the run. This, however, also would simplify the systems contribution, but would at least provide reviewers with a better understanding of production.

Response

These estimates have been made for the 1981 and 1982 estimated escapement past Talkeetna.

W-3-009 (ii) Sport Fishing: Paragraph 2: If more recent surveys are available, this section should incorporate them.

Response

Surveys from 1978 through 1981 have been incorporated.

W-3-010 (iii) Subsistence Harvest: The following three ADF&G reports would allow for a more expansive discussion of this important topic:

1. Forster, Dan. November 1982. The Utilization of King Salmon and the Annual Round of Resource Uses in Tyonek, Alaska. ADF&G. 55 pp. + appendices.

2. Stanek, Ronald, James Fall and Dan Foster. March 1982. Subsistence Shellfish Use in Three Cook Inlet Villages, 1981: A Preliminary Report. ADF&G. 17 pp. + appendices.

3. Webster, Keith. April 1982. A Summary Report on the Tyonek Subsistence Salmon Fishery, 1981. Upper Cook Inlet Data Report Number 81-3. ADF&G. 16 pp. + appendices.

Response

The expanded discussion of subsistence harvest is in Chapter 5.

2.2 - Species Biology and Habitat Utilization in the Susitna River Drainage
(a) Species Biology
(iii) Resident Species

W-3-011 - Arctic Grayling: Paragraph 8: The statement that, "Assuming other conditions for spawning are favorable,..." should be expanded to allow an understanding of what these other conditions are and why we should assume they would be favorable.

Response

The text has been appropriately revised.

W-3-012 (b) Habitat Utilization
(ii) Talkeetna to Devil Canyon

- Mainstem and Side Channels: References are made to low flow and maximum flow. The flows should be quantified so that an understanding of potential impacts and mitigative flows can be related to how it would influence habitat.

Response

The text has been revised to include specific flow values where available. See Chapter 2, Section 2.2 for a more detailed discussion of the river morphology and sediment transport characteristics.

W-3-013 . Species Occurrence and Relative Abundance: The baseline information and analysis should incorporate the 1982 field season data.

Response

Substantial 1982 field season data have been incorporated into the baseline and analysis sections.

W-3-014 - Slough Habitat: Paragraphs 2 and 3: The effects of various flow levels should be referenced by the number of sloughs which would be impacted by the particular problem and the relative importance of the effected sloughs in terms of salmon habitat.

Response

Information indicating the importance of the various sloughs to spawning adult salmon has been added. The impact on each slough from operational flows is being addressed in the referenced AEIDC study.

W-3-015 Paragraph 4: The basis for the intragravel temperature statements should be provided, whether conjecture or based upon a study of x number of sloughs.

Response

The referenced report (Atkinson 1982) is the basis for the statements; the study covered sloughs 8A, 9, 11, 19, 20, and 21.

W-3-016 . Significance of Habitat

. Salmon: Paragraph 2: The relative value of tributary sites (mouths?) vs sloughs may be a reflection of ease of study, or effort.

Response

The text has been appropriately revised to focus the discussion on slough habitats.

2.3 - Anticipated Impacts to Aquatic Habitats

W-3-017 Paragraph 3: Please refer to our discussion under Fishery Section - General Comments.

Response

Please refer to our response under Fishery Section - General Comments.

(a) Anticipated Impacts to Aquatic Habitat Associated with Watana Dam
(i) Construction of Watana Dam and Related Facilities - Watana Dam

W-3-018 . Changes in Water Quality: Although turbidity levels may be decreased, on the average, throughout the year, a more appropriate impact evaluation would be to examine turbidity levels by season or month vs aquatic life stage.

Response

As stated in the text, turbidity would vary with the type and duration of construction activity and may be significantly influenced by rainfall events. The probable temporary nature of turbid conditions would make prediction of turbidity levels on a season or monthly basis not feasible. In any event, increases in turbidity as a result of construction activities will not exceed the DEC standards in 18 AAC 70.020.

W-3-019 Paragraph 11: Examples of "...good engineering practices, and a thorough SPCC plan," should be provided in the mitigation plan. The abbreviation of the plan should be spelled out.

Response

The appropriate discussion is included in the mitigation plan (Section 2.4.3).

W-3-020 .Direct Construction Activities: Paragraph 1: Material sources should generally be confined, unless unavoidable, to that area which would be inundated by the impoundment, or upland sites. In that the Devil Canyon dam is not a certainty, rehabilitation of Cheechako Creek should be planned.

Joyce, Rundquist, and Moulton (1980) is referenced several times. We request that this reference be provided, and the pertinent discussions from this paper be incorporated into this section.

Response

The concerns are addressed in the mitigation section (2.4.3(d) (ii) of Chapter 3).

Copies of the Joyce, Rundquist, and Moulton (1980a and b) references which are USFWS/OBS publications are available through John Stout of the U. S. Fish and Wildlife Services, 1011 E. Tudor Road, Anchorage, Alaska. Pertinent discussion occurs in Section 2.4.3 (Mitigation).

W-3-021 - Watana Camps, Village and Airstrips

.Construction and Operation of Camps, Village and Airstrips: Paragraph 1: Reference is made to Exhibit A which has not been provided, although we have requested it.

Response

Comment noted.

W-3-022 ..Indirect Construction Activities: We expect secondary impacts, avoidable and unavoidable, to be much greater than that indicated by this discussion. We provided comments on this topic in response to appropriate Chapter 5 sections, where this topic is also inadequately discussed.

Response

Additional discussion of this topic has been included. Secondary impacts are considered to be the most significant construction-related impacts and this point is more clearly stated.

W-3-023 (ii) Filling Watana Reservoir
- Watana Reservoir Inundation

.Mainstem Habitats: Paragraph 4: Although overwintering habitat would be increased, the overall impact would probably be a net loss of habitat value. The discussion does not identify what species might benefit from this increase in overwintering habitat.

Response

Agreed - this point has been reemphasized. The fact that grayling, whitefish, burbet, lake trout, Dolly Varden and scuplin are expected to utilize the impoundzone has been added.

W-3-024 Paragraph 5: The basis for the statement, "Reservoir temperatures in the top 100 ft are expected to be in the range of 1° to 2°C," should be provided. First, the reservoir temperature model has not been run for the period November through May. Second, the statement is in apparent conflict with the information provided at the Susitna Hydro Exhibit E Workshop in which Eklutna Lake was presented as a model for Watana Reservoir. Eklutna Lake shows winter temperatures between 0° and 3.6°C within the upper two meters.

Response

The basis for the statement regarding reservoir temperatures is now provided in Chapter 2 on the basis of temperature model runs for the winter period. Data from Eklutna Lake were considered in the modeling of Watana Reservoir.

W-3-025 - Talkeetna to Watana Dam

.Mainstem Habitats: Paragraph 1: In that the river would no longer be clear, the effect of this change in turbidity upon movement of juvenile salmon and resident fish should be addressed.

Response

It is not known why it is expected that increased winter turbidity levels would affect movement of juvenline and adult salmonids. If more study is needed your recommendations will be considered when developing future study plans.

W-3-026 Paragraph 4: The apparent importance of the receding limb of high spring flows to stimulate outmigration is noted yet we see no effort to simulate this in the recommended instream flow regime.

Response

Other factors besides declining flows may influence salmon fry out-migration, including photoperiod and water temperature. Salmon fry out-migration will be exasmined during Spring 1983. If more study is needed, your recommendations will be considered in developing the future study program. When the significance of flow-related stimuli to smolt out-migration is defined, the flow regime can be adjusted.

W-3-027 Paragraph 9: It is recognized that the outflow temperatures during the second open-water season could have substantial adverse impacts. This problem in relationship to how it was handled at other hydropower projects should be discussed.

Response

No data from equivalent hydroelectric projects has been found regarding influence of low water temperatures on upstream migration of adult salmon. The discussion has been expanded, but we are continuing to investigate the problem.

W-3-028 .Side-Channel Habitats: Paragraph 3: Until an adequate instream flow study is conducted, these statements will remain speculative.

Response

Comment noted - this is being addressed by the referenced AEIDC studies.

W-3-029 Paragraph 4: It should be stated whether or not rearing habitat is considered limited.

Response

Any statements at this time on rearing habitat would be speculative; this topic is being addressed by ongoing studies. In many systems, rearing habitat does limit Chinook and coho populations.

W-3-030 Paragraph 5: The decreased temperatures expected would probably counteract any benefits derived through decreased suspended sediments.

Response

The decrease in water temperature is limited to the second year of filling. Decreased suspended sediments during the summer will continue for the life of the project.

W-3-031 .Slough Habitats: The potential impacts during filling should be discussed. Flows and temperatures would be changed from ambient. Until the ground water relationship, in regard to flows and temperatures, is adequately established the potential for impacts should not be dismissed. Whether or not the colder second year releases would have a delayed temperature effect upon the sloughs should be examined.

Response

Potential impacts to sloughs are discussed; the potential for impacts is not dismissed. The text has been expanded to clarify these impacts.

W-3-032 Paragraph 3: It should be explained that the basis for these statements is preliminary results from an examination of one slough (No. 9).

Response

We have revised the text to incorporate your comment.

W-3-033 Paragraphs 4 and 5: The slough which had a backwater form above 14,000 cfs should be identified. It is not explained whether this is typical of all sloughs, some sloughs, or even just that one unidentified slough. It is apparent from this section that 12,000 cfs would hamper or restrict passage of adults into an undisclosed proportions of the sloughs and would not create a backwater effect for an unknown proportion of the sloughs. The biological basis by which 12,000 cfs was chosen as the preferred flow for August should be explained in light of the discussion of this section.

Response

We have revised the text to reflect the most recent analysis of the potential problem of fish access into sloughs. The basis for the proposed flow releases is presented in Chapter 2, Section 3.2.3(a) and alternatives are discussed in Chapter 10.

W-3-034 .Tributary Habitats: Paragraph 4: It is noted that some creeks may become perched under the proposed filling schedule. The desirability and feasibility of altering the filling schedule to avoid this impact should be discussed.

Response

The Chapter 2 and Chapter 3 texts have been revised to discuss potential mitigative measures for perched tributaries.

W-3-035 -Cook Inlet to Talkeetna Reach: It has not been clearly established that the project would not adversely impact fisheries below Talkeetna during reservoir filling and project operation.

Response

It is recognized that small changes in flow can have dramatic impats on habitat in some situations; however, based on available data it is expected that impacts on fishery resources resulting from the proposed flow alterations will not be significant below Talkeetna. If more study is needed regarding project impacts in aquatic habitat/fisheries resources in the Susitna River downstream from Talkeetna, your recommendations will be considered for FY 1984 program.

W-3-036 .Mainstem Habitats: It is our understanding that millions of eulachon spawn in the lower river. If this spawning run is stimulated by certain temperatures or peaking spring flows the project could significantly impact this species. Secondary impacts would occur to those species, such as bald eagle and belukha whale, which feed on them. This potential problem should be discussed.

Response

As indicated in the text, little change is expected in water temperature in this reach, and reductions in long term average monthly streamflows of 12 percent are predicted at Susitna Station during May. These changes are not expected to affect the spawning run of eulachon.

W-3-037 .Slough Habitats: Paragraph 1: This discussion is in apparent conflict with Section 2.2(b) (iii) Slough Habitat - Significance of Habitat.. Salmon (page E-3-51) where it is stated that these habitats may be used for spawning.

Response

The text has been appropriately revised to reflect the current level of knowledge.

W-3-038 <u>..Tributary Habitats: Paragraphs 2 and 3</u>: A 10 percent reduction in flows could mean a zero reduction in habitats of concern or 100 percent reduction or something in between. We recommend that these flow reduction percentages be related to their effect on habitats of importance to life stages of those species of concern.

<u>Response</u>

We have identified the percentage reductions in flow. These reductions will lead to some reduction in habitat, primarily in side channels and sloughs. The percentage of habitat loss in these areas will depend on the channel geometry; these relationships are being addressed by the AEIDC study. The tributarymouth habitats discussed in the section being referenced are expected to be relatively insensitive to flow changes of this magnitude.

W-3-039 <u>(iii) Operation of Watana Dam - Talkeetna to Watana Dam -Talkeetna to Watana Dam</u>

<u>.Mainstem Habitats</u>: Discussion should be provided specific to the fixed-cone valves. There is no indication of the anticipated extent of their use. In that they would be withdrawing water from the hypolimnion they would often be counterproductive to what is intended to be achieved through use of the multilevel intake. The potential for thermal shock, or shock due to rapid changes in other water quality parameters, should be evaluated. Rapid water level changes would also be a potential problem that should be explained.

<u>Response</u>

An expanded discussion of the fixed-cone valves occurs in Chapter 2.

W-3-040 <u>Paragraph 8</u>: Discussion appears to be in conflict with Paragraph 16 of this section concerning suspended sediment transport.

The text has been clarified to remove this conflict.

W-3-041 <u>Paragraph 9</u>: Sediment load and turbidity are not synonomous. Turbidity should increase substantially over ambient winter levels.

<u>Response</u>

The text has been clarified to remove the confusion between sediment load and turbidity.

W-3-042 Paragraph 16: The observation that fish apparently overwinter in the turbid Kenai River allows one to conclude that, over a long period of time, these (unidentified) species can adapt to turbid conditions. The conclusion that the Susitna stocks can, in one year, adapt to Kenai River like conditions is a big step. Please more fully discuss this potential problem.

Response

There is no evidence to suggest that a long period of time is required for the species discussed to adapt to turbid conditions. All species discussed are frequently exposed to high turbidity levels and ADF&G indicates that substantial number of juvenile salmon may be present in the mainstem throughout the summer (ADF&G comment E-3-71/3). Resident species were also captured in the mainstem throughout the summer. If these juvenile anadromous and resident species can successfully rear in the open-water mainstem conditions it seems reasonable to expect that the moderate increases in winter turbidity will have minimal effects.

W-3-043 - Cook Inlet to Talkeetna Reach: Please refer to our comments under Section 2.3(a) (ii) - Cook Inlet to Talkeetna Reach.

Response

Comment Noted.

W-3-044 (b) Anticipated Impacts to Aquatic Habitat Associated with Devil Canyon
(i) Construction of Devil Canyon Dam and Related Facilities
- Devil Canyon Dam

- Alteration of Waterbodies: Paragraph 3: Please refer to our comments on Section 2.3(a) (i) - Watana Dam - Direct Construction Activities.

Response

Please refer to our response on Section 2.3(a) (i) Watana Dam Direct Construction Activities.

W-3-045 Disturbance of Fish Populations: Please refer to our comments on Section 2.3(a) (i) - Watana Dam - Direct Construction Activities.

Response

Please refer to our response on Section 2.3(a) (i) - Watana Dam Direct Construction Activities.

Response

Please refer to our response on Section 2.3(a) (i) - Watana Dam Direct Construction Activities.

W-3-046 - Devil Canyon Camp and Village

. Construction and Operation of Camp and Village: Paragraph 1: Reference is made to Exhibit A, which we requested. It has not been provided. We have not had input into the decisions regarding the type, administration , or siting of the construction camp/village. Avoidance of impacts to fish and wildlife resources should have been a major consideration in these decisions. In that we did not participate in these decisions and no alternatives to those which are considered "preferred" are examined in Chapter 10, we can only conclude that little, or no, consideration was given to this mitigation procedure.

Response

The discussion of alternatives has been expanded in Chapter 10. Also, see our response to comment W-10-010.

W-3-047 .Direct Construction Activity: Please refer to our comments under Section 2.3(a) (i) - Watana Camps, Village and Airstrip. Construction and Operation of Camps, Village and Airstrips. Indirect Construction Activities.

Response

See responses under Section 2.3(a)(i).

W-3-048 (iii) Operation of Devil Canyon Dam - Talkeetna to Devil Canyon Dam

.Mainstem Habitats: Paragraph 1: We assume that the 500 cfs flows in this reach would be provided by compensation flow pumps, discussion of which does not appear to be provided in this Exhibit. An explanation should be provided as to the function of these devices, their purpose, and how water from this source would effect water quality parameters of the water released from the powerhouse and the fixed-cone valves, and the basis for the flows which would be provided from this source. Please provide the rationale for the statement that a reduction in flows of the magnitude which would occur would not be expected to adversely affect fish populations in this portion of the river.

Response

Surface water inflow will be the only flow in approximately 1.3 miles of river between the dam and the powerhouse outlet; this is a change in the project operation since the draft Exhibit E was submitted for review. Since this reach of Devil Canyon has not been sampled because of safety considerations for the study crew and the inability to maintain gear set in high velocities (9-16 ft/s), the loss to resident species is unquanitified, but is not expected to be great. The area used used by salmon for milling activity will be displaced to the powerhouse outlet facilities.

W-3-049 .Slough Habitats: An explanation should be provided for the statement that changes in streamflow during the open-water season are not expected to affect slough habitats. We consider the potential for significant adverse effects to this habitat type to be high.

Response

The additional alterations in streamflow, (i.e., beyond that incurred during the operation of Watana and filling of Devil Canyon) are not expected to affect slough habitats during the open-water season.

W-3-050 - Cook Inlet to Talkeetna: Small changes in flows can have dramatic impacts on habitat. The relationship between flows and impacts on habitat must be established before one can dismiss small changes in flows. We expect the AEIDC insteam flow study will sufficiently define this relationship.

Response

It is recognized the small changes in flow can have dramatic impacts on habitat in some situations; however, based on the available data, it is expected that impacts alterations will not be significant below Talkeetna.

W-3-051 (c) Impacts Associated with Access Roads and Auxiliary Roads
(i) Construction

- Construction of Watana Access Road and Auxiliary Roads: Once an acceptable access routing is agreed upon, studies would need to evaluate the existing resources. Only at that point can specific mitigative measures be satisfactorily addressed based upon quatified impacts. We recommend that you proceed in this matter.

Response

The recommendation for studies to evaluate existing resources impacted by access routing is acknowledged and will be considered in development of future study programs.

W-3-052 . Alteration of Water Bodies: The potential problem of beavers damming culverts and thus interfering with fish passage needs to be addressed.

Response

Appropriate control measures as a part of routine maintenance will be undertaken to insure that beaver dams do not interfere with fish passage needs.

W-3-053 - Construction of Devil Canyon Access Road and Auxiliary Roads: Paragraph 1: We assume that APA has decided on a preferred access plan to Devil Canyon consisting of road or rail access, or both. Whatever it is should be stated.

Response

The preferred access plan to Devil Canyon consists of both road and rail access.

W-3-054 Paragraph 3: Although we have previously expressed our preference for rail access in lieu of road access, proper siting of rail is highly important to minimizing impacts, primarily through avoidance. Coordination specific to this issue should occur when siting decisions are being made.

Response

Coordination for proper siting of rail access has occurred and is continuing to occur.

W-3-055 (ii) Operation and Maintenance of Roads
- Operation of Watana Access Road and Auxiliary Roads

. Disturbance to Fish Populations: Paragraph 3: In that "...the increased accessibility of fish streams and lakes to fishermen..." would possibly be "...the greatest source of adverse impacts..." it would appear to be consistent with the APA Mitigation Policy document and NEPA to give emphasis to mitigation through avoidance of these impacts.

Response

Emphasis has been placed on avoidance of potential impacts, whenever possible, to streams and lakes resulting from increased accessibility.

W-3-056 (d) Transmission Line Impacts
(i) Construction of Transmission Line

- Watana Dam: Paragraph 1: Baseline information on the transmission corridor from the damsites to the Intertie has been acknowledged as lacking within the Exhibit. As with other project features, Exhibit E should provide baseline data, impact assessment, and mitigation planning. Avoidance of adverse impacts would occur by a combined construction access/transmission line access corridor north of the Susitna River between the two damsites. This is our preference. For further comments please refer to our letter dated January 5, 1982 on the Transmission Corridor Report. This letter was provided as formal pre-license consultation and we continue to view it as such.

Response

The transmission line has been realigned to follow the Devil Canyon access road.

W-3-057 (ii) Operation of the Transmission Line
- Watana Dam

. Alteration of Water Bodies: Please refer to our comments under Section 2.3(d) (i) - Watana Dam.

Response

Please refer to our response under Section 2.3(d) (i) Watana Dam.

W-3-058 . Disturbance to Fish Populations: Please refer to our comments under Chapter 5, Section 3.7(c) (i) - Aquatic Species. Impacts of the Project.

Response

This subject is addressed in the revised Chapter 5.

W-3-059 2.4 - Mitigation Issued and Proposed Mitigating Measures

(a) Mitigation of Construction Impacts Upon Fish and Aquatic Habitats: Please refer to our comments under Fishery Section - General Comments.

Response

Please refer to our responses under Fishery Section - General Comments.

W-3-060 (i) Stream Crossings and Encroachments
- Mitigation: Please refer to our comments under Section 2.3(c) (i) - Construction of Watana Access Road and Auxiliary Roads. Alteration of Water Bodies.

Response

The text has been appropriately revised.

W-3-061 . Methods of Installation: Paragraph 3: Certain construction practices should be scheduled to occur during the winter to minimize and/or avoid adverse impacts.

Response

Construction practices will be scheduled whenever feasible to minimize and/or avoid adverse impacts, as indicated in the text.

W-3-062 (ii) Increased Fishing Pressure

- Impact Issue: If the construction access and transmission line between the two damsites were in the same corridor the impact could be partially reduced or avoided. Please refer to our letter dated January 5, 1982 on the Transmission Corridor Report for additional comments.

Response

The construction access and transmission line have been moved to the same corridor to minimize impacts.

W-3-063 (iv) Material Removal

- Mitigation: Please refer to our comments under Section 2.3(a) (i). Direct Construction Activities: Paragraph 1.

Response

The text has been appropriately revised.

W-3-064 Paragraph 3: Mining should be scheduled to avoid conflicts with fish migrations, spawning, or other important occurrences.

Response

Efforts will be made to schedule mining activities to avoid conflicts with fish migrations, spawning, or other important concurrences.

W-3-065 Paragraph 6: Please refer to our comments under Fishery Section - General Comments regarding monitoring.

Response

Please refer to our responses under Fishery Section - General Comments regarding monitoring.

W-3-066 (viii) Susitna River Diversions

- Mitigation: Grating of the diversion tunnel would prevent losses to fish and should be considered as a mitigative measure.

Response

Providing fish screens or a bypass facility at the diversion tunnel is a mitigative measure of temporary value since the habitat of the fish that may pass through the tunnel would be eliminated with reservoir filling, and successful reproduction would no longer be possible. The mitigation efforts would be more appropriately allocated to measures with long-term benefits.

W-3-067 (x) Clearing the Impoundment Area

- Mitigation: If it would minimize these impacts, then clearing should occur during the winter.

Response

Clearing will be undertaken at a time of year that would minimize impacts whenever feasible.

W-3-068 (b) Mitigation of Filling and Operation Impacts

(i) Approach to Mitigation: Although, "Avoiding impacts through design features or scheduling activities to avoid loss of resources," is listed as top priority, in reality it has not received this type of emphasis.

Response

Avoiding impacts through design features or scheduling activities to avoid loss of resources has received highest mitigation priority and this approach has been applied whenever possible. Environmental values have been given, and will continue to be given, equivalent consideration with other project parameters, such as cost, schedule etc. However, planning based solely on environmental considerations would be contrary to NBPA and the Power Authority mitigation policy.

W-3-069 (ii) Mitigation of Downstream Impacts Associated with Flow Regime: Under General Comments for Chapter 2 we have provided a synopsis of the AEIDC instream flow proposal which has been contracted by APA. We believe that this proposal would provide the basis for a reasonable, quantified instream flow impacts analysis which would allow an assessment of mitigative alternatives. Since APA has contracted this study, we assume that APA agrees with our view. The AEIDC proposal should be fully described in either Chapter 2 or 3. It seems premature to discuss mitigative flows prior to quantification of potential impacts.

Response

The instream flow modeling presently being conducted for the Power Authority by the AEIDC will, in conjunction with the input from ongoing fisheries and hydraulic studies, provide a significant input into the assessment of flow alterations. This assessment will assist in refining the proposed mitigation alternatives.

W-3-070 - Impact Issue: Paragraph 1: Reference is made to Exhibit A. Although we have requested this, as well as other Exhibits, it has not been forthcoming.

Response

See response to comment W-2-015.

W-3-071 - Measures to Minimize Impacts: Please refer to our comments under Sections 2.3(s) (ii) - Talkeetna to Watana Dam. Slough Habitats: Paragraphs 4 and 5 and 2.3(a) (ii) - Talkeetna to Watana Dam . Mainstem Habitat: Paragraph 4: It is apparent that the flow release schedule neither minimizes loss of downstream habitat nor maintains normal timing of flow-related biological stimuli.

Response

Please refer to our response under Sections 2.3(a) (ii) Talkeetna to Watana Dam Slough Habitats: Paragraph 4 and 5 and Mainstem Habitat: Paragraph 4. The text has been modified to include alternative flow regimes to minimize loss of downstream habitat and provide flow-related biological stimuli. The optimal flow regimes will be determined for an analysis of the ongoing Aquatic Studies Program.

W-3-072 . Winter Flow Regime (November - April): Paragraph 1: Please refer to our comments under Sections 2.3(a)(ii) - Cook Inlet to Talkeetna Reach . Tributary Habitats: Paragraphs 2 and 3.

Response

Please refer to our response under Section 2.3(a) (ii) Cook Inlet to Talkeetna Reach, Tributary Habitats: Paragraphs 2 and 3.

W-3-073 Paragraph 2: We also feel strongly both ways.

Response

Comment noted.

W-3-074 . Summer Flow Regime (July - October): Paragraph 3: Discussion should be provided regarding the instream flow studies which lead to the conclusion that 12,000 cfs is of sufficient magnitude to allow rectification of project impacts.

Response

The proposed flow releases of 12,000 cfs for a portion of the summer flow regime is equivalent to a volume of water that has been allocated for mitigation of downstream impacts to fishery resources. This volume of water was derived from a cost-analysis of lost power production vs flow augmentation for fisheries. Chapter 2 contains an expanded discussion of the flow selection methodology.

W-3-075 - Rectification of Impact
. Winter Flows: We strongly disagree with the conclusion reached in this section. How this conclusion can be derived from the information provided in this chapter and Chapter 2 needs to be fully explained.

Response

The statement has been clarified.

W-3-076 . Summer Flows: We fully agree that the proposal must be demonstrated effective before it can be incorporated into a mitigation plan.

Response

Comment noted.

W-3-077 - Reduction of Impacts Over Time: Please refer to our comment under Section 2.4(a)(iv) - Mitigation, Paragraph 6.

Response

Please refer to our response under the same section.

W-3-078 - Compensation for Impacts: Paragraph 2: Please provide documentation on the success of this alternative in Alaska, or similar environs. Several ideas are discussed in this section which should be considered for demonstrative projects during the 1983 field season.

Response

The text has been modified to include documentation.

W-3-079 Paragraph 9: Discussion of the development of a hatchery should be expanded. If other mitigation alternatives prove not to be feasible then we will need to fully understand what could be achieved through hatcheries.

Response

Additional discussion of hatchery development has been provided in the text.

W-3-080 (ii) Mitigation of Downstream Impacts Associated with Altered Water Temperature Regime
- Measures to Minimize Impacts

. Water Temperatures During Filling Watana Reservoir: If the addition of a fifth portal would, based upon thermal modeling of the reservoir, provide additional temperature control during filling, then we recommend that this be added.

Response

Comment noted.

W-3-081 . Water Temperatures During Operation of Watana Reservoir: Paragraph 3: Please refer to our comments under Section 2.3(a) (ii) - Watana Reservoir Inundation . Mainstem Habitats: Paragraph 5.

Response

Please refer to our responses under Section 2.3(a)(ii).

W-3-082 - Measures to Rectify Impacts: Documentation should be provided on the success on this type of proposal in Alaska, or other subarctic systems. Demonstration of the techniques would need to occur prior to incorporation into the mitigation plan. In that the sloughs are also utilized for rearing by chinook and coho juveniles, discussion should be provided on how chum salmon (we have assumed that chum is the species which is being managed for although it is not stated) would interact with the other species. Also, the mechanisms which might allow entrance to chinook and coho salmon into the sloughs while holding the chums from egressing needs to be explained.

Response

The text has been revised.

W-3-083 - Compensation for Impacts: Documentation should be provided on the success of hatchery propagation of grayling.

Response

The text has been revised to include a discussion of the steps required for successful hatchery production of grayling.

W-3-084 (ii) Operation Mitigation

- Mitigation of Access and Impoundment Impacts: Paragraph 1: In that other study components (e.g. wildlife, and recreation) are also considering uses for the borrow areas, coordination should be directed toward resolving potential problems. Maps depicting the borrow pits and the agreed upon, "best" uses for the individual sites should be provided.

Response

Maps appear in Chapter 2; Mitigation Measures appear in Chapter 3.

W-3-085 - Mitigation for Downstream Impacts: Paragraph 2: We fully support the statement that, "Continuing reservoir thermal modeling will allow an evaluation of available water temperatures throughout the year so that a detailed release plan can be developed. The release plan will need to consider both water temperature and volume in order to minimize impacts." We recommend that this be carried out and the proposed release plan be included in the license application.

Response

The proposed release plan is included in the license application. Modifications to this plan may occur as results of the design studies and aquatic studies are acquired.

W-3-086 2.5 - Aquatic Studies Program: Please refer to our comments under Fishery Section - General Comments.

Response

Please refer to our response under Fishery Section - General Comments.

W-3-087 2.6 - Monitoring Studies: Please refer to our comments under Section 1.3: Paragraph 8.

Response

Please refer to our response under Section 1.3.

SPECIFIC COMMENTS

3 - BOTANICAL RESOURCES

3.1 - Introduction

W-3-088 (a) Regional Botanical Setting: A more complete description should be provided for vegetation north of the Susitna River to the Denali Highway, through which the proposed access road is to pass. The primary importance of botanical resources as a key component of wildlife habitat should be restated here as the object of this report (see Section 1.2, Page E-3-3, Paragraph 1).

Response

Additions made; see Sections 3.1 and 3.1.1.

W-3-089 (b) Floristics

(i) General: Paragraph 1: We suggest that the difference in numbers of plant species between the upper and lower basins are a result of the following: Larger study area; greater time spent in sampling the upper basin, and the numerous vegetation communities associated with elevation changes and topographical diversity.

Response

We agree. A statement to this effect has been added to Section 3.1.2(a).

W-3-090 Paragraph 3: Please explain the quantification of plant species for the Willow-to-Cook Inlet and Healy-to-Fairbanks transmission corridors, when no floristics work was done in that area. (Section 3.2[e][i] and [ii] and Tables W24 and W25.)

Response

Plant species of the Willow-to-Healy intertie corridor were identified by Commonwealth Assoc. (1982) and are listed in Appendix 3.D. Hectares, acres, and percent total area of vegetation types within the Healy-to-Fairbanks, Willow-to-Cook Inlet, and Willow-to-Healy study corridors are presented in Tables E.3.77, E.3.78, and E.3.79, respectively.

W-3-091 (c) Threatened or Endangered Species: Since no plant species are officially listed, we suggest addition of the word "candidate" prior to any discussion of "threatened or endangered" plant species. In many places, the discussion would be more accurate by referring to "plant taxa" rather than species since these plants are generally varieties or subspecies rather than distinct species. Please clarify that the calciphilic plants referred to in Paragraph 4 of subsection (i) refer to Murray's, not FWS, categories for threatened or endangered.

Response

All of the above recommendations have been incorporated in Section 3.2.1.

W-3-092 (d) Contribution to Wildlife, Recreation, Subsistence and Commerce: Because of their key function both as habitat for fish and wildlife resources and in maintaining water quality relative to drainage, high water energy dissipation, flood storage, ground water recharge, filtering surface runoff, etc., wetlands and floodplains have been protected by Executive Orders (11990, 11998) and national legislation (e.g. Clean Water Act as amended in 1977). Since vegetation is a characteristic component of any wetlands, we suggest addition of a general section here on the prevalence of wetlands in the project area and their widely recognized biological and water quality values (please also see our following comments on Section 3.2[a][vi], Wetlands.)

Response

A separate and expanded discussion of wetlands and their significance has been added (Section 3.2.3).

W-3-093 (iii) Subsistence: Use of area timber resources for building or heating homes is an additional subsistence use which should be mentioned.

Response

Noted in Section 3.2.2.

W-3-094 3.2 - Baseline Description: Paragraph 1: A brief description is needed here of the Viereck and Dyrness hierarchical vegetation classification system for Alaska, levels used for this study, and number of categories mapped (note, this description should cover the vegetation type maps now under preparation). An explanation for the mapping of up to 16 kilometers (km) from the Susitna River and 0.8 km from the impoundments should be provided.

Response

All of the above recommendations have been incorporated in Section 3.2.2(a).

W-3-095 Paragraph 2: A brief description should be given as to sampling intensity. Whether vegetation dominance within the project area and/or susceptibility to project impacts were considered in study design should be explained. General information on elevation, slope, aspect, and land form should be briefly related here and in subsequent sections of the report to better define areas and their vegetation cover. The prevalence of permafrost, a determining factor in some project impacts (e.g. pages E-3-166, paragraph 2 and E-3-170, paragraph 3) should also be considered.

Response

Discussions of sampling intensity and factors governing study design have been incorporated in a new and expanded discussion of methods (Section 3.2.2[a]). Terrain features and permafrost occurrence are treated in relation to vegetation patterns and project impacts in the revised and expanded discussions of plant communities (Sections 3.2.2[b-f]), wetlands (Section 3.2.3), and impacts (Section 3.3).

W-3-096 Paragraph 3: Successive descriptions of vegetation types by project area would be clarified here by defining closed, open, and woodland forests, tall versus low shrublands, and wetlands (also see comment under Section 3.2(a)[v]), rather than defining them in the following sections (a) and (i). The discussion would also be aided by including an overlay of project features on the vegetation map, Figure W1, as well as restating information on the elevations range for each proposed impoundment area. We recommend the license application include a larger, more readable vegetation map and that quantitative data on how common or uncommon specific vegetation types are, as well as the occurrence of various types relative to elevation or aspect, be presented in the text as well as tables. In so describing the revised vegetations classification, it will be possible to better evaluate potential project impacts on vegetation, and thus wildlife habitats, by project feature. This recomended level of effort also applies to the proposed access and transmission corridors.

Response

Definitions of vegetation types are consolidated in Section 3.2.2(a). Project features are shown in Figure E.3.37. In Figures E.3.39 through E.3.41, boundaries of project features are overlain on the 1:63,360 scale vegetation mapping of the middle basin. Project features are discussed relative to locations, elevations, and vegetation types in the impact section (3.3).

Figure E.3.38, the 1:250,000-scale vegetation map of the Watana and Gold Creek watersheds, is included as a large-format enclosure. Data presented in tabular format, including percent cover, as well as more detailed information on elevation ranges, aspect, and other terrain features, are incorporated throughout the plant community descriptions and tables presented in Sections 3.2.2(b-f).

W-3-097 (a) Watana Reservoir Area

(i) Forests: Please see comment under Section 3.2 regarding including quantified information in the text as well as tables. Providing the range of elevation in which these types were sampled rather than one average would show the extent and overlap in distribution of each forest type.

Response

Quantitative data on percent cover and elevation ranges have been incorporated in text descriptions of forest communities.

W-3-098 -Spruce Forest: Paragraph 5: Black spruce forests on poorly drained soils would most likely also be classified as wetlands. Please refer to our comments under Sections 3.1(d) and 3.2(a)(vi).

Response

Black spruce forests on poorly drained soils are discussed as wetlands in Section 3.2.3; quantitative data on percent cover are provided in Table E.3.55.

W-3-099 (ii) Tundra: Please refer to comments under Section 3.2; paragraph 3 regarding providing quantitative data on the prevalence of different tundra types and of ranges rather than average elevations. The wet sedge-grass tundra should also be described as a wetland type. See Sections 3.1(d) and 3.2(a)(iv), as above.

Response

See response to W-3-092 and W-3-096 above. In addition, Section 3.2.3 describes forest, shrub and tundra wetland categories as well as more completely describing aquatic vegetation.

W-3-100 (iii) Shrubland: Refer to comments under Sections 3.2(a)(i) and (ii) above.

Response

Definitions of shrubland community types and descriptions of classification procedures are consolidated in the new methods section (3.2.2[a]).

W-3-101 (iv) Herbaceous: For consistency with the rest of the report, we recommend describing common species within the referenced herbaceous pioneer communities. Corresponding tables on the herbaceous vegetation types are missing.

Response

Done; see Section 3.2.2(b)(iv), Table E.3.64, and Figures E.3.53 through E.3.65. Percent cover of herbaceous communities is quantified in Table E.3.52 for a portion of the study area (see response to W-3-102).

W-3-102 (v) Unvegetated Areas: Again, quantification of the extent, and thus importance, of these areas should be provided.

Response

Quantification of the areal extent of unvegetated portions within the Watana and Gold Creek watersheds is provided in the new Table E.3.51 as hectares and percent of total area, based on mapping at a scale of 1:250,000. New Table E.3.52 provides similar data for the area 16 km on each side of the Susitna River from the Maclaren River (RM 260) to Gold Creek (RM 136.8), based on 1:63,360-scale mapping. These data have been incorporated into the text.

W-3-103 (vi) Wetlands: This section is significantly lacking in three areas. First, the legislatively recognized importance and protection of wetlands should be described, including the U.S. Army Corps of Engineers' (CE) definition of wetlands and regulation of activities on these areas. (Please also refer to our comments under Section 3.1(d) regarding this concern.) Secondly, there should be a discussion of how wetlands may be a second level of classification applied to the vegetation types previously discussed. Finally, as with other ongoing studies, this section should cover the wetlands delineation scheme agreed to at the 2 December 1982 wetlands session of the Susitna Hydro Exhibit E Workshop. This agreement included the following: project consultants will meet with the FWS and CE to identify the appropriate detail for wetlands mapping; existing wetlands maps will be improved on the basis of additional aerial photography and overall vegetation remapping; soils information will be obtained from the CE; ground truthing, in consultation with FWS and CE, will be undertaken in summer, 1983; final maps should be available by fall, 1983;

and additional field checks may be necessary in summer 1984 (see page 5 of Wetlands Meeting notes, received from John Hayden, Acres American, Inc.). Given the doubtful accuracy of existing wetlands maps, it would be inappropriate to include those maps in the license submittal.

Redefinition of wetlands to properly include such types as black spruce bogs, willow and poplar along watercourses, and herbaceous sedge-grass marshes, in addition to the more completely aquatic types now described under the wetlands section. A definition of "wet tundra" (paragraph 6) should be included. The final paragraph of this section would be a better opening statement to the expanded discussion needed on wetland values and types.

Response

We concur and have made substantive additions to the wetlands discussion now in Section 3.2.3. The subject section includes (1) a discussion of the legislative and regulatory provisions governing actions affecting wetlands; (2) existing wetland maps of impoundment and borrow areas at a scale of 1:24,000 (Figure E.3.66 through E.3.73), and of access corridors at a scale of 1:63,360 (Figures E.3.W29 through E.3.45); (3) a discussion of wetland types as a secondary classification level based on Viereck and Dyrness (1980) vegetation types (Table E.3.81); (4) quantification of wetland areas potentially affected by project components (Table E.3.82); and (5) an explanation of agency consultations and ongoing activities implementing the wetlands delineation program proposed at the 2 December 1982 wetlands session of the Exhibit E workshop.

Existing wetlands mapping is included in Exhibit E to provide the FERC with information necessary to determine the adequacy of environmental input to preliminary engineering design and construction planning.

Section 3.2.3 describes forest, shrub, and tundra wetland categories as well as more completely describing aquatic vegetation. The latter is discussed in further detail in Section 3.2.2(b)(v).

W-3-104 (b) Devil Canyon Reservoir Area: Please refer to comments under Section 3.2(a) regarding need for a brief elevational and landform description. Again, there will be need for an overlay of the impoundment area on the (revised) vegetation type map. We appreciate inclusion of the percent of the impoundment area covered by major vegetation types. Please refer to our previous comments regarding need for a comprehensive discussion and definition of wetlands.

Response

Brief elevation and landform descriptions are provided in Section 3.2.2(b), which describes the Watana and Gold Creek watersheds (the Upper Susitna Basin of McKendrick et al. 1980). The impoundment areas have been overlaid on the 1:63,360 vegetation maps of the Susitna River and environs (Figures E.3.39 through E.3.41).

W-3-105 (c) Talkeetna to Devil Canyon: Clarification of this specific area is needed. Again, refer to comments under Section 3.2(a)(i) and (ii), above. While early, mid, and late successional stages appear a suitable categorization for floodplain vegetation, these stages should be correlated with the forest, shrub, tundra, wetlands, etc. classification previously used.

Response

The recommended areal clarification is provided in Section 3.2.2(c) and Figure E.3.34. Correlations between successional stages and vegetation types are provided in Section 3.2.2(c).

W-3-106 (d) Talkeetna to Cook Inlet: Please refer to comments under Section 3.2(a)(i) and (ii), above. We believe that existing data do not substantiate the conclusion that the project will have minimal impacts on vegetation in this area. Thus we recommend mapping the area within the 10 year floodplain downsteam of Talkeetna at least to the Delta Islands. Further discussions on expected impacts should be initiated to better pinpoint the precise area which should be covered.

Response

Effects of regulated flows on downstream floodplain vegetation are discussed as an impact issue in Section 3.3.1(b)(iii). The recommended mapping will be considered during preparation of detailed study plans for fiscal year 1984. Further discussion on downstream impacts to vegetation will be initiated at mitigation planning workshops and technical meetings.

W-3-107 (e) Transmission Stubs and Intertie: Again, we suggest adding a map, and elevation information, as well as quantifying the vegetation type, for each of the following four subsections.

Response

The recommend additions have been made to Sections 3.2.2(e)(i-iv). Quantifications of vegetation types is presented in Tables E.3.77 and E.3.80. Mapping is provided in Figures E.3.39 through E.3.41 and E.3.48 through E.3.52.

W-3-108 (i) Healy to Fairbanks: Paragraph 5: Reference to "wet lowland sites" should be expanded to discuss wetlands per our comments on Section 3.2(a)(vi).

Response

Comment noted.

W-3-109 (ii) Willow to Cook Inlet: Paragraph 1: Here too, "wet sedge-grass marshes" should more completely be discussed as wetlands, see Section 3.2(a)(vi).

Response

The discussions have been expanded as recommended; see Sections 3.2.2(e)(i and ii) and 3.2.3, and Figures E.3.48-52.

W-3-110 Paragraph 2: The first sentence is contrary to data provided in Table W25, please clarify.

Response

In the revised Section 3.3.2(e)(ii), paragraph 3 now reads, "Closed conifer-deciduous forest is the predominant vegetation type, covering 29 percent of the total area."

W-3-111 Paragraph 5: Placement of this paragraph between the first and second paragraphs would be more logical.

Response

This revision has been made as recommended.

W-3-112 (iii) Willow to Healy: The compatability of vegetation types as mapped by Commonwealth Associates, Incorporated (1982) with those mapped by McKendrick et al. (1982) should be described.

Response

The referenced vegetation types are not compatible beyond Level 1 of the Viereck and Dyrness (1980) classification system; noted in Section 3.2.2(a).

W-3-113 (iv) Dams to Intertie: We question the comparability of vegetation types mapped here at a scale of 1:250,000 with those in all other transmission corridors which were mapped at 1:63,360, e.g. Tables W27 and W28 document difficulties of mapping closed birch and balsam poplar types at the 1:250,000 scale. This transmission corridor should be separately mapped during ongoing mapping.

Response

Mapping of vegetation types crossed by the Watana-to-Gold Creek transmission corridor (including the tie-in from Devil Canyon) is presented at a scale of 1:63,360 in Figures E.3.39 through E.3.41. Quantification is provided in Table E.3.80.

W-3-114 3.3 - Impacts: Fragmenting this analysis into a project feature by impact issue format is useful for a first overview. However, the section lacks a comprehensive picture of cumulative impacts to vegetation. That cumulative picture is essential for understanding overall impacts of the project on fish and wildlife species occupying areas within and beyond each project feature. Although this section identifies the full range of vegetation impact issues, there is no attempt to quantify areas which may be potentially affected by changes in vegetation cover. A given change may be both beneficial to one species of wildlife yet adverse to another. By not completely prioritizing mitigation in the previous Fishery Section and later Wildlife Section, the report fails to identify the tradeoffs or objectives of a project-wide mitigation plan or mitigation plan alternatives. For example, information should be provided here on the tradeoffs analysis relative to fish, wildlife and botanical impacts, as well as cost and design considerations in the siting of project support facilities, roads and transmission lines. We remain concerned that we were not consulted in the siting of project support facilities.

Response

We concur. A section on cumulative impacts has been added. Discussions of individual impact issues have been revised to provide an estimate of changes in vegetation type over time for each area which will be affected by development. Although such estimates must of course be highly conjectural, as the timing of plant succession is dependent on climate, soil type, slope, aspect, elevation, moisture, fire, flooding, ice scouring, use by wildlife, and other factors all complexly interacting over time, an effort has been made to base our estimates on discussions such as those found in:

Nieland, B.J., and L.A. Viereck. 1977. Forest types and ecosystems. In North American lands at latitudes north of 60 degrees. Proceedings of a symposium held at the University of Alaska, Fairbanks. September 19, 20, 21, and 22, 1977.

Viereck, L.A. 1970. Forest succession and soil development adjacent to the Chena River in interior Alaska. Arctic and Alpine Research 2:1-26.

Areas which will be affected by changes in vegetation are quantified in Tables E.3.82-86. Cost and design considerations are discussed in relation to mitigation in Section 3.3.4. The Alaska Power Authority will consult further with resource agencies in the siting of project support facilities during the detailed siting and design program.

W-3-115 (a) Watana Development

(i) Construction

- Vegetation Removal: Paragraph 1: Again, we suggest restating the elevation range within which vegetation will be removed. Spoil areas should also be described.

Response

Elevation ranges of areas which will be affected by vegetation removal have been incorporated into the impact discussions. Spoil disposal sites are described for the Watana and Devil Canyon facilities in the impact and mitigation analyses for botanical resources (Sections 3.3 and 3.4, respectively).

W-3-116 Paragraph 2: Please provide the percent loss expected for birch forests as shown in Table W27. Loss of a vegetation type relative to its abundance within the basin is half the issue relative to the loss of vegetation; however the value of each type relative to other types for selected wildlife species should also be provided. In some cases habitat factors would also be considered; see our comments throughout the Wildlife Section.

Response

Percent loss expected for birch forest is presented in Section 3.3.1(a)(i). The relative values of vegetation types as components of wildlife habitat are discussed in Section 4. In revising the botanical resources and wildlife sections, we have made an effort to emphasize the fact that habitat-based assessments of wildlife impacts are derived largely from vegetation type quantifications provided in the botanical resource baseline, impact, and mitigation discussions (Sections 3.2, 3.3 and 3.4, respectively).

W-3-117 - Vegetation Damage by Wind and Dust: Paragraph 1: Given the difficulty of reading the vegetation map supplied here and the later need to understand the potential for lost nest sites or wildlife cover, please describe the primary tree species and vegetation type(s) in which blowdown may occur on the southside of the Watana damsite.

Response

A statement that woodland black spruce stands with a typical rooting depth of less than 35 cm (12 inches) will be the primary vegetation type subject to blowdown on the south side of the Watana reservoir has been incorporated in Section 3.3.1(a)(iii).

W-3-118 Paragraph 3: Some relationship should be made between referenced possible delays in snowmelt and vegetation types which may be affected. Similarly, increases in cottongrass and decreases in mosses and lichens should be related to their occurrence in vegetation types adjacent to impoundment and borrow areas. Such relationships should be the basis for fully considering the impacts of project-induced changes on vegetation relative to wildlife (see our comments under Sections 4.3(a)[i], [ii], [iv], and [v]).

Response

The relationship between potential delays in snowmelt as a result of heavy dust accumulation and the vegetation types which may be affected is discussed briefly in Section 3.3.1(a)(iii). Where potential increases or decreases in plant taxa are discussed relative to project-induced climatic changes in Section 3.3.1(b)(iv), we have indicated the occurrence of these taxa in vegetation community types present in the potentially affected areas.

W-3-119 (ii) Filling and Operation

- Vegetation Succession Following Removal: In order to understand the magnitude of vegetation alterations, some quantification should be presented for the areas of forest, shrub, tundra, etc. which will be rehabilitated during project filling and operation. A scenario should be developed outlining potential acreages of each affected vegetation type and the various successional stages they will pass through during the life of the project.

Response

Areal coverage of vegetation types in locations to be rehabilitated is quantified in Section 3.4.2(a). The scheduling of rehabilitation on a location-by-location basis is also indicated. We have provided rough estimates of the length of time required for rehabilitated areas to return to their pre-project vegetative cover, and a general description of the successional stages likely to occur during the license period, based primarily on Nieland and Viereck (1977) and Viereck (1970) as cited above.

W-3-120 . Forest Areas and Shrubland: Anticipated heights of each vegetation stage, over time, should be included here.

Response

The requested information has been included.

W-3-121 . Tundra: The extent of permafrost should be described, please see our comment under Section 3.2.

Response

Areal extent and locations of permafrost are described in Exhibit E, Chapter 6, Sections 2.5.5 (Watana) and 2.6.5 (Devil Canyon), and shown in Figure E.6.3.2 through E.6.4.5 (Watana) and E.6.2.1 through E.6.2.9 (Devil Canyon).

W-3-122 Information is needed on successional patterns in herbaceous vegetation types and on wetlands within each type, for consistency with Section 3.2(a). An additional concern is the nutritional quality and quantity of plant regrowth relative to wildlife.

Response

The discussion of successional patterns has been expanded to include herbaceous vegetation types and wetlands. Nutritional quality of successional stages following project disturbance, rehabilitation, or intentional browse enhancement measures is addressed in Sections 4.3 and 4.4. Changes in and loss of moose browse vegetation receives particular emphasis in these sections, and is the subject of an intensive simulation modeling program now in progress. In addition, browse baseline inventories initiated and funded by the Alaska Power Authority will be documented in a report available in May 1983. A detailed browse nutritional study is under consideration for the spring and summer of 1983.

W-3-123 - Effects of Erosion and Deposition: Paragraph 2: See preceeding comment and that under Section 3.2 regarding need to map and quantify the aerial extent of permafrost.

Response

Areal extent and locations of permafrost are described in Exhibit E, Chapter 6, Sections 2.5.5 (Watana) and 2.6.5 (Devil Canyon).

W-3-124 - Effects of Altered Downstream Flows: Overall, this discussion is too general. Consideration of daily flow fluctuations in response to peak power needs is neglected.

Several other potential projects impacts are left unclear; especially those related to wetlands and floodplains. For example, please provide the extent of floodplain areas, (1) now subject to annual, 5 year, 10 year, etc. flooding, and (2) which will become exempt from flooding. Given the successional information depicted in Figure W3 and revised vegetation maps, it should be possible to quantify expected changes in vegetation, over time, for a variety of flow regimes. Such information is necessary to fully determine project impacts to wildlife and make mitigation recommendations. If existing hydrologic or vegetation information is considered insufficient for developing such models, additional studies should be initiated.

Response

The discussion has been revised to provide a more detailed assessment (Section 3.3.1(b)(iii). Your requests will be considered during formulation of detailed study plans for Fiscal Year 1984.

W-3-125 . Watana to Devil Canyon: A more detailed treatment of the potential for rime ice or icefog formation is needed here. For example, ice buildup on vegetation has been found to keep the soil surface open in forests.10 Sapling tree stands heavily damaged by ice produced more brush whereas ice damage in mixed-oak tree stands resulted in loss of understory saplings and low tree branches with herbaceous plant growth enhanced in summer.11 Such changes in understory or reduction in winter browse availability could be particularly critical to wildlife subject to extensive adjacent habitat losses. The types of vegetation which may form, over the project life, on "newly-exposed areas with adequate soils" should be described relative to adverse or potential benefits for various wildlife species.

Response

Section 3.3.1(b)(iv) has been revised to provide a more detailed discussion of potential ice fog and rime ice formation, with possible effects on vegetation. The provided references have been reviewed and incorporated. The relative values of plant successional stages to wildlife are discussed in Sections 4.3 and 4.4

W-3-126 . Devil Canyon to Talkeetna: Paragraph 3: This quantified description of expected vegetation type changes is the type of detailed impact analysis necessary for other project areas (e.g. preceeding section on Watana to Devil Canyon and following section on Talkeetna to Yentna River). Once the revised vegetation mapping and analysis is completed, this type of analysis should be the basis for examining the positive and/or negative impact to wildlife of these vegetation changes, over the life of the project.

Response

Section 3.3.1(iii)(b) has been revised to provide more detailed information for the Watana-to-Devil Canyon and Talkeetna-to-Yenta River reaches. Your recommendation concerning use of revised vegetation mapping coupled with hydrologic analysis wll be considered during formulation of detailed study plans for Fiscal Year 1984.

W-3-127 Paragraph 4: The statement that, "Post-project ice formation in this reach will be similar to present conditions," appears to conflict with previous descriptons whereby ice formation will not occur until approximately river mile 130, slightly more than half way to Devil Canyon from Talkeetna (Section 2.3(a)(iii), Page E-3-90). In order to understand how area vegetation may be less-influenced under post-project breakup, it would be useful to explain present impacts of breakup on the vegetation. Please address the change from a bank-full flood interval of 1 to 2 years for this section of the river. Quantification is needed of the area over which vegetation could be established with this schedule for less frequent disturbances.

Response

Section 3.3.1(b)(iii) now states that "the ice front at the end of winter is expected to occur between Portage Creek (RM 149) and Curry (RM 120.5)." A discussion of breakup impacts on vegetation under pre-project conditions has been incorporated as a basis for comparison with potential effects on regulated flows. The effects of less frequent flood events on floodplain vegetative recession and succession are also discussed. The revised analysis emphasizes that vegetation removal will depend primarily on ice scouring at freezeup and breakup. The area of floodplain scoured will be dependent on winter flow releases, as determined by power demand. Modeling of scour effects on vegetation could be done for a series of hypothetical flow releases, and will be considered during formulation of detailed study plans for Fiscal Year 1984.

W-3-128 . Talkeetna to Yentna River: Paragraph 2: Again, the vegetated areas and types which could become established on the active gravel floodplain under (less frequent bank-full floods should be described.

Response

As stated in Section 3.3.1(b)(iii), "It is impossible to predict with certainty the vegetation changes that will occur post-project in this reach. The bankfull flood will have a post-project recurrence interval of once every 5 to 10 years, as opposed to the present 2-year interval (R&M 1982). In areas where such floods control the vegetation, early-successional stands may develop for about 5 to 10 years before being removed by the next bankfull flood. In some of these stands, however, silt deposition of vegetation growth may be rapid enough to stabilize the area against subsequent floods. Increased winter flows with subsequent increases in ice staging may cause other areas to undergo regular ice scouring during freezeup. The amount of area supporting mature stands of vegetation will be directly influenced by floods and the flow releases from Watana each winter."

W-3-129 Paragraph 4: We question the suggested vegetation changes between Talkeetna and the Yenta River. Vegetation allowed to establish over a longer period of time (e.g. 5 to 10 rather than 1 to 2 years) would seem less likely to be disturbed when the bank-full flood does occur. Given the annual flow variations over this stretch of the river, it would seem possible and necessary to predict areas of vegetation change for maximum and minimum flow scenarios.

Response

Please see the previous two responses.

W-3-130 - Climatic Changes and Effects on Vegetation: As for other ongoing studies, a schedule is needed for incorporating phenology study results into project plans.

Response

This schedule has been provided in Section 3.4.3.

W-3-131 Paragraph 3: We recommend calculating the potential vegetated area and types therein within the referenced 2.5 km area downwind of the reservoir within which air tempertaures may be affected. Resultant impacts on timing of vegetation green-up or leaf-drop could be important for area wildlife.

Response

The requested information has been provided in Section 3.3.1(b)(iv).

W-3-132 Paragraph 4: A more extensive treatment of fog bank development should be included here, please refer to our comments under Section 3.3(a)(ii) - Effects of Altered Downstream Flows . Watana to Devil Canyon. Also see comment above recalculating the areas within 3 km offshore which may be affected by ice development.

Response

A more detailed discussion concerning fog bank development has been provided. Comment noted concerning recalculations.

W-3-133 - Effects of Increased Human Use: We have repeatedly cited the important opportunity for minimizing project impacts on fish and wildlife by carefully siting and regulating access (see FWS letter to Eric Yould, APA, of 17 August 1982). The potentials for off-road vehicle (ORV) use and accidental fires with project access described here confirm that such use may need to be effectively controlled as fish and wildlife mitigation. Please refer to comments under Section 3.4(c)(ii) re our recommendations to eliminate the Denali Highway access route and to restrict worker and public use of project access routes.

We are concerned about inconsistencies with the first sentence here, regarding greater access opportunities, and with points made in the Wildlife Section. That section appropriately contains repeated descriptions of (1) the significant negative impacts from increased use and access; and (2) the need to carefully control project area use and access (e.g. Sections 4.4(a)[i], [ii], [iv], and [r] and 4.4(c)[ii]). Please clarify.

Response

Policy matters concerning access are discussed in the response to general comments raised in the USFWS cover letters of 14 January 1983.

The first sentence is true as stated. The section goes on to discuss consequent impacts. The mitigation plan states how those impacts will be alleviated, and residual impacts which will remain despite mitigation. No inconsistencies in this approach have been identified.

W-3-134 . Off-Road Vehicles: Paragraph 3: In view of previous incomplete coverage of wetlands (see our comments under Section 3.2(a)(vi), we question the definition behind use of the term wetlands here. This discussion illustrates the need for the improved wetlands map which is to be developed.

Response

Use of the term wetlands is quite valid in this context. The discussion addresses potential effects of off-road vehicles on wetlands in a general sense, and has no bearing on precisely defined vegetation or soil types, or mapping of any kind.

W-3-135 (b) Devil Canyon Development

(i) Construction: Other than quantifying direct vegetation losses from reservoir inundation, the section fails to provide any indication of the relative magnitude of other potential losses or alterations in vegetation.

Response

Additional quantification for camp and village, borrow sites, access routes, rail terminal, and transmission corridors to be developed in conjunction with the Devil Canyon facility is provided in Tables E.3.80, 82, 84, and 85.

W-3-136 - Vegetation Removal: Please refer to our concerns under Section 3.3 re lack of consultation in siting camp, village, and borrow areas.

Response

These concerns are discussed in the responses to general comments raised in the USFWS cover letter of January 14, 1983.

W-3-137 - Vegetation Loss by Erosion: Again, a map of permafrost areas would be useful. Given the likely ineffectiveness of replacing topsoil and recontouring (Section 3.3(b)(i) . Indirect Consequences of Vegetation Removal), we suggest that clearing may be a significant source of erosion.

Response

We concur that clearing may produce erosion which may in turn result in further vegetation loss in adjacent uncleared areas. This statement has been added to the text.

W-3-138 - Effects of Altered Drainage: We recommend that this section include the area of lakes, ponds, and other wetlands which may be affected by proposed borrow areas.

Response

These areas are quantified in Tables E.3.82 and E.3.84.

W-3-139 (ii) Filling and Operation: Paragraph 3: The potential for movement of the large landslide at river mile 175, causing upstream flooding and loss of mid- and late-successional vegetation in valuable riparian areas, should be described in more detail. For example, the potential size of the area to be impacted should be described.

Response

The potential extent of the area which might be affected by river blockage due to landslide would depend on season, river stage and flow, and the volume, height, and duration of blockage material persisting in the active channel. It would be foolhardy to attempt a quantitative prediction based on such unpredictable variables.

W-3-140 - Vegetation Succession Following Clearing: Please refer to our previous comments, Section 3.3(a)(ii).

Response

Please refer to the corresponding responses.

W-3-141 - Downstream Effects: The unknown consequences of frost buildup on vegetation adjacent to the reservoir represent a significant potential change in vegetation and thus impact to wildlife (see our comments under Section 3.3(a)(ii)). These consequences should be the subject of continuing studies and quantification.

Response

This recommendation will be considered during formulation of detailed study plans for Fiscal Year 1984, and will also be incorporated into post-construction environmental monitoring.

W-3-142 (c) Access

(i) Construction: Paragraph 1: Please refer to our comment under Section 3.2 regarding omission of base line data on proposed access corridors. Because of this omission, the exact areas which would be cleared within the 34 meter (m) x 67 km access corridor described here are unclear. Please explain why this description appears to conflict with earlier descriptions of road width and length (Section 2.3(c)(i)). Inconsistent use of both metric and English units within the same report adds further confusion.

Response

Areas of each vegetation type to be cleared within the specific access road routing presented for this license application are shown in Table E.3.85 for the Denali Highway-to-Watana and Watana-to-Devil Canyon roads and Devil Canyon-to-Gold Creek railroad. Proposed clearing widths have altered as design has progressed. Correct widths are 37 m (120 ft) for access roads and 15 m (50 ft) for the railroad. In the revised botanical resources and wildlife sections, metric units are presented with equivalent English units to aid coordination with other sections, chapters, and exhibits.

W-3-143 (ii) Operation: Paragraph 1: Our comments under Section 3.3(a)(ii) apply here also.

Response

Please refer to corresponding responses.

W-3-144 Paragraph 2: The potential for ice buildup on the railroad tracks and resultant impacts on vegetation should be examined.

Response

This potential was examined, but the results were too negligible to mention.

W-3-145 (d) Transmission Corridors

(i) Construction: Paragraph 1: Please clarify the differences among hectares to be impacted by the transmission corridors as cited here and in Tables W24, W25, and W26. Moreover, referenced Table W29, has nothing to do with transmission corridors.

Response

The inconsistencies and error have been corrected; see Tables E3.80 and 86.

W-3-146 Paragraph 2: Wetlands, as used here, should be defined. Precalculation of affected vegetation types will need to be undertaken after the ongoing vegetation remapping. Notation should be made that, (1) low-lying vegetation types will remain largely undisturbed, and (2) beneficial impacts of increased browse production will be realized, only if access and ORV use along transmission corridors are effectively controlled. Quantification of potential increases in browse should be possible on the basis of succession models and continuing classification studies. Such quantification is needed to compare overall losses and thus mitigation requirements for the project.

Response

The undefined useage of wetlands has been deleted, and quantification of vegetation types to be affected by transmission corridors is provided in Tables E.3.80 and 86. The requested notations are appreciated and have been incorporated into the revised discussions of transmission corridor construction and operation. The recommendation concerning quantification of potential browse increase will be considered during ongoing mitigation planning and development of detailed study plans for Fiscal Year 1984.

W-3-147 (ii) Operation: Our comments above under Section 3.3(d)(i) apply.

Response

Please refer to corresponding responses.

W-3-148 (e) Impact Summary: An explanation is needed for the process or criteria for determining impact "priorities of importance."

Response

The requested explanation has been incorporated into an expanded introductory statement to Section 3.3.6, which explains the criteria and process of impact prioritization and relates them to the Susitna Hydroelectric Project Mitigation Policy.

W-3-149 (i) through (v): This qualitative summary describes several data gaps which we believe should be answered, e.g. the vegetated area which may be lost with land slumpage from permafrost, changes in downstream floodplain vegetation, etc. Overall, we are concerned with lack of attention of cumulative impacts, an inattention made more acute by nonquantification of most impacts. The numerous "minimal" and "minor" impacts for each project feature may cumulatively represent significant alterations or loss of vegetation. From the standpoint of fish and wildlife habitats, project-related activities throughout this primarily undisturbed area represent the first intrusions similar to those which have led to significant and losses of fish and wildlife throughout the conterminous United States. A serious omission in this section is consideration of impacts to wetlands and floodplains.

Response

The impact summary has been quantified and expanded to include topics previously lacking, e.g., effects or the downstream floodplain, discussions of thermal erosion, and alterations to sheet flow and drainage patterns by linear structures. We strongly concur with the need to emphasize cumulative impacts and have incorporated this concern into the revised mitigation plan, Section 3.4.

W-3-150 (vi Prioritization of Impact Issues: We concur with the evaluation of acreage losses for a vegetation type relative to the proportion of that type in the region. Since vegetation is a key component of wildlife habitats, the basis for evaluating whether community changes are "good" or "bad" should follow in the Wildlife Section of this chapter. However as discussed there, an integrated evaluation of all species is lacking. There is little basis for making decisions on prioritizing species concerns or resultant tradeoffs in project impacts or mitigation alternatives. Our previous comments on each impact issue identified here apply. Additionally, we have a few specific comments.

Response

We agree that the basis for evaluating changes in sparse vegetation should be relative values to wildlife, and that prioritization of species for mitigation must have a rational and defensible basis. These issues are discussed in the revised Sections 4.3 and 4.4

W-3-151 - Direct Losses of Vegetation

Access Roads: While the actual area covered may be small relative to other project impacts, access routes indirectly impact a much larger area because of their linear nature.

W-3-152 . Transmission Corridors: We would like to be assured that the reference to a "median strip for transport of personnel and materials", is consistent with the environmental guidelines for transmission corridors (Appendix AE - Transmission Corridors, item 1) with which we concur. As with access roads, above, transmission corridors indirectly impact a very large area.

Response

Transmission corridor design has been revised and no longer incorporates a longitudinal access strip. Low shrub vegetation will not be cleared during construction or maintenance. Access for maintenance of the Watana-to-Devil Canyon corridor will be from the adjacent access road. For other transmission corridors, access will be overland from the nearest road. Nodwell or Rolligon- type vehicles will be used for maintenance purposes.

W-3-153 - Indirect Losses Of Vegetation: The cumulative impact of project features mentioned previously, is of particular concern here. Many of the identified losses will be in riparian corridors which are of particular significance to wildlife species.

Response

We concur. Many of these impacts will not be quantifiable and must therefore be monitored during construction and operation (Section 3.4.2[b]).

W-3-154 - Alteration of Vegetation Types: We again recommend that successional type changes over the project life be quantified in the license application.

Response

These estimates have been provided in discussions of downstream floodplain impacts and rehabilitation of disturbed areas.

W-3-155 3.4 - Mitigation Plan: We find the proposed plan incomplete and too general. There are two main problems with this plan. First, because impacts are incompletely quantified, it is not possible to determine the value of recommended/accepted mitigation measures or the magnitude of unavoidable, adverse impacts which will not be mitigated. Not integrating this plan with the fish and wildlife mitigation plans is the second main problem. Thus there is no comprehensive picture of overall project impacts, priorities for mitigation, potential for achieving those priorities, or tradeoffs among mitigation options for various area resources.

W-3-156 An approach similar to that for the Fishery Section mitigation plan (pages E-3-120 through E-3-144) would be more appropriate. We recommend restating the full range of mitigation alternatives here, prioritized in accord with NEPA guidelines; avoid, minimize, rectify, reduce or eliminate over time, and finally, compensate. This approach should be expanded to include reasons for rejecting high priority mitigation in lieu of lower priority measures (e.g. proposing regulations on access rather than alternate siting or scheduling of access). A mitigaton plan, incorporating specific, effective measures which have been selected through this process, should then be presented.

W-3-157 Many of the identified impacts are not addressed in the mitigation plan itself. In those cases, impacts should be clearly identified as unavoidable, short or long-term, adverse impacts. Moveover, we find the report lacks information specifically required by FERC regulations (F.R. Vol. 46, No. 219, 13 November 1981), Section 4.41(f)(3)(iv), i.e. there are no implementation, construction, or operation schedules for recommended mitigation measures; which measures have actually been incorporated into project plans is unclear; and neither replacement lands nor habitat manipulations have been identified as to either suitable sizes or locations.

W-3-158 Generalities of the plan are exemplified by references to using, "depleted or non-operatonal upland borrow pits...as overburden storage areas where feasibile" (page E-3-187) or reference to "a feasible haul distance," (page E-3-187).

Response

The revised mitigation plan (Section 3.4) is responsive to all of the above comments and recommendations. Specifically, the following major changes have been made:

1. Greater emphasis is placed on the complementary relationship between the mitigation plans for botanical resources, fisheries, and wildlife, both in an introductory statement (Section 3.4.1) and throughout the text.

2. In Section 3.4.2, the full range of mitigation options is explained for each of the impact issues discussed in Section 3.3. Where a particular option has not been followed, the reasons are stated.

3. In accordance with 18 CFR Part 4, Subpart E (Federal Register, Vol. 46, No. 219, 13 November 1981), mitigative measures recommended through agency consultation are described and documented in Section

3.4.2. Where such recommendations have been incorporated in the mitigation plan, explanation is provided. Cases where alternative measures have been adopted are also explained.

4. In further compliance with the regulations cited above, Section 3.4.2 provides estimates of the costs of construction, operation, and maintenance of proposed mitigative measures where such measures are not included as project capital costs. Project capital costs are described in Exhibit D.

5. Every effort is made to provide defensible quantification, where available, of the extent to which mitigation will be achieved by area and over time for each impact issue. In accordance with the regulations cited above, implementation, construction, and operation schedules for mitigative measures are stated by month or year, commensurate with the level of detail provided by the overall project schedule presented in Exhibit C.

6. Only measures actually incorporated into project features or into mitigation planning currently in progess are described. Further recommendations for mitigation measures not actually incorporated are not discussed, except where provided through agency consultation; see (3) above.

7. In accordance with the regulations cited above, the following mitigative design modifications are illustrated in Figures E.3.79-82:

   a) Changes in the general routing of access roads;

   b) Localized access route adjustments to avoid site-specific biological features;

   c) Alterations in construction procedures for the Denali Highway-to-Watana access road section; and

   d) Clearing and maintenance features for transmission corridors.

8. A consolidated, itemized mitigation summary (Section 3.4.3) is presented in well-organized format after the option analysis has been completed. This plan provides a summary of mitigative measures, schedule, and costs relating to each impact issue and, where justified, provides estimates of residual impacts.

9. A synopsis of agency consultation and mitigation recommendations is provided in Section 3.4.4, with references to the text where these recommendations are discussed.

The option analysis (Section 3.4.2) clearly states mitigative features which have been incorporated into engineering design and construction planning; reasons for incorporating or not incorporating agency recommendations pertinent to botanical resources are also stated. These topics are further summarized in Sections 3.4.3 and 3.4.4, respectively. Siting of construction camps and villages is discusssed in Section 3.4.2. Policies and enforcement measures of the Alaska Power Authority regarding off-road or all-terrain vehicle use will be consistent with concurrent management policies of landowners or resource agencies with jurisdiction over lands surrounding the project.

W-3-159 (a) Watana Development

(i) Construction: Paragraph 1: Mitigative features which have been incorporated into engineering design and construction planning should be clearly stated. Reasons for rejecting our recommendations have never been formally provided (e.g. access pond siting). Location of the construction camp and village on shrublands (per Table W27) rather than forestlands may not minimize impacts, depending on the wildlife species of concern, erosion potentials, proximity to construction and access facilities, etc. Again, since we were not consulted in siting of those facilities and have not seen Exhibit A, we cannot fully understand the situation. A mechanism for enforcing the referenced prohibition of off-road or all-terrain vehicle use should be included (see FERC regulations, Section 4.41(f)(3)[iv]) in F.R. Vol. 46, No. 219, 13 November 1981.

Response

Engineering design and construction planning mitigative measures are described in Chapter 3, Section 3.4 and 4.4 and in Chapter 10. Reasons for access road location are discussed in Chapter 10, which has been expanded. Reasons for location of construction camps and villages are discussed in the response to your comment in Chapter 10. A mechanism for enforcing prohibition of ATV use is described in Section 4.4.

W-3-160 Paragraph 3: We suggest that facility siting to avoid wetlands be rereviewed in consultation with the FWS and CE and proposed revisions to the wetland maps. As with similar points about "minimizing" or "reducing", there is no quantification, particularly relative to the amount of wetlands, or other impacts in other report sections, which will be impacted and which can be avoided.

Your recommendation will be considered during early stages of the detailed facility siting and design program. Quantification of impacts to wetlands and vegetation community types is provided in the impact discussion (Section 3.3).

W-3-161 Paragraph 5: We concur that spoils should be placed in the inundation area as long as such placement will not create a sedimentation problem.

Response

Spoil disposal sites within the impoundment areas will be located to avoid or minimize entrainment of fines during inundation. In the Watana impoundment area, spoil will be deposited on relatively flat sites at higher elevations within the impoundment area. These sites will not be inundated until after the diverson tunnel has been blocked. Exact locations of spoil disposal areas will be determined during detailed engineering design and mining plan developments.

At the Devil Canyon facility, spoil will be deposited at borrow site G, which ranges from about 280 m (925 ft) to about 356 m (1175 ft) in elevation. Spoil deposited on this first-level terrace site will not be entrained during river diversion.

W-3-162 Paragraph 6: We recommend explaining whether project engineers have confirmed that floodplains or first-level terrace locations will not be needed for borrow for ancillary project facilities.

Response

Project engineers stated on 14 February 1983 that active floodplain and first-level areas downstream from the Watana damsite will in fact be used to obtain borrow for the construction of ancillary facilities. No active floodplain borrow sites are planned for the Devil Canyon development, but borrow area G, a first-level terrace location, will be used.

W-3-163 Paragraph 7: We recommend that similar detailed information be provided throughout the report.

Response

Recommendation noted.

W-3-164 (ii) Filling: Please refer to our General Comments, Botanical Resources, regarding identifying feasible habitat enhancement measures or replacement lands. The contention that moose winter browse "may be compensated" is useless, given that (1) there is no guarantee in this plan that enhancement or land acquisition will ever occur; and (2) quantification for how much/where/what type of land must be enhanced or acquired is lacking. Moveover, tradeoffs regarding compensation for moose to the neglect or adverse impact of other species have not been settled or even discussed.

Response

Habitat enhancement measures and acquisition of replacement lands for compensation of adverse impacts to wildlife are discussed in Sections 3.4 and 4.4. Quantification has been provided on a preliminary basis but will depend on the refinement of ongoing habitat-based simulation modeling as well as the results of monitoring during construction and operation.

W-3-165 Paragraph 3: Because of internal inconsistencies, the overall effect of siltation is unclear.

Response

The revised Exhibit E, Chapter 2 (water resources) discusses siltation effects in greater detail.

W-3-166 Paragraph 5: Whether rectification will be one percent or 99 percent is unclear.

Response

The point of this comment is not understood and appears to be out of context.

W-3-167 Paragraph 7: We concur with revegetation plans to emphasize fertilization and minimize seeding where erosion will not be a problem.

Response

Noted. This approach is maintained in the revised report.

W-3-168 Paragraph 8: We strongly support plans to rehabilitate all sites by the first growing season after they are no longer needed. Assurances should be provided that sufficient quantities of seeds would be stockpiled and regrowth potentials of available native strains will be tested prior to project abandonment of disturbed sites. Choice of plants for site rehabilitation should be in consultation with Federal and State natural resource agencies.

Response

These assurances have been provided in the revised draft.

W-3-169 (iii) Operation: Paragraph 1: We concur with the proposed monitoring of downstream vegetation changes but note that monitoring in itself is not mitigation. Periodic controlled flooding to maintain primary and secondary successional stages must be coordinated with the Fishery Section and Wildlife Section mitigation plans.

Response

As explained in Section 3.3.1(b)(iii), flow releases coordinated with freezeup and breakup will be the determining factors in maintaining early plant successional stages downstream. Flow releases required for fishery impact mitigation will not necessarily correspond with these times (Section 2.4). Considerable attention will be given to the magnitude and timing of mitigative flow releases during detailed operations planning.

W-3-170 Paragraph 2: We have assumed that nonessential portions of the disturbed areas will be promptly rehabilitated. Please specify.

Response

Quantification of areas to be rehabilitated after dismantling of the construction camp and temporary portions of the village is provided in the revised report.

W-3-171 (b) Devil Canyon Development

(i) Construction: Paragraph 1: Our comments relative to the Watana development (Section 3.4(a)[ii]) mitigation apply here also. An additional mitigation need is monitoring and enforcement relative to ORV and unauthorized access uses. Spoil disposal described here was not discussed or previously covered in the impacts Section 3.3(b)(i).

Response

The appropriate revisions have been made.

W-3-172 (ii) Filling and Operation: Again, our comments under Watana Development, Section 3.4(a)(ii) and (iii) apply.

Response

Please refer to the corresponding responses.

W-3-173 (c) Access

(i) Construction: Paragraph 1: Please clarify why avoidance of closed forests was termed as a mitigative measure in siting of the Denali Highway to Watana access road. Section 4.4(b), paragraph 2 supports this siting regarding minimization of project impacts to pine marten. If this is the reason, that reference should be made here and further information is necessary on other species adversely affected by this siting and adverse/beneficial impacts of alternative sitings which were eliminated. Wetlands will need verifying per our previous comments (Section 3.4(a)[i]). At least one line of this paragraph was omitted.

Response

Avoidance of closed forest by access routing is cited as a mitigative measure because of avoidance of impacts to pine marten and bird species which utilize this vegetation type. Appropriate references have been incorporated. It is recognized, however, that closed forest may not be more valuable than shrubland or tundra where other species are concerned, and the tradeoffs are discussed in the wildlife mitigation plan (Section 4.4). cussed in the wildlife mitigation plan (Section 4.4). As a botanical resource in itself, closed forest is not necessarily more or less valuable than any other vegetation type, but less total clearing of vegetative biomass is achieved by avoiding closed forest, as noted in the revised text (Section 3.4.2[a]).

W-3-174 Paragraph 3: We refer you to our previous comments on wetlands, Sections 3.2(a)(vi) and 3.4(a)(i).

Response

Please refer to the corresponding responses.

W-3-175 Paragraph 4: Information is too general. We concur with the intent but do not have necessary specifics as to the extent of mitigation which will be achieved.

Response

Considerably more detail is provided in the revised text, including the introduction of side-borrow techniques as a means to reduce gravel extraction requirements to an absolute minimum. An illustration of side-borrow procedures has been incorporated (Figure E.3.83).

W-3-176 (ii) Operation: The referenced management provisions should be described here including busing of workers and restrictions on non-project-related uses.

Response

Management options for mitigating access-related impacts during project operation are under review by the Alaska Power Authority and will depend largely on inter-agency agreements which have not yet been reached. Busing of workers during operation is not planned. Any restrictions on non-project-related use of access roads by the public will be consistent with management policies of landowners and resource agencies with jurisdiction over lands surrounding the project.

W-3-177 Paragraph 2: The extent of mitigation which can be achieved for many project impacts will depend upon the management options under review by the APA. In the APA Mitigation Policy document and under NEPA guidelines, avoidance is to be the first priority in implementing mitigation. Therefore, we refer you to our previous correspondence on this issue (letter to Eric Yould from FWS, 17 August 1982) as part of our prelicense consultation. In brief, the necessary avoidance should include elimination of the Denali Highway to Watana access road and prohibiting use of other project access routes for non-project-related access. Instead, construction access should be by rail from Gold Creek, along the south side of the Susitna River to Devil Canyon, and access on the north between the two dams. Non-project-related use of these access routes should be prohibited during project construction. A thorough analysis should be provided here of public access from the standpoint of adverse impacts to fish and wildlife and their habitats in comparison to any positive impacts for recreational and subsistence fish and wildlife uses.

Response

The Alaska Power Authority Mitigation Policy and NEPA guidelines do not indicate that avoidance of a project feature for purposes of mitigating impacts to biological resources must take priority over all other project-related considerations. Recommended mitigation measures and facilities included in the cited correspondence are discussed in the revised option analysis (Section 3.4.2). Where a recommendation has been rejected, the reasons are provided and the selected alternative measure or facility is then explained. Any analysis of impacts to fish, wildlife, and their habitats in comparison to enhancement of recreational and subsistence opportunities afforded by increased access will indicate that impacts to fish and wildlife will increase as recreational and subsistence activities increase. In reality, adverse impacts to fish and wildlife resulting from increased non-project-related human activity must depend on management decisions implemented cooperatively by the boards, agencies, and landowners with jurisdiction over the affected lands and resources. Management options available to state, federal, and private entities are reviewed in Section 3.4.2 of the revised document. Access-related management policies of the Alaska Power Authority will be consistent with the policies of boards, agencies and landowners with jurisdiction over the affected lands.

W-3-178 We note some conflict between the statement that the APA is reviewing a variety of access management options with the suggestion that the project access route from the Denali Highway may be eligible as a National Scenic Highway. That designation would stimulate public access to the increased detriment of fish and wildlife, effectively foreclosing some mitigative management options.

Response

The point of the referenced statement, as clearly stated, is that National Scenic Highway designation "would entail restrictions on off-road vehicle use and other potentially disturbing activities initiated from the access road."

W-3-179 Paragraph 3: Please refer to our more extensive comments on the Recreation Plan regarding consistency with fish and wildlife protection priorities. We strongly concur with the proposal to monitor fish, wildlife, and vegetation impact but again note the report's deficiency in not describing how and by whom monitoring will be completed (see our General Comments, Fishery Section). Moreover, the process for modifying project operations or the Recreation Plan to better effect mitigation is not described.

Response

We have reviewed the referenced comments, but suggest that protection of fish and wildlife is not the only objective of FERC requirements for a recreation plan. Commitments for monitoring fish, wildlife, and vegetation are discussed in in the corresponding mitigation plans (Sections 2.4, 3.4, and 4.4, respectively). Attention is given to the process by which the Alaska Power Authority will modify project operations and recreational planning to achieve mitigation objectives with respect to biological resources.

W-3-180 (d) Transmission

(i) Construction: Please clarify what criteria were used for siting of transmission corridors. Assurance is required that project plans include construction by helicopter or winter access.

Response

The primary consideration in siting the Watana-to-Gold Creek transmission corridor was to provide as nearly as possible a common corridor with the access road, so that an alternative *de facto* access route would not be created along the transmission corridor. Criteria for the evaluation and selection of all transmission corridor alternatives is provided in Chapter 10. Construction will therefore emphasize access from the adjoining road. Construction by helicopter is no longer planned. Winter access for construction will be considered during detailed construction planning.

W-3-181 Paragraph 2: Again, refer to our previous comments on wetlands. We recommend minimum 150 m buffers between swan nests and any portions of the transmission corridor.

Response

This recommendation will be considered during detailed alignment determination.

W-3-182 (ii) Operation: We concur with this plan but are concerned that it may not be implemented. We hope to avoid a repeat of the Intertie situation where on-ground access was later guaranteed to the operating utilities contrary to residents' and agencies' recommendations. That guarantee already contradicts this plan, given the dependence and interrelationship of the Susitna project with the Intertie.

Response

Access for maintenance of transmission corridors will be ground-based and may occur at any time of the year attention is required. In the corridor between Watana and Devil Canyon, the adjacent access road will allow direct overland entry of maintenance equipment across a distance ranging from about 0.1 to 1.2 km (up to 0.75 mile). Where nearby road support is not available, equipment will be transported from the point of entry along the corridors themselves. Equipment will be mounted on flat-tread or balloon-tire vehicles to minimize soil or ground-cover disturbance. As explained in the revised text, the area directly beneath the lines and to about 1.5 m (5 ft) on each side will be cleared to about 0.75 m (24 inches) above ground level. Trees and tall shrubs will be removed only where they present an obstruction or hazard to lines or towers.

W-3-183 Since habitat manipulations, including fire, crushing, etc. (Section 4.4(a)[i] and [iv]) are being suggested as a prime mitigation measure for wildlife, we recommend that potential effects of those activities on vegetation types within different project areas be discussed here. The potential value for mitigation of various habitat manipulations should be explained similar to the discussion on fire, Section 3.2(a)(ii).

Response

A discussion of the effects of controlled burning, clearing, and crushing on various vegetation types has been incorporated in Section 3.4.2.

W-3-184 Two additional items which should be covered in this mitigation plan are the monitoring and surveillance plans referred to earlier and an erosion control plan specific to project features and schedules.

Response

Monitoring as an impact-reduction measure is discussed in Section 3.4.2. An erosion control plan specific to project features, soil and terrain types, and construction scheduling will be prepared during detailed engineering design.

W-3-185 Specific comments on tables and figures relative to the Botanical Resources Section follow:

Response

Comment noted.

W-3-186 Table W3: Please change in accord with our recommendations under Section 3.1(c), to "Candidate endangered and threatened plant species", etc.

Response

The requested change has been made.

W-3-187 Tables W5 through W19: We suggest including a footnote or appendix briefly describing how these data were collected with some explanation of whether sampling intensity was commensurate with the availability of the vegetation type within the project area and potential for that type to be impacted by the project.

Response

Sampling methods are described in a new addition to the botanical resources baseline dscription (Section 3.3.2(a)), and sampling locations are shown in new Figures E.3.34, E.3.79, and E.3.80. Sampling intensity was greatest in areas of high impact potential.

W-3-188 Tables W21 through W23: The number of sites sampled in each type should be included. As in our comments on the text, information should be provided on how these categories compare with the vegetation categories sampled within the upper Susitna basin.

Response

The requested information is provided in Section 3.3.2(a) and Table E.3.50.

W-3-189 Tables W24 through W26: Please clarify whether the 400 to 500 foot right-of-way or 110 foot cleared centerline area was used in these calculations. Per our previous comment on the transmission corridor, a similar table for the Intertie portion of the transmisson corridor should be included. We also suggest a summary table showing the vegetation impacts from all segments of the transmission corridor.

Response

Actual right-of-way widths likely to be affected by construction were used in the referenced calculations, as follows:

2 towers wide = 91 m (300 ft)
(Watana to Devil Canyon, Anchorage to Fairbanks)
4 towers wide = 155 m (510 ft)
(Devil Canyon to Gold Creek)

Areas or vegetation types within the Willow-to-Healy intertie corridor are provided in Table E.3.79, based on a uniform right-of-way width of 91 m (300 ft).

W-3-190 Please refer to our comments in the text on need for an additional table showing vegetation types to be impacted by all access corridors, preliminarily identified borrow areas (e.g. borrow area G is not included in Table W28) and spoil areas. Where questions remain on the size of borrow/spoil areas to be used or the necessity of all potentially identified areas, notation should be made of potential maximum and minimum sizes and any ordering regarding use of these areas.

Response

Additional Tables E.3.80, 82, 83, 84, 85, and 86 show areas of vegetation types to be affected by all prlject facilities quantifiable by area and location at this time.

W-3-191 Figure W1: Granted, it is difficult to reproduce such a map at this scale. However, we recommend a larger reproduction be included in the final application. That map should include an overlay showing reservoir inundation areas, access roads, transmission corridors, and other project features. A corresponding map of downstream vegetation and overlay of transmission corridors is also needed.

Response

Figure E.3.40 is reproduced in large format as a pocketed enclosure in the revised Exhibit E. This figure shows vegetation types of the Watana and Gold Creek watersheds (formerly Upper Susitna Basin) at a scale of 1:250,000 (McKendrick et al. 1982).

W3-192 Figure W3: Once the remapped vegetation classification is completed, it should be correlated to this table to quantify potential vegetation changes and types over the life of the project.

Response

We concur and foresee use of the remapped vegetation types as allowing not only refinements of impact quantification, but also more precise input to design engineers during detailed siting studies.

W-3-193 Figure W4: As above, this figure should be a basis for analyzing downstream successional trends given the projected longer times between floods. Maintenance of habitat manipulations should be specified on the basis of this figure and mitigation objectives.

Response

This recommendation has been noted.

CHAPTER 3 - SECTION 4 - WILDLIFE

W-3-194 4.1 Introduction: We recommend expanding this section to at least acknowledge the ecological values of all wildlife species, as well as to more clearly outline objectives of the report and resultant mitigation plan. We again point out the need for an overall discussion of fish, wildlife, and botanical resources, overall mitigation plans, and tradeoffs in benefits to some resources at the expense of others.

Response

This section has been expanded to explain the treatment of various species of wildlife.

W-3-195 (c) Species Contributing to Recreation, Subsistence and Commerce: Not only birds, but all wildlife species in the project area contribute to non-consumptive forms of recreation. Incidental viewing of wildlife in conjunction with other activities is an unquantifiable but well documented value. For example, the importance of downstream fish and wildlife habitats to fish, wildlife, and the significant numbers of people using them has been recognized by the State and agreed to by the Matanuska-Susitna Borough Assembly. Fish and wildlife have been designated a primary use on every State land management unit on the east side of the Susinta River from Cook Inlet to just below its confluence with the Kashwitna River. These management units and state guidelines for protecting fish and wildlife are described in the recent State report, Land Use Plan for Public Lands in the Willow Sub-basin, October 1981, by the Alaska Department of Natural Resources, (ADNR), Matanuska-Susitna Borough, and ADF&G.

Response

Incidental viewing in conjunction with other activities is an unquantifiable value which increased access will facilitate. This impact is therefore treated superficially throughout. Current use of upstream areas is extremely low. Downstream from Talkeetna, where access is less prohibitive, a larger number of users may currently view wildlife incidentally. However, the project is not anticipated to negatively impact incidental viewing in this area.

W-3-196a A discussion as to why the evaluation species were selected and prioritized as described here is as applicable to terrestrial wildlife species as it is to fish (Section 2.1[d]). We suggest referencing that discussion here. Such information is particularly important with regard to mitigation plans for one species which conflict with another species.

Response

See paragraph 1 and 2 of Section 4.1, and Sections 4.1.2 and 4.1.3. With regard to conflicts in mitigation plans, see Section 4.1, paragraph 2.

W-3-196b We also suggest noting values of key bird species, i.e. bald and golden eagles have received national protection (Bald Eagle Protection Act, 16 U.S.C. 668-668c); trumpeter swans are highly valued because of their former endangered status; and other migratory birds are protected under international treaties and the Migratory Bird Conservation Act (16 U.S.C. 701-718h).

Response

This section has been expanded, and specifically mentions the value of eagles and trumpeter swans. Most bird species in North America are protected under international treaties and the Migratory Bird Conservation Act. However, we do not feel that this protection justifies the prioritization of these bird species over other species not similarly protected. Also, please note that trumpeter swans have never been endangered in Alaska.

W-3-197 Please note, all references to tables in the wildlife section of the text are to table numbers one greater than the actual table. We have referred to tables as they are actually numbered.

Response

This has been corrected.

W-3-198 4.2 Baseline Description
(a) Big Game
(i) Moose:
- Distribution: Please document how moose are "one of the most economically important wildlife species in the region;" also see our comments on Chapter 5, Section 3.7(b).

Response

See Section 4.2.1(a) (i) paragraph 1 "because of their regional contribution to subsistence...." See Chapter 5.

W-3-199 . Special Use Areas: In view of your repeated citations that winter range is a key area for moose (e.g. Section 4.2(a)(i)
. Seasonal Movements: Paragraph 6; Section 4.2(a)(i)
. Mortality Factions: Paragraph 5; and Section 4.3(a)(i)

. Winter Use, we suggest including a section here on the use and availability of winter range in both severe and mild winters, as well as the data gaps and plans to overcome them relative to this study. Maps showing use areas described here relative to project features would clarify this section.

Response

See Section 4.3.1(a) (i) paragraphs 4-7. See Section 4.3.1(a) (iii) for treatment of data gaps.

W-3-200 Calving Areas: Paragraphs 3 and 4: Numbers of male and female moose radio-collared in each of the downstream study areas should be described here.

Response

Male moose do not calve. Sample sizes are given in Section 4.2.1(a) (i) under - Seasonal Movements, paragraph 8 and - Special Use Areas, paragraph 3.

W-3-201 . River Crossings: To better understand how not only the reservoirs, but ancillary project features such as the Devil Canyon camp and village, may also influence moose crossings of the Susitna River, crossings both immediately up and downstream of the impoundment areas should also be described (also see our comments under Section 4.3(b) (i) - Interference with Movements).

Response

No interference with moose crossings upstream from the Watana reservoir will occur since no facilities or other project-induced obstacles will be located there. Since the Devil Canyon reservoir will extend upstream to the Watana damsite, your statement pertains only to the area immediately downstream from the Devil Canyon damsite. The Susitna River adjacent to the Devil Canyon damsite is bordered by steep canyon walls which physically prevent moose crossings. No moose crossings have been documented in this area; this has been noted in the river crossing discussion.

W-3-202 - Habitat Use: The main problem with this and the following section on populations is that there has, apparently, been no integration of moose and vegetation data.

Response

The integration of vegetation overstory types and moose radio-locations recommended by the USFWS would not provide meaningful results, and therefore an alternative method for evaluating the relative importance of vegetation types in the Susitna Basin and elsewhere in Alaska is being developed. This method is described in Section 4.3.1(a) (iii).

W-3-203 . Cover Requirements: Paragraph 7: Please describe the scope and schedule for the necessary studies of habitat use, or reference the discussion under Section 4.3(a) (i) - Quantification of Project Effects. Correlating aerial observations to the remapped vegetation types should provide additional information on habitat use. Elevation, slope, or other habitat parameters may also need to be incorporated in this analysis.

Response

Section 4.3.2(a) (iii) outlines the approach for evaluating the relative importance of vegetation types in the Susitna Basin.

W-3-204 Habitat Use in the Upper Susitna Basin: Paragraph 3: Further information is needed on the understories associated with these habitat types. Please indicate when such information will become available.

Response

See Tables E.3.89, E.3.90, and E.3.91. Mapping of vegetation, including understory classifications in open and woodland forest stands, will be conducted in 1983.

W-3-205 Habitat Use in the Lower Susitna Basin: Paragraph 2: For consistency, the number of female moose radio-collared north of Talkeetna should be provided, also see our comments under this section, Calving Areas. The discussion is confusing due to frequent combining of quantitive data with qualitative statements such as "most female use", "at most relocation sites", etc. Where it is available, we recommend supplying quantitative information, with qualifying discussions on limited sample sizes, periods of observations, etc.

Response

See Section 4.2.1(a) (ii) paragraphs 11-13. See also discussion in paragraph 3 of the introduction.

W-3-206 . Food Habits: Paragraph 2: Again, please describe the scope and schedule of ongoing analyses and how that information will be integrated into mitigation planning in a timely manner. Reference to your Section 4.3(a) (i) - Quantification of Project Effects will provide some of this information.

Response

The food habits discussion has been expanded to include data collected in 1982. The scope and schedule of additional food habits work is found in Section 4.3.1(a) (iii).

W-3-207 Paragraphs 4 and 5: We suggest examining how browse availability and vegetation types utilized by moose correlate with moose relocations in reference to the remapped vegetation types.

Response

This analysis would be inappropriate because of sampling biases during moose captures and relocations, and because of the problems described in Section 4.2.1(a)(ii), paragraphs 6 and 7. The approach outlined in Section 4.3.1(a) (iii) will provide more meaningful results.

W-3-208 . Home Ranges

The Upper Susitna Basin: The rational should be given for selecting an 8 km wide analysis zone adjacent to the impoundment.

Response

This distance was arbitrarily selected by the Principal Investigator of the moose studies based on moose home range data.

W-3-209 Lower Susitna Basin: Paragraph 2: Please describe or reference the scope and schedule for continuing studies. We recommend giving some consideration to the relative habitat values of all river study areas.

Response

The results of radio-tracking studies and bi-weekly winter river surveys conducted in 1982 will be available in June 1983. Study plans for additional field studies beyond that date are still being formulated.

Studies conducted since 1980 have included the entire Susitna River from its source in the Alaska Range to its mouth at Cook Inlet. Because of the large size of this study area, more intensive work has been conducted at representative sites along the river floodplain.

W-3-210 - Population Characteristics

. Historical Population Trends: Paragraph 1: An overlay of project features on the map of count areas (Figure W6) is needed.

Response

A map showing project features is included in the impact section. For purposes of clarity and consistency, project features are not included on figures in the baseline sections.

W-3-211 Paragraph 2: Substantiating population and productivity data in Tables W32 through W34 should be referenced here.

Response

These tables have been referenced in Section 4.2.1(a) (iii) paragraph 1.

W-3-212 . Population Estimates - Upper Susitna Basin: Please describe what types of habitat correlations can be made from remapped vegetation types and other habitat parameters for low, high, and moderate moose density areas.

Response

Stratification of census areas is a statistical method of reducing sample variance by subdividing the census area into subareas with relatively homogeneous moose densities. Densities within strata are relative values within a particular census area only. Stratification is based on a subjective evaluation of moose densities derived from whatever clues to density are available, including prior knowledge of the area, observations of moose or moose sign during stratification flights, and habitat characteristics. However, habitat characteristics alone may not give accurate stratification data, particularly when densities are non-uniform. Therefore, strata designations of high, medium and low density may be unrelated to vegetation types and certainly should not be used for correlation or extrapolation to assess habitat use patterns.

W-3-213 . Population Estimates - Lower Susitna Basin: Paragraph 2: Please describe differences between habitats up and downstream of Montana Creek.

Response

See Section 4.2.1(a), paragraph 1.

W-3-214 . Mortality Factors: Paragraph 1: We recommend describing how range quality has been decreasing.

Response

See discussion in paragraph 1: "decreasing range quality... thought to be less important ...." However, range quality may be decreasing because fire suppression reduces the frequency of creation of early sucessional habitat. Nonetheless, moose are likely to be below carrying capacity even considering any reduction in range quality, for reasons discussed in the above referenced and following paragraphs.

W-3-215 Paragraphs 2 through 4: Please describe the comparability of brown bear populations and habitat types between the Nelchina and Susitna River basins.

Response

The referenced calf mortality studies were conducted in the Nelchina and middle Susitna River Basins. This has been clarified in the discussion. Predation patterns and bear movement data collected during the studies in 1977-1979 were similar to those found recently in the Watana watershed. The two study areas overlap each other considerably and therefore the habitat types and brown bear populations are similar.

W-3-216 We recommend expanding the discussion to include hunting as a mortality factor. Both recreational and subsistence hunting can affect population size and structure. Hunting figures prominently in later impact discussions. Historical hunting effort and success data relative to changing management regulations should be described, and coordinated with Chapter 5. Please also refer to our comments under Chapter 5, Section 3.7(b).

Response

This is discussed in Chapter 3, Section 5.

W-3-217 (ii) Caribou

- Distribution and Movements Patterns: Paragraph 6: Please describe below how many animals were radio-collared and the numbers of radio locations made for each one.

Response

See Section 4.2.1(6) paragraph 3. Number of radio-locations for each individual are available in ADF&G 1982c, appendix 1.

W-3-218 Figures W9 and W10 of caribou radio locations should include the locations of project features.

Response

Project features are not shown on figures in the baseline section for clarity and consistency. See Figure E.3.37 for major features.

W-3-219 - Habitat Use: Please clarify whether aerial observations or an overlay of radio locations on existing vegetation type maps were used to determine caribou use of different vegetation types. A correlation should be provided for the proportion of the basin which is in each type relative to the type (Table W36). Please discuss whether vegetation remapping efforts will affect the interpretation of caribou data.

Response

See Section 4.2.1(c)(iii) paragraph 1. Basin vegetation coverage is presented in Table E.3.51. Habitats used by caribou are widespread and a very small proportion of total range will be lost to the Susitna project (see Section 4.3.2(c)). Habitat loss is not considered a significant impact and greater emphasis is placed on more important aspects of caribou ecology. No additional interpretation of caribou vegetation relationships is planned.

W-3-220 - Population Characteristics: Paragraph 1: This section should reflect present and future management plans and be consistent with Chapter 5, Section 3.7(b)(ii).

Response

See Section 4.2.1(c)(iv) paragraph 1. Future changes in management plans will reflect the ability of the resource to sustain harvest and the demand for harvest opportunities, and will be determined by the Alaska Board of Game. This is beyond the control of the Alaska Power Authority to predict or control.

W-3-221 Paragraph 10: Changes in the number of permits from 1972 to 1982 should be described and percents of the herd harvested, by year, included in Table W38.

Response

Permit controlled hunts were begun in 1977. Number of permits issued since that date are given in Section 4.5. Data on harvests from 1972 to 1981 appear in Table E.3.104 and total herd size estimated in years for which an estimate was made appear in Table E.3.103. The percent of the herd harvested each year has been added to Table E.3.104.

W-3-222 Paragraph 11: Please tabulate data on wolf population, wolf predation, and caribou numbers from 1957 to 1981.

Response

A summary of this relationship is provided in Figure E.3.96. More information on wolf populations appears in Section 4.2.1(g).

W-3-223 (iii) Dall Sheep

- Distribution: Paragraph 2: We recommend including maps which more specifically delineate seasonal sheep use of the Susitna basin relative to project features.

Response

Maps showing project features are not included in the baseline sections for reasons of clarity and consistency. The information given in the text is considered adequate.

W-3-224 Paragraph 5: We recommend further justification be provided to support the conclusion that impacts from the impoundments will be minor. Clarificati on of where the sheep winter and of sheep movements between seasonal ranges should be provided.

Response

Sheep studies in the Susitna Basin have been conducted for over 15 years. There is no evidence that sheep cross the Susitna River, and the populations found north and south of the river are considered distinct. Considering the topography of the project area, and information on sheep movements obtained in the Susitna Basin and elsewhere, it is extremely unlikely that the impoundments will interfere with normal sheep movements. The exception to this is in the vicinity of the Jay Creek mineral lick, as discussed in the text.

W-3-225 Paragraph 6: Reference should be provided for the judgment that the sheep population has remained stable or slightly increased.

Response

This statement was made by ADF&G investigators and has been referenced in the application.

W-3-226 Paragraph 8: Please provide a map of the Jay Creek mineral lick, and probable travel corridors to the area, relative to the Watana impoundment. We recommend providing historical harvest data and explaining how project surveys relate to area populations.

Response

Intensive ground observations at the Jay Creek lick will be made in April-June 1983. The results will be provided when they become available. Historical harvest data have been discussed in Section 5. The relationship between project surveys and area populations is described in Section 4.2.1(c) paragraph 1, and in Section 4.2.1(c)(i).

W-3-227 (iv) Brown Bears

- Distribution: We recommend providing data on the numbers of bears radio-collared and radio locations made, as well as maps of those radio locations relative to project use.

Response

These data have been added to Section 4.2.1(d)(i). The analyses of home range overlap included in the text were felt to be more informative than a map of radio locations, and no map has been included.

W-3-228 - Habitat Use: Paragraph 2: Please describe whether aerial observations or vegetation type maps were used to determine vegetation types relative to brown bear radio locations. An explanation should also be provided of how more detailed vegetation data and the vegetation remapping efforts will be integrated with the analysis of brown bear habitat use.

Response

Vegetation types were recorded during relocation flights; this has been clarified in the text. The utility of additional vegetation mapping and ground sampling to brown bear research is being discusse d, but there are currently no plans to expand on the habitat use analyses already provided.

W-3-229 . Home Range: Paragraph 1: Please correct the referenced Table W42 which lists data from project studies in the Susitna, not the Nelchina basin.

Response

The referenced data were collected in both the Nelchina and Middle Susitna basins. This has been clarified in the table.

W-3-230 Paragraph 2: An explanation should be provided as to why 1.6 km and 8 km were chosen as the breakdown for study zones around the impoundments.

Response

These distances were arbitrarily selected by the Principal Investigator for bear studies for purposes of a quantitative analysis.

W-3-231 Paragraph 4: Please describe data on bear radio locations relative to access roads, transmission corridors and ancillary project features.

Response

The potential impacts of these facilities are discussed in Sections 4.3.3 and 4.3.4. See also the brown bear summary section in 4.3.5.

W-3-232 (v) Black Bears

- Distribution: We recommend including maps of bear radio locations relative to project features.

Response

The analysis of home range overlap with project features as included is more informative than a map of radio locations, and no map has been included.

W-3-233 - Habitat Use: Please describe how further vegetation studies and remapping will be integrated with the analysis of black bear habitat use.

Response

See response to this statement under brown bear, above.

W-3-234 - Food Habits: The scope, schedule, and integration of ongoing predation studies relative to further project planning should be addressed here.

Response

Study plans for fiscal year 1984 are being developed in conjunction with investigators and agency representatives. These studies have not yet been finalized.

W-3-235 (viii) Belukha Whales: Please note that several of the references cited here do not appear in the bibliography.

Response

The bibliography has been completely revised and edited.

W-3-236 - Distribution and Habitat Use: Paragraph 5: We suggest integrating data on chinook salmon from the fisheries studies in order to obtain some estimate of the importance of that fishery and of project impacts to the fishery on belukha whales. Please also describe what data will be gather ed on smelt for better evaluating project impacts on belukhas.

Response

As discussed in Section 4.3.1, belukha whales will not be measurably affected by anticipated reductions in salmon populations during the period when whales concentrate at the river's mouth. Smelt studies conducted in 1982 found that the upstream limit of the eulachon spawning migration is near RM 48.0, and that the habitat requirements necessary for eulachon spawning were quite broad. Eulachon were seldom found in areas of low water velocity or backwater or eddy habitat zones. Additional eulachon and salmon spawning data will be available in June 1983.

W-3-237 (b) Furbearers

(i) Beavers: We recommend including a map of the study area which details specific study sections, available density data, and representative main channel, side channel, slough, and clearwater areas. The discussion should be expanded to cover the extent to which suitable beaver habitats are fully utilized or explanations where they are not.

Response

The study area is described in sufficient detail in the text, Section 4.2.2(a)(i) paragraphs 2-3. Maps with the landmarks mentioned appear in Figure E.3.101. Available density data appear in Tables E.3.118 and E.3.119. Beaver habitat studies are continuing; additional data will be provided in June 1983.

W-3-238 Paragraph 4: We recommend investigating the extent to which bank lodges are used by beaver and to which the activity levels reported in Table W53 may be underestimated. An on-ground survey when beavers come out of their dens to forage just before spring break-up could verify such use.

Response

Fall surveys of caches are a more effective means for providing data on beavers which use bank dens. This was attempted in 1982, but summer flooding had destroyed many food caches. Study plans for additional investigations are being formulated.

W-3-239 Paragraph 8: Further quantification should be provided on trapping effort and success, see our comments under Chapter 5, Section 3.7(c).

Response

Records of effort and success are not available.

W-3-240 (ii) Muskrat: Paragraph 2: Please clarify whether the 106 lakes surveyed contitute all the lakes between the Oshetna River to Gold Creek impact area. Please relate this discussion to the number of muskrats potentially inhabiting this area.

Response

The text has been changed to indicate all lakes within 4.8 km of the river. It is impossible to relate number of pushups to number of muskrats and we suggest that the number of lakes with resident muskrat is the best possible index of muskrat density.

W-3-241 Paragraph 3: Please provide an indication of downstream muskrat populations and habitat quality.

Response

The text has been altered to indicate availability and characteristics of muskrat habitat. Muskrat sign, as reported in the text, is the only available index to population size.

W-3-242 Paragraph 4: Please quantify present and historical trapping effort/success.

Response

Such data are not available.

W-3-243 (v) Marten

- Population Characteristics: Paragraph 2: No data is provided to substantiate that pine marten are the "economically most important furbearer," or to relate densities to populations and habitat quality. Please also refer to our comments under Chapter 5, Section 3.7(c).

Response

Gipson et al. (1982) indicate that pine marten are economically the most important furbearer in the impoundment zones. Few other furbearers are regularly sought in the area. An index to habitat preferences and density in various vegetation types is provided by snow track data which appear in Tables E.3.121 and E.3.122.

W-3-244 (vi) Red Foxes

- Habitat Use

. Denning Habitats: Please provide information on the density of fox dens relative to habitat quality, and to other Alaskan and/or North American fox populations.

Response

It is unlikely that all fox dens in the study area were located (see Section 4.2.2(f)(i) paragraph 3 and Gipson et al. 1982). This is true in most red fox study areas. A comparison of densities would be misleading at best. Fox populations are generally not limited by den site availability and den site location has little direct relation to habitat quality per se. Appropriate denning habitat as characterized in the text is widespread in the study area. Den sites are relatively small and can be found in micro-habitats of many vegetation and terrain types.

W-3-245 Paragraph 5: Some explanation should be provided for the disparity of more fox tracks on the south side of the river but more dens on the north side .

Response

The text has incorporated more information on this discrepancy. See Section 4.2.2(f)(i) paragraph 2.

W-3-246 - Food Habits: Paragraph 3: The postulated link between fox and hare populations may be overstated. Apparently hare numbers have never been high or an important food source for fox in this area (Furbearer Study Coordinator Phil Gipson, personal communication; also see Section 4.2(b)(vii): Paragraph 3 and Section 4.3(a)(xiii): Paragraph 5).

Response

Gipson et al (1982) state, "Several investigators have found that snowshoe hares are a very important component in the diets of red foxes. Snowshoe hares are presently scarce in the Susitna study area and therefore relatively unimportant in the diets of foxes." We postulate the presence of hares in the basin would increase the available prey base and obviate the necessity of foraging for ptarmigan at higher elevations in winter. Very little historical information is presented by either Gipson et al. (1982) or Kessel et al. (1982a) on snowshoe hares. However, both sources indicate a probable chronic scarcity of hares in the basin which we reference in the paragraph in question and in Section 4.2.2(g) and 4.2.4.

W-3-247 - Population Characteristics: Please refer to our previous comments under Denning Habitats relative to habitat quality (Section 4.2(b)(vi) -Habitat Use). Again, trapper effort and success should be documented, also see our comments on Chapter 5, Section 3.7(c).

Response

An objective measure of habitat quality for red foxes does not exist . The concept of habitat in itself is problematic. Habitat is the place where a particular organism is found. Characteristics of an area which determine whether or not it's habitat include a multitude of considerations, particularly for a complex and highly mobile species, and particularly for higher order carnivores and opportunistic species. The utility of defining and evaluating an area as habitat of high or low quality irrespective of its use is questionable, although it may be of great theoretical interest. Indeed, it is dangerous for a manager or consultant to pretend to be capable of precisely estimating the ability of an area to support populations of all species based on a few simple measures of vegetation characteristics used as indicators of supposedly high, medium or low quality habitat. For red foxes in particular, prey availability varies week to week, season to season and year to year as small mammal populations rise and fall, and migratory bird populations arrive, nest and leave. Red foxes are residents of a very wide range of habitats in North America and Eurasia and their ecology varies dramatically from site to site. While we can say that fox density is related to habitat quality (by definition) we cannot objectively identify good quality habitat and accurately predict fox density.

No data are available on trapper effort and success. Fur records for GMU 13 do not accurately reflect the actual location of take. However, harvest data have been added to Section 4.2.2(f)(ii).

W-3-248 (vii) Lynx through (x) Least Weasel: We understand that none of these species were chosen as high priority for evaluating project impacts. However, we recommend providing some quantification for the descriptions of "fairly numerous" but not "limited," "locally abundant," and "sparse," in addition to trapper effort/harvest; also see our comments on Chapter 5, Section 3.7(c).

Response

Any attempt at quantification beyond track counts given in Table E.3.121 for marten, fox, short-tailed weasel, mink and otter, and those given in the text for lynx and least weasel would be sheer conjecture. The qualitative terms used above are self-explanatory and no further information should be read into them.

W-3-249 (c) Birds: Paragraph 2: Please note that waterfowl breeding pair surveys have been conducted by FWS in the lower Susitna River basin for over 20 years.[12] The FWS has also conducted statewide surveys for trumpeter swans in 1968, 1975, and 1980.[13]

Response

Please note that trumpeter swan surveys were in the far eastern edge of the basin and did not cover the project area. They therefore provide no applicable data. Breeding pair surveys are restricted to three transects in the extreme lower floodplain. No impacts to water birds are anticipated in the regions covered by those surveys.

W-3-250 Paragraph 3: We recommend further information be provided on how relative abundances of bird species were determined. Please clarify the difference between 60 percent of the area being in shrublands, as cited here, with the just over 40 percent in shrublands, as cited in Table W4. At the August 1982 AEA Workshop on the project, much discussion centered on problems with correlating the bird habitat classification scheme used by Kessel et al. for project bird studies with the Dyrness and Viereck Alaskan vegetation classification system used for project baseline vegetation maps. We recommend describing those problems here and how they will or will not be overcome by ongoing vegetation remapping. Throughout the bird sections of the draft application, we are concerned that sources(s) for referenced data, or data manipulations, may not be fully documented. Thus, we recommend describing where and how data from more than one source has been manipulated for this report. In particular, the tables and figures should be more completely referenced, including explanatory footnotes.

Response

The text has been revised.

W-3-251 (i) Raptors and Raven: Paragraph 1: We are concerned that 1980 and 1982 raptor surveys were not conducted at the optimum time: i.e. summer foliage would make it difficult to initially locate nests (we note that 50 percent more nests were found in 1981 than in 1980); according to Table W60, nesting raptors will have fledged their young by 30 September making it difficult to determine nest activity in October. Please indicate the experience of observer(s) conducting the raptor surveys and methods used, (e.g. whether surveys were by helicopter or fixed-wing aircraft). We also recommend that maps of actual nest locations be included. We note that goshawk nests are often difficult to find by air and thus question whether the number of nests cited here is a thorough assessment. Please clarify in the text whether all raptor nests active in 1980 were also active in 1981.

Response

No raptor surveys as such were conducted in 1982, with the exception of a bald eagle survey of the lower Susitna River floodplain, and reference to an October survey as such has been deleted. This error arose because a short helicopter flight was made on October 16, 1982, in a preliminary attempt to recheck elevations of some nesting locations using the aircraft altimeter (discrepancies were found between original survey maps and data presented in Kessel et al. 1982a). Because precise elevations of nests and cliff-tops relative to maximum impoundment fill levels are integral to a sound mitigation plan, a survey to obtain this information is planned for May-June 1983 using an American Paulin precision Micro-Surveying Altimeter (or equivalent).

Regarding timing of 1980 and 1981 surveys and personnel and survey methods, survey methods for raptors are described in Section 4.2.3. The 1980 survey by helicoptor was conducted by University of Alaska Museum personnel (especially B. Cooper) with the invited assistance of Alan M. Springer (see Kessel et al. 1982a, p.8). Mr. Springer is a biologist with approximately 12 years experience with raptors in Alaska including extensive aerial surveys for cliff-nesting species on the Seward Peninsula in the early 1970s and 1980, and boat-based surveys for peregrine falcons on the Porcupine, Yukon, Colville and Tanana Rivers, Alaska since 1976. He has also conducted work on bat falcons and peregrines in South America. Mr. Springer was invited to participate in the 1980 survey to begin instructing B. Cooper, University of Alaska Museum, in appropriate techniques, because of his familiarity with a wide range, and his experience in looking for and identifying raptors and raptor nests from the air.

The 1981 survey by helicopter was conducted by University of Alaska Museum personnel (especially B. Cooper) with the invited assistance of D.G. Roseneau (see Kessel et al. 1982a, p. 8), a biologist with approximately 20 years experience with raptors in Alaska. Mr. Roseneau devised and tested aerial survey techniques for cliff/nesting gyrfalcons, golden eagles and rough-legged hawks in northwestern Alaska in the late 1960s while working for the Alaska Department of Fish and Game. This technique subsequently came into regular use to cover large areas of habitat in Alaska, and has since been used by several other raptor biologists (including T. Cade of Cornell and C. M. White of Brigham Young), personnel of the ADF&G, and personnel of other agencies (including BLM). Mr. Roseneau, who also has considerable experience with Alaskan peregrines and peregrine habitat, has surveyed much of northern, northwestern and interior Alaska for peregrines and other raptors, and was invited to participate in the 1981 survey to provide B. Cooper, University of Alaska Museum, additional instruction in the use of aerial techniques, to assist in checking some areas farther from the impoundment zones and to provide additional advice on where peregrines might attempt to nest.

Regarding assessment of goshawks, surveys in 1980 and 1981 were not designed to specifically include goshawks or other tree, ground or cavity nesting species (with the exception of tree-nesting bald eagles) because nests of many of these species are indeed very difficult or impossible to locate from the air, and because many of these species occur throughout their breeding range in very low densities (relative to other groups of birds, including passerines, waterfowl and shorebirds). Surveys for many of the tree, ground and cavity-nesting species require ground-based plot censuses (e.g. Kessel et al. 1982a) or other appropriate ground-based sampling techniques in various habitat types. However, it should be pointed out that in northern regions of Alaska beyond the coastal zone dominated by such coniferous species as sitka spruce, western hemlock and cedar, goshawks are one exception to the general case. An experienced aerial observer who is also familiar with this species' nesting requirements and habits has little difficulty locating a relatively large number of nesting territories prior to leaf-out in the spring or after leaf--drop in the fall (at least to the extent that a reasonable assessment of general numbers present and relative importance of selected areas can be made) (e.g. see Roseneau and Bente 1981; see also McGowan, J.D. 1975. Distribution, Density and Productivity of Goshawks in Interior Alaska. Fed. Aid in Wildl. Restoration. Final rep. W-17-3, W-17-4, W-17-5 and W-17-6. Job No. 10.6R. 31p.). That point aside, and of more importance in the specific case of the Susitna River drainage, it was readily apparent after two years of survey that little goshawk nesting habitat occurred in the middle and upper basin (D. G. Roseneau and A. M. Springer pers. obs.). Goshawks, north of the coniferous-covered coastal areas of Alaska (e.g. Prince William Sound, portions of the Kenai Peninsula), predominantly prefer to build nests in large, mature paper birch trees in stands of paper birch or in stands of mature white spruce-paper birch wherever it occurs (and especially on hillsides). Some nests are also built in medium to large aspen trees, and very occasionally in medium to large poplar trees. Use of trees other than birch appears to depend in part on the region (regular use of aspen occurs in one section of the middle Tanana Valley where very few birch occur), and in part on the population level of goshawks (goshawks fluctuate markedly in number and productivity in response to snowshoe hare cycles). In interior Alaska most of the nestings that have occurred in aspen and poplar have occurred during the height of a population cycle (with the exception of a few areas where birch do not occur, as mentioned above). In any event, reasonable goshawk nesting habitat becomes very limited upstream from Devil Canyon in the Susitna valley. For this reason, the few nests that have been found probably are reasonably representative of the area in spite of no formal surveys for them. The vast majority of suitable goshawk nesting habitat is found below Devil Canyon along the widening valley slopes.

We feel that including maps of raptor locations in what will become a public document serves little positive purpose. Maps of the scale which would be appropriate to this document would not be accurate enough to base engineering and other design changes on, or to help determine accurate buffer zones to protect nesting locations from disturbance. Detailed maps of the nesting locations exist and are being provided to the Alaska Power Authority for incorporation into engineering design. Copies of these maps can also be provided to agencies for in-house use.

W-3-252 Paragraph 3: Please expand the discussion to more completely describe the habitat suitability of the project area for golden eagles, given their apparent high density.

Response

The text has been revised.

W-3-253 Paragraph 4: Refer to our comment under Section 4.2(c)(i): Paragraph 1 , above, regarding the late timing of 1980 and 1981 surveys for nesting bald eagles. Please provide a description of the survey methods used.

Response

See Section 4.2.3. Timing of surveys for tree-nesting location of bald eagles is much less critical than for species such as goshawks. Pre-leafout surveys offer some advantages in that some nests can be detected at greater distances, and some nests that are not occupied (i.e. inactive in the survey year) are easier to detect. Some of these latter nests can go undetected after leaf-out if the stand of trees is not carefully scrutinized. On the other hand, in much of central Alaska (and the upper and middle Susitna River basins are no exception) many bald eagle pairs nest in white spruce trees;

pre-leaf out surveys often provide little advantage in detecting these nesting locations. In general, the majority of bald eagle nests are conspicuous throughout much of the year (even during the winter months) and remain conspicuous even when foliage is present, because the nest structure is large and exposed (i.e. conformation of the tree tops is an important feature of nesting trees, and openness of the canopy is a requirement of the eagles, so that they may easily enter or depart from the nest). Furthermore, the 1981 survey of the middle basin occurred at a time (May 16-17) prior to advanced leaf-out of poplar trees and visibility into and through tree canopies was good (as planned on the basis of the preliminary 1980 survey).

W-3-254 Paragraph 5: We recommend that discussion be provided relative to habitat values re how Susitna habitats compare with those along the Tanana River where slightly lower nesting densities are reported.

Response

The text has been revised.

W-3-255 Paragraph 7: Due to the status of the arctic peregrine falcon (*Falco peregrinus tundrius*) as an endangered species under the Endangered Species Act of 1973, as amended (16 U.S.C. 1531-1543, as amended), we are particularly concerned with the adequacy of surveys for them, e.g. peregrines would have already left the area by October when the 1982 survey was done. Thus, we again recommend describing how the surveys were conducted annually, in early July, throughout project studies and construction, or until there is sufficient evidence that peregrine falcons do not inhabit the project area. Sufficient evidence would be no sightings over several years of helicopter surveys, by a reputable observer during the proper time of year. Observers should be individuals who have worked with peregrine falcons. FWS review of specific times and survey techniques would be appropriate.

Response

Surveys for cliff-nesting raptors, including the peregrine falcon, were not conducted in 1982 (see above). Furthermore, the "... status of the arctic peregrine falcon (*Falco peregrinus tundrius*) as an endangered species..." has little bearing in regard to the proposed Susitna Hydroelectric Project. The reference to *F. p. tundrius* in this question is of concern, because the USFWS is the lead federal agency with responsibility for endangered species. *F. p. tundrius*, given the name 'arctic peregrine falcon' by the USFWS, was described by C. M. White in 1968 (see *Auk* 85:17191) (this race is still not formally recognized by the American Ornithologists's Union). In Alaska, birds generally considered to be the tundrius type breed north of the Brooks Range and southwestward into parts of northwestern Alaska (see USFWS Arctic Peregrine Falcon Recovery Plan). Peregrines breeding in the taiga zone of Alaska, including those that might occasionally occur in the region of the Susitna River, are F. p. anatum, a second North American race considered to be endangered (the third North American subspecies, F. p. pealei, is a coastal race that has never been listed as endangered). F. p. tundrius would only occur as an occasional migrant in the project area. It is recommended that agency questions regarding peregrines first be routed through the USFWS Endangered Species Coordinator, Anchorage.

Methods of survey are described in Section 4.2.3 (see also Kessel et al. 1982a). In 1981 special ground and aerial searches were made for peregrines at the few locations identified by D. G. Roseneau that appeared to offer some degree of potential for nesting peregrines (see Kessel et al. 1982a, pp14 and 15). Attention was also given to two general locations where White (1974) observed single, non-brooding peregrines. In 1980 the time of survey (July 6) corresponded to the early nestling stage of peregrines when active sites become easier to find from the air. In 1981, the aerial survey was conducted on May 16-17, a time corresponding to the general egg laying/early incubation periods when peregrines are more secretive, but also when some pairs are present that may fail reproductively and thus often not be present later in the summer. All potential-appearing habitat was rechecked from the ground in June 1981, after pairs would have laid eggs (see Kessel et al. 1982a, p. 15).

It should also be noted that it is clear that the Susitna River drainage does not provide habitat typical of or comparable to any of the important areas of peregrine nesting habitat in the taiga zone of Alaska (i.e. the upper Porcupine, upper Yukon-Charley, middle Yukon, lower Yukon, Tanana and Kuskokwim river drainages). Furthermore, it is the opinion of several biologists with considerable experience with northern peregrines and peregrine nesting habitat that the Susitna River drainage provides only marginal potential peregrine nesting habitat (see also Kessel et al. 1982a, p64). Key elements of the existing habitat, in addition to the combined surveys conducted in 1980 (aerial) and 1981 (aerial and ground), provide reasonable evidence that peregrines do not presently inhabit the project area, and that biologically significant numbers of them are unlikely to in the future with or without project development.

Surveys to monitor for the continued absence or future occasional presence of breeding peregrines can easily be combined with planned efforts to monitor the success of a mitigation program for other cliff-nesting raptors. Such a program will be conducted by a raptor biologist whose experience will encompass Alaskan peregrines. It can be assured that all such efforts will occur at appropriate times of the year(s).

W-3-256 We recommend the discussion be expanded to describe the area's importance in raptor migrations as well as for breeding.

Response

A comment on raptor migrations has been included (see Section 4.2.3(a).

W-3-257 (ii) Waterfowl and Other Large Waterbirds: Please provide some quantification for terms used here, e.g. "large" concentrations of waterfowl (paragraph 1); "little used" (paragraph 4), etc.

Response

See Kessel et al. (1982a, 1982b).

W-3-258 Paragraph 3: We recommend you incorporate additional trumpeter swan data which is available from the FWS. Please refer to footnotes 12 and 13.

Response

If significant additional trumpeter swan data existed, these data would be incorporated. However, such data either do not exist or are unavailable. King and Conant (1981) summarize information through 1980, and provide the most up-to-date, complete published information available. It was cited by Kessel et al. (1982a). In 1981 and 1982, BLM conducted partial, informal surveys (only one 1:63,360 quad was surveyed in the Gulkana Basin region in 1981, and only two 1:63,360 quads were surveyed in 1982--both quads surveyed in 1982 were far to the east near the Richardson Highway). These data were subsequently provided to J. King by BLM, and are mentioned in King and Conant (1982). Since only relatively small areas of the Gulkana Basin were surveyed in 1981 and 1982 and since most of the survey effort was expended well east of the project area, it would be inapppopriate to draw comparisons or conclusions from them. Furthermore, the computerized compilation of this limited data set will not be available until at least January 26, 1983 (G. Konkel pers. comm. to M.K. Raynolds, January 20, 1983).

W-3-259 Paragraph 4: We agree with the conclusion, however, we suggest that data from FWS annual surveys be included to quantify this statement (e.g. see footnotes 12 and 13, as well as Conant and King 1981 and King and Conant 1980 as referenced in this section).

Response

The text has been altered.

W-3-260 - Migration: Paragraph 1: We recommend referencing the specific study(ies) from which conclusions in the CE reference are taken. Please note that trumpeter swans are moving through the area in increasing numbers.

Response

Although numbers of swans have increased, the level of increase does not appear to justify changing the conclusion that "...does not appear to be a major migration route for waterbirds".

W-3-261 Paragraph 3: Please explain the discrepancy between the statement here that the "upper Susitna Basin was less important to migratory waterfowl in spring than fall," with data in Table W62 which shows spring waterfowl densities over twice that of fall densities.

Response

Table W62 (now Tables E.3.130, E.3.131, and E.3.132) was corrected.

W-3-262 Relative Importance of Water Bodies: Paragraph 1: Given the previously described problems with the wetlands classification used for the project, and remapping efforts currently underway, please define "wetlands" as used here.

Response

The term wetlands as used in Exhibit E is defined in Section 3.2.3 as "lands where saturation with water is the dominant factor determining the nature of soil development and the types of plant and animal communities living in the soil and on its surface. These areas are characterized by soil or substrate that is at least periodically saturated with or covered by water (Cowardin et al. 1979)."

W-3-263 We suggest clarifying whether the reference is to 22.5 adult waterfowl/km^2 and 22.5 adult gulls/km^2 or to 22.5 adult waterfowl and gulls)/km^2.

Response

The text has been altered to clarify this.

W-3-264 We question the validity of only comparing productivity of these wetlands to the most productive wetlands in Alaska. Upper Susitna area waterfowl productivity may be more typical of Alaska wetlands in general and represent average populations and productivity (FWS Marine Bird Management Project Leader John Trapp, personal communication).

Response

It is agreed that "middle Susitna area waterfowl productivity may be more typical of Alaska wetlands in general and represent average populations and productivity". Comparing the productivity of such less productive wetlands with wetlands that typically support high productivity provides contrast, scale and perspective. It is agreed that no areas of high productivity will be lost as a result of the Susitna Hydroelectric Project, and that impacts to waterfowl populations will be considerably less (i.e. 'average' at the worst) than if richer wetlands were involved.

W-3-265 Paragraph 3: Please clarify how "Importance Values" were calculated; also refer to our comments under Figures W19 and W20 and Table W63. We suggest describing any consumptive use of waterfowl within the project area.

Response

The text has been revised to clarify how "Importance Values" were calculated (see Section 4.2.3[b][iii]).

W-3-266 (iii) Other Birds
Grouse and Ptarmigan: We recommend mentioning any consumptive use of these species within the project area.

Response

Such statements are contained in Section 4.4.

W-3-267 Woodpeckers and Passerines: We recommend providing some discussion of the importance of the area to migration, as well as, breeding activities of these birds.

Response

This recommendation has been noted.

W-3-268 Upper Basin Bird Communities: Please refer to our comments under Section 4.2(c) re the need to identify here how 1981 and 1982 data were combined , given that Kessel et al. (1982) only includes data from 1981.

Response

The 1981 and 1982 data are provided separately in Tables E.3.136 and E.3.137.

W-3-269 Last Paragraph: Please describe how these habitat types do or do not correlate to vegetation types as now being remapped.

Response

There is no direct correspondence between the habitat types of Kessel et al. (1982a) and any other published vegetation classification system. Mapping now in the preparatory stage will identify vegetation known to be important as moose browse and vegetation characteristic of wetlands, using the system of Viereck, Dyrness and Batten (1982) to Level IV and, for wetlands, the system of Cowardin et al. (1979) as adopted by the U.S. Fish and Wildlife Service (1980). Approximate vegeatation type equivalents to Kessel's Avian Habitat Types are presented in Table E.3.139.

W-3-270 (d) Non-game (small) Mammals: We appreciate the thorough description of the ecological role of small mammals in project area ecosystems.

Response

Thank you.

W-3-271 (ii) Habitat Use: We suggest updating the discussion to correlate with ongoing vegetation and wetlands mapping efforts.

Response

The thrust of the remapping effort will be to provide more accurate maps of vegetative cover using the same classification scheme. Therefore, no updating of the discussion on habitat use is necessary.

W-3-272 4.3 Impacts
(a) Watana Development
(i) Moose: Paragraph 1: Criteria for concluding that moose is one of the "most important" species should be provided here.

Response

This statement is supported by hunter effort and harvest data presented in Chapter 5. The importance of moose as a prey resource for bears and wolves is discussed in detail throughout the application.

W-3-273 Paragraph 2: We suggest that the proposed evaluation of carrying capacity incorporate consideration of habitat values over the life of the project. Please provide the referenced figure. Considering the severity of project impacts by spatial areas to be affected and numbers as in Ballard et al. 1982 (page 106) would improve the discussion.

Response

The simulation modeling approach being developed is particularly suited to assessing habitat changes through time. Potential changes will be incorporated through this approach to the extent that they can be predicted. The deleted figure number has been added. The modeling approach is based on different spatial areas extending to and occasionally beyond the watershed boundaries. The movements of moose between these areas will be included in the analyses.

W-3-274 We are further concerned with the inadequacy of the impacts definitions in not accounting for impacts to special concentration areas (e.g. breeding), in key seasons of use (e.g. calving), and under infrequent but critical conditions (e.g. severe winters), and the overall interspersion and availability of such important habitat features.

Response

The text incorporates references to special use areas and periods of greater sensitivity to disturbance. The carrying capacity model will provide an understanding of the effects of winters of any snow depth, which in the absence of census data in a deep snow winter is presently difficult to accurately assess. Habitat use and characteristics such as interspersion of forage and cover vegetation are discussed.

W-3-275 Paragraph 3: Lack of quantification prevents analysis of whether an impact is half, twice, three times, etc. as severe as one of lower priority. We again recommend integrating the analysis with that in Chapter 5 re also providing and discussing data on hunting pressure and success here (see our comments under Section 4.2(a)(i) . Mortality Factors). Please note provision of access is a major indirect impact; additional developments or settlement stimulated by this access would be a secondary impact.

Response

Quantification has been included wherever a defensible statement is possible. There are many situations where no data from past experiences are available, and one person's guess is as good as another's. Some insight into potential effects of increased mortality or other changes resulting from the project will be gained through the use of habitat and population modeling. This approach is described in Section 4.3.2(a)(iii). The statement regarding access has been corrected.

W-3-276 Paragraph 5: We find the discussion entirely too general and inconclusive: (1) there is no indication of the relative difference between "some" moose which will disperse, adapt, die, etc; (2) both overall cumulative impacts and secondary impacts from moose dispersing to adjacent areas are ignored; (3) impacts on habitat values from increased use are not considered; and (4) no explanation is given for how and when ongoing studies will "refine this assessment."

Response

The inability to adequately quantify these impacts reflects the need for the approach being developed. The approach and its implementation is described in Section 4.3.1(a)(iii).

W-3-277 Construction: We are concerned that we have been given no opportunity to comment on siting and scheduling for camps, townsites, etc. The location and use of these ancillary project features will influence the magnitude of resultant impacts. Alternative spoils sites have not been proposed, yet they should be part of the discussion.

Response

This procedural matter has been addressed in the Alaska Power Authority's response to the general statements included in the cover letter.

W-3-278 . Habitat Loss: Paragraph 1: We recommend including a more thorough, quantitative discussion of habitat loss in the text. The necessary integration of vegetation and wildlife studies should include a discussion of (remapped) vegetation losses relative to their value as moose habitat i.e. winter range, calving and breeding area, etc. We also see no quantification of these losses over the life of the project, i.e. the area of each type which will be lost forever, vs the area which will be lost for some length of time during construction, vs the areas in different successional stages throughout reclamation.

Response

While accurate estimates of the area of various well-defined vegetation types lost can be made, the only objective quantification of 'habitat' loss possible is through measurement of forage availability in these habitats at various seasons and snow depths. Vegetation types are easily defined. Habitat is quite another thing. Any estimate of the value of a particular vegetation type as calving, breeding or winter habitat must be qualitative. Accurate estimates of areas lost to various project features appear in Tables E.3.82, E.3.83, E.3.84, E.3.85, and E.3.86. A schedule of anticipated impacts appears in Table E.3.144. Plant succession will begin within a several year period for nearly all of the Watana impacts, and similarly for the Devil Canyon impacts (Table E.3.144), approximately 10 years later.

The approach outlined in Section 4.3.1(a)(ii) will address these concerns. Preliminary calculations of moose carrying capacity changes have been incorporated into the application.

W-3-279 Paragraph 2: The paragraph is somewhat inconsistent with the Fishery Section. Given the mitigation proposed in that section of clearing areas just before flooding, successional growth development appears negligible (Section 2. 4 (a)(x) - Clearing the Impoundment Area).

Response

Impoundment clearing is scheduled just prior to flooding. Much of the low-growing vegetation will remain after clearing, and some species grow rapidly enough in one or two seasons to provide forage for a large number of moose. The cleared impoundment area will be utilized by moose for feeding, but we agree that the eventual loss of this habitat makes the availability of this new growth of little consequence.

W-3-280 Paragraph 3: Ongoing studies should be fully described. Please describe when the habitat use analyses will be reevaluated on the basis of remapped vegetation and forage quality studies.

Response

The ongoing studies are a continuation of studies fully described in the application. The schedule for habitat analyses is given in Section 4.3.1(a)(iii).

W-3-281 Winter Use: Paragraph 2: Please clarify the first sentence and inconsistencies between that sentence and the previous paragraph.

Response

These two paragraphs have been corrected.

W-3-282 Paragraph 3: It would be helpful to also express the number of moose in the impoundment area as a density and compare that density to areas outside both the impoundment and project area.

Response

The impoundment area and areas outside of it consist of several density strata, and therefore no single density figure was given. Since densities in a particular area are greatly influenced by season and snow depth, it would be inappropriate to compare the density of moose within the impoundment area as determined in March 1982 with other areas surveyed under different conditions.

W-3-283 Paragraph 4: We recommend that ongoing studies provide data for quantifying the relative values (quantity and quality) of winter range within and outside the impoundment area. Such information is necessary for determining mitigation requirements.

Response

The data being collected, and the planned approach for incorporating these data, will allow these comparisons.

W-3-284 Spring Use: Paragraph 2: Quantification is needed for the habitat areas described here.

Response

Plant phenology studies related to spring use of the impoundments by moose will continue in spring 1983 and provide results by December 1983. A map of moose calving locations has been added to the application.

W-3-285 Paragraph 3: We recommend tying this discussion to project impacts on brown bear which could compound the predation problem.

Response

This has been treated in Section 4.3.1(d)(i).

W-3-286 Summer and Fall Use: Paragraph 2: We are assuming that a heading for "-Disturbance" was omitted just before this paragraph.

Response

The heading and first paragraph of the Disturbance Section, which were omitted from the draft application, have been added to the application.

W-3-287 Paragraph 4: Since the magnitude of project impacts would appear to significantly vary, depending on whether hunting and harassment of moose are effectively prohibited, we suggest providing "best" and "worse" case scenarios. Those scenarios should be used to quantify potential losses of habitat for comparing impacts and determining mitigation needs.

Response

These possibilities can be best addressed through the planned modeling approach.

W-3-288 Paragraph 5: Please refer to our previous comments under Section 4.3(a) (i) Moose and 4.3(a)(i) - Construction .Habitat Loss re the generality of this discussion.

Response

Please refer to our response under Section 4.3(a)(i).

W-3-289 .Mortality: Please refer to our comments under Section 4.3(c)(i).

Response

Please refer to our responses to your previous comments.

W-3-290 .Alteration of Habitat: We suggest this discussion be dropped as inappropriate and unfounded. If this discussion only covers the construction phase of the development, then we would assume there would be no chance for successional growth. Moreover, the suggestion that moose could utilize these disturbed areas during construction conflicts with the previous discussions on how disturbance and increased susceptability to predators would cause moose to avoid major activity centers and large cleared areas. We also find the suggestion that borrow pits may provide forage inconsistent with the Fishery Section which proposes to make fish ponds out of the pits (Section 2.4 (3) (e): Paragraph 2, Construction Mitigation). Please refer to our previous comments under Section 4.3(a)(i)

- Construction, .Habitat Loss re the unlikelihood for forage development within the impoundment area. Moreover, under .Permanent Loss of Habitat, page E-3-287, moose use of the impoundment area prior to filling is discounted. The need to resolve conflicts between sections of the draft application is amply illustrated by the latter two points above. As we have recommended elsewhere, some mechanism should be instituted for resolving these types of conflicts and analyzing the tradeoffs of mitigating for one species to the detriment of another.

Response

This discussion was eliminated from the application. Several of the points made in the draft are now covered in other sections of the application. The inconsistencies between sections as pointed out have been eliminated.

W-3-291 - Filling and Operation

Permanent Loss of Habitat: Paragraph 1: As we commented under Section 4.3(a)(i) - Construction, we are concerned with the lack of quantification. Of all possible impacts, loss of habitat can be most easily quantified. The analysis should include the area of each (remapped) vegetation type which will be inundated each year.

Response

Quantification has been provided where possible. Where data are unavailable, an approach for making reasonable predictions about future situations has been outlined. Since the impoundment area will be cleared prior to filling, the area of each vegetation type inundated each year seems irrelevant.

W-3-292 Paragraph 2: We again refer you to our comments under Section 4.3(a)(i) Construction re necessary quantification, study description, and incorporation of study findings into the quantification of losses required under FERC regulations (Section 4.41(f)(3)(ii) in F.R. Vol. 46, No. 219, 13 November 1981).

Response

See response above.

W-3-293 .Alteration of Habitat

Upper Susitna Basin: We concur with the points raised here. Please refer to our comments under Botanical Resources re the impacts of ice fog and rime ice formation, as to well as need for quantification. The discussion should also consider the effective loss of an even larger area than described here due to dust from project activities which would further retard snowmelt (see Section 3.3(a)(i) - Vegetation Damage by Wind and Dust).

Response

Dust from project activities could have the opposite effect on snowmelt if only a thin layer were deposited. In addition, the ground during the snow-covered period would often be frozen or damp, thus reducing dust problems. It is therefore impossible to give an accurate prediction of the effects of this impact on vegetation or wildlife.

W-3-294 Lower Susitna Basin: Paragraph 2: Given a mid-successional stage of approximately 25 years (see Figure W4) and project life of 50 years plus planning and development, we question the conclusion that vegetation favored by moose will still be available at the end of the license period. Please refer to our comments under Section 3.3(a)(i) - Effects of Altered Downstream Flows re quantifying these and other impacts described in the remainder of this section as well as discussing the potential for further alteration of habitat because of ice fog and rime ice formation.

Response

These sections have been completely rewritten.

W-3-295 .Blockage of Movements: Given the potential for moose to avoid clear cut areas (see discussion under Section 4.3(a)(i) - Construction .Interference with Seasonal Movements, page E-3-286), we suggest mapping the effective area which could be eliminated from use. Some discussion should be provided on the likelihood of moose crossing the flowing narrow river as compared to the wide impoundment, plus drawdown zone; maximum and minimum widths of the impoundment should be provided. Also refer to our comments under Section 4.3(a)(i), River Crossings. Information presented here will be important to later considerations re choosing sites for habitat enhancements which may be undertaken as part of mitigation.

Response

The discussions in the application related to these concerns are considered adequate.

W-3-296 Paragraph 5: Again, please detail ongoing studies.

Response

The ongoing studies are a continuation of the studies thoroughly described in the application.

W-3-297 .Disturbance: Once more, we note the need to (1) consistently assess the potential for increased access and hunting; and (2) integrate consideration of this issue throughout the report. We again suggest listing and analyzing the impacts from alternative access and use options.

Response

The potential effects of increased access and hunting is described in Section 4.3.3(a). The entire application has been revised to make sections more consistent. Alternate access options are discussed in Chapter 10, and in Section 4.4.1.

W-3-298 .Mortality: See comments under .Disturbance, the previous discussion for Section 4.3(a)(i) - Construction, and Section 4.2(a)(i) .Mortality Factors. Please define when postulated increases in hunting will occur relative to project development.

Response

The access roads and airports will be closed to the public during construction, and as outlined in the Mitigation Plan, project personnel will not be able to use these project facilities for hunting or trapping. Increased hunting as a result of the project probably began in the late 1940s when the area was first investigated for its hydroelectric potential. Regulation of hunting is controlled by the Alaska Board of Game, and the Alaska Power Authority has no jurisdiction over future changes in fish and game management policies.

W-3-299 - Quantification of Project Effects: We appreciate this discussion of ongoing studies but note that references to this section should be made through out the report. Once more, we recommend including a schedule and describing how the studies will be incorporated into the license application, project design, and mitigation planning. Please note, references in this section are not included in the bibliography.

Response

This section has been expanded. The list of references has been revised.

W-3-300 - Watana: Summary of Impacts: The summary is a useful, qualitative description of project impacts, yet provides no quantification for minimal, moderate, or severe impacts. The definitions given under Section 4.3 (a) (i) Moose: Paragraph 2, should be restated if they are to apply here. To better evaluate the "ifs" common to the discussion, we again suggest analyzing an array of impact scenarios. Attention should also be given to the cumulative impacts of habitat loss, alteration, disturbances, etc. We disagree with the conclusion that "because hunting mortality can be easily regulated, this will not necessarily be a major impact." Because of the politics involved and independence from project development of hunting regulations, there is no guarantee that regulations consistent with project mitigation goals will be implemented. Moreover, increasing hunter demands for a diminished resource will further affect harvests and hunter satisfaction.

Response

A summary of project impacts on each species or group of species has been incorporated into the application. Your other comments regarding quantification have been addressed above. The Alaska Power Authority has no authority for fish and game management.

W-3-301 (ii) Caribou

- Construction: Paragraph 2: We recommend providing figures on the proportion of the herd which could be affected by borrow areas A, D, and F. Although these areas will be only temporarily used within the 50 year project life, that temporary use involves several years.

Response

Please reread Section 4.2.1(b) to gain an understanding of factors limiting caribou population. Given the size and location of these borrow sites, the requested data are unnecessary.

W-3-302 - Filling and Operation: Paragraph 3: Consideration should be given to the future management options which will be foreclosed with project development. That is, now that the herd has recovered from previously low numbers, the ADF&G could change their management goals, even before project construction begins. We recommend considering loss of this management option in mitigation planning.

Response

The application has been rewritten to consider future management possibilities.

W-3-303 Paragraph 7: We recommend also considering the compounding effect of predation on caribou which become injured in crossing the reservoir or which alter their movements due to the presence of the reservoir. Predation was earlier cited as responsible for up to 30 percent of annual adult mortality (Section 4.2[a][ii]).

Response

This section has been modified to further consider this hypothetical impact.

W-3-304 (iii) Dall Sheep: Paragraph 2: Please clarify the last sentence.

Response

This introductory sentence is explained in later paragraphs.

W-3-305 Paragraph 4: Please provide information on when and how seasonal Dall sheep ranges will be defined and used to influence siting and scheduling of possible borrow site C.

Response

Borrow site C will not be used for construction materials and therefore has been eliminated from the Dall sheep discussion.

W-3-306 Paragraph 5: Please document other cases where remote mineral licks have been altered to remain available to wildlife; we are concerned with the unproven effectiveness of enlarging the area if partial loss of the Jay Creek mineral lick affects sheep. Thus there is a need to demonstrate the techniques to ensure that sheep would use the mineral source if one were provided.

Response

There are no comparable examples where additional mineral soil has been exposed.

W-3-307 - Filling and Operation: The potential for disturbance from increased recreational or hunting use in the area should also be covered here.

Response

This has been included in the discussion.

W-3-308 (iv) Brown Bear

- Construction: Paragraph 5: Please describe the scope and schedule of ongoing studies and plans for integrating those results into project designs and mitigation planning.

Response

The ongoing studies are a continuation of the studies thoroughly described in this application. Studies will be continued in spring 1983 and will provide results by December 1983. Section 4.4 describes mitigation procedures for avoidance of bear-human conflict.

W-3-309 Paragraph 6: We are concerned that the discussion downplays the importance of project impacts from both disturbance and loss of additional food sources. Original project studies 14/ and other reports 15/ emphasize that disturbance from project features and associated human activities will cause bears to avoid those areas.

Response

This section has been largely rewritten to more accurately reflect a similar concern for these problems.

W-3-310 Paragraphs 7 through 9: Two other impacts to vegetative food sources should be discussed here. Green-up of critical spring food plants may be delayed because construction-caused dust may retard snowmelt on vegetation; at the same time, herbaceous growth in summer may be increased (see the Botanical Resources Section and our comments, Section 3.3(a)(i) - Vegetation Damage by Wind and Dust and - Effects of Altered Downstream Flows.

Response

Construction-caused dust is more likely to speed snowmelt. No accurate predictions of these effects on wildlife is possible, although in this case both might be considered beneficial.

W-3-311 Paragraph 12: We question the statement that, "No measurable changes in the number of moose or other important prey species are expected." Previous lack of quantification and the ongoing nature of salmon, moose, and caribou studies make it difficult to fully assess project impacts to brown bear. However, preliminary indications that up to 2,400 moose will be affected by the project in the upper Susitna basin alone (Section 4.3(a)(i): Paragraph 4, page E-3-280), and other report findings that "moose populations will probably be reduced", (Section 4.3(a)(vi): Paragraph 5, page E-3 -312) suggest that there will be both losses and distributional shifts in brown bear prey, with resultant impacts to brown bear. Brown bear concentrations on already fully utilized adjacent ranges may result in intraspecific conflicts and further decreases in brown bear populations (Spencer and Hensel 1980, footnote 15).

Response

The text has been clarified relative to the fact that the above quotation applies to the construction phase only, when impacts on moose will be mainly distributional. We concur on the difficulty of assessing impacts. The section has been largely rewritten to clarify these concerns. Please refer to the text (Section 4.2.1[a]) re: the accuracy of the figure (2,400 moose) affected.

W-3-312 - Operation: Paragraph 1: Our comments under - Construction apply here too (Section 4.3(a)(i). Please discuss potential impacts to bears resulting from impacts to the salmon resource in greater detail.

Response

The importance of spawning salmon cannot currently be assessed. Although the occurrence of this resource in the areas downstream from Devil Canyon increases the sustainable population, the exact extent of this effect cannot be predicted. Bear studies in spring 1983 will include research along the salmon sloughs.

W-3-313 Paragraph 2: Also refer to our comments under Section 4.3(c)(i) re the need to define access.

Response

Discussion of access impacts has been transferred to Section 4.3.3 and is defined there.

W-3-314 Paragraph 5: Please see our comments two paragraphs above (Section 4.3 (a)(iv) - Operation) on the need to better evaluate the importance of salmon to area bears. Overall, we note the need to quantify impacts and discuss the cumulative effects of project impacts on brown bears.

Response

Continuing studies will provide additional information on the importance of salmon, but may fail to resolve this complex issue quantitatively. Where data are available and a defensible prediction of impacts is possible we have provided an analysis. The magnitude of cumulative unquantified impacts is difficult to predict. We have, however, predicted a decrease in carrying capacity and increases in mortality.

W-3-315 (v) Black bears

- Construction: Paragraph 1: As in our comments under brown bears, above (Section 4.3(a)(iv)), we suggest that greater attention be given to impacts of reduced prey, compounded here by the significant loss of black bear habitat with the Watana development.

Response

This section has been revised.

W-3-316 - Filling and Operation: Paragraph 1: Please refer to our comments under Section 4.3(a)(iv) - Construction re project impacts to vegetation. Since black bears will be subject to much greater impacts than brown bears, the cumulative impacts of each additional project-caused stress could be severe.

Response

Consideration of these impacts has been added to the text.

W-3-317 Paragraph 2: We question the ability of habitats to the east and west of the impoundment area to support bears now inhabiting the impoundment areas. If those areas are already fully stocked with black bears, resultant intra-specific strife and stress would ultimately lead to lower population.

Response

The sentence was misleading and has been altered. We did not intend to suggest that bears inhabiting the impoundment area would be able to invade adjacent habitats without consequence to resident bears.

W-3-318 Paragraph 3: We again refer you to our comments under brown bear (Section 4.3(a)(iv)). Please describe ongoing studies and their integration with project design and mitigation.

Response

Ongoing studies are a continuation of those described here. Additional results of 1982 field work will be available in June 1983.

W-3-319 (vi) Wolf: Paragraph 3: Please refer to our comments under Section 4.3(a)(xii) re the likelihood for wolf populations to decrease and coyote populations to increase in the project area.

Response

Our statement that wolves habituate readily to man-made disturbance stands. Experience with construction of the Trans-Alaska Oil Pipeline has amply demonstrated that wolves habituate readily to human presence in the absence of hunting and harassment. Coyotes are excluded from areas inhabited by wolves and are unlikely to invade if wolf populations remain healthy and productive. Coyote populations will replace wolves if wolves are eliminated through attempted predator-control practices or uncontrolled harvest, both of which are independently managed by the ADF&G.

W-3-320 Last Paragraph: Given the increased access expected with project development, an increased wolf harvest appears likely. We recommend that a quantification of project impacts should consider the effects of an increased harvest on wolf population levels. The cumulative impacts of (1) wolves concentrated in a smaller area due to disturbance, (2) effects on territoriality and stress, (3) relative values of impacted as compared to remaining habitats, and (4) reduction in prey, should also be considered here.

Response

Impacts due to increased access are considered in Section 4.3.3. Cumulative impacts are treated in the impacts summary. However, the discussion indicates that disturbance is unlikely to cause changes in distribution and that current wolf population levels are unlikely to be affected by a reduction in prey. Also current high harvest levels are likely to have an overriding effect on territoriality in this far from natural environment (for wolves). The value of affected habitats to the Watana pack which utilizes them is thoroughly discussed.

W-3-321 (ix) Beaver: We question the certainty of the statements here, given the undecided nature of the project water management regime. If reservoir releases are regulated to stabilize downstream flows, downstream beaver habitats may be enhanced. However, the extent to which that enhancement will offset beaver losses in the upper Susitna River basin is not provided. Such data is necessary to evaluate the relative tradeoff in alternative flow regimes (i.e., for beaver, fish, moose, etc.) and thus the overall magnitude of project impacts.

Response

No losses in the impoundment areas are expected. At least 40 beaver are expected to be lost due to access (Section 4.3.3(h)). See mitigation section for information on habitat enhancement for beaver in downstream sections. Reservoir releases will stabilize downstream flows. Any stabilization of downstream flows will enhance use of river habitats by beaver and muskrat.

W-3-322 - Construction: We recommend that the location of beaver colonies be considered, in conjunction with other wildlife values, in siting borrow area access roads.

Response

This has been done. As discussed in the Mitigation Plan, the areas of Deadman Creek inhabited by beaver are no longer to be used for borrow materials, and the borrow sites for the Watana dam support no beaver. One or two beaver colonies may be destroyed by the Devil Canyon facilities, but this loss will be more than compensated for as a result of regulated flows.

W-3-323 - Filling and Operation: Paragraph 1: Please quantify "few beavers" currently supported by the impoundment area.

Response

The text has been altered.

W-3-324 Paragraph 4: Refer to our comments under Section 4.3(a)(ix), above; we recommend using hydrologic data in conjunction with the revised vegetation maps and vegetation succession dynamics to quantify the areas which may be affected under different flow regimes. We find some inconsistency between the statement here that, "Beaver habitat south of Talkeetna may also be enhanced as a result of the increased occurrence of favored food plants (page E-3-316)," and the statement in Section 4.3(a)(i) that, "few changes are expected in channel morphology, frequency of flooding, or vegetational succession" (page E-3-289, paragraph 1).

Response

Section has been largely rewritten. Available hydrologic data will be used to determine the most likely locations for enhancement in downstream sections.

W-3-325 Paragraph 5: During the August 1982 AEA Workshop on the Susitna project, access was considered as much of a limiting factor to trapping pressure as was pelt price. This section justifies our mitigation recommendati ons under Section 4.4(b) for alternate access routing, restrictions on use of access routes, and prohibition of trapping by construction workers.

Response

Ease of accêss is limiting at low pelt price levels. Access is not a factor when pelt values are high (P. Gipson 1982 pers. comm.). Restrictions to access and regulating harvest are even more important when pelt values are high.

W-3-326 (x) Muskrat: Paragraph 1: We find no section correlating to the referenced Section 3.3(a)(ix). Please define "minor" impacts.

Response

Increased value of beaver habitat downstream is referenced throughout the above-mentioned section. The extent of impacts are further defined in paragraphs following this introduction.

W-3-327 Paragraph 2: Please refer to our previous comments on quantifying improvements in downstream habitats under Section 4.3(ix). Accordingly, we question the contention that, "Improved downstream habitat will probably compensate for this loss."

Response

See our response to your above-referenced comments. Sentence has been changed to read "...will compensate."

W-3-328 Paragraph 4: Again, refer to our comments under Section 4.3(ix), re mitigation of trapping impacts.

Response

Regulation of trapping after construction is the responsibility of the Alaska Board of Game. During construction, the mitigation plan notes that trapping and hunting by project personnel in the project area will be prohibited.

W-3-329 (xi) Mink and Otter

- Upstream Effects: We recommend defining "moderately abundant" and "substantial impacts". Other than lacking quantification, the discussion thoroughly describes potential project impacts to mink and otter. Please clarify the reference to "65m" in Paragraph 3.

Response

Reference to the baseline description has been added for access to available data on abundance. Available information related to assessing the impacts to mink and otter are discussed in subsequent paragraphs. The reference to 65m was a typographical error and should read: "65 mi."

W-3-330 - Downstream Effects: We suggest the discussion be expanded to better explain the relative magnitude of project impacts to mink and otter. Since there was no previous quantification of those populations, we find it difficult to evaluate the significance of these impacts.

Response

Available information allows no expansion of this discussion.

W-3-331 (xii) Red Fox and Coyote: Where human activities have developed in a previously undisturbed area, coyotes have become abundant while fox numbers have decreased (Furbearer Study Coordinator Phil Gipson, personal communication). For example, in the Cantwell to Healy corridor there has been a marked increase in coyotes with increasing numbers of people and area developments. Researchers believe there has been a corresponding decrease in both fox and wolf numbers, although both those species pass through the area from undisturbed habitats in the adjacent Denali National Park.

Per our comments on other furbearers, quantification of relative area populations, habitat quality, and trapper demand and harvest is necessary to fully evaluate project impacts.

Response

See our response to the comment on section 4.3.1(f). Coyotes are likely to increase significantly only where wolves are eliminated. No data are available indicating a decrease in fox numbers in the Cantwell to Healy corridor. See also Section 4.3.a(1). Where numbers are available quantification is provided. Harvest data are discussed in Section 4.2.2(f). No data are available on trapper demand.

W-3-332 (xiii) Other Furbearers: Again, quantification is needed re baseline populations, habitat quality, and use, in order to fully evaluate project impacts.

Response

Quantification has been provided where possible. When data are unavailable, the most reasonable predictions of impacts are provided.

W-3-333 Paragraph 3: Note should be made of the previous years' trapping activity which may be responsible for low trapping success of pine marten near Watana Creek (Furbearer Study Coordinator Phil Gipson, personal communication).

Response

This has been noted. It is also possible and we consider more likely that seasonal differences in trapability are responsible for low trap response in July.

W-3-334 Paragraph 4: We suggest considering additional parameters for evaluating pine marten habitat quality (e.g. the availability of berries is important as late summer/fall food) in conjunction with remapped vegetation types to reevaluate impact estimates.

Response

Direct estimates of density are likely to provide more accurate and timely information on numbers to be affected than indirect and subjective measures of habitat quality.

W-3-335 Paragraph 6: We question the extent to which snowshoe hare habitat may be improved by revegetation of disturbed areas, given the much larger amount of habitat which will be destroyed by the project and historically low hare populations in the basin.

Response

Current and historically low population levels reflect the lack of early successional habitat available. Disturbance of soil and vegetation by the project and mitigation plans for moose will increase availability of early successional habitat in the middle and lower basin. Burning, in particular, will improve habitat for snowshoe hare.

W-3-336 Paragraph 8: No correlation is made between "moderate" levels of disturbance from logging and different levels of disturbance from the project re the applicability of these references to project impacts.

Response

Disturbance associated with logging is likely to be similar (in adjacent habitats) to borrow extraction or construction site activities and is therefore referenced as an equivalent impact.

W-3-337 (xiv) Raptors and Raven

- Habitat Loss: Paragraphs 2 and 5: Please refer to our comments under Section 4.3(a)(xiv) - Disturbance, below concerning the taking of eagle nests.

Response

Protection afforded bald eagles and their nests under the Bald Eagle Protection was clearly recognized (see Section 4.3.1(n), "Disturbance").

W-3-338 Paragraph 4: In order to understand the relative magnitude of project impacts, we recommend discussing the estimated loss of golden eagles in terms of project area populations and habitat values.

Response

Discussion has been added to the text.

W-3-339 Paragraph 5: Please clarify the statement that potential downstream nesting habitats may become more important as upstream habitats are lost with project development. Whether downstream habitats are fully utilized, their value compared to upper basin habitats, and potential disturbances from other project activities should be described.

Response

Project-related disturbances are not expected to occur in the potential downstream bald eagle habitats that are referred to (i.e. especially Portage Creek, Stephan Lake and Prairie Creek). These areas may become more important to bald eagles because they are the closest locales to the project area that contain habitat similar to that typically used by bald eagles. These potential habitat areas do not appear to be currently used by bald eagles with the exception that one bald eagle nest was found near Stephan Lake. Among the three areas, two basic nesting habitat types are found--balsam poplar stands (especially Portage Creek) and occasional small stands of larger spruce. The value of these areas and the few locales of habitat that will be lost as a result of the project are judged approximately equivalent. Portage Creek is of particular interest since bald eagles do not appear to be using it at present. One reason for that may be that the medium and occasional larger poplars appear to lack larger branches of appropriate form, and canopies tend to be relatively closed. This area may become considerably more suited to eagles if some appropriate habitat enhancement measures are taken.

W-3-340 Paragraph 9: Please clarify whether downstream raven habitats could absorb use by ravens displaced from upstream habitats.

Response

The text has been revised and clarification provided.

W-3-341 Paragraph 10: The blowdown of trees near cleared areas represents an additional source of habitat loss (e.g. see Section 3.3(a)(i) - Vegetation Damage by Wind and Dust).

Response

Potential blowdown of trees is recognized as an additional potential source of perching habitat loss, if the trees that are blown down are of appropriate sizes and conformations to provide perches. If one recognizes that the majority of clearing of larger trees will occur in the impoundment zones over a relatively short time, and that the area will then be inundated, also in a relatively short period of time, it seems reasonable to conclude that any potential losses as a result of blowdown will be negligible. Furthermore, because most raptor species readily perch on transmission towers and poles, such losses will probably be compensated for, providing precautions are taken to reduce collisions with lines and guy wires, and prevent electrocution.

W-3-342 Bald Eagles: Paragraph 3: We recommend describing the overall impacts of the project on salmon and other fish which serve as bald eagle food. Such consideration should include potential impacts to smelt runs near the mouth of the Susitna River. Any impacts to these resources could affect eagl es now depending on them as food.

Response

Text has been revised. However because bald eagles also eat a variety of birds and some mammals, and because they are limited by availability of nesting sites as well as food (see additional comments about limiting factors for raptors below), we doubt that impacts to fish, especially considering planned mitigative measures for them, will be of special consequence to the bald eagle population. Smelt may provide some food to bald eagles near the mouth of the river since they occur mainly below the Yentna River (see Section 2), but it is doubtful that they are an important food source for many of the nesting pairs in the total population. Furthermore, no major adverse impacts to smelt are anticipated (see Section 2).

W-3-343 Paragraph 4: We question the significance of any compensation for lost eagle feeding habitat through attraction of waterfowl to the impoundment. Please quantify the potential for such compensation and/or provide an explanation of why waterfowl may be attracted to the reservoir without a concomitant increase in their food sources (also see our comment under Section 4.3(a)(xv) Waterbirds, below).

Response

The text has been revised to reflect some attraction of waterfowl which may occur in spring solely because of open water, regardless of the presence or absence of food that would support them for longer periods of time. Furthermore, please note various comments on food as a limiting factors to raptors, and the probability that loss of feeding habitat will be of much less significance than loss of nesting sites in the middle basin.

W-3-344 - Disturbance: Paragraph 1: We appreciate the description of protection afforded eagles under the Bald Eagle Protection Act (16 U.S.C. 668-668 c). However we are concerned that the intent of this act relative to project design has not been adequately acknowledged or incorporated, as explained below.

Paragraph 6: Under a recent amendment to the Bald Eagle Act, the Secretary of the Interior may permit the taking of golden eagle nests which interfere with resource development or recovery operations (16 U.S.C. 668a). Regulations for implementing this amendment should be available within the next couple of months.

Paragraph 7: The Bald Eagle Protection Act does not authorize the taking of bald eagle nests which interfere with resource development or recovery operations. The Act does provide for the taking of nests for scientific and certain specific exhibition purposes when compatible with the preservation of this species. Service eagle permit regulations, 50 C.F.R. 22.21, implement this section of the Act. Secretarial approval is not required for the taking of bald eagle nests in Alaska provided no eagles are killed and the nest is not exported from the United States. Authority to take such nests has been delegated to the FWS Regional Director. We suggest that the applicant promptly consult with the FWS to reach a mutually satisfactory solution to this potential conflict.

Response

The intent of the Bald Eagle Protection Act (including golden eagles) was acknowledged--it was stated in the text that the act prevents taking birds, parts thereof, eggs or nests (take includes molesting or disturbing) without a permit. Because the act does not authorize the taking of bald eagle nests which interfere with resource development or recovery operations, consultations to reach a mutually satisfactory solution or compromise was understood as necessary if the project were to be built. Such consultation has been initiated in a letter of February 1, 1983, from the Alaska Power Authority, to the Alaska USFWS Regional Director. Revisions have been made in the text to clarify this. Furthermore, the mitigation plan for both bald eagles and golden eagles was developed in the spirit of satisfying the meaning of the act. The mitigation plan will be implemented in a manner that should satisfy taking of bald eagle nests as part of a scientific study to learn about the effectiveness of several possible mitigation methods that will be useful as evaluative and mitigative tools should similar conflicts arise between this species and other future developmental or industrial projects.

The mitigation plan for golden eagles was devised in the same spirit and will be implemented in the same manner. Since a recent amendment to the Bald Eagle Protection Act allows taking of golden eagle nests which interfere with resource development or recovery operations, this issue will undergo review (once regulations are available) to determine implications to the project and proposed mitigation measures. Mutually satisfactory interpretations and means of complying with these new regulations will be arrived at in consultation with the USFWS.

W-3-345 (xv) Waterbirds

- Habitat Alteration: Paragraph 2: Please substantiate that "fish populations will probably remain sufficient" to support birds such as mergansers. According to Meeting Summary notes from the December 2, 1982, Susitna Hydro Exhibit E Workshop on Water Use and Quality and Fishery Resources, most of the grayling population (estimated to be at least 10,000 in Section 2.3(a)(kk) - Watana Reservoir Inundation will be lost and any production of lake trout is expected to be limited.

Response

The test has been revised.

W-3-346 Paragraph 3: We suggest quantifying the number of lakes, miles of streams, and acres of wetlands (per revised wetlands typing) which may be affected by project borrow areas, spoils sites, etc., as well as those which will be completely lost. We recommend including those habitat types in Table W78a. This information will allow better quantification of project impacts.

Response

Your suggestion and recommenation have been noted. Also see Tables E.3.81 to E.3.86.

W-3-347 Paragraph 4: Please substantiate further the value of the reservoir as habitat for migrating birds. Since existing resident fish populations are expected to be severely impacted by reservoir development and no biologically productive nearshore zone will be developed, we question that there would be food necessary to support birds attracted to the reservoir. Moreover, winter open water areas could attract waterbirds to their detriment, particularly since food supplies are already limited. Swans attracted to open water at Red Rocks Lake National Wildlife Refuge in Montana must now be fed during winter; similar problems have occurred in other areas of the conterminus United States (FWS Migratory Bird Management Project Leader Rod King, personal communication).

Response

The text has been revised.

W-3-348 - Disturbance: Paragraph 2: We suggest that greater emphasis be placed on the potential for the project to disturb trumpeter swans. Recent increases and overstocking of swans in the Gulkana Basin may result in more swans moving into the upper Susitna Basin (FWS Migratory Bird Management Leader Rod King, personal communication). Yet those habitats will become less suitable with the human activities and disturbances caused by the project. As areas in the Cook Inlet Basin and Kenai Peninsula have been affected by human use and development, swan use of those areas has shifted to areas largely inaccessible to people.[16]

Response

This suggestion has been noted.

W-3-349 (xvi) Other Birds

- Construction

. Habitat Loss: We appreciate the thorough, quantitative discussion included here.

. Habitat Alteration: We suggest that species and their relative abundance be correlated to the postulated negative and positive effects of habitat alteration. This would provide some indication of net project impacts. Loss to the Watana impoundment of existing natural edge, e.g. rivers, ridgetops, etc., will undoubtedly be far greater than the increases in edge suggested here.

Response

This suggestion is being considered. However, revised wetland mapping is not yet available.

W-3-350 - Operation: We question whether any feeding habitat for spring migrant shorebirds will be created in the drawdown zone. The reservoir drawdown zone will remain an unvegetated mudflat. If current low bird populations indicate lack of high quality habitat, it seems doubtful that food organisms would suddenly proliferate with reservoir development.

Response

Agreed. Creation of feeding habitat for spring migrant shorebirds is doubtful. The text has been revised, and the comment acknowledged.

W-3-351 (xvii) Non-game (small) Mammals: For small mammal species which inhabit identifiable vegetation types, we suggest describing whether the percent of the habitat to be lost is proportionately greater or less than the occurrence of the type within the entire basin.

Response

This will be done once accurate areas for the various vegetation types are available.

W-3-352 (b) Devil Canyon Development

(i) Moose: Converting the number of moose in the Devil Canyon impoundment to a density figure and then comparing that to a similar figure for the Watana impoundment would allow a better quantitative comparison of impacts. We are concerned with the judgmental nature of the discussion in stating that impacts "are of less concern" and suggest that, "will be of smaller magnitude" might improve the statement (pge E-3-338). The smaller area of the Devil Canyon as compared to Watana area should also be mentioned, although we do note that moose density here is about half that of the Watana area. An evaluation of relative habitat values of the adjacent areas which will be less directly impacted, and any lands proposed for acquisition or enhancement, is necessary for a complete impact and mitigation analysis.

Response

We consider density estimates less useful than actual numbers in this case (the reader can easily compute density from information provided). Wording has been changed to reflect our concern as suggested. The modeling approach being developed will provide a means of assessing values of forage habitats. See Section 4.4 for mitigation discussion.

W-3-353 - Construction: Again, spoils disposal is an additional impact which should be described.

Response

The exact location and area of spoil disposal sites has not yet been determined. However, the total volume of spoil will be much smaller than the volume removed from borrow sites and will be disposed of somewhere within the impoundment. Habitat loss from spoil disposal will be inconsequential.

W-3-354 . Habitat Loss: Our comments under this heading (Section 4.3(a)(i)), for the Watana development also apply here.

Response

See our response to your previous comments.

W-3-355 . Interference with Movements: The discussion should consider whether a 1.6 km crossing would also be a barrier to moose in that area or moose diverted from upstream crossings because of the Watana impoundment. Quantification should also be provided of the additional distances which might have to be traveled and consideration given to additional energy expenditures relative to forage quality should moose alter their movement patterns. Also refer to our comments under this heading, Section 4.3(a)(i), for the Watana development.

Response

This discussion states that the 1.6 km cleared area may present a visual barrier to crossing. Quantification is not possible. Currently available information cannot provide estimates of energy expenditures relative to forage quality. The proposed modeling effort will provide data by which such estimates can be made.

W-3-356 . Disturbance: Please refer to our comments under this heading, Section 4.3(a)(i), for the Watana development.

Response

Please refer to our response to your comments.

W-3-357 - Mortality: As above, our previous comments under Section 4.2(a)(i) . Morality Factors; 4.3(a)(i) - Filling and Operation, . Disturbance; and 4.3(c)(i) - Mortality apply.

Response

Please refer to previous responses to your previous comments.

W-3-358 - Filling and Operation

. Alteration of Habitat: Please refer to our comments under this heading, Section 4.3(a)(i), for the Watana development. We are concerned that increased water temperature could result in a larger area being affected by ice fog and rime ice formation, also see our comments under Section 3.3(a)(i). We again recommend quantifying several impact scenarios re successful vegetation changes from any of the impacts discussed here.

Response

No data are available to determine actual areas which may be affected by icing of vegetation. Local variation in air temperature, wind speed and direction will all affect the distribution of icing. Refer to Section 4.3.2(a)(ii) Paragraphs 4 and 5.

W-3-359 . Interference with Movements: By reducing browse availability due to rime ice formation, the presence of ice fog could be a compounding impact to moose.

Response

Rime ice formation can occur independently of ice fog. There is no quantitative support for either of these potential impacts, but they have nevertheless been included.

W-3-360 Moose movements may already be inhibited because of greater visual exposure to predators in the vicinity of the reservoir. We refer you to our comments under the Watana development (Section 4.3(a)(i) - Filling and Operation; . Blockage of Movements).

Response

See our earlier response to your comment.

W-3-361 . Disturbance: Again, our comments for Watana (Section 4.3(a)(i)) apply.

. Mortality: Please refer to our previous comments on hunting (Section 4.2(a)(i) . Mortality Factors, and Disturbance and Mortality discussions under Section 4.3(a)(i)).

Response

See our responses to previous comments.

W-3-362 . Devil Canyon: Summary of Impacts: As we commented on the Watana impacts summary, quantification and better definition of impacts is needed here. We are also concerned about inattention to cumulative impacts. While habitat alterations, disturbance, or blockage of movements may each be a "minimal" impact, together they may be sufficient to severely stress moose or reduce moose use of the project and adjacent areas.

Response

This discussion has been eliminated. See impacts summary for discussion of cumulative impacts (Section 4.3.5).

W-3-363 (ii) Caribou: Definitions for the qualitative terms used here should be provided (e.g. "little use").

Response

No quantification is possible. Movements of caribou relative to infrequently used areas of their range cannot be predicted.

W-3-364 (iv) Brown Bears: Lack of quantification here, as in Section 4.3(a) (iv) precludes evaluating even relative impacts for each major project feature.

Response

Where data are available, quantification is provided (see ADF&G 1982e). Evaluation of project impacts based on available information are provided.

W-3-365 (v) Black Bears: As in Section 4.3(b)(iv) above, lack of quantification prevents a thorough analysis. Consideration should be given to the cumulative effects of disturbances, loss of habitat, decrease in habitat value, and increased mortality from human/bear conflicts from the Devil Canyon development in conjunction with the Watana development.

Response

Where data are available, quantification is provided. See impact summary, Section 4.3.5 for discussion of cumulative impacts.

W-3-366 (vi) Wolf: Please refer to our comments under Section 4.3(a)(vi) re the importance of disturbance and cumulative impacts.

Response

Please refer to our analysis of disturbance effects herein and Section 4.3.1(f). Cumulative impacts are treated in Section 4.3.5.

W-3-367 (ix) Beaver: Refer to our comments under Section 4.3(a)(ix) re the need to quantify the amount and quality of downstream habitat improvements which could offset upstream habitat losses and the dependence of any habitat improvement on the operating flow regime. We suggest describing impacts under a variety of potential flow regimes.

Response

Refer to our responses to previous comments. See also Section 4.4 for mitigation plans to enhanace downstream beaver habitat. Modeling of hydrology, floodplain vegetation, and beaver is being conducted to evaluate beaver responses to different flow releases.

W-3-368 (x) Muskrat: Please refer to our previous comments under Sections 4.2(b)(ii) and 4.3(a)(ix) - Filling and Operation re quantifying and controlling potential increases in trapping.

Response

Trapping will be prohibited from project facilities and equipment by project personnel during the construction phase. During operation, trapping will be the jurisdiction of the ADF&G and beyond the control of the Alaska Power Authority.

W-3-369 (xi) Mink and Otter: Again, we recommend providing some quantification, definition, or relative correlation among species and project areas for the qualitative impact descriptions.

Response

Quantification is not possible on the basis of currently available data. Discussion is considered a clear and accurate portrayal of anticipated project impacts.

W-3-370 (vii) Coyote and Red Fox: We would expect an increase in coyotes per our previous comments (Section 4.3(a)(xii)).

Response

See previous responses and revised text.

W-3-371 (xiii) Other Terrestrial Furbearers: Our comments under Section 4.3 (a)(xiii) apply here too.

Response

See previous responses.

W-3-372 (xiv) Raptors and Ravens

- Construction and Filling

. Habitat Loss: Paragraph 1: Refer to our comments under Section 4.3(a)(xiv) - Disturbance.

Paragraph 2: Should any eagle build a nest, between now and filling of Devil Canyon Reservoir which would subsequently be lost in construction and/or filling of Devil Canyon, please refer to our comments under Section 4.3(a)(xiv) - Disturbance.

Response

Acknowledged.

W-3-373 Paragraph 3: Please clarify what is meant by the first sentence.

Response

Typographical error corrected: "know" should have read "known".

W-3-374 Paragraph 4: Please refer to our comments under Section 4.2(c)(i) re the difficulties in locating goshawk nests.

Response

Please refer to our comments regarding surveys for goshawks and habitat available to goshawks (above).

W-3-375 Paragraph 5: Please clarify the discussion and consider whether the cliffs and trees which may increase in nesting importance are as suitable as existing nest habitats.

Response

Text revised. In general, cliffs and trees referred to are suitable because ravens have much lower nesting requirement "standards" than do raptors. Furthermore, some of these cliffs may have been used in the past by ravens since they often build new nests each year, and many such nests in certain nesting situations last only a short time (i.e. one breeding season), and leave little evidence of their having been present.

W-3-376 . Disturbance: Paragraph 1: Again, please refer to our comments under Section 4.3(a)(xiv) - disturbance.

Response

Acknowledged.

W-3-377 Paragraph 2: See our comments under Section 4.3(b)(xiv) this section, Habitat Loss: Paragraph 2, above.

Response

Acknowledged.

W-3-378 (xv) Waterbirds: Please refer to our comments under Section 4.3(a)(xv) as to the questionable value of the reservoir area, i.e. generally birds will not appear in the area any earlier; birds which remain in the area longer may have problems finding food when encountering frozen waterbodies once they do leave; no data has been provided re any supplemental food value in the reservoir area.

Response

Noted. The text has been clarified.

W-3-379 (xvi) Other Birds: Paragraph 2: Please clarify the last sentence.

Response

Clarified.

W-3-380 Paragraph 3: Please quantify the extent to which open water in the reservoir will compensate for loss of dipper breeding habitat and describe what feeding habitat would be available in the reservoir.

Response

Text has been revised.

W-3-381 (xvii) Non-Game (small) Mammals: Please refer to our comments under Section 4.3(a)(xvi).

Response

Please refer to our response to these comments.

W-3-381 (c) Access

(i) Moose: The qualitative, general discussion precludes any definitive analysis of potential impacts. We suggest quantifying current and potential hunter demand and harvests, area moose populations and habitat quality for access route areas. Varying degrees of winter severity and the length of each access link should then be considered in conjunction with the information described above and data on vehicle/moose collisions in other areas of the state to assess the potential for railroad or automobile collisions with moose.

Response

Where data are available in source documents, numbers have been provided. The outlined modeling approach will allow a more accurate assessment of the impact of direct habitat loss, various levels of mortality from both hunting and vehicle collisions, and various degrees of winter severity.

W-3-383 Since access is a key feature to any mitigation plan for the project, we again recommend evaluating the range of impacts which would result from a variety of access/use options and coordinating this with the Socioeconomics and Recreation Chapters. Please refer to our 17 August 1982 letter to Eric Yould re access alternatives; our comments there remain applicable.

Response

We have referred to the letter and note the concerns expressed therein.

W-3-384 Please correct internal inconsistencies in this paragraph: loss and alteration of habitat, disturbance, and mortality are certain, not "possible," impacts as verified in subsequent portions of this section (page E-3-350). Maps of proposed access routes should also be included.

Response

Sentence has been altered. Routes appear in Figures E.3.37, E.3.42 to 47, and E.3.79 to 82.

W-3-385 - Mortality: Paragraph 2: Before discussing impacts from access, please specify any public access and hunter take restrictions assumed to be in effect for planning, construction, and operation phases of the project. Impacts will vary from severe with no restrictions to minimal with strong restrictions on access. In this respect, we find Chapter 3 confusing. The potential impacts from public access and hunting along project access routes are discussed here and then the suggestion is made that these impacts will be minimized by prohibiting worker access and hunting, yet the chapter never consistently describes what restrictions actually will apply. Project impacts, such as habitat degradation and population disturbance associated with increased access, could be further minimized by controlling public access (through restrictions on ORVs, seasons or times of day of use, etc.)

Response

The impact section is based on the assumption that access roads will have unrestricted access for project personnel during the construction period but that public access will be prohibited. After construction, the roads will be open to the public, the impact discussions further assume that workers will be allowed the same hunting, trapping and rights as other Alaskans, and that regulations currently in effect will continue. The mitigation plan includes restrictions on worker recreational activities as a means of avoiding or minimizing certain impacts.

W-3-386 Please substantiate the conclusion here that "carefully managed hunting may effectively mitigate for some indirect project effects." The impact of diminished hunter opportunities is not fully described here or in Chapter 5 (see our comments there, Section 3.7(b) (ii) - Impacts on the Hunter).

Response

Section has been revised to clarify the utility of reducing surplus populations created by a sudden reduction in carrying capacity. See also Section 4.4. Socioeconomic impacts are treated further in Chapter 5.

W-3-387 Paragraph 4: Please define use of the terms "small" and "negligible." During severe winters, moose may seek cleared roadways as travel corridors and be subject to collisions. Since the Denali Highway is not kept open during the winter, it is not possible to fully compare the collisions on that road with the potential for collisions on project access roads. However, we suggest that a better understanding of the subject could be gained with information as described under Section 4.3(c)(i), above. We also note that if workers are allowed to commute to the project site or have free access in and out of the project area, the volumes of road traffic would be that in significantly higher. The analysis should be coordinated with that in Chapter 5. Consideration should be given to the times of year for recorded collisions and utilized in scheduling access if patterns exist in that information.

Response

Section has been rewritten with reference to traffic volume data provided by Frank Orth, Assoc. (Table E.3.167). Traffic volume estimates provided are considerably higher than those used for the original analysis.

W-3-388 Paragraph 5: Please describe current railroad use as compared with the projected additional eight round train trips each week. We believe that project railroad use may be a significant impact to wildlife in view of present winter use of four round trips each week.

Response

We concur that impacts may be substantial. Current railroad traffic information has been added.

W-3-389 The length of additional track, as well as existing track, should also be given for comparison with the mortality figures given here. Information on moose densities and habitat values in the area of the new as compared to existing railroad would also be helpful in quantifying potential impacts, as described above. We are concerned that in severe winters the loss of winter range may be compounded by the potential for numerous vehicle/moose collisions.

Response

The distribution of railroad kills, as described in the text, is concentrated in low elevation areas during severe winters. Therefore, some caution should be exercised in comparing kills per length of track. The proposed modeling effort will allow flexibility in comparing various habitat values along the new and existing corridors. The loss of winter range will be a severe impact in the Watana reservoir area and will affect a separate population of moose, for the most part, than the rail access to the Devil Canyon facility.

W-3-390 . Loss of Habitat: We concur with the analysis but suggest some quantification be made of areas and vegetation types which could become unuseable in a worst case scenario where disturbance causes moose to avoid using the road corridor area.

Response

No data are available on the distance from the road disturbed moose may maintain. Any attempt at such an estimate would be conjectural and misleading. In reality, individual responses will vary. As indicated in the text, little winter range or other special use areas occur in the access corridor (see also Table E.3.84).

W-3-391 . Interference with Seasonal Movements: With respect to the seasonal migrations described here, please refer to our comments under Section 4.3(c)(i) - Mortality, re the compounded potential for even greater numbers of vehicle/moose collisions.

Response

The text indicates the increased likelihood of mortality due to collisions in recognized movement corridors.

W-3-392 (ii) Caribou: Paragraph 1: We reiterate our recommendation to eliminate the Denali Highway to Watana access route (also see Section 3.4(c)(ii)) which, as documented here, is "likely to have a substantial effect on caribou movements."

Response

Your recommendation was considered in access route selection. See Chapter 10.

W-3-393 Paragraph 6: Please provide substantiating data for the judgment that although cows calving in the area may avoid the road, there will not be an effect on herd productivity. We recommend quantifying the portion of the herd utilizing this area.

Response

No effect on herd productivity has been found during long-term, intensive studies of the Central Arctic Herd, as discussed. This includes productivity data for a calving concentration area in the Kuparuk oilfield which is surrounded by intensive development. Although calving areas are traditional, exact locations of calving vary from year to year in an unpredictable fashion. No defensible quantification of the portion of the herd affected in any particular year is possible.

W-3-394 Paragraph 7: Please provide further information on times of day or seasonal variations expected for truck traffic. An additional concern in considering the potential severity of access-related impacts is the question of worker access. If project workers are all housed onsite, the intensity of road use will still be greater than described here; workers traveling to and from the site at the beginning and end of their times off represent a substantial road, or even airstrip use. Moreover, if workers are allowed to individually commute, or even if busses are used on a daily or weekly basis, road use will be even more significant.

Response

Available projected traffic figures appear in Table E.3.167. No other traffic data are available.

W-3-395 Paragraph 9: Our previous comments on herd management apply (Section 4.2[a][ii]). We recommend quantifying impacts described throughout this section.

Response

This section has been altered accordingly. Quantification is provided where data are available.

W-3-396 (iii) Dall Sheep: Paragraph 1: The issue of disturbance from air access to the project should be covered here; as described in Section 4.3(a)(iii). Please provide information on the expected intensity of aircraft use for the period of construction.

Response

A reference to that discussion has been added here.

W-3-397 Paragraph 2: Consideration should be given to increased recreation and other activities which may compound habitat loss impacts near the critical Jay Creek mineral lick. Please restate those impacts as described in Section 4.3(a)(iii).

Response

Reference to previous discussion of these impacts has been added.

W-3-398 (iv) Brown Bears: We concur with the assessment but recommend that quantification of impacts be provided.

Response

Where numbers are available, quantification is provided.

W-3-399 (vi) Wolf: Our previous comments under Section 4.3(a)(vi) apply.

Response

Please refer to our responses to your previous comments.

W-3-400 (vii) Wolverine: Paragraph 2: Quantification of trapping effort and potential increases relative to wolverine populations should be given. Please justify the inference that emigration from other areas will mitigate for loss of wolverine to trappers yet not affect overall populations.

Response

No data are available on trapper effort. Sentence has been rewritten to prevent similar misinterpretation regarding emigration. The word "mitigate" does not appear in this discussion and our meaning has been misconstrued. The inference is that no detectable decrease in harvest is expected because of the wide-ranging habits of the species and the large area of habitat surrounding the basin which will provide a source of dispersing individuals. Likewise, no detectable change in population levels will occur, though the social structure and use patterns will undoubtedly be affected.

W-3-401 (viii) Furbearers: In general, we find the discussion somewhat inconsistent with other sections, with no clear objectives outlined for mitigation (see paragraphs 2, 8, and 9 of this section). Please also refer to our comments on the socioeconomics (Chapter 5, Section 3.7 (c)(i) - Impacts of the Project) and our recommendations under the wildlife mitigation plan (Section 4.4[b]). We recommend you then ensure these sections are consistent with each other and with overall project objectives and mitigation goals. Specific comments follow:

Response

Please refer to Section 4.4 for mitigation plans. Socioeconomics are treated in Chapter 5 and Section 4.5.

W-3-402 Paragraph 1: Please provide further data to substantiate the conclusion that pine marten home ranges may become realigned along the access road. Although we appreciate the thorough discussion of potential project impacts, we are concerned that repeated lack of quantification makes it difficult to assess the relative importance of such "minor" impacts as compared to the more severe impacts of direct habitat losses and increased trapping mortality.

Response

Discussion is considered adequate. Considering small ranges and use of forest habitats, the local distribution of individuals with home ranges adjacent to the road is expected to be affected. Quantification is provided where available. Increase in trapping pressure is explicitly identified as the single most significant impact.

W-3-403 Pargraph 5: The well-documented likelihood of beavers using bridges and culverts for damsites more probably represents further negative impacts to beaver than a source of habitat improvement. Beaver use of those structures would conflict with project access, undoubtedly resulting in road maintenance to remove beaver dams. If that removal occurs at the wrong time of year, i.e., autumn, beaver in the area may be effectively eliminated (Furbearer Study Coordinator Phil Gipson, personal communication.)

Response

Discussion should be read more thoroughly; it states that habitat improvement is not anticipated in the prime beaver habitat along Deadman Creek. No change has been made in this discussion.

W-3-404 Paragraph 9: We are concerned with the use of the word "desirable." Thus, we suggest modifying the last sentence to say that to date, trapping pressure on mink and otter has been low in this part of Alaska (Furbearer Study Coordinator Phil Gipson, personal communication.)

Response

Gipson et al. (1982) state: "Local trappers seldom take river otters. The animals are difficult to trap and pelt values have usually not been high enough to justify the effort." Mink are also taken mostly incidentally and are not specifically sought by trappers.

W-3-405 (ix) Raptors and Ravens

- Denali Highway to Watana Damsite: Paragraph 1: We recommend describing how this area was surveyed.

Response

See Kessel et al. (1982a). Access routes were surveyed by helicopter on July 3 and 5, 1981. D. G. Roseneau also surveyed the Denali Highway to Watana Damsite access road by helicopter on October 16, 1982. Although the breeding season was long since over and snow covered the ground, it was clear that no cliff-nesting habitat was present within several miles of the new alignment. It was also evident that bald eagle nest location BE-6 (previously identified) was the only tree nest near the alignment.

W-3-406 Paragraph 2: Our comments under Section 4.3(a)(xiv) - Disturbance would apply should golden eagles subsequently nest along the access road.

Response

Agreed--however, no cliff habitat occurs within several miles of the access road. (Few trees also occur near it, and furthermore, there are only about 10 instances of golden eagles nesting in trees known from Alaska - see Roseneau et al. 1982.)

W-3-407 Paragraph 3: Refer to our comments under Section 4.3(a) (xiv) - Disturbance re the illegality of destroying a bald eagle nest.

Response

The illegality of destroying bald eagle nests is clearly understood (see previous comments above.)

W-3-408 - Watana Damsite to Devil Canyon Damsite

. Disturbance: We again refer to you to our comments under Section 4.3(a) (xiv) - Disturbance.

Response

Comment noted.

W-3-409 - Devil Canyon Damsite to Gold Creek

. Disturbance: We recommend that the conclusions of minimal disturbance here, be consistent with those in Table W76 which says that "construction and operation activities may result in considerable disturbances." If the nest is active, we will recommend timing constraints on the construction activities near it (see Section 4.4 [c][i]).

Response

The inconsistent statement in the text was corrected.

W-3-410 (d) Transmission Lines: As with the previous Section 4.3, (c) Access, the severity of impacts from the transmission lines will depend on restrictions on access (e.g. by siting, access to the lines, and/or access along the lines) as well as the methods of construction and maintenance (e.g. helicopter, winter, and/or onground). Please clarify what methods and schedule for construction and maintenance will be utilized and what restrictions, if any will be placed on access; we find the Exhibit E inconsistent on these points. The reference here is to helicopter and winter construction and only selective clearing of vegetation; in Chapter 5, reference is made to increased hunter access along the lines which infer greater clearing and road access (Section 3.7 [c][i] . Impacts of the Project). Increased snowmobile and ORV access and their disturbance along the transmission corridors should also be addressed here. Our comments under (Section 4.3[c]) Access on the need to quantify expected additional harvests also apply here.

Response

Transmission line impacts have been largely rewritten.

W-3-411 Please refer to our transmission corridor comments under Botanical Resources, Sections 3.3(d) and 3.4(d). We refer you to our January 5, 1982 review letter on the November 9, 1981 Transmission Corridor Report. Our comments there remain applicable. In particular, we recommend incorporating into project plans: (1) on-ground evaluations with representatives of the FWS, ADF&G, and the Alaska Plant Materials Center regarding the appropriate management along various lengths of the transmission lines (e.g. the extent of clearing, maintenance, possible seeding, etc. should depend on the wildlife species of concern and vegetation types present; (2) coordinated access to the transmission lines with access to other project facilities; (3) controls on public access to the transmission lines during and post-construction to reduce habitat degradation and population disturbances; and (4) controls on access along the length of the lines. We would appreciate your response where project plans may be in conflict with either these points or the five specific recommendations in our January letter.

Response

Refer to proposed mitigation plans in Section 4.4. Also note letter of January 5, 1982, was responded to on April 14, 1982.

W-3-412 We are concerned with the generality and lack of quantification of this section. Using the vegetation remapping, a successional model should be applied; the selective clearing and maintenance to be used along the transmission lines should be factored into that model. Areas within each type to be impacted and vegetation type changes over the project life can then be calculated. Maps of the proposed transmission line corridors should also be provided.

Response

Please refer to Section 3.3, Botanical Resources impacts. Vegetation remapping is not yet available. Maps appear in Figures E.3.32, 35, and E.3.49 to 52.

W-3-413 (i) Big Game

- Cook Inlet to Willow: Paragraph 1: Again, the degree of impact will depend on the type of clearing and maintenance and thus, habitat alterations which result. We have recommended selective clearing, winter and helicopter construction and maintenance and controlled access along the line. Maintenance should involve selective clearing and topping of trees and tall shrubs to help maintain increased forage production. We agree that transmission line clearing may increase moose and black bear carrying capacities if vegetation types which can be enhanced are present along the line. Thus, we recommend quantifying the types present and their value to big game.

Response

Methods have been more thoroughly described here and in Section 3.3. Types present are described in Table E.3.77 to E.3.79.

W-3-414 Paragraph 2: Please describe the presence or absence of moose calving grounds and bear denning sites. The cumulative impacts of the transmission lines in conjunction with existing disturbances should be discussed.

Response

Surveys for such features have not been conducted.

W-3-415 - Healy to Fairbanks: Again, quantification of types to be impacted and successional changes over the project life should be provided.

Response

Types affected appear in Table E.3.86. See Botanical Resources for description of successional types.

W-3-416 - Willow to Healy: Please refer to our January 5, 1982 letter regarding the dependence of the Susitna project on the Intertie. Thus, we recommend full consideration of impacts from the Intertie within this analysis. Quantification of impacts is needed, as above.

Response

The Intertie is described and evaluated in a separate report. Additional impacts resulting from the Susitna Hydroelectric Project are thoroughly described here. See the Power Authority response to the FWS letter of January 5, 1982.

W-3-417 - Watana Dam to the Intertie: Please provide a quantification of impacts, as above.

Response

Where quantification is possible, data have been provided.

W-3-418 (ii) Furbearers: Paragraph 3: Please refer to our comments under Section 4.3(c)(viii) regarding inconsistencies between Chapters 3 and 5 in presenting impacts. We are also concerned with inconsistencies between the increased access acknowledged here and mitigation guidelines to prohibit such access (Appendix EE, item 1); please clarify. Our previous recommendations to quantify impacts apply here too.

Response

Transmission corridor impacts have been largely rewritten. Impacts anticipated as a result of use of the design described here and in Chapter 3 are dealt with in this section. Section 4.4 treats design changes and other actions which will mitigate for such impacts. Quantification has been provided where possible.

W-3-419 (iii) Birds: Paragraph 1: We recommend providing references for the broad conclusion that species diversity may increase near the transmission lines. Removal of nest and forage trees will decrease available habitat for species such as pine grosbeak and boreal chickadee.

Response

The text has been altered and references added.

W-3-420 Paragraph 2: We concur. Please also refer to our comments under Section 4.2(c)(i) regarding continuing peregrine falcon surveys.

Response

Comment noted. Please refer to our previous comments regarding likelihood of peregrines occurring in the area and surveys for them as part of a monitoring effort.

W-3-421 Paragraph 4: Powerlines are particularly deadly to swans.1/ However, mortality from collisions, not electrocution, is the major adverse impact to swans. Locating and marking lines is the key to minimizing that impact (see our comments under Section 4.4(c).

Response

We concur - clarification has been provided.

W-3-422 We recommend expanding this discussion to describe: (1) the potential for swan collisions; (2) migrations of swans through the project area; and (3) swan use of remote lakes, including those in the Matanuska-Susitna Valley, for nesting and rearing. Refer also to our comments on increasing developments and disturbances which have caused swans to abandon areas, Section 4.3(a)(xv) - Disturbance, and our January 5, 1982 letter to Eric Yould, as above.

Response

Text has been revised.

W-3-423 (e) Impact Summary

We are concerned with the emphasis of this summary on impacts which can be most easily mitigated. Consideration should also be given to documenting unavoidable, adverse impacts, cumulative project impacts, and differences between long- versus short-term impacts. The uncertainty of predicting project impacts on the basis of existing information are clearly apparent here.

Response

The impact summary has been largely rewritten. Emphasis is concentrated on what are considered to be the most serious anticipated impacts. Impacts which are considered unlikely or of small consequence are not treated in the summary except where they are considered to have a potentially significant cumulative impact.

W-3-424 Paragraph 2: We concur that increased human use is positive, but the habitat alteration and disturbance which may also result from increased access are often a significant negative impact to wildlife populations. There is a need to integrate this discussion with those in Socioeconomic and Recreation Chapters of the exhibit.

Response

The positive and negative effects of access have been discussed in the application. The application has been improved to better document the considerable interaction between the recreation and wildlife programs. A section on socioeconomic/wildlife relationships has been added to Chapter 3.

W-3-425 Paragraph 3: We recommend also considering habitat values and how they relate to wildlife populations over the life of the project.

Response

Where habitat values can be assessed meaningfully, they are indeed considered. The modeling approach for moose is an example. However, for many species, habitat value cannot be assessed.

W-3-426 (i) Big Game: Paragraph 1: As above, the increased access afforded to hunters is more of a concern from the standpoint of resultant population disturbances and habitat alterations, assuming that harvest is regulated to protect population levels.

Response

Changes in population numbers of big game species attributable to hunting can be easily documented. In contrast, few cases are available where disturbance and habitat alteration, such as that anticipated for this project, have measurably affected population size. The emphasis has therefore been placed on direct hunting mortality rather than disturbances or habitat changes.

W-3-427 Paragraph 3: We are concerned with the subjectivity of the first sentence here. Please provide quantitative data for comparison with the previous paragraph to justify the relative magnitude of project impacts.

Response

Section has been rewritten.

W-3-428 Mention should also be made that project impacts will be particulary critical during years of severe winter. During such years, an additional impact to be considered would be moose/vehicle collisions. Cumulative impacts are also of concern with moose.

Response

Section has been rewritten.

W-3-429 Paragraph 4: Inability to predict major impact on caribou, as cited here, is a serious data gap. We recommend describing additional information to be gathered to help make such predictions. Best and worst case impact scenarios should be described to provide at least an indication of how caribou could suffer from increased disturbance, impacts near calving areas, and alterations in seasonal movements.

Response

Section has been rewritten.

W-3-430 Paragraph 6: Again, cumulative impacts are a concern in evaluating overall project impacts to both brown and black bear.

Response

Section has been rewritten.

W-3-431 Paragraph 7: Disturbance from increased access and the presence of human activities should be the more direct concern here (please see our comments under Section 4.3[a][vi]).

Response

Section has been rewritten.

W-3-432 (ii) Furbearers: Paragraph 1: We again note the potential for red fox populations to decrease as coyote populations increase (please see our comments under Section 4.3[a][xiii]).

Response

See our previous responses.

W-3-433 Paragraph 2: We suggest clarifying these conclusions to be consistent with previous impact descriptions, e.g. Section 4.3(a)(ix), paragraph 1, page E-3-315, says beaver populations are likely to increase; this paragraph says they "may increase", downstream (page E-3-371). We again recommend describing the water management regimes under which furbearer populations will most likely benefit. Overall, we are concerned with the uncertainties expressed in this discussion and recommend that additional furbearer work be considered, to satisfy these uncertainties (e.g. we suggest focusing on beaver and pine marten per our comments under Section 4.4[b]). Since impacts to valuable habitat in the vicinity of Deadman Creek can be mitigated by alternative road siting, they should be described here.

Response

Section has been rewritten.

W-3-434 (iii) Birds: We recommend also describing the negative impacts from swan collisions and raptor electrocution with transmission line development. Similarly, disturbance to nesting swans and raptors is another negative impact which should influence mitigation planning.

Response

The text has been altered to mention those negative impacts. Disturbance to birds was previously mentioned as a primary effect. Disturbance to nesting swans is doubtful. All swan nests are well removed from the immediate project area. Potential disturbance has influenced mitigation planning (see mitigation section and impact section).

W-3-435 4.4 Mitigation Plan: As with the mitigation plan for Botanical Resources, we find the mitigation plan for wildlife incomplete and too general. Our detailed comments on lack of quantification, lack of integration with other resources evaluated, and need to consider the full range of mitigation options possible should be considered here as well (see Section 3.4).

Because the wildlife analysis is much more qualitative than quantitative, we commonly found the emphasis on minor impacts rather than on major ones. A similar misemphasis is in the mitigation plan where attention is often focused on small, more easily mitigated impacts. Alternatively, severe impacts are left to undefined and uncertain mitigation measures such as later habitat enhancement and/or lands acquisition. Please refer to our earlier comments on the need to clarify overall project mitigation objectives (Section 4.1).

Response

We have attempted to clarify and augment mitigation measures and impact assessment in response to your comments. However, differences of opinion remain in some instances. We have presented impacts we consider significant and indicated our analysis, based on available information, of each impact's gravity. Where data are available, we have provided elaboration and defense of our analysis; thus, the emphasis on treatment of some issues over others. In addition, when impacts are hypothesized to which no defensible probability of occurrence can be provided, the mitigation plan suggests action appropriate to the relative magnitude of the impact in terms of its effect on population size or carrying capacity (as determined by supportive data or scholarly opinion). We have attempted to more carefully describe measures necessary for choosing areas and techniques for replacement and out-of-kind mitigation.

W-3-436 This section should clearly explain why mitigation measures already recommended by FWS and other resource agencies have not been adopted. For example, negative impacts to wildlife from the Denali Highway to Watana development access route are consistently documented throughout the report: the road will result in substantial disturbances; the Deadman Creek area paralleling the road is particularly important habitat to numerous wildlife species (e.g. calving moose, Section 4.2[a][i] - Distribution . Special Use Areas: Calving Areas: Paragraph 2; brown bear denning, Section 4.3[a][iv] - Construction: Paragraph 10; caribou movements, Section 4.3[c][ii]; wolf denning, Section 4.3[c][vi]; valuable beaver habitat, Section 4.3[c][viii]; bald eagle nesting, Section 4.3[c][ix], etc.). Mitigation of these impacts can be effectively accomplished by completely avoiding the impact, that is alternative siting as recommended in our August 17, 1982 letter to Eric Yould and further detailed in our comments on the Botanical Resources mitigation plan, Section 3.4(c)(ii).

Response

Refer to responses to general comments raised in the cover letter of January 14, 1983, and/or treated in Chapter 10 describing the alternatives for project features. See Section 4.4.4 - Documentation of Agency Recommendations.

W-3-437 We also request that you (1) confirm the inclusion of recommended measures in project design, and (2) clarify the extent of public access and uses in the project areas throughout planning, construction, and operation of the project. For example, please specify the extent to which the environmental guidelines in Appendices EA to EE have and will be guaranteed in project design and operation.

Response

This document represents a guarantee by the Alaska Power Authority that actions indicated herein will be incorporated into project design and operation. Appendices referred to above were guidelines for design, not design stipulations and may or may not be incorporated by the Alaska Power Authority.

W-3-438 Establishment of a monitoring and follow-up program for all phases of project construction and operation is an essential feature of the mitigation plan. Key components of this program are that it: (1) include appropriate federal, state, and local agency participation; (2) be fully supported by project funding; and (3) be utilized to modify, delete, or add to the mitigation plan in response to both information from ongoing studies and needs which become apparent as project impacts are realized. While monitoring by itself is not mitigation, actions taken as a result of that monitoring can ensure the effectiveness of the implemented mitigation plan.

Our final general recommendation on the mitigation plan is that continuing consultation between the license applicant and resource agencies include initiation of working sessions with project design engineers to fully incorporate wildlife mitigation plans.

Response

See Section 4.4.2(a), Continued Monitoring and Study Needs, and Section 1 for a description of a proposed structure for interactions with appropriate agency and project personnel to insure a flexible and adaptable mitigation plan. Also see the Power Authority response to FWS covering letter of January 14, 1983.

W-3-439 (a) Big Game

(i) Moose: Paragraph 3: We concur with the processes now being used to quantify probable impacts of habitat loss and to develop selection criteria for replacement lands. Our previously described concerns for the need to evaluate habitat values are of particular note here; habitat quality must be a factor in quantifying the areas of specific land parcels which are to be enhanced or acquired as mitigation. A schedule for the availability and incorporation of this data into project plans is also needed. Some assessment should be made of the locations and potential sizes of such areas.

Response

Forage availability, as measured for the modeling approach described, is a measure of habitat value. For moose this information is obtainable and represents a habitat characteristic of primary importance.

W-3-440 Paragraph 5: Further details should be provided on the schedule, potential size, habitat types, and studies, which would be involved in the Alphabet Hills burn. Land ownership, vegetation types, and other constraints to the potential value of burning or other manipulations to enhance habitat should also be described.

Response

Details on the proposed Alphabet Hills burn are provided in Section 3.4.2. Land ownership constraints and a description of the potential to increase browse by burning and other techniques are also described.

W-3-441 Paragraph 6: Please clarify the criteria to be used in replacement land selection. We caution that replacement lands only contribute to offsetting unavoidable habitat quality losses elsewhere when: (a) habitat value of the replacement land would be degraded by some predictable means other than the project during the life of the project but, through management for fish and wildlife, that degradation could be prevented; or (b) replacement lands are currently degraded and through management for fish and wildlife, productivity could be increased over the life of the project; or (c) through management of fish and wildlife, the productivity of an existing natural unit of habitat could be increased by reducing or eliminating one or more factors limiting its productivity. Identified replacement lands must be a manageable unit.

Response

See Section 4.4.2(b) - Mitigation Plan 6.

W-3-442 Paragraph 7: To maintain the increased value of managed habitat, provisions should be included for ongoing management of them until such times as the project area is returned to the pre-project state.

Response

Management obligations will continue through the license period.

W-3-443 Paragraph 8: The maximum design speed of 40 miles per hour referred to in Appendix EC, item 1, should be assured here as one means of minimizing the potential for moose/vehicle collisions.

Response

A variable speed design has been incorporated (not a maximum 40 mph design). This design will not significantly reduce the potential for moose/vehicle collisions. It will, however, reduce loss of sensitive habitats.

W-3-444 Paragraph 9: We strongly support the proposed Environmental Briefings Program and recommend that it be a mandatory requirement for all project personnel before they begin work on the project.

Response

Comment noted. See Mitigation Plan 15.

W-3-445 Paragraph 10: Assistance from APA in regulating access should also be for the purposes of minimizing habitat degradation and unnecessary disturbances.

Response

Comment noted.

W-3-446 (ii) Caribou: Provisions to monitor and remove logs and other debris from the impoundments should be included in the overall project monitoring program. This will ensure that such debris does not inhibit caribou movements (see Section 4.3(a)(ii) - Filling and Operation, paragraph 9).

Response

This has been incorporated as Mitigation Plan 9.

W-3-447 (iii) Dall Sheep: Please describe how the prohibition of visits to the Jay Creek mineral lick is to be enforced. We recommend that the portion of the reservoir adjacent to the lick be closed to boat and floatplane use. We suggest that the effectiveness of any measures to expose new portions of the mineral lick be demonstrated and then incorporated into the mitigation plan if effective.

Response

See Mitigation Plans 10 and 13.

W-3-448 (iv) Brown and Black Bear: Paragraph 2: We strongly concur with recommendations to promptly incinerate garbage and fence camps. Experience from other projects (e.g. Terror Lake hydroelectric project) shows the need to clearly sign and monitor gate closures to maintain the effectiveness of fencing. The Environmental Briefings Program referred to under Section 4.4(a)(i), paragraph 9, is particularly applicable here.

Response

Comment noted. This impact is treated in detail in this document. See Mitigation Plan 15.

W-3-449 Paragraph 3: The habitat values to be gained from mitigation measures referred to here must be quantified before any mitigation for bear impacts can be claimed.

Response

Comment noted. See Mitigation Plan 6 and Section 4.4.3 - Residual Impacts.

W-3-450 (v) Wolf: Please refer to our comments in the previous paragraph about quantifying recommended mitigation measures.

Response

Comment noted. See Section 4.4.3 - Residual Impacts.

W-3-451 Beaver and pine marten are both ecologically and economically important; mitigation of some project impacts is possible. We recommend revising the first sentence to describe what processes and/or criteria were used here in deciding to emphasize beaver and pine marten in mitigation planning.

Response

Mitigation Plan has been rewritten. Prioritization of beaver and pine marten has been justified in all furbearer sections.

W-3-452 Potential benefits to other species from beaver activities is the type of minor impact we believe to be overemphasized while more significant and difficult to mitigate impacts are not treated as thoroughly. For example, beaver activities may conflict with slough management plans for salmon. Moreover, benefits from beaver activities may ultimately be negated by increased trapping which will be facilitated by project access and transmission corridors. The consistent lack of quantification in the draft Exhibit E precludes evaluating the significance of any such benefits relative to overall project impacts and recommended mitigation measures.

Response

Comment noted.

W-3-453 Paragraph 2: We recommend discussion be provided on how proposed mitigative siting of the transmission corridor for pine marten will conflict with, or benefit, other wildlife species.

Response

See Impacts Section on Transmission Corridor for other species.

W-3-454 Paragraph 3: Per our previous comments, we recommend coordinating the discussions of impacts and mitigation measures between Chapters 3 and 5. We see a need to clearly and consistently state project objectives in both chapters. We concur that workers and their families be prohibited from trapping or hunting while working in the project area and request assurance that such prohibitions will be part of project plans.

Response

See Section 4.4.4 - Documentation of Agency Recommendations.

W-3-455 Although increased access may be viewed as a net benefit to trappers, habitat degradation, disturbances to the population, and conflicts with project management (e.g. removal of beavers which conflict with road culverts) would result in less than expected benefits to these groups. Thus, we recommend continued monitoring to assess that potential. We also then recommend that a process be developed for implementing further mitigation (e.g., recommendations to the Game Board on greater harvest restrictions, habitat manipulations, alternative flow regimes, etc.), should these efforts fail or impacts be found more severe than intially evaluated.

Response

See Section 4.4.2(a) - Continued Monitoring and Study Needs and Section 4.4.4 - Documentation of Agency Recommendations. Also Mitigation Plan 18.

W-3-456 Paragraph 4: We request confirmation that project design plans will not include gravel extraction from Deadman Creek. Please provide further information on how disturbance of riparian vegetation will be minimized.

Response

Confirmation provided in Mitigation Plan 17.

W-3-457 Paragraph 5: Please refer to our comments under Sections 4.3(a)(ix) and 4.3(b)(ix) re the need for quantified data to support the conclusions here. We strongly support the proposed monitoring and model development programs. These programs should also be the basis for verifying impact predictions. Although by itself monitoring does not mitigate project impacts, it should be the basis for determining additional mitigation needs.

Response

Comment noted.

W-3-458 Paragraph 6: We concur. To maximize the effectiveness of the mitigation plan, we recommend continuing studies to fill data gaps, quantify conclusions given here, and complete habitat models for beaver and pine marten.

Response

See Mitigation Plan 18, also Section 4.4.4 - Documentation of Agency Recommendations and Section 4.4.2(a) - Continued Monitoring and Study Needs.

W-3-459 (c) Birds

(i) Raptors and Ravens: Paragraph 1: We recommend expanding the list of major impacts to include loss of hunting habitat, a corollary impact to the loss of nesting habitat identified here. A mitigation need we have repeatedly recommended is realignment of roads and transmission corridors away from riparian corridors and other wetlands valuable in migration, as well as breeding (e.g. letter from FWS to Eric Yould, 5 January 1982).

Response

Some realignment of road and transmission corridors has been made (see Figures E.3.79 to 82) It is agreed that loss of hunting habitat to raptors is a valid impact that must be addressed. However, it is not agreed that loss of hunting habitat will be a major impact comparable to loss of nesting habitat. It is a misconception that raptors are primarily food limited (see Newton 1979). For instance, cliff-nesting habitat consists of fixed geological features whose distribution and number are considerably more restricted than "hunting habitat" for raptors that often range considerable distances to hunt in a variety of land form and habitat types. Furthermore, it should be pointed out that for many raptors, "hunting habitat" and productive areas of prey habitat, including riparian zones and wetlands, are not necessarily equivalent. Such habitats are, of course, important--they tend to produce or concentrate prey species, but they also provide escape cover for prey species. Several large raptors, including gyrfalcons, peregrine falcons and golden eagles, have difficulties hunting in these areas. Instead, they tend to hunt over them for avian prey or in open, coverless terrain somewhere near them because "hunting habitat" must also afford prey availability and vulnerability. Peregrine falcons provide an excellent example in that the three-dimensional "gulf of air" over rivers in front of and extending either side of their river cliff nesting locations is primary, important "hunting habitat" (see Roseneau et al. 1982). Nearby wetlands, forests, and riparian areas produce and harbor prey, but the prey are caught as they cross through this gulf of air. Land birds are especially vulnerable because they cannot (some try!) take advantage of the water as escape cover. Thus, some of the very best peregrine nesting habitat is found only along major rivers, regardless that similar cliffs also may be present on narrow side tributaries. In the case of the Watana impoundment, riparian habitat (prey production) will be lost, but on the other hand, the wide, long water body will in turn provide excellent hunting habitat (prey vulnerability) for some raptors as prey species from other nearby, untouched terrestrial habitats cross it. In general, most raptors, including eagles and falcons, are very opportunistic hunters and are capable of and do take a wide range of prey species and sizes of prey. This tends to buffer them from some oft-times marked changes in availability of some prey species, and it tends to allow them to utilize a wide variety of habitats (e.g., golden eagles successfully inhabit and exploit mountains, forests and sea coasts from temperate latitudes to arctic latitudes). To quote from the USFWS Alaska Peregrine Falcoln Recovery Team Recovery Plan (draft-April 1982) for Alaskan peregrines, "A significant alteration of large areas of hunting habitat would result in a reduction of prey abundance. Minor habitat alterations by man, such as roads, probably do not destroy a large enough percentage of the habitat to be of consequence." And it needs be remembered that many forms of habitat alterations produce open areas that in turn enhance prey vulnerability.

W-3-460 Furthermore, we recommend that the monitoring program include continuing surveys for peregrine falcons (see Section 4.2(c)(i)) as well as other raptors (see Sections 4.3(b)(xiv) .Habitat Loss), to confirm their absence in construction activities areas.

Response

The monitoring progam would automatically include monitoring for presence/absence of peregrines. However, we also wish to refer you to previous comments regarding the quality of the area as habitat for this species--at best it is marginal habitat, and it is doubtful that more than the odd peregrine or two will ever naturally inhabit it.

W-3-461 We are concerned with the emphasis on creating artificial nests. That emphasis is based on the assumption that nest sites are the limiting factor to raptor use of the project area. This has not, to date, been adequately supported by on-going studies. For example, overall loss of feeding habitat may negate potential benefits from such structures.

Response

We appreciate this concern. However, most raptors in most regions are in fact primarily limited by occurrence and availability of nesting locations (e.g. a cliff or stand of trees which may contain one or more nest sites --a pair may have one or more alternate nesting locations) and nest sites (the actual nests or ledges used by the pair--a pair may have one or more alternate nest sites at a given nesting location). To quote from Newton (1979), who has summarized this aspect of raptor biology quite well ("Population Ecology of Raptors, Buteo Books, Vermillion, South Dakota, and T. & A.D. Poyser Ltd., England):

"Raptors are among the few groups of birds whose numbers and nest success are in some regions clearly limited by the availability of nesting places. To pick an obvious example, most cliff-nesters are restricted geographically to breeding in areas with cliffs. Within such areas, their breeding density may be limited by the number of cliffs with suitable ledges, and their breeding success by the accessibility of these ledges to predators. Other raptors may be limited in open landscapes by a shortage of trees, and even in woodlands, nest-sites may be fewer than they at first appear. In a large area of mature forest in Finland, less than one in a thousand trees were judged by a biologist to be suitable for nests of white-tailed eagles, while in younger forests, suitable open-crowned trees were even scarcer or non-existent. More concrete evidence that lack of good nest sites may often restrict breeding density or success came from the experiments described in Chapters 3 and 16, in which pair numbers increased or success improved following the provision of artificial sites."

W-3-462 - Creating Artificial Cliff-Nesting Locations: We concur with the recommendations to continually monitor for nest destruction and to provide additional mitigation later, if found necessary.

Response

Comment noted.

W-3-463 - Creating Artificial Tree-Nesting Locations: Paragrah 1: Please provide or correct the complete reference for creating successful bald eagle nests; it was apparently omitted from the bibliography. We question the suitability of presently unused habitats cited here as potential nest sites. Since eagles are not using these areas, food or some other habitat parameter may be limiting.

Response

The reference has been added to the bibliography section (see Olendorff et al. 1980). It must be noted that there is a distinct difference between providing artificial, but natural appearing nests (replicas) in appropriate suitable habitat, and providing other devices, including artificial platforms and nest structures. It must also be noted that when bald eagle nests have been rebuilt to replace nests that were lost nearby, these attempts were successful in virtually every case. Such attempts have been limited in number primarily as a result of lack of opportunity, interest, funds or other circumstances, not because they are unlikely to work. The state-of-the-art is such that modifying habitat and constructing nests near the project area is a relatively small step beyond rebuilding blown down nests. It is correct to assume that some habitat parameter may be limiting bald eagle use of the unused habitats suggested for mitigation measures. However, for various reasons, including some of those mentioned in regard to loss of hunting habitat (see above) and the presence of several species of fish, especially in two of the areas (e.g., spawning chinook and sockeye salmon in Portage Creek and white fish at its mouth, and similar fish stocks associated with Prairie Creek--see Section 2) and nearby ponds and lakes supporting water birds (e.g., between Indian River and Portage Creek, and between Portage Creek and Devil Creek, and Stephen Lake vicinity), it is unlikely that food is a limiting factor. Instead, it appears that these areas are little used because of an absence of appropriate nesting locations (an extremely important "habitat parameter" (again, see Newton 1979). The best example is Portage Creek. Considerable balsam poplar (a tree species especially favored by bald eagles in northern, non-coastal regions) are located along it.

Many of these trees are large enough to support bald eagle nests, but stands tend to be dense, canopies tend to be closed and formation of the branches tends to be less than desirable. All basic factors considered (e.g., food sources, land form, vegetation cover, reasonable proximity to the project area where some existing, albeit limited, nesting habitat with nests will be lost), and reasonable proximity to other nesting areas (e.g., Deadman Creek, main channels downstream from Indian River) suggest that habitat modification and enhancement along Portage Creek would provide a reasonable (or better) chance to successfully replace bald eagle nesting locations that will be lost as a result of the Susitna Hydroelectric Project.

W-3-464 Paragraph 2: We suggest expanding the discussion to describe the comparability of habitats, circumstances, and species of birds using artificial nesting platforms as listed in Table W81. The success of those efforts may not be directly applicable to the project area, given the different habitats and species involved. Please include information on whether such structures have ever been successful in Alaska.

Response

Additional information has been provided in the text. Table E.3.176 was provided to show a range of examples of devices and species, and to show general applicability to raptors as a group. Some species listed eagles, red-tailed hawks, American kestrels) are the same species that occur in the project area, and the success of these efforts is clearly applicable to the project area (e.g. especially for golden eagles!). Differences between project area habitats and habitats where successes have occurred must be recognized. However, this is not a major issue when compared to the basic biology and behavior of the species, and choosing appropriate designs for nest sites. Many of those species, including golden eagles (a species that will perhaps be impacted by the project to a greater extent than any other) are adapted to a wide range of basic habitat types (forest, mountain, seacoast, warm desert, cold arctic "desert"). They make use of these habitats as long as an adequate prey base is available (most areas), and more importantly, as long as suitable nesting locations and nest sites exist in them (only in some areas). (Again, see other comments on food vs nesting locations and nest sites as limiting factors; also see Newton 1979.)

Examples of successful use of many of these structures in Alaska are unavailable, because no attempts have been made to try them in Alaska. However, some examples of a few are available. Boreal owls have readily accepted nest boxes placed out specifically for them near Fairbanks. (At least two attempts involving several boxes each--both attempts successful. D.G. Roseneau and W. Tilton pers. com.)). Hawk owls have nested in one nest box in spite of its being designed for boreal owls (W. Tilton pers. comm.). A ledge, unusable to gyrfalcons, was modified to replace a nest ledge that was becoming unstable on a cliff--gyrfalcons have since nested in it (.D.G Roseneau and W. Walker, unpubl. data) (also see text). Successes elsewhere in the world and new techniques currently being developed (with some modification of course, or individual species, particular habitat situations and other particular circumstances) clearly suggest there is little reason to doubt applicability to Alaska (in general) and the Susitna River drainage (specifically).

W-3-465 -Seasonal Restrictions: We strongly support the measures included here with the addition of three points. First, we recommend coordinating with project design engineers to ensure that such timing and siting restrictions are fully incorporated into project designs, schedules, and cost estimates. Secondly, our previous comments on the need for follow-up monitoring of raptor nesting in response to construction activities are critical here. Finally, for bald eagles, we recommend there be no blasting with 0.5 miles of nests.

Response

We concur. However, we see no reason to restrict blasting to 0.5 miles or farther if the nesting location is inactive at the time the blasting occurs (non-breeding season, or nesting location unoccupied in a given breeding season). In fact, blasting could be conducted relatively close to the nesting location (as long as it and perches are not destroyed) under such circumstances.

W-3-466 (ii) Waterbirds: Paragraph 1: We recommend revising this paragraph to describe factors which may limit benefits outlined here (see our comments under Section 4.3(a)(xv)). An additional concern we believe should be described here is the potential for collisions of swans with transmission lines.

Response

Paragraph has been revised.

W-3-467 Paragraph 2: We recommend that the monitoring program described previously should be coordinated with ongoing FWS surveys for trumpeter swans and other waterfowl, with particular attention to the impacts of project disturbances on trumpeter swans. We again note the importance of carefully siting all project facilities, roads, and transmission lines away from wetlands (as being remapped), including stream corridors and lakes. Since trumpeter swans and other water birds frequently migrate along stream corridors, siting and marking of transmission lines is particularly critical to avoid collisions and electrocutions in those areas.

Response

This recommendation will be considered during formulation of detailed study plans for FY 1984.

W-3-468 (iii) Other Birds: We again note the ecological importance of these species. We recommend that nest and roost boxes be considered as mitigation for passerines. Hairy woodpecker, boreal chickadee, and brown creeper would all adapt readily to such structures. These three species populations would be reduced by 10.1, 7.4, and 19.9 percent, respectively. The hairy woodpecker is on the National Audubon Society's "Blue List" and is thought to be declining in the Pacific Northwest. We also recommend that all unavoidable adverse impacts from the project be fully acknowledged.

Response

We concur with the ecological importance of all species. We have noted the recommendation concerning mitigative measures for passerines. The same recommendation is also noted in regard to woodpeckers, although woodpeckers (order Piciformes) are not passerines. These recommendations will be considered during formulation of detailed study plans for FY 1984.

W-3-469 (d) Small (non-game) Mammals: We refer you to our comments above, re fully acknowledging unavoidable adverse project impacts.

Response

Comment noted.

W-3-470 Comments on Tables and Figures for Section 4 - Wildlife

Overall, many of the tables and figures are incompletely footnoted and referenced. Few will stand on their own and many are confusing or inconsistent even when referring to the text. We recommend cleaning up the tables and figures to alleviate these problems in general, as described in our comments on the text of the report itself, and as specified below. Rather than commenenting on all editing or corrections needed, we have focused on major problems or points important in understanding our comments on other portions of the document.

Response

Comments noted. Editing corrections have been made.

W-3-471 Tables W21, W22 and W23: Please include the number of sites sampled in each community.

Response

Number of sites sampled appears in Table E.3.50. Location of sample sites is shown in Figure E.3.79.

W-3-472 Table W64: We recommend footnoting a brief definition of "importance value ratings." Please provide dates for the summer 1981 survey.

Response

Dates and description of I.V. ratings appear in text where this table is referenced.

W-3-473 Tables W65, W66, W68 and W78a: Please clarify how habitat types as classified here do or do not coordinate with the revised vegetation classification scheme. We are concerned that data manipulations not obvious from the original references be fully described here (see Section 4.2(c): Paragraph 3).

Response

This information has been added to text and appears in Table E.3.139.

W-3-474 Figure W11: We suggest adding reservoir elevation levels.

Response

Such a change would imply a significant loss of range which is not at all the intent of the figure.

W-3-475 Figures W19 and W20: We recommend including some description of how "relative importance" was determined and how "importance indices" were calculated. Sources for this data should be cited here.

Response

These additions have been added to the text in sections which refer to these tables.

GENERAL COMMENTS - APPENDICES

Comment 1

Overall, we concur with the environmental guidelines to the extent that they are presented here. However, we are concerned that the guidelines are somewhat incomplete and lack specifics needed for effective implementation. Please specify the degree to which these guidelines are being incorporated into project planning. We recommend that you explain any situations where the guidelines will not be followed. In

gest the definition include project camps, access roads both to and within the project site, and any construction areas (including the dams, borrow sites, disposal sites, etc.).

8. Blasting determinations should be made in consultation with the resource agencies. Such determinations could be incorporated into the previously recommended monitoring program (see our comments on Section 4.4: Paragraph 5).

9. Please discuss the feasibility of disposing of part, or all, of project spoils within the impoundment area in accord with project scheduling. An estimate should be provided of the quantities which may be involved, or when those quantities will be determined. Stockpiling needs, and reclamation considerations should also be provided. We suggest this item be expanded into an additional appendix section similar to Appendix AD - Material Sites.

11. Please refer to our previous comments on the need to map permafrost areas (Section 3.2 and 3.3[a][ii] - Effects of Erosion and Deposition).

13. We recommend specifying that fertilization and seeding be initiated in the growing season immediately following site disturbance. The interagency monitoring program referred to in Item 8, above, should review and concur with species chosen for revegetation.

14. Please refer to our comments under Item 13, above.

15. We concur; again please refer to our comments on Item 13. Initiating test plots as part of continuing project studies would provide information on which successful site restoration can be based. Plantings to provide wildlife food and/or cover should also be considered in developing restoration plans.

SPECIFIC COMMENTS - APPENDICES

3.A - All Facilities

W-3-476 3.A - All Facilities

1. The referenced buffer to waterways or wetlands should be a 500-foot minimum width, not maximum width as presented here.

7. Please define project "facility" as used here. We suggest the definition include project camps, access roads both to and within the project site, and any construction areas (including the dams, borrow sites, disposal sites, etc.).

   Trumpeter swan nests and caribou calving areas should be added to the list of areas to which the guideline is to apply.

8. Blasting determinations should be made in consultation with the resource agencies. Such determinations could be incorporated into the previously recommended monitoring program (see our comments on Section 4.4: Paragraph 5).

9. Please discuss the feasibility of disposing of part, or all, of project spoils within the impoundment area in accord with project scheduling. An estimate should be provided of the quantities which may be involved, or when those quantities will be determined. Stockpiling needs, and reclamation considerations should also be provided. We suggest this item be expanded into an additional appendix section similar to Appendix AD - Material Sites.

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13. We recommend specifying that fertilization and seeding be initiated in the growing season immediately following site disturbance. The interagency monitoring program referred to in Item 8, above, should review and concur with species chosen for revegetation.

14. Please refer to our comments under Item 13, above.

15. We concur; again please refer to our comments on Item 13. Initiating test plots as part of continuing project studies would provide information on which successful site restoration can be based. Plantings to provide wildlife food and/or cover should also be considered in developing restoration plans.

16. We strongly endorse both programs outlined here. Reference should be made to U.S. Coast Guard (C.F.R. 33, Part 154[b]) and Environmental Protection Agency (C.F.R. 40, Part 112) regulations which require use of a Petroleum and Hazardous Substance Plan and Manual with such developments. It should be mandatory for all project personnel to take part in the Environmental Safety Program prior to starting work on the project.

17. We suggest that storage containers for fuels and hazardous substances also be located at least 1,500 feet from wetlands. All personnel involved in transfer and handling operations for such materials should carry portable spill containment/absorption materials. Impervious material used to line containment areas should be securely tacked in place and frequently monitored for tears; such tears should be promptly repaired and water which may collect in the areas should be promptly removed.

18. Please specify the degree to which this recommendation is being followed as described under our General Comments for these appendices.

19. We recommend addition of an item outlining the need for the contractor to train personnel, prepare, and follow an erosion control plan which is subject to resource agency review and comment (see our comments on Section 3.4[d][ii]). That plan should then be incorporated into these guidelines.

<u>3.B - Construction Camps</u>

1. and 2. We concur and recommend that there be no trucking of garbage between camps; each camp should have its own incinerator capable of burning that day's wastes.

3. We concur; please refer to our comments under Section 4.4(a)(iv) on the need to clearly sign and monitor all gates to ensure they remain closed. We recommend the interagency monitoring group review and concur with the fencing specifications.

4. We suggest that the recommended effluent sampling and testing program be outlined in construction camp design plans.

5. Again, resource agency review and concurrence should be involved.

3.C - Access Roads

3. We concur and recommend that the proposed program for identifying wetlands in consultation with the CE and FWS be used in access route siting (see Section 3.2[a][vi]).

5. Instream work should be scheduled to avoid critical spawning times and minimize sedimentation of downstream habitats.

6. through 10. Criteria should be included for determining when a culvert rather than a bridge can be used for stream crossings. Resource agencies should be consulted in the development of such criteria.

13. We suggest adding, "as well as after significant storm events" at the end of this item. This issue needs further definition.

3.D - Material Sites

1. We concur and recommend that the interagency monitoring program be integrated with the interdisciplinary team effort so that resource agencies are consulted in the development and implementation of mining plans.

2. and 3. Please identify the extent of borrow materials needed for project construction which may be available within the impoundment area, relative to the extent of borrow which will have to come from other sites. Our comments under Appendix EA - All Facilities, Item 9, on stockpiling and reclamation, and under Appendix EC - Access Roads, Items 6 through 10 re criteria for determining when to use the lower priority mitigation measure (e.g., culverts instead of bridges; first-level terrace sites over well-drained uplands) apply here also.

7. We suggest that construction schedules be evaluated in order to determine optimum coordination and use of material and disturbance sites.

3.E - Transmission Corridors

1. We recommend addition of the phrase "and maintained" after the work "constructed" in Line 2 of this item. Our text comments on the need to fully integrate Intertie development with all other project transmission lines apply here (see Sections 3.4[d][ii] and 4.4[d][i] - Willow to Healy).

3. Transmission towers should not be placed in wetlands, as defined by ongoing remapping efforts.

4. We concur, and suggest that selective cutting be used to control vegetation along transmission corridors.

Appendix EG

Please provide the source for data cited which was not provided by the University of Alaska Museum.

Response

Your specific comments have been noted. The referenced 500-foot maximum-width buffer was a typographical error; guidelines provided to project engineers recommended a 500-foot minimum-width buffer. All specific comments on the guidelines will be considered during detailed engineering design and construction planning.

COMMENTS CONTAINED IN U.S. FISH AND WILDLIFE SERVICE LETTER OF JANUARY 14, 1983

GENERAL COMMENTS - SOCIOECONOMIC IMPACTS - FISH & WILDLIFE

Comment 1

We see this socioeconomic impact evaluation as an integral component of the overall evaluation of alternative means of satisfying energy needs in the least environmentally damaging way. Accordingly, we offer the following comments for consideration in the evaluation of these alternatives.

Evaluation of a proposal must examine impacts, positive and negative, and mitigation over the life of the proposal. Data bases provide the point from which this evaluation must progress. How this project could effect fish and wildlife resources over its life is strongly dependent upon how the project influences future user demand of those resources. This evaluation should incorporate: (1) a widely accepted projection of future population and economic growth (increasing user groups) or, if there is substantial uncertainty as to the validity of key assumptions (as we believe there is), then a multiple scenario model should be pursued examining at least high, medium, and low projections; and (2) a tradeoff analysis examining the competing mitigation proposals for the different interests. Chapter 5 fails in respect to both points.

The Base Case, as expressed in this document, is a minimum project impacts scenario. We are led to this conclusion by the following:

1. The recent downturn in State oil revenues directly leads to a downturn in State spending. Increased State expenditures result in economic expansion which then attracts and supports the new population (Department of Policy Development and Planning (DPDP) Policy Analysis Paper No. 82-10). The expected lower level of State spending should be reflected in decreased economic expansion and population. One could deduce from this that without the project economic and population Base Case should be substantially lowered from what is presented in this document. Since this turn of events obviously does not impact the cost of the project, the project socioeconomic impacts would be accentuated.

   Response

   Assumptions underlying socioeconomic forecasts of economic expansion and population growth are consistent with those used in the electric power requirements forecasts (see Exhibit D). Requirements' forecasts are being reassessed in an ongoing study. If different forecasts are adopted, socioeconomic forecasts will be revised. (Note: Population growth for Anchorage and the Mat-Su Borough has been more rapid during the last year than projected in the Base Case. Our Base Case population projections for future years in these areas might be too low.)

Comment 2

With less oil revenue the state would need to concentrate a greater percentage of its income and/or bonding capability on this project. The state would then not be able to afford projects in other areas of the State. We therefore, believe a closer look at statewide impacts is necessary.

Response

FERC does not require an assessment of statewide fiscal impacts as part of Chapter 5, Report on Socioeconomic Impacts. The FERC guidelines require an evaluation of incremental local government expenditures in relation to the incremental local government revenues that would result from the construction of the proposed project. Information about the state's bonding capability under different scenarios is provided in Exhibit D.

Comment 3

The power which this project would provide could act as an attractant to various industries, to the detriment of other areas of the state.

Response

It is unlikely that this project will act as an attractant to various industries (see SRI International. July 1982. Electric Power and Industrial Development Data for State Planning. Task III Report. Synthesis--Industrial Location Probability. Prepared for the Division of Policy Development and Planning, Office of the Governor, State of Alaska). The Base Case is intended to approximate a "most likely" scenario.

Comment 4

Potential impacts due to the seasonality of the workforce is not fully addressed in this document. Other hydropower projects in Alaska, such as Terror Lake, and those constructed in other remotely situated areas should be examined to explore this potential impact.

Response

The discussion of potential impacts due to the seasonality of the work force has been expanded in Sections 3.2.2 and 3.3.1(c). Your suggestion to examine impacts resulting from seasonal labor demands of other hydropower projects in Alaska will be considered in the development of future studies.

Comment 5

Impacts result from the number of people attracted by potential jobs not by the number of jobs created, either directly or indirectly. This is supported by the letter to Eric Yould dated March 27, 1982, from the Alaska Department of Community and Regional Affairs (ADCRA).

Response

We agree that impacts will result from unsuccessful in-migrating job seekers. However, it is not possible to predict the number of unsuccessful in-migrating job seekers.

As discussed in Section 4, Mitigation, a monitoring program will track this phenonomon. Information will be made available to impacted jurisdictions to help them identify the extent of disruption and to indicate what can be done to reduce the disruption. Based on this information, measures to mitigate adverse impacts can be developed and implemented.

The discussion concerning unsuccessful in-migrating job seekers has been expanded in Section 3.2.2. A full discussion of the types of impacts that could result is contained in (Dixon, Mim. 1978. What Happened to Fairbanks?--The Effects of the Trans-Alaska Pipeline on the Community of Fairbanks, Alaska. Social Impact Assessment Series, No. 1. Westview Press, Boulder, Colorado).

Comment 6

The implications of Item 5 above regarding local and regional hiring assumptions and impacts to local communities.

Response

Local and regional hiring assumptions were made through analysis of unemployment data for laborers, semiskilled/skilled workers and administrative and engineering personnel; and discussions with local union officials, Alaska Department of Labor economists, and construction contractors. The assumptions provide the best estimates for sources of manpower for the project.

We acknowledge that impacts to local communities depend, in part, on these assumptions. These assumptions cannot be improved, however, until: (1) more accurate and detailed manpower requirements are developed (this will happen in the latter stages of detailed design work); (2) new unemployment data become available; and (3) labor negotiations are completed. Due to unknowns such as these, the socioeconomic forecasts with and without the project will be updated with new information both before and during construction activity. Information from the updated forecasts and the monitoring program will be used to develop appropriate mitigation measures. This is discussed further in Section 4.

Comment 7

We have not previously had input into many of the decisions which were reached regarding the construction camp/village such as siting, type of camp, and administration. These decisions have large implications for the fish and wildlife resources and users. Consideration of a Prudhoe Bay type camp should be given. We are not aware of any construction camp alternatives having been discussed in terms of minimizing adverse impacts to fish and wildlife resources, and their use.

As illustrated by many of our comments, we are concerned that not only were the resource agencies not consulted previously on many of the actions described herein but that communication and coordination between the socioeconomic component and the fish and wildlife resources components has been insufficient.

Response

We agree that construction camp/village siting, type and administration will have implications for fish and wildlife users. It will also have implications for workers and impacts on communities. The siting, type, administration, and other aspects of the construction camp/village will be further considered in the development of future study plans. Any such plans will continue to provide for proper coordination between socioeconomic and fish and wildlife components.

Comment 8

It is stated several times in this chapter that monitoring of impacts is proposed and that this program would add flexibility to the mitigation program. We concur. However, we believe this monitoring team should better reflect the spirit of the APA Mitigation Policy document. We believe a monitoring program should be established, at project expense, consisting of representatives of appropriate local, state, and federal agencies, to carry out the function of assessing the extent of actual impacts and recommending modifications to the mitigation program. Modification of the mitigation plan, as represented in the license, would then be through license amendment.

Response

It is the intention of the Power Authority to establish a monitoring program that responds to and implements the articles of any forthcoming FERC license for the project.

With respect to formulation of the specifics of the program, we invite and also expect your agency, as well as other regulatory entities, to play a major role in this effort. With respect to monitoring the effectiveness of mitigation measures and compliance with stipulations of the license application, we see that as the licensee's responsiblity.

We expect that observations by the monitoring team will establish whether the mitigation programs are achieving their goals. If they are not, the mitigation programs will be modified as will undoubtedly be required by the license.

Comment 9

Modification of the Base Case to accommodate the concerns raised in the ADCRA letter of May 27, 1982, and in our comments would dramatically change the impacts predicted and ultimately the mitigation requirement. Additionally, an assessment of socioeconomic impacts must be reactive to other study components. For example, to evaluate impacts to users of fish and wild resources, the impacts to the resources must first be assessed. In that many of these resource impacts have not been sufficiently quantified, one could not expect an acceptably quantified socioeconomic analysis. This could only have lead to a highly general mitigation plan, which is what we find here. In fact, reference is made to certain actions which (Section 4.2(a), page E-5-91), "...will be considered in the mitigation plan." A mitigation plan should be a part of this document, and be specific to the anticipated impacts based upon a broadly accepted data base. The burden of formulating an acceptable mitigation plan is the applicants.

Response

One element of the Impact Management Program is to periodically update the Base Case (see Section 4.5). This will next be done in 1983. Your concerns and those raised in the ADCRA letter of May 27, 1982, will be incorporated into this update.

The socioeconomic component has been and will continue to be reactive with other study components. This interaction will intensify as the project enters the detailed planning and design phase, and as more in-depth fish and wildlife impact information becomes available.

As requested, the mitigation plan has been made more specific (see Section 4).

SPECIFIC COMMENTS

2 - BASELINE DESCRIPTION

2.1 - Identification of Socioeconomic Impact Areas

W-5-001a 2.1(c) Impacts Areas - State

(c) State: We concur that identifiable impacts would be concentrated at the local level, and most difficult to evaluate on a statewide basis. It should be recognized that how this project is approached economically has tremendous implications for the state. If the state provides a grant of billions of dollars, that money cannot be spent on other programs. Bonding of the project would have a large impact on the state's ability to bond other projects. Additionally, the relationship between large projects and population growth should be given greater emphasis.

Response

Please see Exhibit D of the License Application.

The Institute of Social and Economic Research's Man-in-the-Arctic Program model provides the relationships between large projects and population growth. This model is the best available in the state. It was used in both the electricity demand forecasts and the socioeconomic analysis. Future socioeconomic studies will include new assumptions for large projects and, therefore, new population growth projections.

W-5-001b Increased state expenditure results in economic expansion that attracts and supports the new population (DPDP Policy Analysis Paper No. 82-10). The state would be impacted through services provided to this project caused higher population level.

Response

We agree that the relationship between large projects and population growth is important. The specification of this relationship in the Institute of Social and Economic Research's Man-in-the-Arctic econometric model is among the best available. We used the results from several statewide and regional runs of this model in our baseline forecasts. Updates of the baseline forecast could also rely on results from updated runs of this model.

W-5-002 2.2 - Description of Employment, Population, Personal Income and Other Trends in the Impact Areas

(a) Local

(ii) Population: Paragraph 3: Acceptance of the projected Mat-Su Borough population figures would be on the basis of a review and acceptance of the underlying assumptions. Without these we are left with what appears to be relatively high projections which apparently come from a single source, the Mat-Su Borough, which could be viewed as having a vested interested in the project, and a high probability that the projections rest upon by the original, outdated project economic analysis. The impacts analysis and mitigation planning is strongly tied to population projections with and without the project. We recommend that the data base be broadened and projections updated.

Response

We do not agree that the baseline (i.e., without the Susitna project) population projections for the Mat-Su Borough are too high, nor that they were distorted by the input of the Mat-Su Borough. We agree that population projections should be broadened and updated periodically to reflect new knowledge. These projections will be broadened and updated as part of future studies. These updates will incorporate new information on development projects, state government revenues, and the results of the monitoring of socioeconomic conditions in local communities before construction on the project starts.

The projections of baseline population growth in the Mat-Su Borough were developed by the Alaska Power Authority. The only connection of the Mat-Su Borough government with these figures lies in the use of the figures on the Borough's population in 1981 as the baseline from which future growth was calculated; these figures were derived from the Mat-Su Borough Planning Department's survey of population and housing in that year. A decision on the use of these data as a starting-off point instead of the 1980 Census data was made after an analysis of the available data on borough population growth indicated that the Census data were too low; this is not surprising, considering the rural and dispersed nature of population in Mat-Su Borough.

The projections of growth in the Mat-Su Borough rest partially on the projections of growth in the Railbelt region and in the state which were developed for the Railbelt energy requirements study by the Institute of

Social and Economic Research. The scenario used was one of moderate economic development and moderate state government spending. The socioeconomics impact portion of the study used these projections in order to be consistent with the energy requirements study (see Exhibit D).

Calculations of the population of the Mat-Su Borough over the next twenty years took into account the fact that growth in the borough over the past ten years has been increasing far more rapidly than the rest of the Railbelt (as many people who work in Anchorage began to move their residences to Mat-Su Borough) and that there is reason to believe that this trend will continue and perhaps accelerate. Thus, while there may be reason to believe that the original projection on population in the Railbelt may be too optimistic, we still believe that the Mat-Su Borough will continue to grow rapidly as a result of its proximity to Anchorage and the large amount of relatively inexpensive land available for new housing. Recent population estimates for 1982, developed by the Mat-Su Community and Regional Affairs, have supported this professional judgment. It should also be noted that the projections developed by the Alaska Power Authority for this chapter of Exhibit E are considerably lower than other sets of projections which the consultants reviewed during the course of their work and which have been used as the basis of planning efforts in the Mat-Su Borough.

W-5-003 Paragraph 4: We recently received a Scoping Document (dated November 29, 1982) for the Knik Arm Crossing from the Alaska Department of Transportation and Public Facilities (ADOT/PF). In that ADOT/PF is just beginning to evaluate the desirability of this project, it would be premature for APA to view it as a foregone conclusion.

Response

The Power Authority does not view the Knik Arm Crossing as a foregone conclusion. When the socioeconomic baseline forecasts were made, it was assumed by the socioeconomics contractor that there would be a crossing in the early 1990s. However, this assumption does not affect the amount of population projected to be in the Mat-Su Borough. This assumption affects only the future distribution of population in the Borough.

W-5-004 Paragraph 5: Please discuss the assumptions upon which these population projections are based.

Response

The assumptions upon which population projections are based have been added to Section 3.1.2.

W-5-005 (b) Regional

(ii) Population: Paragraph 2: We accept the underlying assumption that, in Alaska, population growth is strongly associated with natural resource development projects. Please identify the development projects that have been assumed to be going forth. The recent downturn in state income, due to weakening of oil prices, should be factored into this analysis.

Response

The development projects that are assumed to be going forth are shown in (Battelle Pacific Northwest Laboratories. 1981. Alaska Economic Scenarios Review Document. Working Paper No. 2.1, Railbelt Electrical Power Alternatives Project. Prepared for the Office of the Governor, State of Alaska). Refer to the "moderate case" in this document.

It has been more than a year since this development scenario was developed. Some projects that were assumed to be going forth have been postponed, while others that were assumed not to be developed are being developed. On balance, it appears that the current and likely future mix of development projects will have population effects that are similar to those associated with the moderate case in the document cited above. The Base Case update to be done during 1983 will include an updated development projects scenario as well as an updated state government spending scenario.

3 - EVALUATION OF THE IMPACT OF PROJECT

W-5-006a 3.1 - Impact of In-migration of People on Governmental Facilities and Services: Paragraph 2: The underlying assumptions which lead to the conclusion that this project would have minimal impacts to the Mat-Su Borough should be discussed in greater detail. Peak project employment would be 3,498 (page E-5-37) and 95 percent of these workers would have dependents, with an average of 2.11 dependents (page E-5-44). This would lead one to believe direct project worker impacts would be more than 10,000 people. If all these people were housed at the construction site, we would have a city approximately three times the size of Palmer, with all the encumbent needs of this size community. This figure would be substantially inflated by secondary and induced jobs resulting from the project. Spreading these numbers out over the small, local communities would be expected to result in significant adverse impacts.

Response

A fuller description of the methodology used to project the population influx associated with the Susitna project has been added to the text in Section 3.1.2.

As explained in the text, 90 percent of the work force that moves into communities in the Mat-Su Borough will be accompanied by dependents. This high percentage is likely because workers with families will have the most incentive to move closer to the project, in light of the fact that housing facilities for all workers will be available at the site. This is not to say that 90 percent of all workers on the project have families.

It is true that the work camps and family village at the work sites will have extensive public facility and service requirements. The project management will be responsible for providing these facilities and services. This is the reason that it is expected the impacts of the onsite population will be minimal.

The population influx associated with the secondary and induced jobs generated by the project has been included in the population influx projections.

W-5-006b In the May 27, 1982, letter from the ADCRA to Eric Yould, it was noted that, "...given the current state of the economy, it seems reasonable to expect a sizable influx of people from the Lower 48 seeking highly-paid employment, therefore competing directly with the local labor force. This was the state's experience during the Trans-Alaska Pipeline project (TAPS) and, in fact, just recently for the as-yet to be started Alaska Natural Gas Transportation System. Yet this proven phenomenon apparently was not considered in the analysis. This influx of people seeking instant riches in Alaska during major construction projects has historically contributed to impacts far in excess of what otherwise might normally be expected."

In reference to, "...the buffering effect of the expected continued increase of population," please refer to our Chapter 5 General Comments.

(a) Watana - Construction Phase

(i) Local

- Mat-Su Borough: As stated in our Chapter 5 General Comments, we find it difficult to accept that, "in most areas of the Mat-Su Borough, the population influx related to the project will only add slightly to the substantial increases in need for public facilities and services that will be resulting from the population growth projected under the Base Case." It is stated in the previously referenced May 27, 1982, letter from ADCRA, "The state's experience has been that the impacts from large construction projects (most notably TAPS) are far in excess of what were originally anticipated. Those impacts were due to a substantially greater in-migration [SIC] of people than those anticipated based solely upon the size of the required construction and support work force. This was due in part to a large number of people who migrated to Alaska with no intention whatsoever of seeking employement, at least on the construction project. Another unforeseen impact was in the secondary job market. In-migrants [SIC] competed for, and filled, secondary and induced jobs, many of which were vacated by local residents obtaining employment on the high-paying construction project. This situation only exacerbated the local unemployment situation.

"Certain public services were severely taxed as a result of the larger than expected influx of people. The public safety and public health were jeopardized by increased 'people problems;' too few public safety officials and inadequate or non-existent facilities delayed the state's ability to adequately respond. Lack of adequate housing led to overcrowded living conditions and sanitation problems. Increased vehicular traffic devastated the roads and at times created safety problems as well. Utilities, such as power and telephone, were overtaxed. Heightened demand for housing produced rent gouging, displaced families, hastily and poorly constructed housing, and use of substandard or even non-residential units as places of residence.

"It seems, therefore, that the potential exists for the types of impacts described above to occur as a result of the Susitna project, and to occur in large part in the Matanuska-Susitna Borough. Simply put, we believe that past experience has shown that more people will show up than originally anticipated, bringing with them all the problems attendant to a 'boom-town' situation. We do not feel that this was adequately addressed in the draft feasibility report, nor that the state's prior experience with TAPS was taken into account."

Response

We agree that it is reasonable to expect an influx of persons seeking Susitna construction and construction-related jobs. This influx of persons would probably create the types of impacts that you mention, especially in the greater Anchorage area and, perhaps, Fairbanks.

We did review the TAPS experience. We found no analysis of the impact of unsuccessful job seekers on Fairbanks and the state; nor could we find any analysis of the degree to which "outside" labor displaced Alaska labor. We could not even find any data that would allow such analyses to be done.

Aside from this lack of information, it should be noted that even if appropriate studies had been done on TAPS, they would have been of little help in trying to estimate the numbers of persons who will be attracted to Alaska by the Susitna project. This is because each project (e.g., TAPS, ANGTS, and Susitna) is unique and different economic forces prevail in different years. For example, the types and amounts of workers, and wage rates are different for each project. This will influence the attractiveness of the project to workers living "outside." Also, economic conditions "outside" relative to those in Alaska change and influence the attractiveness of Alaska projects to outsiders.

For these reasons and several others, it was not possible to estimate how many persons would be attracted to Alaska by the Susitna project. The monitoring and mitigation program discussed in Section 4.5 is designed to detect the total project-induced increase in population and to help appropriate institutions mitigate impacts that might be caused by persons who come to the Railbelt region in search of Susitna construction and construction-related (secondary and induced) jobs.

W-5-007 We would expect that a high percentage of those attracted to the area would become fish and wildlife resource users. This would lead to increased demand for these resources at the same time and in the vicinity of more direct project-related impacts to these resources. Additionally, because the project work force would be highly seasonal (page E-5-37), the impact of these employees on the fish and wildlife resources would be greater than other area residents.

Response

Whereas it is likely that the members of the population influx caused by the project would increase the demand for recreation involving the use of fish and game, it does not necessarily follow that actual use will increase. For the most part, fish and wildlife use is controlled by regulation so that not everyone with the desire to harvest these resources actually harvests these resources. It is, therefore, erroneous to assume that new members of the area population would become resource users. And, if they become users, there is nothing to indicate that the new members would tend to use the resource more than other area residents. The fact that work at the project will be seasonal does not necessarily allow these newcomers to participate in resource harvest more than other area residents. A significant amount of work in the area is usually seasonal.

W-5-008 . Public Recreation Facilities: Paragraph 1: Please clarify whether the assumption that full public access would be provided by the project through the upper Susitna Basin has been made. We understood this was not the case (see Page E-5-24, Transportation).

Response

For purposes of analysis, it has been assumed that the access road will be open to use by the public upon completion of project construction. However, access can be restricted at a future time as a mitigation measure.

W-5-009 Use projections and anticipated fish and wildlife resource impacts should be examined.

Response

Full description of the impacts of the project on recreation in the impact area are presented in Chapter 7, Recreation Plan. The text has been modified in Section 3.1.3 (a)(i) to refer to that chapter.

The section that this comment is addressing is concerned with public recreation facilities and services, such as parks, playgrounds, campsites, and other facilities that are maintained by public entities. This was not considered to be the place to discuss use patterns of and impacts on fish and wildlife resources. These subjects are discussed in Section 3.7 of Chapter 5 and in Chapter 3.

W-5-010 . Transportation: Paragraph 1: We concur that, "the ultimate status of the road is unsettled at this time." The road is a proposed project feature and as such the ultimate resolution or mechanisms for resolution of this issue needs to be provided in the FERC license, if in fact we do still have road access at that time as a project feature. We have not concurred that road access is either necessary or desirable.

Response

Comment noted.

W-5-011 Paragraph 3: Reference is made to, "scheduling of commuting workers." Yet, on Page E-5-91, it is stated that, "...there will be no daily commuting...and workers will not have the opportunity to drive personal vehicles to the camp/village..." These conflicts need to be resolved.

- Cantwell

. Transportation: Paragraph 2: Reference is again made to commuting workers. Please refer to our comments immediately above (Section 3.1(a)(i) - Mat-Su Borough. Transportation: Paragraph 3).

Response

These conflicts were resolved. Please refer to Section 4.4.1(d).

W-5-012 (ii) Regional: Please refer to our Chapter 5 General Comments and to our comments regarding Sections 3.1 and 3.1(a)(i). - Mat-Su Borough.

(b) Watana - Operation Phase and Devil Canyon - Construction Phase

(i) Local

- Mat-Su Borough: Please refer to our comments immediately above (Section 3.1(a)(ii)).

Response

Please see the response to Comment W-5-006(a) and (b).

3.2 - Onsite Manpower Requirements and Payroll, by Year

W-5-013 (b) Seasonality of Manpower Requirements: Please refer to our comments regarding Section 3.1(a)(i) - Mat-Su Borough. The seasonality of the project work force could, if they remain in the state, result in significantly higher use levels of fish and wildlife resources, and recreational resources than that found for residents employed year-round. We recommend that this should be examined. The TAPS project and in-state hydropower projects, such as Terror Lake, should provide valuable information.

3.3 - Residency and Movement of Project Construction Personnel:

Paragraph 3: The proposed administration of the construction camp/village appears to simplify problems by minimizing constraints on the work force. Given the APA Mitigation Policy, which is consistent with NEPA and our Mitigation Policy, to first avoid adverse impacts to fish and wildlife resources, we find it difficult to accept the construction site camp/village plan or administration of it. In many ways it tends to maximize adverse impacts to fish and wildlife resources, in direct conflict with APA's stated mitigation goals. It appears that plans other than that proposed have not been evaluated as none appear in Chapter 10.

We recommend that a Prodhoe Bay type camp be examined as an alternative which could minimize project-related impacts to fish and wildlife resources and socioeconomic impacts to the local communities. Our position concerning rail versus road access to the construction camp/village has been previously stated (FWS letter to Eric Yould dated August 17, 1982).

Response

We agree that both temporary and permanent movements of people into the state could result in a larger number of people seeking fish and wildlife for consumption. It is not predictable, however, whether persons who work seasonally on the construction of the dam(s), and remain in the state during periods when they are not working on dam construction, will have a higher per capita use of fish and wildlife than others in the state.

It seems that the most important issue is controlling the use by the work force of fish and wildlife near the construction camp and access road. The second most important issue is management of fish and wildlife use in other places, in view of the increasing population in Alaska and the construction work force. The first issue will be considered in future study plans. Fish and wildlife use information will be available from other Power Authority-funded hydropower projects when this issue is considered.

Considerable study was done to determine the best siting, type of camp, and administrative policies for camp operation. During the development of a camp plan, consideration was given to recent experience in Alaska on projects like the Trans-Alaska Oil Pipeline as well as large hydroelectric projects in northern Canada. In addition, the environmental concerns were taken into account.

Selection of camp siting was made after studying possible locations on both river banks and giving consideration to access, work areas, and environmental impacts. The type of camp (a balance between family and single status personnel with emphasis on community and recreational facilities) was the result of an in-depth study of successful construction communities on other large scale, long-duration hydroelectric projects. The type of camp was selected to complement the hours of work and the policies of time-off for personnel to visit families. The overall objective has been to provide a community that would attract the skilled workers required for the project, while at the same time controlling costs to a reasonable level and keeping environmental impacts to a minimum. Mitigation measures discussed in Chapter 3 include those specifically addressed to the camp construction and operation.

A further multidisciplinary analysis of the siting, type, size, administration, etc. of the construction camp/village will be done in 1983.

W-5-014 (a) Region

(i) Regional Work Force: Paragraph 4: The assumptions stated for the onsite construction work force were questioned in the previously referenced May 27, 1982, letter from ADCRA, "Although there are currently enough unemployed in Southcentral Alaska to more than fulfill the project's labor demands, in terms of numbers, that does not necessarily mean that the appropriately skilled people are locally available. Also, given the current state of the economy, it seems reasonable to expect a sizable influx of people from the Lower 48 seeking highly-paid employment, therefore competing directly with the local labor force." In addition, on Page E-5-94, it is stated, "There are at least a couple of reasons to believe that local labor might have a difficult time obtaining construction jobs." This would appear to support the contention that hiring assumptions are overstated, and thus the impacts of project-induced population increases are understated.

(iv) Relocating Workers and Associated Population Influx: Concerning secondary and induced population, please refer to our comments under Section 3.1 and 3.1(a)(i) - Mat-Su Borough.

Response

Our analysis indicates that there is a sufficient number of unemployed and appropriately skilled, and underemployed and appropriately skilled workers in Southcentral Alaska to fill the construction jobs that we have assumed they will fill.

We agree that "outside" labor will compete with Alaska labor for jobs. This was considered in making the geographic sources of labor assumptions (see Section 3.3.1).

One point that we were trying to make is that residents in the smaller communities such as Cantwell and Trapper Creek could have difficulty competing with others for jobs. This would be the case if relatively few of the small community residents were members of unions, or if it were more difficult for them to be available at the place(s) of hire.

3.4 - Adequacy of Available Housing in Impact Areas

(a) Watana - Construction Phase

(i) Local

W-5-015 - Matanuska-Susitna Borough: Paragraph 1: It is stated that, "The majority of construction workers on the project are expected to use the onsite housing facilities. These workers will not be in-migrating into established communities and therefore will have no impact on the housing market in the Mat-Su Borough." Could we not conclude from the above that a minority of some unknown number of workers would not be housed onsite? This would lead one to expect workers commuting, and impacts to the housing market. Please quantify these potential impacts. Concerning commuting workers, please refer to our comments on Section 3.1(a)(i) - Transportation: Paragraph 3. In addition, in the previously referenced May 27, 1982, letter from ADCRA, the following statement is provided:

"The key supposition in support of the minimal impacts described is that the majority of the labor force and their families will live onsite and largely remain onsite throughout the duration of the project. This presumes affirmative actions are taken to preclude or limit mobility, particularly by private automobile, and to provide sufficient incentives for workers to locate their families onsite rather than in the more attractive and urban settings of Anchorage, Palmer, or Wasilla. If those conditions do not occur, workers and their families in some undetermined numbers will reside elsewhere, and the workers will commute. If that occurs, impacts on the Borough will increase dramatically."

Response

First, it should be clarified that there is a distinction between workers who commute on a daily basis to work at the site, and workers who will use the housing and facilities onsite and return to their permanent places of residence on a weekly or less frequent basis.

None of the communities in the Mat-Su Borough is within daily commuting distance of the project site, as a result of the routing of the access road from the Denali Highway. Workers will need to stay at the project-supplied facilities on a day-to-day basis, unless they decide to commute daily from Cantwell (which is not located in the Mat-Su Borough, and which is estimated to be an 80-minute commute from the Watana site, under the best of conditions, when the access road is in place).

Workers who fall into the second category will, by their periodic commuting, affect the amount of traffic on the Parks and Denali Highways, but they will not necessarily affect the housing market in the Mat-Su Borough. Periodic commuters will affect the housing market in the borough only if they were not currently living in the borough communities.

The chapter has been adjusted to present a case in which there is no organized transportation program and no prohibition on personal vehicles at the site. Under this scenario, some workers will decide to commute on a daily basis to and from the Cantwell area, the only existing community within daily commuting distance of the project area. The amount of in-migration into Cantwell may be limited if land that is controlled by Ahtna, Inc. is not made available for housing.

W-5-016 3.5 - Displacement and Influences on Residences and Business

(b) Businesses: Paragraph 2: It would follow that if, "Most businesses in the upper basin are dependent upon abundance of fish, big game, and furbearer species," and the project holds the potential to severely impact these species through elimination of their habitats, then most of the businesses would suffer severe adverse impacts. This paragraph illustrates a possible problem relating to coordination or communication of Exhibit E study programs.

Paragraph 3: Please refer to our comments immediately above (Section 3.5(b): Paragraph 2).

Response

The conclusion in the comment presented will only result if the unlikely potential of the second assumption actually occurs.

The discussion of impacts to natural resource-dependent businesses has been expanded (see Sections 3.5 and 3.7).

W-5-017 Paragraph 4: Please refer to our comments above (Section 3.5(b): Paragraph 2). We cannot dismiss impacts to fish and wildlife resource users as insignificant. The existing user levels must be established in addition to fish and wildlife resource levels with and without the project. Proposals designed to mitigate for unavoidable fish and wildlife resource losses should then be examined as to potential impacts on these user groups.

Response

Based upon the fish and wildlife impact analyses, it is clear that the biophysical impacts of the project, with mitigation, will be negligible to most users. Changes in the distributions of caribou, moose and salmon could disrupt the use patterns of local users. This includes guides, transportation services, and lodges, as well as local residents who use the resources for food and other consumptive purposes. A study of the project's effects on these users (through project-induced changes in resource distributions) should be considered in future study plans if/when resource distributon changes are predicted in more detail.

The largest impact of the project on fish and wildlife users will probably result from easier and, therefore increased, access to fish and wildlife. Existing as well as potential users will have easier access. This will increase competition for fish and wildlife among existing users and among existing and new users. Areas of greatest potential conflict are described in Chapter 3. Potential conflicts could be reduced through effective management.

Local user's attitudes will be taken into account, as these have been to date, as project design work continues and when mitigation measures are further developed. Through survey work scheduled during 1983 in Cantwell and other communities, additional information on users' attitudes and the relative importance of fish and wildlife as income will be available to support project design studies and the development of mitigation measures.

W-5-018 3.7 - Local and Regional Impacts of Fish and Wildlife User Groups

(a) Fish

(i) Methodology: The work which was completed for 1981 did provide point estimates. The capability of the system to produce salmon is dependent upon a number of factors which are being examined as part of the Aquatic Studies Program (e.g., winter water temperature, availability of spawning gravel, flow regime, etc.). The number of fish that pass a point along the river does little to establish a river's production capability other than to establish a bottom figure for it.

A comparison of point estimates of 1981 vs 1982 demonstrates the great variability that exists in this system. Both years are "representative."

Response

We agree with the comments. They support the statements in Section 3.7.1(a).

W-5-019 (ii) The Commercial Fishery

- Specific Impacts: Paragraph 1: We concur.

Paragraph 2: Given the qualifications stated in the first paragraph, this discussion fails to recognize the potential of the project to impact fisheries downstream of Talkeetna, the potential of the river above Devil Canyon to support salmon (future opportunities lost), the importance of commercial fishing as a way of life, the importance of commercial fishing in terms of secondary and induced job creation, value of the fishery lost over the life of the project (based upon the same economic assumptions as the rest of the project), the cost of various mitigation proposals over the life of the project, etc. We recommend that a more detailed discussion be provided in the Exhibit E taking into account at least the factors listed above.

Response

There are many parts to this comment. Each part will be responded to separately.

a) Failure to recognize impact downstream from Talkeetna. Impacts to the salmon resource downstream from Talkeetna are analyzed as "limited" in the FERC application. See Chapter 3, Section 2.3.1 (b)iii.

b) Future opportunities lost, Secondary and induced job creation, and value lost over the life of the project. Comment noted. Inclusion of these issues in future study plans will be considered.

c) Commercial fishing as a way of life. Section 3.7.1 provides data on the value of the commercial catch and participation levels (i.e., no. of permits).

Since the project impacts on fish populations are estimated to be small, even without mitigation, the change to the way of life for commercial fishermen in Cook Inlet should not be significant (see Chapter 3, Section 2.2.1(a)).

e) Cost of mitigation proposals. Mitigation is evaluated in Chapter 3, Section 2.4.

W-5-020 (iii) The Sport Fishery: Paragraph 4: We concur that the type of research described is necessary. Additional information on the scope and schedule for completing this work should be provided here. We would appreciate future coordination on this research as we had not been contacted previously.

Response

Work has stopped on the task mentioned, as continuation of the task is not presently under contract. The reference will be removed. The Power Authority will consider this suggestion in future study plannings.

W-5-021 (iv) Subsistence Fishing: The impact of the project on this issue has not been evaluated and remains a large data and analysis gap. The importance of the Susitna system to subsistence, potential losses, and how mitigation proposals affect subsistence use should be addressed in the Exhibit E. The data provided is not applicable to the project. Enactment of a state subsistence law in 1978, subsequent litigation, and changes to that law in 1982 invalidate direct comparisons of permit numbers for different years. Additionally, we do not consider the price of salmon at the supermarket an adequate reflection of the importance of the resource to this lifestyle. Cultural, social, and recreational values should also be considered in this analysis.

Response

Additional analysis of the impact of the project on subsistence use will have to wait until the subsistence issue is resolved. It is not possible to conduct this analysis until subsistence is defined, or until additional subsistence data become available from ADF&G.

The data on subsistence harvest in Cook Inlet are the only user information currently available and are presented as such. Since the subsistence fishery in Cook Inlet is on mixed stocks, only an indeterminate amount of the harvest discussed in Section 3.7.1 (d) is Susitna River fish.

Subsistence fishing within the Susitna Basin is not a recognized harvest of the state of Alaska.

We agree that complete evaluation of "subsistence" salmon would include social, cultural and religious parameters, if appropriate. Section 3.7.1(d) has been revised to reflect this point.

W-5-022 (b) Game: The primary deficiencies of the Socioeconomics Chapter are prevalent here: (1) inconsistency with Chapter 3, Fish, Wildlife and Botanical Resources; (2) lack of coordination such that mitigation recommendations from Chapter 3 are not evaluated in Chapter 5 directly conflict with recommended mitigation measures; and (3) data gaps and incomplete analyses which prevent full evaluation of socioeconomic issues (e.g., Pages E-5-75, Paragraphs 2 and 5; E-5-76, Paragraph 1; E-5-81, Paragraphs 1 and 4; and E-5-82 to 83 discussion under Section 3.7(c)(i) - Data Limitation).

Response

All inconsistencies have been corrected. Additional coordination between Chapters 3 and 5 personnel has taken place to reconcile conflicts that might have existed between assumptions and mitigation recommendations of these chapters. Some data gaps remain, leaving some analyses incomplete. These data gaps and analyses will be considered in future study plans as more information about impacts on fish and wildlife become available.

W-5-023 (i) Commercial

- Guides and Guide Services: Paragraph 7: Please refer to our comments on Section 3.5(b). In that "worst case" potential losses were examined in Section 3.7(a)(ii), we recommend that a similar examination be provided here, particularly since moose estimates have previously been furnished by the ongoing Big Game Study Program.

Response

Reference is made to Section 3.7.2(a)(i) for a discussion of this point. Updated information on impact estimates has been added to the text. Possible decreases in the wilderness attributes of the area are recognized in the text. Implications of potential decreases for the guiding industry and other users are not clear at this time.

W-5-024 Discussion should be included on the possible decrease in the area's attractiveness for remote, wilderness hunting given the increase in access and human activities with project development. By definition, guided hunting involves a more remote type experience. Loss of this remoteness and potential impacts to the guiding industry should be considered here. Ongoing data collection/analysis regarding this issue needed to be fully described.

Response

See Chapter 5, Section 3.7.2(a). Loss of remoteness and the implications of this loss to the guiding industry are difficult to predict. The inclusion of these issues in future study plans will be considered.

W-5-025 (ii) Recreational

- Resources: We recommend expanding the discussion to consider relative demands and values for commercial, recreational, and subsistence hunting for each species in comparison to other species.

Response

A brief analysis of the relative uses of game resources has been added to Section 3.7.2(b)(ii) of Chapter 5.

W-5-026 Including a section on "Management" would clarify the remaining discussion on recreational hunting. The section should briefly describe ADF&G management responsibilities and the Game Board; and include a map of Game Management Units in relation to major project features and access routes.

Response

Section 3.7.2(b) in Chapter 5 has been modified to discuss management. A map has been included along with the discussion of use of game resources in the area.

W-5-027 . Caribou: Including the map recommended under Section 3.7(b) (ii) - Resources above, would clarify the discussion.

Response

The map included in Chapter 5 now clarifies the discussion of the area utilized by Nelchina caribou.

W-5-028 Resource Status: The present permit system is designed to under harvest the herd so that it can continue to grow. This section should reflect the present and future management plans for this important resource, see similar comments under Chapter 3, Section 4.2(a)(ii) - Population Characteristics.

Response

Section 3.7.2(b)(ii) of Chapter 5 now contains a fuller discussion of current management objectives for caribou and moose in the vicinity of the project.

W-5-029 The Experience Sought by Hunters: Please clarify by identifying the other area or resource to which hunting of the Nelchina herd by nearby Anchorage, Fairbanks, etc. residents is being compared.

Response

Section 3.7.2(b)(ii) has been clarified to indicate that Nelchina caribou are harvested mainly by people from the South-central region. The comparison, therefore, is between the participation rate of South-central region residents and that of hunters from elsewhere.

W-5-030 Transportation to and from Hunting Grounds: Project impacts on hunter access, and indirectly, to the caribou herd should be discussed. We suggest coordinating the discussion with that in Chapter 3, page E-3-356, Paragraph 3 and Page E-3-371, Paragraph 1, and our comments on those sections.

Response

A brief discussion of the implications of the Denali access road is contained in Section 3.7.2(b)(ii) of Chapter 5. A more extensive analysis of this road's impacts on the animal populations is given in Chapter 3. Also contained in Chapter 3 are mitigation measures which are designed to minimize this kind of impact.

W-5-031 Hunting Pressure: Management changes invalidate direct comparisons between the number of hunters in 1980 and 1970. Increases of human populations should also be described. If it were not for the permitting system, the hunting pressure would be much higher. Although the number of permit applicants provides a clearer picture of the importance of the herd, we consider this figure to also underestimate the importance of the herd. Since the chance that an applicant would obtain a permit is low, many people are discouraged from applying. If warranted, a survey could provide an estimate of the number of people who would hunt the Nelchina herd if the permit system were removed.

Response

Refer to Section 3.7.2(b)(ii) of Chapter 5. Information has been provided to give additional perspective to the comparison of harvest effort over the years.

W-5-032 To adequately evaluate potential project impacts to the herd, one would need to examine ADF&G present and future management plans, projected demand forecasts, most likely behavioral responses to the reservoirs, access routing and control, alternative reservoir filling and operation schemes, construction and public use of the access mode and routing alternatives, the tradeoffs involved in conflicting mitigative proposals on user groups, etc. We recommend that the impacts evaluation examine the aforementioned factors.

Response

The issues raised are, in part, discussed in Section 3.7.2(b)(ii) of Chapter 5. However, as outlined in Chapter 3 of Exhibit E, the state-of-the-art does not allow for precise prediction of project impacts. Nonetheless, the suggestions made in this comment by the U.S. Fish and Wildlife Service will be considered for incorporation in future studies.

W-5-033 Supply and Demand for Hunting Opportunity: Again, the situation is not fully discussed. Data should be provided comparing rates of increase for both permit applications and human area populations.

Response

Refer to Section 3.7.2(b)(ii) for an expanded treatment of this question. The discussion recognizes the shortcoming of using the permit applications to indicate demand. It would be better to be able to relate demand to human population growth. However, because of the hunting regulations, the picture is less clear. Even if the regulations did not complicate the picture, it is unlikely that the growth in hunter participation would grow at the same rate as the population.

W-5-034 Success Rate: The impact of hunting on caribou populations should be described here (e.g. see Chapter 3, Pages E-3-220 to 222). Increases in herd numbers may have also contributed to the increased success rate. A map of take relative to existing and proposed project access points may aid in evaluating project impacts. An analysis of those impacts on existing supply and demand for caribou should be provided.

Response

Section 3.7.2(b)(ii) of Chapter 5 now has a discussion of caribou population size changes, changes in hunting regulations over time and how these factors relate to hunter success rates.

The impact of increased access on caribou populations is described in Chapter 3.

W-5-035 . Moose: Since the subject of this chapter is socioeconomics, we recommend expanding the discussion to include information on moose being the most economically important wildlife species in the region, per Chapter 3 (see Page E-3-197).

Response

The discussion in Section 3.7.2(b)(ii) has been expanded to address part of this comment.

Although one can state that moose is one of the most important game resources economically (as was done in Chapter 3), and whereas moose are known to be important to the guiding industry and to noncommercial use of wildlife in the area, it is impossible to state whether it is the most important. Many guided hunts are combination hunts in which the hunter has the opportunity to hunt for more than one species. Furthermore, many guides, through providing hunts for individual species, will (in one season) provide guiding services to various clients for a number of species. This makes it difficult to evaluate the relative contributions of individual species to the income of the guiding industry and to the economy of the area as a whole.

W-5-036 Resource Status: The paragraph is inconsistent with Chapter 3 which includes 1981 data and an estimate of 4,500 moose in the upper basin. Recent and long-term ADF&G management plans for moose, as well as a map of applicable Game Management Units would help relate impacts described here to potential mitigation measures.

Response

Updated discussions are contained in Chapter 3 and in Section 3.7.2(b)(ii) of Chapter 5. The geographic area referred to in Chapter 5 is more clearly defined by including a map.

W-5-037 Transportation To and From Hunting Grounds: The discussion describes the type of data available yet fails to provide any quantification. Figures delineating present and project-related access points should be included and correlated to current hunting intensities.

Responses

Comment noted. Analysis of this type will be considered as part of future study plans.

W-5-038 Hunting Pressure: Please explain the hunting permit and/or habitat changes responsible for the significant decrease in hunters and harvest while area human populations have substantially increased. Reference to 2,859 hunters in 1981 is the same number of hunters as for 1980 in Table E-5-42. Please correct if this is not the case.

Response

The regulatory history for moose hunting is included in Section 3.7.2(b) (ii) to explain some of the reasons for decline in hunting effort. The correct figure for reported number of hunters for moose in GMU 13 during 1981 season is 3105. The text has been modified accordingly (see Section 3.7.2(b)(ii) under moose hunting pressure).

W-5-039 Success Rate: Refer to comment above. Local human populations, permit regulations, and area moose populations are critical factors in the success rate which should be discussed.

Responses

These critical factors influencing success rates of hunters are analyzed in Section 3.7.2(b)(ii) of Chapter 5.

W-5-040 . Other Species: We concur that a large data gap exists. The schedule for acquiring these data and incorporating them into project planning should be discussed. Once socioeconomic mitigation proposals are established, they must be examined in regard to impacts on fish and wildlife resource user groups. A tradeoff analysis would then be needed to examine conflicting mitigative proposals. Because coordination among project studies has been lacking, each study described impacts relative to optimal project management for the subject of that study, e.g., recreation, fish, moose, subsistence, power, etc. We recommend alternative management scenarios be evaluated within each study before the necessary tradeoff analysis is completed.

. Importance of Regulations: Paragraph 1: Access routes, restrictions on access, and construction schedules will also greatly influence opportunities to hunt in the project area. Quantification should be provided for possible impacts under at least two scenarios - severely restricted access and permits and open access without permits. Such analysis should be fully coordinated with ongoing big game studies and also discussed in Chapter 3. Given the substantial agency recommendations to omit any project access from the Denali Highway, and the importance of that recommendation as a wildlife mitigation measure, we recommend your analyzing the impacts on hunter access both with and without that road corridor. Additional discussion should also be provided on impacts both with and without restrictions on worker access and hunting. Again, regulation of such use is a significant mitigation measure. Quantification of possible use levels is necessary for full quantification of project impacts on moose populations in Chapter 3.

Response

These suggestions will be considered in future study plans.

W-5-041 Paragraph 2: Consideration should be given to the greater losses expected for black bear than for brown bear habitat in view of the harvest regulations described here.

Response

See Section 3.7.2(b)(ii) of Chapter 5 for the discussion of the importance and implications of regulations.

W-5-042 . Impacts on the Hunter: Factors contributing to a high quality hunt should be defined here. Availability and accessability of animals are key factors which will be affected by the project. Again, the schedule for quantifying recreational project impacts should be described. The present inability to quantify economic effects of the project is recognized as a major problem and should be resolved in the license application. The economics analysis should occur after quantification of wildlife impacts and formulation of mitigation proposals. Please refer to our comments under Sections 3.7(b)(i) and 3.7(b)(ii).

Response

Factors contributing to a high quality hunt are now described in Section 3.7.2(b)(ii). We agree that economic effects of the project on users are most easily addressed after impacts of the project on game are quantified. This type of economic analysis will be considered in future study plans.

W-5-043 (iii) Subsistence Hunting: This section should be rewritten to more accurately reflect current laws and regulations. For example, non-residents cannot qualify as subsistence users. A complete, rather than partial, listing of all qualifications for subsistence use should be included here. The first sentence of the second paragraph pertains to a one-time only regulation which is no longer in effect. The last sentence of this paragraph is an editorial comment which should be deleted. Mention of the controversial nature of subsistence use would be appropriate. The referenced future data compilation and analysis should be provided in the Exhibit E. At a minimum, scope and scheduling of this work should be fully discussed. The concerns expressed under Section 3.7(a)(iv) - Subsistence Fishing would apply to this section in regard to hunting. Please refer to Section 810 of the Alaska National Interest Lands Conservation Act (Public Law 96-487, December 2, 1980) for guidance.

Response

Refer to Section 3.7.2(b)(i). The data on subsistence use of game in the region are nonexistent except for caribou. The text has been expanded to include caribou use by local residents.

W-5-044 (c) Furbearers

(i) Commercial Users: During the August 1982 AEA Workshop on the Susitna project, trapping was considered the primary mortality factor affecting beaver in the project area. Access, in addition to species abundance and pelt prices, is also a key determinant of trapping intensity.

Response

The second portion of this statement has been added to the text in Section 3.7.3 of Chapter 5.

W-5-045 - Data Limitations: Given that there are problems with available trapping data, the records which are available should be described here as a general indication of area trapping activities. We are concerned about the apparent lack of coordination with project furbearer studies which do provide some population and trapping data (see Chapter 3, Pages E-3-250 to 251; E-3-253 to 256; E-3-315 to 317; E-3-321 to 322; E-3-344 to 346; E-3-361 to 362; and E-3-368).

Response

Information on yearly harvests of furbearer species in Game Management Unit 13 have been added to the chapter, as the agency requested. However, as mentioned in the text, the limitations of these data are such that the use of these data in the present context is considered to be inappropriate, except as a very general indicator.

W-5-046 - Trapping Activity: Paragraph 1: Any examination of project impacts needs to examine future opportunities lost. Again, please provide whatever quantification of trapper numbers and harvest values is available. Consideration should be given to the number of additional trappers the area could support under alternative project access location and regulation alternatives.

Paragraph 3: Based on the suggested 25-mile trap line length, it is doubtful whether the project area, with projected access routes, could support more than an additional dozen trappers. There is some indication that the area may be near trapping saturation now (Furbearer Study Coordinator Phil Gipson, personal communication).

Response

There are not sufficient population data on furbearers available to estimate the magnitude of future opportunities lost, the number of additional trappers the project area could support, or to say whether the area is now near trapping saturation.

W-5-047 - Aquatic Species

. Baseline: Paragraph 2: To compliment and parallel the beaver discussion, information should be included on muskrat populations and habitat utilization; please refer to our comments under Section 3.7(c)(i) - Data Limitations, above.

Response

A summary of the information on muskrat provided in Chapter 3 has been added to Section 3.7 of Chapter 5 as requested.

W-5-048 Paragraph 3: Subsistence value of furbearer species should be identified.

Response

This comment refers to a paragraph that states the meat of muskrat and beaver are utilized as well as the fur for dog and human consumption. We do not agree that this is an important subsistence use of these species, or that it is appropriate to quantify their values as food for dogs and humans.

W-5-049 Paragraph 4: References such as "abundant" and "common" should be deleted. Quantification should be available from the 1981 and 1982 field seasons for those species. Please incorporate these data into the discussion and analysis.

Response

To the extent available, specific information on furbearer populations in the project area can be found in Chapter 3.

W-5-050 . Impacts of the Project: The conclusion that the access road and transmission lines would provide increased harvest opportunities through increased access appears to be in conflict with conclusions and statements offered in other chapters and sections (e.g., Chapter 3, Pages E-3-317 to 323; E-3-345 to 346; E-3-360 to 363; E-3-368; and in particular, E-3-377). The statement offered in this section would lead one to conclude that open access is expected to be provided by the preferred access road and through a maintenance road for the transmission line from Watana damsite. It has been our understanding that the former has not been established and the latter was not to occur. Please refer to our comments on Sections 3.1(a)(i) - Public Recreation. Facilities: Paragraph 1 and 3.1(a)(i) - Transportation: Paragraph 1. The lost future opportunities and the potential impact that could occur to trappers due to the expected ice-free winter condition of the Susitna River above Talkeetna should be fully described in this section. The potential for furbearer populations to be trapped out, if open access is provided, should also be considered here.

Response

For purposes of analysis, it has been assumed that the access road will be open to use by the public upon completion of project construction. However, access can be restricted at a future time as a mitigation measure. This has been clarified in the text of Chapter 5.

There is not sufficient information available to estimate the magnitude of future opportunities lost. In the short-run, trapping opportunities will increase as a result of increased access. The potential for certain furbearer species in specific portions of the impact area to be trapped out is mentioned in Chapter 5, but quantification is not possible at this time.

The expected ice-free condition of the Susitna River is not expected to have a significant effect on trappers. Currently, the river does not freeze sufficiently to support substantial travel on it.

W-5-051 - Pine Marten

. Impacts: Paragraph 1: Please refer to comments under Section 3.7(c)(i) - Aquatic Species: Impacts of the Project, above. The last two sentences are contradictory; there is some inconsistency with the last line of the second paragraph which otherwise appears to be an accidental repetition of Paragraph 1 under this section.

Response

There was a typographical error in the section on impacts to pine marten (Section 3.7.3(d)) in which part of the paragraph was repeated twice. This has been corrected. The text has also been clarified to avoid the appearance of contradiction.

W-5-052 Lynx: Paragraph 2: Again, quantification should be given to this trapping pressure and success rate relative to other area furbearers.

Response

Harvest information of lynx in GMU 13 has been provided in Chapter 5.

W-5-053 - Fox: Please refer to our comment under Section 3.7(c)(i) - Lynx, above. Consideration should also be given to project impacts on fox, as they may relate to the fox trapper (also see our comments under Chapter 3, Section 4.3(a)(xii)).

Response

Information on the magnitude of impacts to fox and coyote populations can be found in Chapter 3 and in the response to comments on Chapter 3, Section 4.3(a)(xii).

W-5-054 - Secondary Industries: In order to fully assess project impacts on secondary industries, the "relatively small percentage of Alaskan trappers who operate in the impact area" should be quantified here.

Response

Trappers in the project area represent approximately 0.5 percent of the total number of trappers in the state. This information was added to Section 3.7.3(g).

W-5-055 (ii) Recreational: Inadequacy of data base is identified. Information on this user group should be accumulated, impacts analyzed, mitigation proposed and then re-evaluated to assess effectiveness and impacts in the Exhibit E. The impact due to the loss of access across the upper Susitna River resulting from the probable loss of winter ice cover requires examination in this section.

We suggest addition of a paragraph (iii) Subsistence to complete this section. Information under Paragraph 3, Page E-5-84 would apply, see comment under that section (Section 3.7(c)(i) Pine Marten - Impacts).

Response

The section now contains no distinction between "commercial" and "noncommercial" trappers, since part-time trappers will often sell the furs they obain, and since there are no data to support such a distinction.

Surveys of wildlife users in the project area will be considered in future study plans. This would help to explore further the implications for trappers of the expected ice-free condition of the Susitna River.

4 - MITIGATION

W-5-056 Paragraph 1: The definition should reflect that established in the APA Mitigation Policy document and the NEPA definition.

Paragraph 4: Without proper coordination between Susitna study components, actions designed to minimize one component's adverse impacts can unwittingly adversely effect the ability of another component to mitigate. The major mitigation proposals offered here are often in conflict with the mitigation goals of the fish and wildlife resources components. Greater communication, coordination must result in an open process to examine the tradeoffs when mitigation proposals are offered which may pose impacts to other components. Please refer to our comments concerning Section 3.7(c)(i) Aquatic Species which appears to indicate a lack of component coordination.

Paragraph 5: Appropriate local, state, and federal agencies need to have input to this process. Continued monitoring of changing mitigation needs in regard to compatability with mitigation goals of other components is very important.

4.2 - Mitigation Alternatives: How the goal of mitigation as expressed in this section conforms to the goals of mitigation in the APA Mitigation Policy document and the NEPA definition of mitigation should be explained.

(a) Tools that Influence the Magnitude and Geographic Distribution of Project-Induced Changes

Paragraph 3: Scheduling constraints need to be reassessed in light of the latest power needs forecasts. We recommend that the extent to which impacts could be mitigated in each study component be examined through a tradeoff analysis of the timing constraints which have been imposed.

Paragraph 4: Impacts to fish and wildlife resources, and thus indirectly to users of these resources, are related to the type of construction camp established, access provided (route and mode), and the administration of these facilities. We perceive little coordination designed to minimize impacts to fish and wildlife resources as a part of the socioeconomic analysis.

Paragraph 5: It appears as if management of the construction site is to be passive. That is, workers can come and go without restrictions. This appears to be in conflict with the statement on Page E-5-91, "For this project, there will be no daily commuting." Also, the assumption that workers will maintain their existing residences would follow only if the assumption that the workers would come almost entirely from the local and regional areas households. This was strongly questioned in the previously referenced letter dated May 27, 1982, from ADCRA, and on Page E-5-94, "There are at least a couple of reasons to believe that local labor might have a difficult time obtaining construction jobs."

Paragraph 8: This paragraph suffers from internal inconsistencies concerning daily commuting and use of personal vehicles. Please clarify the discussion.

Paragraph 9: This section is supposed to be the mitigation plan.

Paragraph 12: The referenced studies should be coordinated with fish and wildlife resources analyses and mitigation planning. Please refer to Section 4: Paragraphs 4 and 5 for additional comments.

(b) Tools that Help Communities and Other Bodies Cope with Disruptions and Budget Deficits

Paragraph 2: In accordance with the APA Mitigation Policy document, a monitoring panel would need to be established, at project expense, consisting of representatives of appropriate local, state, and federal agencies to carry out the function of assessing the extent of actual impacts and recommending modifications to the mitigation program. Modification of the mitigation plan in the license would be through license amendment.

Paragraph 10: Please refer to the comments immediately above (Section 4.2(b): Paragraph 2).

Paragraphs 13 and 14: The question of whether or not the labor needs of the project could be fulfilled largely through local hire (Page E-5-44) or not obviously is going to substantially effect socioeconomic impacts. In that uncertainty exists, as expressed in these paragraphs and in the May 27, 1982, ADCRA letter to APA, we recommend a re-evaluation be carried out as indicated in Section 4.3 (on Page E-5-95) and incorporated into the Exhibit E.

4.3 - Impact Management Program: Paragraph 4: Item 1: In many respects, the Base Case, as discussed in this document, is a minimum project impacts scenario; this opinion is clearly expressed in our Chapter 5 . General Comments. We believe that substantial uncertainty exists in key assumptions and that a multiple scenario model is in order. The study should be updated to reflect current state economic and population forecasts.

Item 2: Please refer to our comments on Section 4.2(b): Paragraph 2.

Item 3: Please refer to our comments on Section 4.2(b): Paragraph 2.

Item 4: Please refer to our comments on Section 4.2(b): Paragraph 2.

Paragraph 5: Please refer to our comments on Section 4.2(b): Paragraph 2.

Table E-5-42: We recommend the addition of population estimates and any changes in permit regulations from 1970 to 1981. The number of hunters in 1980 is attributed to 1981 on Page E-5-79.

Response

Thank you for these comments. Section 4, Mitigation, has been revised in response.

COMMENTS CONTAINED IN U.S. FISH AND WILDLIFE
SERVICE LETTER OF JANUARY 14, 1983

GENERAL COMMENTS - RECREATIONAL RESOURCES

Comment 1

Primary objectives of the Recreation Plan should be: a) to identify and mitigate the project related adverse impacts to the existing uses of fish and wildlife and other resources and, b) to maximize additional recreational opportunities that are not in conflict with existing uses and the resources they are based upon. This should be accomplished in the context of projected demand during the construction and operation phases of the project.

In general we find this chapter suffers from a lack of necessary information which would achieve these objectives. In particular, 1) the chapter fails to outline alternative recreation options; 2) evaluate the recommended plan and alternatives over the entire economic project life; 3) distinguish between specific recreation users; 4) recognize and identify specific responsibilities with regard to implementation and operation of the plan; and 5) lacks specificity necessary to influence project development for the betterment of recreational opportunities.

Response

1. Section 5.5 outlines various conceptual recreation alternatives including the no-build alternative. These alternatives provided the parameters for the elements considered in the proposed recreation plan. In addition, a phasing system has been applied in order to provide flexibility in the evolution of the recreation plan.

2. Sections 2.1.3, 2.1.4, 2.1.5, 2.1.6 are provided to demonstrate the background and composition of the current recreation users. Figures E.7.6, E.7.7, and E.7.8 indicate existing recreation use patterns.

   Section 2.2.2 describes existing recreation use within the study area including user descriptions. Section 3.2.3 discusses estimated recreation demand as related to specific user categories.

3. Section 4.3 outlines the financial responsibility of the Alaska Power Authority. Section 6.0 outlines the implementation of the recreation plan. Future work includes the negotiation and formalization of the agreements between the Alaska Power Authority and managing agencies and the private corporations holding land.

4. Specific responsibilities of all parties regarding implementation of the recreation plan are discussed in Sections 4 and 6 of Chapter 7, Exhibit E. The responsibilities of all parties will be formalized and documented prior to implementation of the recreation plan.

Comment 2

To allow the maximum flexibility for meeting recreational demands, it is important that an array of alternative options be evaluated. This is emphasized by the lack of definitive demand projections and potential for access during the construction periods. Furthermore, we view the tremendous influx of people during the construction period as a major consideration for a recreation plan. Specific measures must be identified which will not only satisfy demand but also act as controls on overuse. The plan must also recognize the limited recreational carrying capacity of the area and deal with the fact that all demand may not be satisfied.

Response

1. Sections 5.1, 5.2, 5.3, and 5.4 discuss the study method within which a maximum flexibility could occur, as based upon the best demand information available from several different sources. The phasing concept, related to construction and operation, is intended to provide not only flexibility, but for the possibility of change in demand or need over the extended construction period.

2. Section 5.4.6 describes the recreation plan for the construction camp. These are specifically intended as alternatives to the normal recreation opportunity.

3. The study methodology recognizes not all recreation demands can be met. There has not been an emphasis upon that concept. Instead carrying capacity, Section 5.3.4, is intended to evaluate each site on the basis of fitness of use.

Comment 3

Identification of specific responsibilities for implementation and operation of the Recreation Plan should be included. It does not suffice to place the responsibility on the "management agencies," without a detailed coordinated effort with the agencies prior to issuance of the license. The plan must clearly identify the applicant's responsibility, the agencies' responsibility, and clearly outline the procedures to be followed. The plan must recognize the inherent restraints placed on the agencies and include as a project cost compensations of them as appropriate for mitigation of project-induced impacts.

Response

In addition to Sections 2.2.2 and 3.2.3, future work includes this necessary work as discussed above. Costs for management of recreation areas are indicated in Figures E.7.19 and E.7.20.

Comment 4

The plan clearly fails to recognize the differences between sport, trophy, and subsistence use of particular wildlife resources. The tendency has been to lump these users as hunters with a major objective of bagging game. We submit these are clearly distinct groups and should be so recognized. Cultural differences regarding recreational pursuits have also been totally ignored in the plan.

Response

Refer to Chapters 3 and 5.

Comment 5

Lastly, the plan appears to have been written in a clearly reactive mode. There is no recognition of any recreational planning initiative that has precluded development of recreational opportunities which could have avoided some impacts while maintaining a higher aesthetic quality to the recreational experience.

Response

We disagree with the comment. Refer to Sections 1.0, 1.1, 1.3, 5.1, 5.3, and 5.5, which describe the conceptual format of the recreation study.

SPECIFIC COMMENTS - RECREATIONAL RESOURCES

3 - PROJECT IMPACTS ON EXISTING RECREATION

3.1 - Watana Development

(a) Reservoir

W-7-001 (i) Construction: The discussion in this section needs to be expanded to address non-consumptive and subsistence recreational users as well as sport and trophy hunters. Furthermore, the section needs to address the eminent competition between existing recreational users and construction workers.

Response

Refer to Chapters 3 and 5. Competition between workers and existing users is discussed in Section 3.

W-7-002 (ii) Operations: Discussions should be provided to address a new recreational opportunity, i.e., boating on the reservoir, primarily for access to other areas.

Response

The potential for boating on the reservoirs was considered, as described in Section 3.1.1; it was concluded that the operational and physical character of the reservoirs created little recreation opportunity.

W-7-003 (b) Talkeetna to Devil Canyon Fishery

(ii) Construction: Since a plan for flow releases during the construction and filling period has not been finalized, we do not know what effect flow will have on fishing opportunity. Mitigation measures will be aimed at maintaining existing fishing opportunities.

Response

Refer to Chapter 3, Exhibit E.

W-7-004 (ii) Operations: Since the proposed operational flow regime will likely reduce water quantity in the sloughs, we anticipate a reduction in fishing opportunity that must be mitigated, the potential for this adverse impact and appropriate mitigation should be addressed.

Response

Refer to Chapter 3, Exhibit E. In addition, new fisheries will be more accessible because of the recreation plan to replace the abovementioned restrictions in opportunity. The recreation plan is mitigation for lost opportunities.

W-7-005 (d) Other-Land Related Recreation

(i) Construction: Paragraph 2: Please expand and clarify the discussion. It is our understanding that the area will be open to the recreating public.

Paragraph 3: The discussion fails to address whether or not existing use shifts to other areas is dependent upon several factors; e.g., species involved, availability of and restrictions on use of those species elsewhere, existing demand already present in other areas, and cultural association with those species.

Response

Refer to Chapters 3 and 5 of Exhibit E.

W-7-006 (ii) Operations: It is the responsibility of the project sponsor to identify specific mitigation measures and develop a comprehensive plan which will address this impact. "Proper control by landowners and managers," is not a mitigation measure without appropriate compensation to implement and operate the recreation plans. This cost should be identified and evaluated over the economic project life and included as a project cost.

Response

Tables E.7.17, E.7.18, E.7.19, and E.7.20 speak to direct recreation development and operations. Further negotiations will occur between the Alaska Power Authority and Division of State Parks (managing agency) for this project.

W-7-007 3.3 - Access (3.1.3)

(a) Watana Access Road

(i) Construction: Paragraph 2: Estimated recreational vehicle traffic both prior to and after 1993 should be presented.

Response

Refer to Chapters 5 and 9.

W-7-008 (b) Devil Canyon Access Road

(i) Construction: Paragraph 2: Mitigation for excavation of the borrow areas could include the future use of these areas for recreation development. These measures should be specifically identified and incorporated as part of the Recreation Plan.

Response

This is included as part of Phase 5 recreation planning. Also it is included as a mitigating measure in Chapter 3 and Chapter 8.

W-7-009 (ii) Operations: These "careful plans" should be a part of this document, if not, who will develop these plans and when? The associated costs should also be discussed and displayed as project costs. Also, management responsibilities during construction should be identified and discussed along with associated costs.

Response

Detailed planning and design is the purpose of Phase II engineering. Tables E.7.17, E.7.18, E.7.19, E.7.20 are costs specific to the recreation plan.

W-7-010 (d) Other Land-Related Recreation

(ii) Operation: We feel this will be a significant impact and specific plans should be identified and discussed in this document.

Response

Other recreation study e.g., transmission line corridors, will be included.

W-7-011 3.5 - Indirect Impacts -- Project-Induced Recreation Demand

(b) Assumptions: Paragraph 1: This paragraph is very confusing and needs to be clarified. In particular, that part dealing with mitigation. We would suggest, "The proposed recreation plan is designed as mitigation for recreation opportunities lost due to project development...."

Response

Agreed.

W-7-012 Paragraph 3: Assumption 6: We would suggest that a likely scenario associated with this development will be a road access provided to the area without the project. This scenario could drastically affect your evaluation.

Response

We doubt the likeliness of similar road access to the Susitna area without the project.

W-7-013 (c) Estimated Recreation Demand

(i) Per Capita Participation Method: Paragraph 8: This paragraph needs to be expanded to discuss how subunits were considered, since you rely on the "management agency" to control project demand, and this will be done on a unit and subunit basis.

Paragraph 17: The simplification of your methodology also does not consider that other recreation opportunities may become saturated, hence areas of low use (project area) may become much more important for future use and receive an increase in demand.

Response

Although possible, the obvious capacity and capture rate of "other" offsite recreation sites within the same travel time and distance zones, plus the attractiveness of other places, limits this scenario in its significance. These are described in Section 3.2.3, Estimated Recreation Demand.

COMMENTS CONTAINED IN U.S. FISH AND WILDLIFE
SERVICE LETTER OF JANUARY 14, 1983

GENERAL COMMENTS - AESTHETIC RESOURCES

Comment 1

We find the chapter deficient in the following areas: 1) it lacks the detail necessary to distinguish the various user groups within the category "hunters and fishermen," e.g., the chapter characterized this group as only subsistence users; 2) avoidance has not been acknowledged as a mitigation measure, which could significantly reduce potential impacts; and 3) the chapter does not reference the incorporation of any mitigation measures into the project plans.

Response

1. Refer to Chapters 3 and 5 for user group discussions. See response to specific comment W-8-001.

2. Avoidance will be used, and has been used, in proposed facility design.

3. Refer to Sections 9 and 10, and the appendices for this inclusion.

SPECIFIC COMMENTS - AESTHETIC RESOURCES

3 - EXISTING ENVIRONMENT (STEP 3)

3.2 - Viewer Sensitivity (Step 4)

Types of Viewers

W-8-001 (A) Hunters and Fishermen: Your categorization of hunters and fishermen lacks the necessary depth to allow meaningful analysis. There are three distinct groups which must be identified and discussed, i.e., sport, subsistence, and trophy users. We submit that they are unique in their appreciation of aesthetic quality.

Response

Baseline sociological data about the characteristics of any normative recreation users do not exist. Other than generalizations about people, the types of viewers were not as critical as was their location and what they were seeing. This section has been changed to reflect this distinction. All people have unique appreciation of aesthetic quality.

W-8-002 (D) Nonresident Outdoor Recreation Enthusiasts: Trophy hunting and fishing are readily identifiable user groups, especially in Stephan Lake area. This should be identified and evaluated.

Response

Refer to Chapter 5.

W-8-003 Expectation of Views (A): The prime concern of some users is not bagging their game or catching their limits. This distinction should be made.

Response

Section 6 has been changed to emphasize principal views and observation points. We agree with the above comment.

W-8-004 5 - PROPOSED MITIGATION MEASURES (Step 9): The mitigation measures you have identified are commendable. However, there is no indication in this section that these measures have been addressed and incorporated into the project plans. Pertinent sections of the license application should be cited to show where these measures are addressed and/or reasons why they were not addressed. We are also concerned that "avoidance," as a mitigation measure has not been addressed. We refer specifically to project features which could be located elsewhere as a mitigation measure or be more easily mitigable in another location. Access routes and town sites would fall into this category.

Response

Sections 8, 9 and 10 include incorporated mitigation measures, including avoidance. Future supplemental work will include more aesthetic measures, and Phase II project engineering design will consider the proposed mitigation measures.

COMMENTS CONTAINED IN U.S. FISH AND WILDLIFE
SERVICE LETTER OF JANUARY 14, 1983

GENERAL COMMENTS - LAND USE

Comment 1

With regard to Section 2.2(d)(i), we find the chapter suffers from a lack of definitive information regarding wetlands and floodplains. These areas should be graphically displayed by type in the document. Furthermore, the chapter should discuss the specific values of these areas, their relationship with other vegetative types, and specifically address the effects of the projects on wetland and floodplains.

Mitigation measures recommended to minimize impacts to wetland floodplains should be discussed including alternative site locations.

This analysis is extremely important to avoid any delay necessitated to insure compliance with federal requirements with Section 404 of the Clean Water Act as amended (86 Stat. 884, U.S.C. 1344), associated regulations, guidelines, and Executive Orders (11988, 11990).

Response

These comments have been addressed in Section 2.2.4 - Special Lands - (a) Wetlands and (b) Floodlands. Wetland maps are included in Chapter 3. Floodplain maps are included in Chapter 2.

Comment 2

Specific measures to mitigate impacts from the transmission line should also be addressed including the right-of-way management techniques.

Response

These comments have been addressed in Section 3.5.1 - Transmission - Proposed Facilities and 3.5.3 - Transmission - Mitigation.

Note: No specific comments were supplied on Chapter 9, Land Use.

GENERAL COMMENT - ALTERNATIVE LOCATIONS, DESIGNS, AND ENERGY SOURCES

Comment 1

Mr. John Lawrence of Acres American, by letters dated November 1981, requested that the FWS review the Development Selection Report and the Transmission Corridor Report. These requests were made for the purpose of fulfilling the FERC requirements of formal pre-license application coordination. We responded to the first review request by letter dated December 17, 1981 and to the second by letter dated January 5, 1982. In that these letters were requested as part of the formal coordination process, they should be responded to at this time.

Response

The letter of December 17, 1981 and our response appear in Chapter 11.

The letter referred to, dated January 5, 1982, was responded to on April 14, 1982. Copies of each appear in Chapter 11.

Comment 2

We have been requested to review the draft Exhibit E without benefit of the other draft license exhibits. In Chapter 10, numerous references are made to other Exhibits (pp. E-10-1, E-10-1, E-10-14, E-10-16, E-10-23, E-10-28, E-10-32, E-10-38, E-10-62, E-10-81). Since we are unable to examine the other Exhibits, we view this pre-license coordination as unsatisfactory. Additionally, in our examination of the Exhibit E chapters, we have seen numerous examples of insufficient internal coordination and/or communication. In that this appears to be a problem within the Exhibit E, we can only assume that this problem occurs between Exhibit E and the other Exhibits.

Examples of lack of coordination and/or communication between Chapter 10 and Chapters 2 and 3 are apparent in the discussion concerning minimum flow releases (pp. E-10-28, E-20-30), temperature modeling (pp. E-10-30, E-10-31), and socioeconomic considerations between this Chapter and Chapter 5 (pp. E-10-138). These conncerns are discussed within the text of our specific comments.

Response

The same material present in the Exhibits not received is present in the Feasibility Report material issued in March 1982. With the exception of the operating scenario, access road, and the transmission line, the project description, maps, etc., have not changed. With the numerous meetings held previous to this request for comments and the presentation of the project by Dr. John Hayden of Acres on November 29, 1982, adequate information was available to review Exhibit E. An updated set of all exhibits is now filed with FERC and will be distributed to agencies on acceptance by FERC.

Any inconsistencies have been corrected.

Since publication of the draft license application, further temperature studies have been conducted. The results of these studies are discussed in Chapters 2 and 3 of Exhibit E.

Comment 3

There is essentially no attempt in this chapter to assess the possibility of no Susitna project or how the Railbelt should contend with time delays of various lengths. Just listing various types of alternative energy sources does not allow an evaluation of what would, or should coccur in the event that Susitna is delayed for a period of years, or is never built. We recommend that this type of planning effort be carried out to examine the effects of short-term delays and to examine long-term alternatives.

Response

Section 5 discusses the ramifications of the Susitna Project not being built. The effects or possibility of Susitna delays is not required in the FERC regulations. The need to build the project and the project schedule are discussed in Exhibits C and D, respectively. Adequate float time is incorporated into the schedule to allow for foreseeable delays.

Comment 4

Any assessment of alternatives, needs to take into account the most current power needs projections. It is our understanding that the power projections which are being used in the license application are generally agreed to be high and are being reevaluated for submittal to FERC after the license application is submitted (Acres American Deputy Project Manager John Hayden, personal communication). The environmental implications are rather evident. Alternatives to Susitna should be examined on the basis of fulfilling future power needs rather than matching the power production of Susitna. Under previous projected power needs, it probably would have taken a combination of a greater number of individual power generating stations than under the latest projections. Several smaller individual generating facilities should lead to greater flexibility in potential combinations and fewer adverse environmental impacts. We recommend that this be examined.

Response

The power projections used were the best available and deemed to be the most accurate at the time of license application. The need to reevaluate these forecasts is being assessed by Alaska Power Authority. The Susitna

Project was designed to most economically meet projected future power needs. In comparing alternatives, it was most logical to compare the Susitna Project with others having the same power output. This permitted a comparison of the environmental impacts. We also question that several smaller individual generating facilities (with associated access and transmission) should lead to fewer adverse environmental impacts.

Comment 5

In the assessments provided on hydropower alternatives, Susitna as proposed and alternative basin developments are not evaluated on an equitable basis.

Tables are displayed which contrast the weak and strong points of these alternatives yet we never see how the Susitna project ranks. This is particularly unfortunate since Susitna would leave one with the initial impression (which is the level to which the alternatives are examined) that it would have significant adverse impacts to many of the environmental criteria (page E-10-4), including: (1) big game, (2) anadromous fish, (3) de facto wilderness, (4) cultural (subsistence), (5) recreation (existing), (6) restricted land use, and (7) access.

Response

The Susitna Project is the proposed project. The tables and analyses referred to are not for the purpose of evaluating the Susitna project but to evaluate alternatives. Much more detailed analysis of the Susitna Project is appropriate and occurs in the remainder of Exhibit E. From an initial review, the Susitna Project would be extremely favorable from an environmental perspective compared to the other large hydro sites evaluated.

Comment 6

There is no attempt in this chapter to examine the environmental trade offs of the different power generation alternatives, including Susitna. Therefore, an assessment as to what would be the "best" power development for the Railbelt is not possible. Additionally, in that no single alternative source of power is contemplated to provide the same level of power as Susitna (assuming the updated future power demand projections assert that this power generation capability is needed) various power generation mixes should be examined. These alternative combination plans should then be compared to Susitna in a tradeoff analysis.

Response

An identification of the "best" alternative power development in the absence of Susitna is made in Exhibit D. This alternative consists of significant development of coal resources supplemented by gas power or peaking energy. The environmental impact of this plan would basically be that as described under Section 4. Without a specific mining/generating plant, it is not possible to provide specific environmental impacts.

Comment 7

One obvious alternative power generation mix (which is further discussed in our Specific Comments) should center on the power generating capability of the West Cook Inlet area. In close proximity to each other and existing transmission lines, we have Chakachamna hydropower, Beluga Coal fields, Mount Spurr geothermal, and the West Cook Inlet natural gas fields.

Response

Further to the previous response, the "best" non-Susitna plan is a mixture of the West Cook Inlet alternatives with emphasis on Beluga coal. This plan and the associated economic comparison is supplied in Exhibit D, as specified in the FERC regulations. The Chakachamna project is addressed as part of the non-Susitna plan sensitivity analysis.

Comment 8

Natural gas is considered by many to be a highly attractive alternative to Susitna 18/, 19/. Yet the coverage devoted to this subject was disappointing, particularly when compared to other alternative power generating technologies. Three times as much space is devoted to nuclear power which is not generally considered as a socially acceptable alternative to Susitna. Biomass, as an energy source, received twice the coverage of natural gas, and wind power received more than four times the coverage devoted to natural gas. This confirms what we perceive as misappropriation of emphasis. Numerous reports have been issued over the last three years on the natural gas alternative, including the two footnoted below. Few reports are referenced in Section 10.3(c) (i) giving the impression that a very limited effort was expended in researching this section.

Response

Natural gas was only one of the alternatives considered. Adequate coverage is devoted to this subject in Section 4.

Comment 9

Section 10.3(f) fails to recognize the most attractive geothermal alternative, Mount Spurr. Further discussion on this alternative is furnished in our Section 10.3(f) specific comments.

Response

Additional information on this subject has been added to Sections 4. It should be noted that the Alaska Department of Natural Resources, in its comments to this Chapter stated "Until exploration of the geothermal potential of Mt. Spurr has occurred, the viability of geothermal power for the railbelt region is unknown."

Comment 10

Apparently no attempt has been made to assess alternatives to the proposed construction camp/village such as siting, type of camp, and administration of the camp. Alternatives to those proposed in the draft application obviously exist and need to be openly examined. These implicit decisions have large implications for the fish and wildlife resources and users. Considerations of a Prudhoe Bay type camp should be given. Construction camp alternatives should be discussed in terms of minimizing adverse impacts to fish and wildlife resources and their use. We are concerned that not only were the resource agencies not consulted previously on these actions but that communication and cooodination between those responsible for this chapter and those involved in the socioeconomic, and the fish and wildlife components did not occur to a satisfactory level.

Response

Considerable study was done to determine the best siting, type of camp and administrative policies for camp operation. During the development of a camp plan, consideration was given to recent experience in Alaska on projects like the Trans-Alaska Oil Pipeline as well as large hydroelectric projects in northern Canada. In addition, the environmental concerns were taken into account.

Selection of camp siting was made after studying possible locations on both river banks and giving consideration to access, work areas and environmental impacts. The type of camp with a balance between family and single status personnel with emphasis on community and recreational facilities, was the result of an in-depth study of successful construction communities on other large scale, long-duration hydroelectric projects. The type of camp was selected to compliment the hours of work and the policies of time-off for personnel to visit families. The overall objective has been to provide a community that would attract the skilled worker required for the project, while at the same time controlling costs to a reasonable level and keeping environmental impacts to a minimum. Mitigation measures discussed in Chapter 3 include those specifically addressed to the camp construction and operation.

Comment 11

Due to the numerous inadequacies mentioned above the "concluding" Section 10.4 should not be expected to provide enlightenment regarding the consequences of license denial. It does not. Additional inadequacies are discussed in the Specific Comments which follow.

Response

The section on consequences of license denial has been expanded. See Section 5.

SPECIFIC COMMENTS - ALTERNATIVE LOCATIONS, DESIGNS, AND ENERGY SOURCES

W-10-001 10.1 - Alternative Hydroelectric Sites

(a) Non-Susitna Hydroelectric Alternatives: Paragraph 1: Reference is made to Exhibit B which was not provided, although we requested it.

(i) Screening of Candidate Sites: Paragraph 1: Reference is made to Exhibit B, which has not been furnished, although we requested it.

- Second Iteration: Paragraph 2: The criteria should reflect that: (1) just because salmon migrate above a site doesn't mean losses to anadromous fish are unavoidable (e.g., Chakachamna); and (2) just because anadromous fish are not found above a potential site, adverse impacts are avoidable (e.g. Susitna).

Response

The methodology for analysis of alternative sites for non-Susitna hydropower development was discussed in Section 1.4 of Volume I of the Feasibility Report, which was issued to all agencies in March 1982. The plan formulation and selection methodologies in Exhibit B discusses the engineering and economic considerations of the analysis; the environmental analysis methodology is explained in full in Chapter 10 of Exhibit E.

The 91 potential sites were a result of reviewing previous studies. It is not necessary nor desirable to increase the length of Chapter 10 by expanding on the sources of information. They are discussed in detail in the Development Selection Report issued to all agencies in November 1981. This report is referenced in Chapter 10.

This paragraph has been revised. It is felt that presence of anadromous fish makes the area more sensitive to environmental disturbances.

W-10-002 (ii) Basis of Evaluation: It would appear appropriate to include Susitna and within Susitna basin alternatives in the evaluation matrices.

Response

The purpose of the analysis was to compare the various alternatives in order to select those for which development would have the least environmental impact and still meet economic and engineering constraints.

W-10-003 (iii) Rank Weighting and Scoring: Paragraph 1: The interrelationships of the environmental criteria should be recognized and assessed. Dramatic changes in any one item would have repercussions to all others.

Response

The evaluation methodology utilized considers ranks and weights the most important environmental criteria. Attempting to include interrelationships would complicate the evaluation scheme, confuse the reader, and most likely not affect the outcome.

W-10-004 (iv) Evaluation Results: We recommend that all evaluation matrices include Susitna and within Susitna basin alternatives.

(v) Plan Formulation and Evaluation: We recommend that all evaluation matrices include Susitna and within Susitna basin alternatives.

This evaluation should be reassessed in terms of current projections for future power needs. The present examination apparently is geared toward looking at various power generation alternatives (which are not specifically described) on the basis of providing an equal amount of generating capacity to what Susitna would provide. We recommend that these alternative plans be reassessed in light of current power projections.

Response

See response to comment W-10-002.

W-10-005 (c) Upper Susitna Basin Hydroelectric Alternatives: Paragraph 3: Reference is made to Exhibit B, which has not been furnished, although we requested it.

Response

The selection process in Exhibit B which is referred to is described in Section 1.4 of Volume 1 of the Feasibility Report which was sent to the U.S. Fish and Wildlife Service in March 1982. Figure E.10.4 depicts the role of environmental concerns in the selection process.

W-10-006 (ii) Site Screening

- Energy Contribution: Reference is made to Exhibit B, which has not been furnished, although we requested it.

Response

Information on load forecasts is included in the Feasibility Report which was distributed to the USFWS in March 1982. The information pertinent to the discussion in Chapter 10 is included; it is not necessary to go into more detail.

W-10-007 (v) Comparison of Plans

- Energy Contribution: Paragraph 2: Reference is made to Exhibit B, which has not been furnished, although we have requested it.

Response

The reference to Exhibit B is in regard to economic and technical considerations. Environmental comparisons, which are the subject of Exhibit E, are included in Chapter 10.

W-10-008 10.2 - Alternative Facility Designs
(a) Watana Facility Design Alternatives
(i) Diversion/Emergency Release Facilites: Paragraph 1: Reference is made to Exhibit B, which has not been furnished, although we requested it.

It is stated that, "Tables B.61 and B.62 of Exhibit B show the minimum flow releases from the Watana and Devil Canyon dams required to maintain an adequate flow at Gold Creek. These release levels have been established to avoid adverse affects on the Salmon (SIC) fishery downstream." Perhaps a more accurate appraisal can be found in Chapter 4 (page E-4-3), "The impact of ... upriver and downriver changes in hydrology ... cannot be assessed at this time due to the lack of information concerning the amount, type and location of disturbances associated with these activities." In Chapters 2 and 3 it is stated that the reduced flows could impair fish migration, dewater spawning and rearing habitat, prevent access to slough and side channel habitats and lower or eliminate intragravel flows to slough and side channel spawning grounds. The minimum flows proposed were not developed using any recognized instream flow methodologies, and lack any biological basis other than the most rudimentary. In fact, no explanation is offered in the Exhibit E as to how the 12,000 cfs minimum operating flows for August and into September were arrived at.

Response

The referenced tables in Exhibit B are included in Chapter 2 of Exhibit E. The impacts referred to in Chapter 3 are all potential impacts; it is expected mitigation will reduce or eliminate many of these. The 12,000 cfs minimum operating flows for August were arrived at as a compromise between avoidance flows (Case D) which would be 19,000 cfs in August and make the project economically unattractive and optimum power flows (Case A) which would be 6000 cfs in August and result in severe impacts. It is believed the selected operating scenario (Case C) will result in impacts which can be mitigated. Further studies, as part of the fish and wildlife mitigation effort, are continuing.

W-10-009 (iii) Power Intake and Water Passages: Paragraph 2: The statement is made that a multi-intake structure would be used, "...in order to control the downstream river temperatures within acceptable limits." The Watana and Devil Canyon dams will cause changes to the existing water temperature of the Susitna River, generally releasing cooler water during summer months and warmer water in winter. This, in turn, may present significant impact to the downstream riverine environment. Temperature variations may affect the ability of fish to migrate, spawn, feed, and develop in the Susitna system. Ice formation may be delayed or possibly not occur above Talkeetna. This issue is discussed at length in Chapters 2 and 3 although an accurate description of post-project temperature impacts is not presented. The model which was developed to describe reservoir outflow temperatures contains input data from only five months (June through October) of one year (1981). The Devil Canyon Reservoir was not modeled, but in Chapter 2 it is stated that the location of ice formation (above Talkeetna) will depend on the outflow temperature from Devil Canyon Dam (page E-2-83).

Response

The multi-level intake structure will be utilized as stated to control downstream river temperature within acceptable limits. It is not meant to imply there will be no changes in river temperatures from current operations. Revised temperature and ice modeling results, including for Devil Canyon, are presented in Chapters 2 and 3.

W-10-010 Paragraph 3: Please reference our comments on Section 10.2(a) (i) concerning minimum flows.

Response

See response to comment W-10-008.

W-10-011 (b) Devil Canyon Facility Design Alternatives

(iii) Power Intake and Water Passages: Paragraph 2: Please refer to our comments on Section 10.2(a) (iii) concerning temperature modeling.

Response

See response to comment W-10-008.

W-10-012 Paragraph 3: It should be clarified what "normally" and "the requirements of no significant daily variation in power flow" mean, particularly in regard to fish and wildlife impacts.

Response

This paragraph has been rewritten for clarity.

W-10-013 (c) Access Alternatives

(i) Plan Selection: Paragraph 2: Although input was solicited from resource agencies and the Susitna Hydro Steering Committee (SHSC), the selection certainly did not reflect this input. Please reference the SHSC letter dated November 5, 1981. In addition, we wish to incorporate into our comments, by reference, our letter dated August 17, 1982 to Eric Yould on this subject. As such, APA should respond to this letter as a part of our formal pre-license coordination.

Response

Although it may appear the access route selected did not reflect agency input, the selection process most certainly did. Section 2.3 more explicitly outlines the selection process and rationale. The Power Authority's response to the August 17 letter appears in Chapter 11.

W-10-014 (ii) Plan Evaluation: Paragraph 1: Reference is made to Exhibit B, which has not been furnished, although we requested it.

Response

The plan evalutation section has been expanded to include this information.

W-10-015 Item Number 5: Paragraph 1: It is acknowledged that a problem exists in the potential of the access road and traffic to affect caribou movements, population size, and productivity. Avoidance of the problem by eliminating the Denali Highway to Watana access segment would be consistent with the APA Mitigation Policy document, the recommendations of the resource agencies, and NEPA. As is stated in Appendix B.3 of the Susitna Hydroelectric Project Access Plan Recommendation Report (August 1982), "From a caribou conservation viewpoint, the Denali access route is far less desirable than proposed routes originating on the Alaska Railroad and Parks Highway.

The Denali route would most certainly have immediate detrimental impacts on the resident subherd and future negative impacts on the main Nelchina herd although these impacts cannot be quantified."

Response

Schedule constraints and logistical and financial considerations resulted in the necessity of the Denali Highway to Watana selection. These considerations are now discussed. Measures to mitigate any potential impacts to caribou are included in the mitigation plan discussed in Chapter 3. Making decisions to avoid rather than minimize environmental impacts, while ignoring significant cost and schedule ramifications, is not consistent with the Power Authority's mitigation policy document.

W-10-016 Item Number 7: Paragraph 5: Both the APA Mitigation Policy document and NEPA acknowledge that it is better to avoid an adverse impact than to try to minimize it, "through proper engineering design and prudent management." APA's approach should better reflect this in their decisions concerning access routing. In addition, reference is made to discussion "in Exhibit E." This is the Exhibit E.

Response

All efforts have and will be made to avoid adverse impacts. See Section 2.4 concerning adjustments that were made to the access route to avoid impacts where possible. The statement referencing Exhibit E has been rewritten for clarification.

W-10-017 (d) Transmission Alternatives: By letter dated November 9, 1982, Mr. John Lawrence of Acres American requested our review of the Transmission Corridor Report as part of the formal pre-license coordination process. We responded by letter dated January 5, 1982. In that it was requested as part of this formal pre-license coordination process and we responded with this understanding, the issues raised and recommendations made in that letter should be addressed at this time.

Response

The letter referred to dated January 5, 1982, was responded to on April 14, 1982. Copies of each appear in Chapter 11.

W-10-018 (iii) Identification of Corridors: Paragraph 2: Reference is made to Exhibit B, which has not been furnished, although we requested it.

Response

The three figures referred to in Exhibit B are present as Figures E.10.10, E.10.11, and E.10.12 in Exhibit E.

W-10-019 (vi) Screening Results
- Central Study Area
Corridors Technically and Economically Acceptable
- Corridor One (ABCD) - Watana to the Intertie via South Shore of the Susitna River

. Environmental: Given the APA decision to have road access for the Watana damsite to the Devil Canyon damsite along the north side of the river, we do not understand how it can be considered best environmentally (rating of "A") to have the transmission line along the south side of the Susitna River. In our January 5, 1982 letter we stated, "How construction - and maintenance-related access is obtained to a great extent determines the project-related wildlife and socioeconomic impacts. Construction and maintenenace of transmission lines should not provide for additional public access over that provided by the dam access route," and, "Access to the dams should be fully coordinated with transmission line routing. Access corridors which serve a dual purpose in regard to project access needs would be highly desirable from several decision-making criteria." This potential for increased access provided by the transmission line routing is readily acknowledged elsewhere in the Exhibit E (page E-5-84). This apparent inconsistency needs to be clarified.

Response

The transmission line, in accordance with the common corridor concept to reduce access, is now routed on the north side of the Susitna River. See Section 2.4 and Table E.10.24 which reflect this change.

W-10-020 . Corridor Thirteen (ABCF) - Watana to Devil Canyon via South Shore, Devil Canyon to Intertie via North Shore, Susitna River

. Environmental: Please refer to our comments above on Corridor One (ABCD).

Response

Refer to response to comment W-10-019.

W-10-021 (ix) Results and Conclusions: Paragraph 3: Reference is made to Exhibit G which was not provided, although we requested it.

Response

Not all exhibits were distributed in the initial review phase. All exhibits will be distributed by FERC as part of their review process.

W-10-022 (e) Borrow Site Alternatives: Unless unavoidable, borrow sites should be restricted to within the future impoundments and/or to upland sites. Selection should be coordinated with access and transmission line routing and with resource agencies. We have not previously been contacted for the purpose of providing input and we do not have any project plans or assessments upon which to provide specific input.

No attempt is offered to assess the environmental tradeoffs that would be made by selecting one borrow site alternative over another. We have assumed this is the underlying intent of including this type of alternatives comparison in the environmental Exhibit E. We recommend that this be undertaken to an equal level for alternative borrow sites, access routes, transmission routes, and other alternative project features.

Response

The major concern in borrow site selection was locating sites where sufficient material of the correct type was present. The environmental aspects of borrow site selection has been added to Section 2.5. Where possible, primary sites were selected which would be in the impoundment zone with secondary sites being those outside the future impoundment zone. This is now stated in Section 2.5.

W-10-023 10.3 - Alternative Electrical Energy Sources

(a) Coal-Fired Generation Alternative

There are three main deficiencies in the discussion of Beluga Coal development as an alternative to the Susitna project:

1. No quantitative estimate of the areas or resources to be affected by coal development are included. We recommend you include a description of: (a) schedules for development; (b) area fish and wildlife populations; (c) habitat types and areas to be disturbed, altered, or destroyed; (d) construction and operation work forces necessary for project development; (e) magnitude of commercial, recreational, and subsistence use of Beluga area fish and wildlife resource; and (f) numbers of fish and wildlife which may be impacted by project development.

We realize that such information is still very tentative for the Beluga project and project impacts have barely been evaluated. However, recent field studies should allow you to approximate the magnitude of the resources involved and potential for impacts to them.

Response

Without a specific proposal to mine Beluga coal, it is not possible to supply this information. The environmental assessment of project alternatives is not required to be as detailed as for the proposed project. The Power Authority will consider this recommendation.

W-10-024 2. A direct comparison with Susitna development plans and anticipated impacts is lacking. Comparison of the information identified in 1., above, with similar information for the Susitna project should be provided. For example, the commercial, recreational, and subsistence harvests and pressures for use of the Beluga area should be compared to Susitna area resources. Acreages and habitat types that would be impacted by alternative development scenarios should be compared. The magnitudes of project impacts relative to fish and wildlife needs to be analyzed. Also, the work force and time frame which would be required for Susitna should be compared to Beluga developments, for the same power needs.

Response

See response to comment W-10-034.

W-10-025 3. Reasons for rejecting Beluga coal-fired generation or Beluga coal in combination with smaller hydroelectric projects or other energy sources, as an alternative to development of Susitna hydropower are not given.

Response

These reasons are included in Section 5 and Exhibit D.

W-10-026 Paragraph 1: Since we were not provided with a copy of Exhibit B, we cannot comment on the adequacy of the referenced analysis of the economic feasibility of Beluga Coal. We would hope the analysis includes discussion of private financial backing for Beluga Coal development as compared to State financing involved with the Susitna project. Further discussion of the feasibility of alternative Beluga development schemes may be found in a State report by Gene Rutledge, Darlene Lane, and Greg Edblem, 1980, Alaska Regional Energy Resources Planning Project, Phase 2, Coal, Hydroelectric, and Energy Alternatives, Volume 1, Beluga Coal District Analysis.

Current soft foreign market conditions are exemplified by recent slow downs of the most active Beluga coal leaseholders in completing ongoing environmental studies necessary for permitting. It would be helpful to know to what extent the State is working with the private leaseholders to consider State use of any portion of Beluga Coal production. We understand that the lease holders do not expect to complete financial feasibility studies before the second half of 1983.

Response

Economic feasibility analysis is not a subject appropriate for Exhibit E according to the FERC regulations. See Exhibit B.

W-10-027 Paragraph 2: Although specifics of plant design and location are not yet available, more detailed information can be provided on the magnitude, and probable initial development alternatives, including export of Beluga coal to Pacific Rim countries. We recommend the addition of an area map with locations of existing leases, potential camps and development facitlities, and alternative transportation and transmission corridors.

Response

Until a specific plan is proposed, this information is not available. It is not felt this level of detail is necessary to compare alternatives.

W-10-028 Paragraph 3: We recommend expanding this paragraph to consider the availability and probability of coal development in Southcentral Alaska. According to current industry plans, Beluga coal resources are sufficient to allow mining for export of 5 million tons per year (with possible expansion to 10 million tons) on Beluga Coal Company leases and 6 to 13 million tons per year from the 20,500 acre Diamond Alaska Coal Company lease for at least 30 years. The availability of this or other developments as an energy source for Alaska has been increased with recent state promotions of additional coal exploration. The state has proposed a competitive coal large sale during the first half of 1983 for 25,000 acres near Beluga Lake. Also under consideration is a noncompetitive coal right disposal west of the Susitna River. Moreover, Bering River coal development has been the subject of recent proposals for exploration and environmental studies.

Response

This paragraph explains the assumptions for the alternative analysis. The information suggested to be added is not relevent.

W-10-029 (i) Existing Environmental Condition: As described earlier, the qualitative discussion provided here allows no comparison with the Susitna project. We recommend describing detailed U.S. Forest Service and Soil Conservation Service data for the area and ongoing studies which should result in a more detailed classification of area vegetation.

The predominance of wetlands, particularly near the coast, are discernable on FWS' National Wetland Inventory maps available for the area. Those wetlands are particularly important habitats for the diverse bird life described in later paragraphs.

Response

The detail of the information suggested is not deemed to be necessary for alternative comparison.

W-10-030 . Fauna, Paragraph 1: Clarification is necessary regarding the referenced "Selvon fishery".

Response

"Selvon" has been corrected to salmon.

W-10-031 Paragraph 2: We recommend describing numbers of bald eagle and trumpeter swan nests relative to numbers in the Susitna project area.

Response

This level of information is not required for assessing alternatives.

W-10-032 - Aquatic Ecosystem: Additional information should be provided on the quantity and quality of this system (e.g., the extent to which spawning, rearing, and overwintering areas have been identified within and downstream of the lease areas).

Response

This level of information is not necessary to assess alternatives.

W-10-033 - Marine Ecosystem: Although species presence is described, there is no quantitative information on their relative abundance, or habitat quality. Figures cited for the referenced Cook Inlet fishery is dependent upon Beluga, Susitna, and other area systems. An assessment of the proportion of that fishery which depends on the Beluga system compared to the Susitna system should be provided.

Response

This information is not available.

W-10-034 - Socioeconomic Conditions: The discussion should be expanded to cover current levels of commercial, subsistence, and recreational fish and wildlife use.

Response

This information is not necessary to assess alternatives.

W-10-035 (ii) Environmental Impacts
- Air Quality: The potential for mitigating the air pollutants described here should be discussed.

Response

The figures for fly ash include the use of precipitators, which is a mitigation device. The point of the discussion is that burning coal, even with mitigation, will result in some degradation of air quality.

W-10-036 Terrestrial Ecosystems: The range of terrestrial habitat to be annually impacted should be quantified and compared with Susitna development plans. In addition to habitats disturbed by mining, project features such as roads and transmission corridors which could be expected with coal development should be described. While the road system required for coal development should be substantially less than that for the Susitna project, the potential for restoring mined lands to original habitat values is untested for the area.

Paragraph 2: ADF&G harvest data should be included here. The correlation between hunting pressure and current access should also be discussed in quantifying roads and human population increases anticipated from Beluga Coal development. Human/wildlife conflicts (e.g., bears shot in defense of life or property, wildlife mortality from additional vehicle traffic and roads) is another critical impact not mentioned here.

Response

The amount of land to be impacted would depend on the quantity of coal to be mined, thickness of seam and other information; a meaningful figure could not be calculated without a specific mining plan. Mining would result in continuous and increasing disturbance of wildlife habitat; the Susitna Project would not.

Quantification of the relationship between hunting pressure and access is not possible. A sentence discussing the impacts from human/wildlife conflicts has been added to this paragraph.

W-10-037 Aquatic and Marine Ecosystems: Some quantification of anticipated impacts can be made and should be included here. Development of both Beluga Coal Company's and Diamond Alaska Coal Company's lease holdings could eliminate nine stream-miles of existing anadromous and resident fish habitat. Stream restoration to original habitat quality will be difficult, to impossible, to attain. According to preliminary flow information, nearly half the total flow in the Chuitna River originates in or flows through the proposed mine pits. Assuming that half the anadromous fish production is lost from the Chuitna system, ADF&G estimates the annual loss of fish available to Cook Inlet fisheries will be within the following ranges:

Pink Salmon	70,000 - 650,000 mean = 275,000
Coho Salmon	5,250 - 48,750 mean = 20,625
King Salmon	2,100 - 19,500 mean = 8,250
Chum Salmon	700 - 6,500 mean = 2,750
Total Salmon	78,050 - 724,750 mean = 306,625

We recommend contrasting this information with preliminary impact assessments for Susitna and other alternative project developments in the license application. The comparison should also cover harvest levels, and areas and types of habitats to be altered or destroyed. Data gaps and uncertainties should be clarified in an accompanying discussion.

Response

Without a specific mining plan proposal, it is not possible to quantify impacts as suggested. The figures provided by the FWS have been added to the report. Similar figures for big game, furbearers, and areas and types of habitats are not available.

W-10-038 - Socioeconomic Conditions: Recently published reports by the ADF&G document the magnitude of subsistence hunting and fishing by Tyonek area residents 21/ 22/ 23. We recommend that you discuss these findings in assessing fish and wildlife resource uses which may be affected by Beluga coal development.

A general discussion of the socioeconomic impacts on Tyonek from developing Susitna or Chakachamna hydropower projects, as compared to Beluga coal development is given in a recent report for the ADCRA 24/. Tyonek apparently supports coal development as long as it does not inhibit their ability to subsistence hunt and fish. Consideration should be given to similar local support or opposition to the Susitna project.

Although the purpose of this section is to describe Beluga as an alternative to Susitna, Beluga coal development would undoubtedly include additional mining for export. Thus while the discussion appropriately describes the incremental workers associated with the power generation facilities only, the entire development will influence the permanence of the work force. The report is confusing in the discussion on whether a fly-in construction camp or permanent townsite is to be established (see pages E-10-81(a) Paragraph 3, E-10-88, last two paragraphs, and E-10-89, Paragraph 1). Some discussion is needed of both alternatives, resultant impacts on fish and wildlife uses, and the potential for mitigation.

Response

Subsistence hunting and fishing by the village of Tyonek is discussed in this section. The Power Authority has conducted an extensive Public Participation Program for the Susitna Project.

In addition, a report of public attitudes and sociocultural conditions and expected impacts from the Susitna Project was prepared by Stephen Braund and Associates. The results of his study are presented in Chapter 5 of the Susitna Feasibility Report, supplied to agencies in March 1982. A summary of this information is included in Chapter 5 of Exhibit E.

The question of a permanent town site or fly-in construction camp would not be resolved without further analysis of the mining plant, schedule, logistics, and cost. It is neither necessary or desirable to assess alternatives within alternatives to the proposed project.

W-10-039 (c) Thermal Alternatives Other Than Coal

(i) Natural Gas: In that natural gas is considered by many to be the best single source alternative to Susitna 25/, 26/, it is disconcerting to see so minimal an effort expended examining this alternative. The effort should be at least equal to that provided to the assessment of alternative hydropower sites and coal. Anything less must be considered inadequate. No examination specific to natural gas in regard to potential environment impacts is provided nor is a trade-off examination of natural gas, and other alternatives. Without this, one cannot determine whether or not a proposal is the best of all alternatives.

Discussion should be provided on the potential impact of the recent signing of natural gas supply contracts between the Enstar Corporation and Marathon and Shell Oil Companies. Discussion should focus on the impacts of these contracts, if approved, not only on allocated natural gas reserves, but also on predicting future use, pricing, potential future demand of electricity for home heating through the Matanuska-Susitna Borough, and future availability and pricing of natural gas for electrical energy generation.

Response

Section 5 provides additional information on the natural gas alternative. Information on impacts on reserves, use, pricing, demand, and availability is not part of the environmental assessment and not appropriate for Exhibit E. Treatment of these topics is in Exhibit D.

W-10-040 (iv) Environmental Considerations: It is unclear as to what this section is in reference to. If it is meant to cover all types of fossil fuel burning power plants, it is insufficient. We do not consider the potential environmental impacts of burning natural gas to be the same as for diesel, oil, or coal. We recommend that environmental considerations be examined separately for each of these fuel alternatives. Then they should be examined through a tradeoff analysis which would include Susitna, as proposed, other hydropower projects, and alternative within basin alternatives, and other alternatives to Susitna.

Much of the section centers on the potential impact/problems which would occur with increased dependence on coal for power generation. Given that the section is entitled (c) Thermal Alternatives Other Than Coal, this would seem inappropriate.

Response

The title of this section has been changed to avoid confusion. It does not cover impacts from burning coal, as this was discussed in the immediately preceeding section. Tables E.10.27, E.10.28, and E.10.29, as referenced, do not include emissions from coal-fired plants. The discussion of coal plants in this section is presented only as comparative information for the regulatory framework section. The tradeoff analysis requested is not possible without site specific plans and proposals.

W-10-041 (f) Geothermal: This section fails to recognize, other than parenthetically, the most attractive geothermal alternative, Mt. Spurr. We therefore, recommend that APA examine the feasibility of geothermal energy development at this site as an alternative to Susitna. Mt. Spurr is being considered by the Division of Minerals and Energy Management of the ADNR as their first geothermal lease sale area. They concluded it is the best potential geothermal development site within their jurisdiction. It is being proposed because: (1) it has high potential; (2) it is located on State land; and (3) it is close to existing transmission lines (Beluga Station). In addition, it is in an area already being explored for power development, being located between the Chakachatna River and the Beluga coal fields, and the area is criss-crossed by logging roads. It would also seem logical to explore the possibility of a West Cook Inlet power generation alternative to Susitna. This combination would be composed of Mount Spurr geothermal, Chakachamna hydropower, Beluga coal, and West Cook Inlet natural gas. Obvious advantages would be found in the isolation of adverse environmental impacts to a relatively small area which already has transmission facilities.

Response

The discussion of the Mount Spurr areas has been expanded. The Alaska Department of Natural Resources in its comment on the draft license application has stated "Until exploration of the geothermal properties of Mount Spurr has occurred, the viability of geothermal power for the railbelt region is unknown."

It is not the intent of the alternative discussion to include all the various combinations of generation mixes. The reader may do this by reading the various sections.

W-10-042 10.4 Environmental Consequences of License Denial: This section provides little insight as to what might occur if Susitna were not built. We hope that a greater planning effort is ongoing to allow the State to adequately address this issue. It would seem that the first approach to this problem would involve a tradeoff analysis, looking at environmental as well as other issuess to examine appropriate alternatives to the Susitna project. The analysis should be directed at: (1) short-term planning, in the event that Susitna is delayed for various lengths of time; and (2) long-term planning so that we do have a fall back plan in the event that Susitna is not licensed. We recommend that this be undertaken.

There is no examination of socioeconomic impacts in the event that the Susitna project license is denied. We consider the potential for a boom-bust occurrence to be great with construction of Susitna. Without Susitna we, therefore, would consider this as much less likely. In the event we do not have Susitna, we would expect the construction of much smaller power generation units which would come online over a much longer period of time. We recommend that the socioeconomic implications of license denial be assessed.

Response

This section has been expanded. Recommendations for further studies will be considered in developing future plans.