

MINUTES OF
EXHIBIT E REVIEW WORKSHOP

SUSITNA HYDROELECTRIC PROJECT

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WJW*

Arctic Environmental Information
and Data Center
707 "A" Street
Anchorage, Alaska 99501

Attention: Mr. Bill Wilson

Dear Mr. Wilson:

A copy of the minutes of the meetings held on November 29 through December 2, 1982 at which Acres environmental project team discussed the Draft Exhibit E for the Susitna Hydroelectric Project FERC license application are attached. A copy of the minutes have been provided to the participants in the meetings as well as FERC. The attached copy of the minutes is for your use and retention.

The Power Authority and Acres greatly appreciate your personnel participation in the meetings.

Sincerely,

Dr. John W. Hayden
Coordinator of Environmental Studies

JWH/kt

cc: C. Debelius

ACRES AMERICAN INCORPORATED

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Anchorage, Alaska 99501
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SUSITNA HYDROELECTRIC PROJECT

FERC License Application Exhibit E Presentation and Discussion

Anchorage, Alaska
Holiday Inn

November 29 - December 2, 1982

Objectives

1. Update Federal, State and local agencies regarding significant changes in project features since the Feasibility Report was published in March, 1982.
2. Use the presentations and discussions as an interactive process whereby Federal, State and local agency review of the draft Exhibit E can be facilitated.
3. Develop a mechanism for continued interaction as the finalized Exhibit E is prepared for submission to FERC.

AGENDA

Monday, November 29 1:00 P.M.

Introduction

Project Operational Description

Watana Dam

Devil Canyon Dam

Access

Transmission

Schedule for Preparation of Exhibit E

Group Definition

Tuesday, November 30 9:00 A.M.

Group 1 Water Use and Quality and Fishery Resources (W. Dyck, L. Moulton)

Group 2 Wildlife and Botanical Resources (R. Sener, M. Grubb)

Group 3 Socioeconomic/Land Use (P. Rogers, P. Lukens, K. Young)

Group 4 Cultural Resources (G. Smith, D. Follows)

Wednesday, December 1 9:00 A.M.

Group 1 Water Use and Quality and Fishery Resources

Group 2 Wildlife and Botanical Resources

Group 3 Recreation and Aesthetics (R. Erickson, J. Chappell)

Thursday, December 2 9:00 A.M.

Group 1 Water Use and Quality and Fishery Resources

Group 2 Wildlife and Botanical Resources

LIST OF ATTENDEES

SUSITNA HYDROELECTRIC PROJECT WORKSHOP

Holiday Inn, Anchorage, AK

Monday, November 29, 1982

<u>Name</u>	<u>Organization</u>	<u>Telephone</u>
Michael P. Storonsky	Acres	276-4888
Philip Hoover	Acres	"
Thomas Lavender	Acres	"
Tony Burgess	Acres	"
Michael Grubb	Acres	716 - 853-7525
Charlotte Thomas	Alaska Power Authority	276-0001
Steve Fancy	LGL Alaska	479-2669
Martha Reynolds	LGL Alaska	274-5714
Robert Sener	LGL Alaska	274-5714
Dave Tremont	Dept. Community Regional Affairs	264-2206
Roland Shanks	Cook Inlet Region, Inc.	274-8638
Priscilla Lukens	Acres	276-4888
Michele Urban	Harza/Ebasco	277-1561
Tom Arminski	Alaska Power Authority	276-0001
Leonard Corin	USFWS	271-4575
Larry Moulton	Woodward-Clyde	276-2335
Jean Baldridge	Woodward-Clyde	276-2335
Keith Quintavell	DNR - DLWM	276-2653
Robert Mohn	Alaska Power Authority	276-0001
George Gleason	Alaska Power Authority	"
John Bizer	Harza/Ebasco	277-1561
Jack Robinson	Harza/Ebasco	"
Randy Fairbanks	Harza/Ebasco	"
Gary Lawley	Harza/Ebasco	"
George S. Smith	University of AK Museum	474-7818
E. James Dixon	University of AK Museum	"
B. Agnes Brown	Tyonek Native Corp.	272-4548
Carole A. Ellerbee	Tyonek Native Corp.	"
Robert M. Erickson	EDAW, Inc.	274-3036
Tim Smith	DNR-Parks (History and Archaeology)	264-2139
Richard Fleming	Alaska Power Authority	276-0001
Bob Madison	USGS-WRD	271-4138
Bob Lamke	USGS-WRD	"
Bob Martin	ADEC	274-2533
Don McKay	ADF&G	267-2284
George Cunningham	ADF&G	344-0541
Randy Cowart	ADNR-R&D	276-2653
Al Carson	ADNR	276-2653
Paul Janke	ADNR	"
Gary Prokosch	ADNR-Water	276-2653
Mary Lu Harle	ADNR-Water Management	"
Robin Hill	Frank Orth & Associates	206-455-3507
Peter Rogers	Frank Orth & Associates	"
Steve Zrake	ADEC	274-2533

LIST OF ATTENDEES - cont..

<u>Name</u>	<u>Organization</u>	<u>Telephone</u>
Jan Hall	USFWS	263-3403
Gary Stackhouse	USFWS	263-3475
Brad Smith	NMFS	271-5006
Bill Lawrence	U S. EPA	271-5083
Floyd Sharrock	NPS	271-4216
Bruce Bedard	Alaska Power Authority	276-0001
Ann Rappoport	USFWS-WAES	271-4575
Bob Everett	ESSA Ltd.	274-5714
Eric Myers	NAEC	276-4244
John Rego	BLM	267-1273
Lee Adler	AHTNA Inc.	822-3476
Bill Wilson	AEIDC	279-4523
Chris Godfrey	COE	552-4942
Ted Rockwell	USCE Reg. Function	"
Larry M. Wright	NPS	271-4236

LIST OF ABBREVIATIONS USED FOR AGENCIES

Alaska Power Authority	APA
Alaska Department of Community and Regional Affairs	ADCRA
Alaska Department of Environmental Conservation	ADEC
Alaska Department of Fish and Game	ADF&G
Alaska Department of Natural Resources	ADNR
Arctic Environmental Information and Data Center (University of Alaska)	AEIDC
Cook Inlet Region, Inc.	CIRI
National Marine Fisheries Service	NMFS
National Parks Service	NPS
Northern Alaska Environmental Center	NAEC
United States Bureau of Land Management	BLM
United States Corps of Engineers	COE
United States Environmental Protection Agency	USEPA
United States Fish and Wildlife Service	USFWS

- Minutes of Meeting -

Subject: Susitna Hydroelectric Project Workshop - FERC License Application
Exhibit E, Presentation and Discussion

Location: Holiday Inn, Anchorage, Alaska

Attendees: see attached

Date: Monday, November 29, 1982 1:00 P.M.

Minutes recorded by: Michael P. Storonsky

I. Introduction - Dr. Richard Fleming (APA)

A) Summary:

Dr. Fleming provided an overview of the purpose of the workshop, the schedule of the license application process and introduced some of the attendees.

B) Purpose of Workshop:

To provide an informal informational session for the various agency attendees. Solicit comments and concerns to improve the final license document to be submitted to the FERC.

C) Application:

- submitted draft Exhibit E to the FERC and the various agencies
November 15, 1982
- workshop November 29 - December 2
- prepare and distribute a copy of the minutes of workshop week of
December 6
- incorporating agency comments into draft as received
- meet with FERC staff 14 December to review Engineering Exhibits
meeting with the FERC staff December 28 to receive their comments on
Exhibit E of draft application
- agency comments due January 15, 1983
- submitting license application to the FERC February 15, 1983

- a supplementary report of 1982 fisheries information and analysis to be submitted in June 1983.
- additional supplemental information as required.

D) Introduced representatives of the Harza/Ebasco/ team that will be handling Phase II of the Susitna Project.

II. Project Operational Description - Dr. John Hayden (Acres)

A) Summary

Dr. Hayden first provided a slide presentation of the major project features and location, and then a series of overhead viewgraphs of the filling and operational processes. Through the use of wall maps Dr. Hayden provided a description of the access routes and transmission lines, their locations and schedules of development. Following an intermission Dr. Hayden outlined the organization of the workshop for the balance of the week.

B) Major Project Features - Watana

- overview of the drainage basin and the relative position of the dams
- location of the proposed damsite looking both upstream and downstream
- location of the proposed borrow areas D&E, existing field camp, intake tunnel, emergency spillway
- project features discussed including the 54 mile length of reservoir, upstream boundary - just above the confluence with the Oshetna River, site of construction camp and village, and location of access road
- construction development schedule described
 - . access road construction
 - . diversion tunnel excavation
 - . completion of diversion cofferdams
 - . diversion of water through 2 tunnels, to be ultimately sealed
 - . plug tunnels 4 - 5 years into construction and begin filling reservoir
 - . complete dam, power facilities and above ground structures
- operation
 - . 1993

- . 6 units x 170 MW = 1020 MW
- . 120' depth of intake structures rather than previous 140' depth
- . 4 intakes levels
- . outlet facilities
- . main spillway for floods > 1:50 years
- . emergency spillway for flood > 1:10,000 years.

C) Devil Canyon Project Features

- location of the proposed site looking both upstream and downstream
- pertinent features
 - . access routes
 - . borrow area locations
 - . powerhouse location on north side of river
 - . long tailrace proposed to provide additional head
 - . 4 units at 150 MW = 600 MW Total capacity
 - . Fixed-cone values will be used to maintain instream flow during filling as well as prevent gas supersaturation during operation.
 - . multiple level intake structure - 2 intakes within upper 50 feet of the reservoir.
- Operational Data
 - . 50' drawdown in August of some years
 - . commissioning date 2002

D) Filling and Operation Processes

(i) Minimum flow requirements at Gold Creek

- Filling
 - . 1000 cfs in winter
 - . 6000 cfs in spring
 - . flows spiked to 12,000 cfs in August and through mid Sept.
- Operation
 - . 5,000 cfs in winter
 - . spring and summer same as during filling

- (ii) Filling Process for Three Filling Scenarios Based Upon the 32 Years of Historical Hydrologic Data
 - three year filling flow scenarios examined with
 - . 90% chance of exceedence
 - . 50% chance of exceedence
 - . 10% chance of exceedence
 - filling begins 1991 - 1993
 - not a lot of difference between 3 scenarios

- (iii) Comparison of Monthly Average Pre-project and Filling Flows at Gold Creek, Sunshine and Susitna Station
 - greatest % change in the summer time

- (iv) Operational Water Levels at Watana
 - normal maximum elevation 2185'
 - surcharged to 2190' during September after the risk of floods diminished
 - mean drawdown 105'
 - maximum drawdown 120'
 - maximum, minimum and mean drawdown scenarios compared
 - very slight water level change with Devil Canyon on line

- (v) Devil Canyon Water Levels
 - wet years; reservoir full all year
 - mean years; 50' drawdown in August and September with filling as rapidly as possible in October
 - dry years; slight drawdowns during April - May also

- (vi) Comparison of Monthly and Annual Pre-project and Post-project flows with Watana alone and with both projects on line

- (vii) Operation of Projects
 - Watana alone will be operated as a base-load plant
 - with Devil Canyon on line, Watana will be peaked and Devil Canyon will be base-load

- (viii) Temperature conditions
- modeling taking place
 - may need to consider a low-level intake to achieve more desirable fall temperatures

E) Access Roads - wall maps

- (i) Watana Route
- railroad transfer point at Cantwell
 - use Denali Highway for 21 miles to Watana access road
 - from Denali Highway, 43 miles south to damsite
- (ii) Construction Schedule - Watana
- begin immediately after issuance of license
 - construct a primitive access road from Denali Highway to Watana damsite first
 - within 1 - 2 years upgrade to allow for additional construction traffic
 - following 1993 it is uncertain as to whether the access road will be public or private, this decision will be made at a later date
- (iii) Devil Canyon
- road from Watana to Devil Canyon north of river
 - railroad access from Gold Creek to damsite, south of river
 - schedule not as critical
 - public vs. private road to be decided at a later date

F) Transmission Line

- two lines from Watana to the intertie
- two lines from Devil Canyon to the intertie
- winter construction of a significant portion of corridor, therefore avoid need for "access road"
- use existing trail from Cheechako Creek to the intertie

G) Other

- pursuant to a question from the audience
 - . outlined project boundary
 - . identified land holdings in the area: native, private and state
- set of drawings of project reproduced from Exhibit F provided

INTERMISSION

H) Organization for Balance of Workshop

- Identified groups, group leaders, and locations and times of meetings
- (see attached agenda).

MEETING ADJOURNED

SYNOPSIS OF WORKSHOP ON SOCIOECONOMICS
NOVEMBER 30, 1982

Frank Orth & Associates, Inc. lead a discussion in which the following topics were addressed: objectives of Section 5 of Exhibit E; the methodology and assumptions used in the socioeconomic analysis; the major areas of impacts; and the proposed mitigation process. Copies of the agenda and the list of participants for this workshop are attached. Significant issues brought up by participants are summarized below:

1. It was requested that clarification be provided on the reasons that impacts resulting from the use of the power that the project will provide are not included in the FERC license application. Discussion followed on the distinction between direct/indirect and induced impacts.
2. The possibility of dam failure and the need for an alarm system for residents living near the river, downstream of the project, was suggested.
3. One participant suggested land use restrictions in the areas that could be affected by flooding in case of dam failure.
4. Several participants commented on the need for policies that would encourage local hire at the community level. Suggestions included requiring unions to enroll workers from rural areas, use of tax policies, and review of NANA Corporation's local hire requirements at the Red Dog mining project.
5. It was requested that more discussion of the possible magnitude and significance of people that will come from other areas of the country, without finding work on the project, be provided. It was stressed that this could change the magnitude of impacts significantly.
6. A table listing the various assumptions regarding the origin and characteristics of the construction work force was recommended.
7. One participant commented that the assumption that 50 percent of the workers whose jobs are terminated upon completion of Watana will remain in the area may be too high. He cited the small economic base and resultant lack of job opportunities in the small communities as the reason.
8. One participant asked about the possible access of local planners to the study team's socioeconomic impact model.
9. It was asked whether cumulative impacts that included other projects in the impact area were taken into account.
10. Several questions were asked and issues were raised concerning the work camps/village including: a) who pays for the camp; b) whether the workers would pay rent; c) the concerns of the Mat-Su Borough and individual communities; d) the degree of access; and e) the implications of the camps on land use in the Upper Susitna Basin.

11. A discussion of the objectives of the mitigation process occurred. Several participants emphasized the need for a continuing mitigation process that will anticipate impacts and initiate measures to mitigate impacts before they occur, in which other agencies be included.
12. One participant suggested additional clarification be put into the section concerning the ongoing studies on impacts to fish and wildlife user groups.
13. It was suggested that more research be conducted on part-time and subsistence use of resources in the impact area. Another participant commented on the need to include discussion of subsistence considerations in Section 810 of ANCSA.
14. Additional use of resources on private land by individuals gaining access with the projects's access road was mentioned as a possible adverse impact that should be monitored and mitigated.
15. Additional use of aircraft to transport workers was mentioned as a possible mitigation tool.
16. It was commented that ranges of population influx, or some form of confidence levels associated with the projections, would make the discussion of impacts more useful to the communities. Threshold levels of population influx that would spur the need for new public facilities were also suggested.

LIST OF PARTICIPANTS
SOCIOECONOMIC IMPACT WORKSHOP
NOVEMBER 30, 1982

NAME

AGENCY

Randy Cowart	ADNR, Research and Development
Al Carson	Alaska Dept. of Natural Resources
Ron Stanek	Alaska Dept. of Community and Regional Affairs
Kevin Young	Acres American
Robert Mohn	Alaska Power Authority
Herbert Smelcer	Ahtna, Inc.
S. O. Simmons	Harza-Ebasco
Ed Busch	ADCRA Anc., Div. of Community Planning
Ken Hunt	Alaska Dept. of Natural Resources, Water Mgmt.
Bruce Bedard	Alaska Power Authority
Robert M. Erickson	EDAW, Inc.
Charlotte Thomas	Alaska Power Authority
Nancy Blunck	Alaska Power Authority
Jim Richardson	Frank Orth & Associates, Inc.
Peter Rogers	Frank Orth & Associates, Inc.
Robin Hill	Frank Orth & Associates, Inc.

CULTURAL RESOURCES MEETING

Anchorage Holiday Inn

November 30, 1982

Subject: Mitigation Planning for Susitna

Purpose: To review research design and methodology used in 1980-82 work.

To review and discuss draft FERC License Application.

To discuss cost effective means by which the initial survey may be completed.

To seek approval from the SHPO on the overall mitigation approach.

In Attendance: Beth Walton, State Archeologist, Bureau of Land Management
Diana Riggs, Department Natural Resources
Tim Smith, State Office of History and Archeology
Floyd Sharrock, Chief Archeologist, National Park Service
George Smith, Project Leader, University of Alaska Museum
E. James Dixon, Curator of Archeology, University of Alaska Museum
Richard Fleming, Alaska Power Authority
Don Follows, Acres American, Incorporated

Guests: Phil Hoover, Acres American, Incorporated
Jack Lobdell, Consultant

The Cultural Resources Program Manager, Don Follows, opened the meeting at 9:10 a.m. in Room 227 of the Holiday Inn, Anchorage. After the introductions, the point was made how critical the cultural resources are to the hydroelectric project schedule. Compliance with Section 106 of the Historic Preservation Act of 1966, Executive Order 11593 and Title 36, Part 800, Code of Federal Regulations and related laws direct the process for Cultural Resources investigation and mitigation planning.

Dr. Dixon presented a synopsis of the field work which has been completed and reported on over the past three field seasons. To date, about 50 percent of the total project area has been surveyed. Of special interest is the location of four tephras which provide dating references for the artifacts recovered. It is hoped that the cultural chronology of the region can be, for the first time, established.

Dr. Dixon explained that in his approach to mitigation planning the term "potential impacts" had been developed to address those sites outside the adversely effected areas. This third category allows for a more flexible means by which to address the large number of sites recorded (167) to date, many of which will not be impacted directly, and only potentially in the future. Potentially, impacted sites would not require systematic testing at this time, but should be monitored from time to time by the appropriate

CULTURAL RESOURCES - 2

land managers to determine conditions. If conditions warrant, mitigation would then be required.

Dr. Sharrock (NPS) asked at what point the Advisory Council on Historic Preservation should become involved in the project. The information that both Acres and the Power Authority had received in separate meetings with FERC in Washington, D.C. was that FERC would not contact the council until the basic reconnaissance was completed.

Serious scheduling problems could arise if FERC requires the Cultural Resources field survey to be completed next summer. The Alaska summer is only two and a half months long. The project size and remoteness introduce unique conditions under which a large workforce can become less efficient because of support logistics required. Based on his many years of Alaska experience, Dr. Dixon felt it would be unrealistic to expect completion in one year. It was the group consensus that two years would be best.

Another significant factor in attempting to complete the work in one field season is the Alaska Power Authority fiscal year which begins July 1. Unless funds are available at present time to launch the spring 1983 workforce, the goal will be difficult to attain because of the University's administrative procedural delays in hiring employees.

Dr. Fleming said that a decision on whether to proceed with a one or two year program will be made by the end of January, 1983.

In summary, the group consensus seemed to favor a two year survey program as outlined in the mitigation plan, and the early (if possible) involvement of the Advisory Council on Historic Preservation so that procedures can be established which satisfy both the FERC scheduling concerns and the Advisory Council.

Phil Hoover will meet with FERC the end of December to discuss the involvement of the Advisory Council.

LAND USE

Questions & Comments

1. CIRI and the village corporations asked that the Power Authority request that DNR identify lands suitable for exchange. They feel that land exchange with the state may offer one mechanism for the Power Authority to acquire project lands from them. Potential lands for exchange are becoming limited. DNR has not commenced such a study.
2. Clarification was requested on the content of Section 24 of the Federal Power Act.
3. Discussion occurred regarding induced land use changes on Native corporation owned land resulting in public pressure to provide increased access, e.g.: potential of fishermen wanting improved access to Portage Creek. Natives are concerned that the project not lead to trespass on their lands.
4. Concern was expressed about the compatibility of the proposed access plan with the Denali Scenic Highway plan.
 - Discussion related to potential recommendations of the ongoing study. The report on Denali Scenic Highway will need to be adopted by the Land Use Council before being released. As identified by BLM, the only incompatibility with the Denali scenic Highway would be temporary transmission going into the Watana site.
5. It was suggested that an assessment should be conducted on the long term economics value of having a more appealing access road.
6. A suggestion was made that a land use committee be established. The potential of having the Power Authority participate on the Mat Su land use planning team was discussed as an option.
7. A request was made that a substation and distribution be located at Cantwell as part of supplying construction power to the site, and thus make Intertie power available to that community.
8. It was suggested that additional assessment of land use changes at the community level will be undertaken, particularly with respect to Cantwell.
9. It was mentioned that Native concerns should be presented in the FERC license application.
10. The Native corporations will not initiate planning until definite project requirements are received.
11. The Native corporations propose the following methods for the Power Authority to acquire project lands: purchase, lease or exchange.
12. Effects of land acquisition procedures on land use development were discussed.

ATTENDANCE LIST

Land Use Workshop
Tuesday, 11/30/82

Charlotte Thomas	Alaska Power Authority
Robin Hill	Frank Orth & Associates
Ron Stanek	Alaska Dept. Fish & Game
Herb Smelcer	AHTNA Inc.
Bruce Bedard	Alaska Power Authority
Steve Simmons	Harza-Ebasco
Nancy Blunck	Alaska Power Authority
Randy Cowart	ADNR-R&D
Robert Erickson	EDAW, Inc.
Dave Tremont	Alaska Dept. of Community & Regional Affairs
Priscilla Lukens	Acres American
Kevin Young	Acres American

COMMENTS RECEIVED

WORKSHOP ON RECREATION
December 1, 1982

1. Questions were asked regarding FERC policy on location of facilities off-site. When recreation resources are off-site or when there are problems developing the reservoir, FERC has accepted development of off-site facilities. State Parks concurs with this position agreement.

The Power Authority stated their position is to a) take advantage of project facilities (roads & reservoirs), b) be responsive to landowners concerns (avoid trespass), c) direct use away from sensitive fish, wildlife and archaeological resources.

2. Why is an expansion of Brushkana campground recommended? The need has been discussed already by BLM and it appears in their management plan. The project would increase demand for camping along the Denali Highway and this is a logical location. It would also keep some auto traffic and camping from penetrating the project area. BLM would manage the area, and BLM and Power Authority would enter into a memorandum of understanding regarding construction, operation and maintenance.
3. State Parks Department is pleased with the plan as presented and confirmed that the plan is in agreement with the state-wide recreation plan. DNR supports the plan.

State Division of Parks will open a new trail along Curry Ridge line, from Coal Creek to Troublesome Creek, in 1983. They would like the Power Authority to consider adding three whistlestops, consisting of small campsites and possibly shelter cabins, at Gold Creek, Curry Ridge and Indian River.

4. Question: Is a full range of recreation facilities provided at Watana Village and are facilities provided for other than rugged hikers?
Answer - Power Authority: Yes, extensive recreation facilities and activities are included in the plan for the village. There is a full range of recreation opportunities provided in the recreation plan, from driving and pull-offs along the road, to a visitor center with educational exhibits, to rugged hiking.
5. Question: There are no improved trails in Denali National Park. Why does State Parks want improved trails?
Answer - State Parks: Brushing out and hardening is done only where necessary (e.g., inclose-in forested areas). In further out open areas, rock cairns may be all that is necessary.
6. Concern was mentioned about Caribou kills on the Watana access road. The reports recommends lower design speed and lower profile for that road (Section 8, Aesthetics). Caribou kills are not known to be a

COMMENTS RECEIVED
WORKSHOP ON RECREATION - 2

problem on the Denali Highway now. The Denali Highway presently has an AADT of 50 vehicles; Parks Highway, 200. The project is projecting 20 truck trips/day. While no firm traffic projections on the Denali access road are available, it will be much lower than the Parks Highway today and lower than the Denali Highway at that time. Recreation traffic will be limited primarily to July, August and September.

7. Question: Are any facilities proposed adjacent to the Watana access road?
Answer: In addition to the turn-outs and trailheads shown on the project maps, rehabilitation of borrow areas for camping is a "Phase 5" item. They cannot be located at this time because the location of borrow areas is not known. A note to this effect will be added to the map of recreation facilities.
8. Question: Why do we assume that demand will build up over time and not be instantaneous when the facilities open (p E-7-42)?
Answer: National Park Service experience has shown this to be the case, even in well-known recreation areas. It takes time to build a sustained market. If a new salmon fishing area close to Anchorage were opened, it would get immediate heavy use. Project facilities will not be that type of area.
9. Demand figures were discussed and agreed with; if anything, they may be high. This is why some facilities have been put in Phase 5.
10. What is the capacity of the Susitna River Boat Launch? 6 vehicle places. This will be checked against DOT's Denali Highway Study.
11. Three facilities require Native concurrence - the Chulitna trail, Fog Lakes trail and campground, and Stephan Lake trail.
Question: Is there a statement that says land acquisition costs will be in addition?
Answer: Yes. The plan also recognizes that additional private recreation development may take place on private land.
12. The plan should mention that snowmobiling will probably increase along the Denali Highway. No specific areas need to be set aside.
13. Page E-7-39, paragraph 3 states fishing is decreasing. The data source should be re-checked to confirm this.
14. Capital investments will be part of Power Authority project financing. Operational costs will be partly done as part of regular operations. MOU's with the agency would detail arrangements.
15. Effects on downstream recreation appear to be mixed. Water quality will improve but quantity will decrease during the open water season. See Chapter 2 - Water Quantity and Quality.

ATTENDANCE LIST

WORKSHOP ON RECREATION

December 1, 1982

Larry Wright, USNPS
Randy Cowart, ADNR
Gary Stackhouse, USFWS
Dave Dapkus, USBLM
Mike Mills, ADF&G
Roland Shanks, CIRI
Jack Wiles, ADNR
Richard Fleming, APA
Bruce Bedard, APA
Nancy Blunck, APA
Gary Lawley, Harza-Ebasco
Jack Robinson, Harza-Ebasco
Peter Rogers, Frank Orth & Associates
Robin Hill, Frank Orth & Associates
Bob Erickson, EDAW, Inc.
Jim Chappell, EDAW, Inc.
Kevin Young, ACRES
Priscilla Lukens, ACRES

COMMENTS RECEIVED

Workshop on Aesthetics
December 1, 1982

1. Be sure that discussion of Watana access road clearly states EDAW's recommended restudy of that alignment.
2. It was suggested that a mitigation measure be to take a film of the river from Tyone River to Gold Creek today, and again periodically after construction, in a "time-lapse" fashion.
3. Discussions of the construction camps and the townsite took place, with agreement that additional location studies and design studies are required.
4. Discussions of the transmission lines took place, with agreement the north and south stubs need additional location studies but the line from the powerhouses to the intertie is well located. (The alignment between Watana and Gold Creek which was assessed in the application and discussed at the workshop was subsequently relocated to provide improved access for construction and operation.)

ATTENDANCE LIST

WORKSHOP ON AESTHETICS

December 1, 1982

Larry Wright, USNPS

Randy Cowart, ADNR

Gary Stackhouse, USFWS

Roland Shanks, CIRI

Jack Wiles, ADNR

Bruce Bedard, APA

Nancy Blunck, APA

Bob Erickson, EDAW, Inc.

Jim Chappell, EDAW, Inc.

SYNOPSIS OF AGENCY COMMENTS
AND QUESTIONS

REVIEW OF DRAFT EXHIBIT E OF FERC LICENSE APPLICATION

WILDLIFE AND BOTANICAL RESOURCES GROUP

Tuesday, November 30, 1982

Room 225, Holiday Inn, Anchorage

ATTENDEES

<u>Name</u>	<u>Organization</u>	<u>Address</u>	<u>Phone No.</u>
Lee Adler (LA)	Ahtna	Box 6 Copper Ctr.	822-3476
Roseann Densmore (RD)	Envirosphere	Anchorage	277-1561
Bob Everitt (BE)	ESSA Ltd.	Vancouver, B.C.	604-872-0691
Randy Fairbanks (RF)	Envirosphere	Seattle	206-451-4620
Steve Fancy (SF)	LGL Alaska	Fairbanks	479-2669
Michael Grubb (MG)	Acres American	Buffalo	716-853-7525
Gary Liepitz (GL)	ADF&G	Anchorage	344-0541x281
Ann Rappoport (AR)	FWS	Anchorage	271-4575
Martha Reynolds (MR)	LGL Alaska	Anchorage	274-5714
Karl Schneider (KS)	ADF&G	Anchorage	344-0541
Robert Sener (RS)	LGL Alaska	Anchorage	274-5714
Gary Stackhouse (GS)	FWS	Anchorage	263-3475
Judy Zimicki (JZ)	No. Ak. Environ. Ctr.	Anchorage	277-2134

Discussion of Preparation of Exhibit E: Baseline Description, Impact Section and Mitigation Section.

KS - What will the February and June submittals entail?
What data will be in which document?

Discussion of Schedule for Submitting Documents and Agency Review Procedures.

AR - What about after June 30? Will there be continuing studies?
When will those data be incorporated?

Discussion of Schedule after June 1983. Discussion of Baseline Vegetation Description.

LA - Is the Susitna basin key winter moose range?

Discussion of Areas That Might be Critical During a Severe Winter.

AR - Is a new classification system being used to help characterize moose habitat?

WILDLIFE AND BOTANICAL RESOURCES GROUP - 2

Discussion of Viereck & Dyrness System and Relation to Moose Browse Identification.

RF - Was all vegetation mapping described in Exhibit E done from 1:120,000 1980 U2 photography?

AR - Does Exhibit E contain all work completed up to this point, so that new data will go into the June 30 document?

Discussion of Threatened or Endangered Wildlife Species, Prioritization of Species, Moose Baseline Description.

KS - New census this fall showed more moose on the Susitna River downstream of Devil Canyon than have ever been measured there before.

Discussion of Moose Calving, Food Habits and Mortality.

KS - Black bear predation on moose calves is important as well as brown bear predation. Early green-up of vegetation in the river valley may be important to cows that are about to calve, even if the area is not a true winter range.

Discussion of the Caribou in the Area, and Dall Sheep.

KS - Sheep sighted in the Watana Mountain - Grebe Mountain area are probably a sub-group of the main Talkeetna Mountains group. The number within the Susitna watershed could vary.

Discussion of Brown Bear Baseline Description.

KS - Yes, one would expect brown bear population to decrease downriver due to poorer habitat and lower elevation.

Discussion of Black Bear, Wolves, Coyotes, Wolverine, Belukha.

KS - Belukha feed on anadromous fish. Smelt runs in Cook Inlet are also an important food source. Have they been studied?

Discussion of Furbearer, Bird and Small Mammal Baseline Descriptions.

AR - What is your perception of the completeness of the baseline information?

AR - How about information on population increases or decreases, or the quality of the habitat? Are there any gaps in that type of information? Are the data being gathered? When will they be available?

WILDLIFE AND BOTANICAL RESOURCES GROUP - 3

Discussion of Data Gaps and 1983 Field Season.

KS - I hope we can get the 1983 field program set up this winter. All issues should be identified.

AR - I'm glad to see the vegetation mapping is being re-done and that you (LGL) are not just accepting the inadequacy of the earlier data.

Will the original researchers (principal investigators) be given the new vegetation maps to re-work their data?

Discussion of Importance of Early Planning, Especially if This is a Severe Winter. Discussion of Impacts to Moose Due to Watana Development.

AR - Hunting regulations are political, and these are not predictable. Unless commitments are actually a part of the license, they will not necessarily be followed.

KS - Project personnel are easier to regulate than the public. Many different regulatory options are available. Permitting to restrict harvest is easier than closing the road.

Discussion of License Application Approach to Issues Outside the Power Authority's Jurisdiction.

LA - Has any consideration been given to regulations Natives may impose? They can control access - trespass - but can't directly regulate hunting.

Discussion of Moose Impacts and Moose Browse Studies.

AR - Both summer and winter vegetation sampling will be needed to accurately determine energy and protein content of browse.

Discussion of Planned Moose Studies and Those in Progress.

AR - The document (Exhibit E) should clearly describe any work that is going to be done, and its schedule.

Discussion of Species Prioritization and Mitigation Tradeoffs.

KS - In many cases, compensation may be the major mitigative technique.

WILDLIFE AND BOTANICAL RESOURCES GROUP - 4

Discussion of Impacts to Downstream Moose and Caribou.

RF - How is FERC going to respond to the lack of specificity in the caribou impact and mitigation section?

KS - The effects on caribou are difficult to mitigate except through the no project option. Out-of-kind mitigation will be determined after impacts have been assessed during construction and operation.

Discussion of Impacts to Dall Sheep.

KS - Might be useful to do a slope stability study of Jay Creek sheep lick. Inundation might even enhance the lick through erosion exposing fresh mineral soil.

Discussion of Impacts to Brown Bear and Black Bear.

KS - Both bear species use several different, scattered food sources, which will be more or less important in different years. Pinpointing the factor limiting bear populations is difficult, consequently the effect of the dams is difficult to predict.

Discussion of Impacts to Wolves of Watana Development.

KS - Activity sensors on wolves showed that helicopters caused reactions, but the wolves, even one in a den with pups, became habituated. Good data are available on the optimum time of day and season to minimize disturbance.

Discussion of Impacts on Wolverine, Belukha, Beaver, Marten, Raptor, Waterfowl, and Small Mammals.

AR - Looking at the project as a whole, is diversity being maintained through mitigation or are moose being favored to the neglect of other species? In some areas, different species may be more important than moose.

Discussion of the Impacts of Devil Canyon and the Access Roads.

AR - Are there any plans to quantify the impact of different alternative construction methods?

Discussion of FERC's Request to Emphasize Commitments Over Options and Recommendations in the License Application.

KS - If the project is not clearly defined, with the associated impacts of each decision, then reviewing the project is difficult.

WILDLIFE AND BOTANICAL RESOURCES GROUP - 5

- AR - The construction method with the least impact should be strongly supported.
- GS - Are the costs of the different options included?
- AR - Exhibit E should contain a table of project impacts and corresponding mitigation measures. All project aspects should be presented and evaluated.
- GS - It is important for the groups to keep up with any changes.
- KS - Is there any mechanism to let agencies know of any changes?

Discussion of Decision Making Process.

- AR - What was the level of communication during the engineering design?

Discussion of Formal and Informal Interactions.

- GS - Access route has potentially severe impacts. Strong recommendation may be made to FERC to change it. The road between the dams might change, too, due to Native bargaining.

Discussion of the Impact of the Access Roads.

- KS - There is not a direct relationship between caribou herd size and range size. Management goals for the Nelchina herd are now $\pm 20,000$, but that could change. Changes in potential caribou habitat are important, even if the population is not immediately affected. 70,000 is too high a population for that herd - caused a crash, however a higher ceiling is being considered, 30,000 - 40,000. You should assume an eventual population of 40,000.
- LA - The population is presently increasing and will continue to increase unless there is some regulatory change.
- KS - When access increases, hunting demand will increase.

Further Discussion of Access Road and Traffic Patterns.

- KS - Traffic data averaged over a year is not good enough. It is important to know about peak traffic flows - when they occur and what the maximum number of vehicles would be. The impact on animals depends on the time of year.
- GS - We need clear traffic data to be able to estimate impacts.
- KS - The time of day of peak traffic might be more important than the time of year.

WILDLIFE AND BOTANICAL RESOURCES GROUP - 6

AR - Suggestions aren't being followed in the Terror Lake project. Need to tie mitigation down, be specific.

KS - We should request some socioeconomic data on traffic predictions.

Discussion of Impacts of Railroad Traffic.

KS - Trains should be scheduled to minimize moose encounters. Scheduling trains close together and using longer trains would also minimize encounters.

GL - Have the effects of the access road mentioned earlier - roadside dust, ATV use - been quantified in terms of loss of habitat or animals?

RF - Roadside dust could actually be beneficial, causing earlier melting and thus early browse.

KS - Impacts should be examined to determine if their effects are significant.

Discussion of Mitigation Measures for Borrow Sites, Access Roads, Transmission Corridors.

AR - Do Exhibit E transmission corridor studies include the intertie? Helicopter construction was agreed to on some sections, but then maintenance was not going to be done by helicopter. The result was less helicopter use.

MG - How do these issues get dropped through the cracks?

AR - The decisions are not written down. If it is written in the permit, then it happens. But if only recommendations are made, then they aren't always followed.

Discussion of Areas of Uncertainty.

AR - Gray areas (where changes are possible) should be identified, so that if things change we have some idea of the impacts of the new option. Construction bids should include all details to make sure the stipulations don't get forgotten.

Discussion of Actions Outside Power Authority Jurisdiction.

LA - Ahtna has no plans to develop project area land if Susitna is built - there is no cash incentive.

WILDLIFE AND BOTANICAL RESOURCES GROUP - 7

Discussion of Plan for Periodic Spring Floods.

AR - Has the plan for 30,000 cfs spring floods been discussed with the aquatic group?

KS - How about the legal effect of causing destruction of property?

Discussion of Negotiations Required for Compensatory Mitigation Measures.

KS - Enhancement of moose habitat is possible, but some impacts cannot be mitigated. Quantification of impacts is perhaps not too important in these cases. General enhancement actions could be taken to preserve the quality of the area (i.e. preserve Stephan Lake area from development).

Discussion of Monitoring Programs.

KS - the cost of mitigation options is difficult to estimate. There may be some trading of State land, and some outright purchase.

REVIEW OF DRAFT EXHIBIT E OF FERC LICENSE APPLICATION

WILDLIFE AND BOTANICAL RESOURCES GROUP

Tuesday, November 30, 1982

Room 225, Holiday Inn, Anchorage

ATTENDEES

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Judy Zimicki (JZ)	No. Ak. Environ. Ctr.	Anchorage	277-2134

RS began the meeting with a description of the preparation of the Wildlife and Botanical Resources sections of Exhibit E. Research reports from ADF&G and the University of Alaska provided much of the data for the baseline description. These data were substantially supplemented with a thorough literature review. The impact section was prepared in a manner consistent with the Susitna Project Fish and Wildlife Mitigation Policy. Impacts were prioritized by:

- 1) percent of population affected;
- 2) certainty of impact occurring; and
- 3) severity of impact.

The mitigation section is still in progress.

SF - Following FERC's request, the impact section assumed normal engineering practices with no special mitigation measures.

RS - Continued his description of the mitigation section.

KS - What do the February and June submittals entail?

John Hayden (JH) entered, and the question was deferred to him.

JH - We expect feedback from FERC on December 28, which will result in correction of the document before the February submittal. FERC will

WILDLIFE AND BOTANICAL RESOURCES GROUP - 2

have a 60-day review period, then any further requirements can be addressed by June 30. We have 90 days to respond to FERC's request for improvements. The June 30 document will be a response to FERC's evaluation, not a total re-write of Exhibit E.

AR - How about after June 30? Will there be continuing studies?

JH - After June 30, FERC hopes to have enough data to be able to start an EIS. FERC will then incorporate 1983 data as they come in from fisheries, wildlife, and archeological studies. Approval could be contingent on certain aspects of 1983 field data. Not until the EIS is prepared will the agencies have an official comment time, probably in fall 1983.

SF began the presentation of the baseline descriptions. He emphasized the draft nature of the document, particularly the literature cited, the tables and figures, and the mitigation section. An effort was made to be comprehensive and supply all the background material that the reviewing agencies would need.

No endangered plant species were found. Vegetation maps are inaccurate, and will be re-done with a more detailed classification system (still Viereck and Dyrness) and large scale imagery.

LA - Is the Susitna Basin key winter moose range?

SF - Yes, particularly when the snow is deep. Sampling revealed 20% utilization of browse. This winter might reveal browsing patterns in severe winters.

AR - Is a new classification system being used to help characterize moose habitat?

SF - No, still Viereck and Dyrness, but past Level 3 to subcategories. The goal is to stratify browse so that heavy and light browse areas can be separated.

RF - Was all vegetation mapping described in Exhibit E done from 1:120,000 1980 U2 photography?

SF - Yes.

AR - Does Exhibit E contain all work completed up to this point, so that new data will go into the June 30 document?

RS - Yes. We will indicate work in progress if it is not complete.

WILDLIFE AND BOTANICAL RESOURCES GROUP - 3

SF Described the ground truth data available. No endangered wildlife species were found except 2 transient peregrine falcons sighted in 1974.

Prioritization of species: 1) moose, 2) caribou, 3) brown bear, 4) black bear, 5) other big game, 6) furbearers, 7) raptors, 8) waterfowl, and 9) other birds and small mammals. Moose in the middle basin were studied separately from moose along the downstream floodplain.

KS - New census this fall showed more moose in the Susitna River downstream of Devil Canyon than have ever been measured there before.

SF described moose calving areas, food habits, and mortality. A strong relationship was found between calf mortality and snow depth. Brown bear predation was also important.

KS - Black bear predation is important as well. Early green-up of vegetation in the river valley may be important to cows that are about to calve, even if the area is not a true winter range.

SF discussed the Nelchina Caribou Herd, its present and historical size and range, traditional calving areas, and its subgroups. He then described Dall sheep in the project area.

KS - Sheep sighted in the Watana Mountain - Grebe Mountain area are probably a subgroup of the main Talkeetna Mountains group. The number within the Susitna watershed could vary.

SF discussed brown bear, their denning habits, food sources, density estimates for the impoundment areas and downstream.

KS - Yes, one would expect brown bear populations to decrease downstream due to poorer habitat and lower elevation.

SF discussed brown bear productivity and hunter harvest. He then discussed black bears, their distribution, denning habits, food sources, and mortality. He further described the wolf packs of the middle Susitna basin, the lack of coyotes, the ranges and densities of wolverine, and the studies of belukhas in Cook Inlet.

KS - Belukhas feed on anadromous fish. Smelt runs in Cook Inlet are also an important food source. Have they been studied?

15 Minute Break

SF continued his presentation with the baseline descriptions of beaver, muskrat, marten, red fox, lynx, coyote, and weasels. He then described the field work that has been done to characterize birds in the project area -- 135 species were recorded in the middle basin, including, in 1981, active nests of 6 golden eagles, 5 bald eagles, 1 gyrfalcon, 2 goshawks, and many raven. Relatively low numbers of waterfowl were found in the middle basin.

WILDLIFE AND BOTANICAL RESOURCES GROUP - 4

The data from these years of small mammal trapping were used to characterize these species.

AR - What is your perception of the completeness of the baseline information? How about information on population increases or decreases, or the quality of the habitat?

SF - Much of that information is included in Exhibit E.

AR - Are there any gaps in that type of information? Are the data being gathered? When will they be available?

SF - Yes, some gaps have been identified.

RS - We are still trying to determine which gaps are most important and design the 1983 field season around these data needs. We have made preliminary recommendations to the Power Authority, but the actual program is still being worked out.

SF - We are expecting input from USFWS and other investigators.

RS - Technical meetings between now and December 6 should also provide some input.

SF - Ann, do you have any particular data gaps in mind?

AR - No, since I haven't had time to read Chapter 3 yet, I don't know what's already covered.

KS - I hope we can get the 1983 field program set up this winter. All issues should be identified.

AR - I'm glad to see the vegetation mapping is being re-done and that you are not just accepting the inadequacy of the earlier data.

SF - The new vegetation maps will change some of the wildlife population estimates that are based on densities.

AR - Will the original researchers (principal investigators) be given the new vegetation maps to rework their data?

SF - All the data will be reworked, but not necessarily by the original researchers. The new vegetation maps will be digitized.

RS - Early planning for field studies will be important, especially if this is the severe winter we have all been waiting for. We need a contingency plan to see where the moose are during a severe winter, and to conduct early spring vegetation studies to check the importance of green-up for moose.

WILDLIFE AND BOTANICAL RESOURCES GROUP - 5

AR - Are there any bear studies being planned?

SF - Yes, but those studies will be done in August, so there's more time for planning.

SF then began a description of the impacts of Watana development on moose. Prioritized impacts included: 1) permanent loss of habitat, 2) blockage of movement, 3) disturbance, 4) accidental mortality, 5) alteration of habitat, and 6) increased hunting mortality.

AR - Hunting regulations are political, and thus are not predictable. Unless recommendations are actually part of the license, they will not necessarily be followed.

KS - Project personnel are easier to regulate than the public. Many different regulatory options are available. Permitting to restrict harvest is easier than closing the road.

RS - The license application can state what the Power Authority will do, but can only state options for issues under ADF&G jurisdiction.

LA - Has any consideration been given to regulations that Native corporations may impose? They can control access - trespass - but can't directly regulate hunting.

RS - This is another issue that is not directly under Power Authority jurisdiction. We are not presently planning to discuss options open to private landowners.

SF resumed the discussion of moose impact. Two approaches are being used to predict impacts to moose: a population based assessment, and a habitat based energetics model. To determine the quality of moose habitat, energy and protein content of browse must be known. Vertical distribution of browse, and consequently the amount available at different snow depths, is also important. In order to get this data, trial moose browse sampling studies will be conducted in the field next summer and the vegetation of the area will be re-mapped to identify variation in moose browse potential.

AR - Both summer and winter vegetation sampling will be necessary to accurately determine energy and protein content of browse.

SF agreed, though most work would have to be done in the summer when the whole plant was available for sampling; some sampling would have to be done in the winter. Brown bear predation and critical winters are probably two factors limiting moose population. A large browse sampling program is planned for the summer of 1984, the data will be worked up that fall, then modelling will be done the next spring (1985).

WILDLIFE AND BOTANICAL RESOURCES GROUP - 6

AR - The document (Exhibit E) should clearly describe any work that is going to be done, and its schedule.

SF - We are also working on mitigation and enhancement techniques, and identifying candidate areas.

KS - Compensation may be the main mitigative technique for moose.

SF described impacts to downstream moose. Changes in vegetation succession should favor moose during the license period. Frozen condensation on vegetation due to open water could reduce browse availability. Open water could cause changes in plant phenology and will act as a barrier to moose movements.

Although caribou are excellent swimmers, the impoundment may influence their movements, as may ice shelving and drifted snow. Long-term monitoring programs will be necessary to determine impacts.

RF - How is FERC going to respond to this lack of specificity with respect to caribou?

KS - These types of impacts are difficult to mitigate except through the no project option. Out-of-kind mitigation will be discussed after the impacts have been assessed during construction and operation.

RS - FERC realizes the limitations of biological prediction and would prefer no numbers to unreliable numbers. Indicating that further investigations will be done is acceptable, if sufficient detail is provided.

SF discussed the impact of borrow areas on caribou, then went on to Dall sheep. The two major impacts on Dall sheep are: 1) aircraft disturbance, and 2) inundation of 20-40% of Jay Creek mineral lick. The consequences of the inundation of the lick are not certain.

KS - It might be useful to do some slope stability studies of the lick. Inundation might even enhance it through erosion exposing fresh mineral soil.

30 Minute Lunch Break

SF continued the description of impacts likely to result from Watana development. There will be no population effects on brown bear due to facilities or borrow areas. However, the impoundment might alter movement patterns. Any mitigation measures to enhance brown bear populations will conflict with moose mitigation since brown bears are their predators.

The resident bear black bear population in the Watana area could be eliminated due to the inundation of den sites. The transient black bear

WILDLIFE AND BOTANICAL RESOURCES GROUP - 7

population might be affected by decreases in salmon runs.

KS - Both bear species use several different, scattered food sources which will be more or less important in different years. Pinpointing the factor limiting bear populations is difficult, consequently the effect of the dam is difficult to predict.

SF - No known wolf dens or rendezvous sites will be flooded. Disturbance during the denning season could cause increased pup mortality.

KS - Activity sensors on wolves showed that helicopters caused reactions, but the wolves, even one in a den with pups, become habituated. Good data are available on the optimum time of day and season to minimize disturbance.

SF - Human harvest of wolves seems to be the limiting factor, not food supply. The same is true of wolverines.

Impacts on belukha whales could occur through changes in water temperature on fish runs, as has been shown for the St. Lawrence River. Neither is expected to change detectably at the Susitna mouth as a result of the project. Bears are expected to benefit from downstream flow regulation. Marten will lose habitat and are also expected to suffer from increased trapping pressure.

More precise data on the altitude of raptor nests is necessary to quantify impacts. Possible mitigation methods include: 1) building new nest structures, 2) moving nests, 3) exposing new nesting rock by blasting, 4) building artificial cliffs, or 5) topping trees to improve their nesting potential.

Waterfowl should benefit from the increased open water. Other birds and small mammals will suffer from habitat loss. Some species will benefit from the mitigation measures proposed for moose.

AR - Looking at the project as a whole, is wildlife diversity being maintained or are moose being favored to the neglect of other species? In some areas different species may be more important than moose.

SF - Other species are being considered, but there has to be some prioritization of species.

Impacts due to Devil Canyon are similar to those expected to result from Watana development, but generally less severe because of the smaller size of the impoundment and the steeper slopes of inundated terrain.

Transmission line impacts will be minimized by constructing in the winter time or using helicopter support. Some trees will be cut, but brush will be left - no clear cutting.

WILDLIFE AND BOTANICAL RESOURCES GROUP - 8

- AR - Do you have any plans to quantify the impacts of different alternative construction methods?
- RS - No, Chapter 3 is not supposed to review options, but rather to present the impacts of the chosen option.
- KS - If the project is not clearly defined, with the associated impacts of each decision, then reviewing the project is difficult.
- AR - The construction method with the least impact should be strongly supported.
- GS - Are the costs of different options included?
- AR - Exhibit E should contain a table of project impacts and corresponding mitigation measures. All project aspects should be presented and evaluated.
- GS - It is important for the reviewing groups to keep up with any changes.
- KS - Is there any mechanism to let agencies know of any change?
- RS - The Power Authority would do that. Decisions such as the access road design speed have been changed due to environmental involvement, and we have written Chapter 3 according to the new decision, but we haven't seen the maps from R&M incorporating that decision yet.
- AR - What was the level of communication during the engineering design?
- RS - We have had formal interaction by memorandum (RS passed around several examples), and also much informal communication in meetings with project engineers.
- GS - The access road has potentially severe impacts. A strong recommendation may be made to FERC to change it. The road between the dams might change also, due to Native bargaining.
- RS - That would not be surprising, since the environmental issues really haven't changed. However, we are writing Exhibit E as if the decision on access was firm, and including mitigative measures relevant to the route in question.
- SF described the impacts of the access road including increased hunting pressure, increased road mortality, increased disturbance, increased ATV use.
- KS - There is not a direct relationship between caribou herd size and range size. Management goals for the Nelchina herd are now +20,000, but that could change. Changes in potential caribou habitat are important, even if the population is not immediately affected. 70,000 is too high a population for that herd, and historically caused a population crash.

WILDLIFE AND BOTANICAL RESOURCES GROUP - 9

However, a higher ceiling of 30,000 - 40,000 is being considered and should be used for your planning.

LA - The population is presently increasing and will continue to increase unless there is some regulatory change.

KS - When access increases, hunting demand will increase.

SF described the potential effects of the access roads on caribou. Predicted road traffic levels are low: 20-30 trucks/day.

KS - Traffic data averaged over a year is not good enough. It is important to know about peak traffic flows: when they occur and what the maximum number of vehicles would be. The impact on animals depends on the time of year.

GS - We need clean traffic data to be able to estimate impacts.

KS - The time of day of peak traffic might be more important than the time of year.

AR - Suggestions are not being followed in the Terror Lake project. We need to tie mitigation down, to be specific.

KS - We should request some socioeconomic data on traffic predictions.

AR - The access plan includes a railroad which will also have an effect on moose.

SF - In Canada, plowing railroad tracks with a wide plow that left no berm did not decrease moose mortality. Eight additional train cars per week will be travelling as a result of the project.

KS - The trains should be scheduled to minimize moose encounters. Scheduling trains close together and using longer trains would also minimize encounters.

GL - Have the effects of the access route mentioned earlier - roadside dust and ATV use - been quantified in terms of loss of habitat on animals?

RF - Roadside dust could actually be beneficial, causing earlier melting, and thus early browse.

KS - Impacts should be examined to see if they're significant.

RS described in-kind mitigation. Borrow sites will be upland areas preferentially. First level terraces will be mined using draglines. Guidelines to minimize impacts of borrow areas were described. Locations of borrow sites for Watana and Devil Canyon dams were also described. Guidelines for camp facilities, access roads, and transmission lines were reviewed.

WILDLIFE AND BOTANICAL RESOURCES GROUP - IO

AR - Do Exhibit E transmission corridor studies include the intertie?

RS - Yes, but most of the data is from the Environmental Assessment Report prepared by Commonwealth Associates.

AR - Helicopter construction was agreed to on some sections of the intertie, but then maintenance wasn't going to be done by helicopter. The result was less helicopter use.

MG - How do these things get dropped through the cracks?

AR - The decisions are not written down.

JZ - It is not clear exactly when the decisions are made.

AR - If a decision is written into the permit, then it will happen. But if only recommendations are made, they often aren't followed.

RS - The scope of work for subcontractors has to be very detailed. Salary and schedule provisions should be established in the design consultants' contracts to facilitate their working as a team with the project environmental specialists. At present, a few gray areas still exist - the regulation of access by workers during construction, extent of clearing and helicopter support for building and maintaining the transmission corridor. But these are basically policy decisions.

AR - These gray areas should be identified, so that if things change, we have some idea of the impacts of the new option. Construction bids should include all details to make sure the stipulations don't get forgotten.

RS - So far we have only prepared guidelines, but our portion of the application assumes that they will be followed. There is an important need for consistency, to make sure the commitments are really acceptable to all parties, and are reflected in all sections of the license application.

RS went over the list of environmental guidelines, which are included as an appendix of Chapter 3 in Exhibit E. Management decisions by some organizations other than the Power Authority will have an effect on mitigation plans: ADF&G, USFWS, BLM, etc.

LA - Ahtna has no plans to develop land if Susitna is built - there is no cash incentive.

RS discussed the recreation plan developed by EDAW, which includes phased implementation, with interagency review and concurrence between phases. He described biological input to that plan.

SF discussed using periodic flood releases (30,000 cfs) to mitigate for maturation of downstream floodplain vegetation.

WILDLIFE AND BOTANICAL RESOURCES GROUP - 11

- AR - Have these plans been discussed with the aquatic group?
- KS - How about the legal impacts of causing property destruction?
- SF - These questions and others such as candidate areas and alternative methods for habitat enhancement will all take lots of negotiation. Ideas such as controlled burning, irregular selective logging, vegetation crushing are all being considered.
- KS - Enhancement of moose habitat is possible, but some impacts cannot be mitigated. Quantification of impacts is perhaps not too important in these cases. General enhancement actions could be taken to preserve the quality of the area, such as preserving Stephan Lake from development.
- RS - FERC is interested in the mitigation process that is being set up, including long-term monitoring studies. They want a description of the program, expected products, and the schedule.
- RF - I'm interested to learn specifics of what will be in the FERC license application, and FERC's response to non-specificity.
- RS - FERC wants a mitigation plan, not a plan for a plan. However, FERC realizes that some aspects of planning may be beyond the Power Authority's jurisdiction. They are also interested in cost estimates for the mitigation plan.
- KS - The cost of mitigation options is difficult to estimate. There may be some trading of State land, and some outright purchase of compensation lands.
- RS - Some measures are easier to assign a cost to, such as engineering design modifications, incinerators, and other points mentioned in the environmental guidelines. The cost of long-term compensatory measures is much more difficult to ascertain, especially since some decisions won't be made until later in the project.

WETLANDS MEETING

Thursday, December 2, 1982

Holiday Inn, Anchorage, Alaska

ATTENDEES

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Bill Steigers (BS)	U of A, Ag. Exp. Sta.	Palmer	745-3257
Judy Zimicki (JZ)	No.Ak. Environmental Ctr.	Anchorage	277-2134

RS introduced the meeting. He discussed the ambiguity of the wetlands classification system used in previous mapping. The goal of this meeting was to come up with a practical method of defining and mapping wetlands to facilitate USFWS review and Army Corps of Engineers (USCE) permitting under Section 404 of the Clean Water Act and possibly Section 10 of the Rivers and Harbors Act of 1899, and to aid facility siting. LGL is looking into the possibility of incorporating wetlands mapping as part of the vegetation re-mapping program.

MR presented a summary of wetlands work that has been done to date. Some work was done to characterize aquatic vegetation of ponds in the project area. That work has been presented as part of Chapter 3 in Exhibit E. Wetlands mapping was done using the Cowardin classification system of the U.S. Fish and Wildlife Service (USFWS). Two sets of maps were produced. One, at a scale of 1:24,000, consists of 7 maps of the two impoundment areas. The other, a set of 3 maps at a scale of 1:63,000, mapped alternative access routes. Vegetation maps of the same scale were used as base maps. A system for converting Viereck and Dyrness vegetation classes to Cowardin vegetation classes was developed (see Table 46, Phase I Report, Plant Ecology). Using Cowardin's definition of wetlands, all wet herbaceous, all shrub, and all forest vegetation-types were mapped as potential wetlands. A subjective judgment of slope was made to eliminate steep, well-drained areas. No re-interpretation of the imagery or ground truthing was done.

JH, when asked how USFWS maps wetlands, replied that they use aerial photography, following the Cowardin system, look for one of three characteristics: flooding, hydrophytes, or hydric soils.

WETLANDS MEETING - 2

- RF - According to Cowardin's definition then, wetlands were appropriately mapped for the Susitna Project.
- JH - Some plant species occur only in wetlands. Many, however, occur in both wetland and upland areas. Then you have to look at the other criteria.
- RS - In order to identify procedures and criteria for wetland mapping, we need to know if the Corps accepts Cowardin for Section 404 permitting.
- TR - We accept and use Cowardin, but it is not always sufficient for Section 404 decisions. Often the USCE jurisdictional boundaries are different from the wetland boundaries. The National Wetlands Inventory (NWI) maps are at a good scale for large projects. However, we often need soil data because all three parameters (flooding, hydrophytes, and hydric soil) are necessary to define USCE wetlands. The Corps also needs hydrologic data to know how a given wetland ties into the watershed.
- RF - The huge scale of the project area (over 60,000 acres) makes it difficult to map. How much sampling would be necessary?
- TR - Sampling areas can be representative of other areas. Maps are only needed of impact areas: roads, borrow sites, camp sites, etc. No wetlands maps of the impoundment areas are needed.
- JH - For USFWS, you do need wetland maps of the impoundment area.
- RF - No need for soils maps of the impoundment.
- JH - Slopes should not be arbitrarily excluded from wetland categories. Larger scale color infra-red photography should have been used. In the Tanana River basin, USFWS is using the Viereck and Dyrness classification system and a wetlands modifier to map the area. The resulting map is easy to convert to the Cowardin classification system. The water regime modifiers in Cowardin's system are especially useful to USCE.
- RS - Remapping of vegetation will be done to Level 3 and beyond for moose browse vegetation types.
- RF - For most areas, we have vegetation maps and slope is available from contour maps. Might need more soil work.
- TR - Once we have maps of the vegetation, hydrology, and project impacts, we'll be able to see where more data such as soil types is necessary.
- RS - Are the soil parameters USCE needs available from engineering borings and soil pits?

WETLANDS MEETING - 3

- RF - Some soil maps exist, though I don't know their scale or adequacy.
- RS - The Soil Conservation Service has not mapped all of the Susitna area. Several questions still need to be answered:
- 1) Appropriate level of detail of vegetation mapping to be useful for wetlands classification?
 - 2) What soil parameters are important to USCE?
- JH - Even Level 4 of the Viereck and Dyrness system doesn't allow direct conversion to wetland categories. Often, other data are needed.
- TR - Ground truthing will be very useful. The USCE personnel who will be responsible for permitting should go along.
- RF - What time of year is best for ground truthing?
- TR - Anytime during the growing season.
- RS - The people doing the vegetation mapping will be working on the ground truthing next summer.
- JH - With a group of people who are familiar with the area, we should be able to sit down with the USCE and a wetlands map and decide which areas need USCE permits and which areas are marginal and need ground-checking.
- RS - Is it proper procedure to involve USFWS and USCE in the preliminary process and ask you to review drafts?
- JH - I'd be glad to work with you.
- TR - Yes, certainly, we prefer it that way.
- BB - Have you discussed the types of permits required? They are:
- USCOE Section 404 - all waters of the U.S.
" " Section 10 - navigable waters - below Devil Canyon.
U.S. Coast Guard - navigable waters - south of Portage Creek.
- TR - The USCE definition of navigable waters may not be the same as other agencies. If Section 10 jurisdiction hasn't been taken yet by USCE, then it will not be.
- RS - We need to alter the approach to vegetation mapping to be sure to distinguish wetlands. We may need to map more vegetation types beyond Level 3.
- RF - Only in access and transmission corridors.

WETLANDS MEETING - 4

RS - We can restrict the mapping to known corridors and impact zones. The major borrow areas for the dams have also been identified. The borrow areas for the access road have not been finalized, but some potential borrow areas have been indicated.

RF - Those potential borrow areas aren't likely to change much.

RS - What should be included in FERC application? I would suggest:

- 1) Wetland maps already prepared.
- 2) Discussion of their preparation and coverage.
- 3) Plans to rectify problems.
- 4) Revised maps coming later. (The new maps can be submitted as supplements when they are done).

JH - I would be concerned about including the old maps.

TR - Could you modify the old maps by double-checking them with some aerial photography?

RF - Might be possible, but probably not by February 15.

JH - It would only take 3-4 days to map wetlands in the whole area (impoundments only). The cartographic work, however, would take awhile. From the slides (John Hayden's talk on Monday), upland wetland areas looked fairly easy to define.

RS - We want to confirm to FERC that we are handling wetlands thoroughly. We should list soil features that will be supplied to USCE.

TR - USCE needs soil profiles, from the litter layer down to ground water, depth to ground water, chroma, mottling, gleying, soil type, location of soil pits. Primary interest is in the root zone, the top 18" - 24". We would be glad to work with any field personnel for a few days to explain the USCE requirements and sampling methods.

TR - A few days work should give us a fairly good jurisdictional map.

JH - The first step would be a wetlands map; regulatory wetlands will be a subset of that.

TR - Final COE regulations are expected by December 15. Our jurisdiction could change.

DM - JH might be interested in talking to Dr. Talbot who did some vegetation sampling in the Susitna basin several years ago.

WETLANDS MEETING - 5

AR - I would like to clarify the timing - the vegetation maps will be drawn up first, so there will be no new maps by February 15. Would the new wetlands map be ready by June?

RS - The vegetation and wetlands mapping will take all spring. We hope to have the preliminary maps by June 30. Ground truthing will be done during the summer, then the final maps will be drawn up. FERC has stated that they will welcome any new data or maps after the June 30 submittal.

RS - To summarize our agenda:

- 1) Get together with Jon Hall and Ted Rockwell to identify appropriate level of detail for vegetation mapping.
- 2) Clean up previous work using aerial photography.
- 3) Prepare discussion of mapping, past and future, for February 15 submittal.
- 4) Coordinate with USCE to get soils data.
- 5) Summer ground truthing.
- 6) Fall: final maps available.

TR - When do you expect to need the first USCE permit?

RS - For building the access road.

MG - Access road construction is scheduled to begin spring 1985.

TR - After the final maps are available in late fall 1983, there will still be time for further field work in the summer of 1984. If construction begins before 1985, then all permit fieldwork has to be done next summer.

RS - There may be wetlands permits required for test drilling and other pre-construction field activities that are planned for next summer.

TR - If so, they should be identified this winter to avoid any permitting delays.

BB - There will be a major staging area around Cantwell, widening the Denali Highway, and a transmission line from Cantwell to Watana. These activities may also need permits. Will the Section 404 permits require socioeconomic input?

TR - Section 404 is not strictly biological, but must also consider the public interest which includes socioeconomics, etc.

RS - How should wetlands be included in various sections of the FERC application?

WETLANDS MEETING - 6

- MG - The whole wetlands section could be repeated verbatim in both the Botanical and Land Use sections.
- RS - I would suggest that permit related discussions go into the Land Use chapter of Exhibit E, and biological discussions into the Botanical Resources section of Chapter 3.
- RS - I would like to set up a project/agency group that will work together on a regular basis. (General agreement).
- BB - Someone should look into the Section 10 question.
- TR - I'll do that and use RS and RF as contacts.
- AR - Any plans for future work on wetlands should be clearly laid out in the application.

AGENDA

WATER USE AND QUALITY AND FISHERY RESOURCES

Monday, November 29 1:00 P.M.

Introduction

Project Operational Description

Watana Dam
Devil Canyon Dam
Access
Transmission

Schedule for Preparation of Exhibit E

Review Process and Group Definition

Tuesday, November 30 9:00 A.M.

9:00 - 10:45 A.M. Baseline, Reservoir Filling and Post Project Flows
and Water Levels

10:45 - 11:00 A.M. Break

11:00 - 12:00 A.M. Reservoir and Downstream Sedimentation and River
Morphology Changes

12:00 - 1:00 P.M. Lunch

1:00 - 2:30 P.M. Reservoir and Downstream Water Temperatures

2:30 - 2:45 P.M. Break

2:45 - 4:30 P.M. Ice Processes - Existing, Construction, Reservoir
Filling and Operation

Wednesday, December 1 9:00 A.M.

9:00 - 10:45 A.M. Groundwater Upwelling and Water Temperatures in
Sloughs

10:45 - 11:00 A.M. Break

11:00 - 12:00 A.M. Other Water Use and Quality Concerns

12:00 - 1:00 P.M. Lunch

1:00 - 2:30 P.M. Fishery Phenology of Susitna River System
Impoundment, Devil Canyon to Talkeetna, Talkeetna
to Cook Inlet.

2:30 - 2:45 P.M. Break

2:45 - 4:30 P.M. Presentation of 1982 Fishery Data

Thursday, December 2 9:00 A.M.

9:00 - 10:45 A.M. Fishery Impacts and Mitigations - Construction

10:45 - 11:00 A.M. Break

11:00 - 12:00 A.M. Fishery Impacts and Mitigations - Reservoir Filling

12:00 - 1:00 P.M. Lunch

1:00 - 2:30 P.M. Fishery Impacts and Mitigations - Filling and Operation

2:30 - 2:45 P.M. Break

2:45 - 4:30 P.M. Fishery Impacts and Mitigation - Operation

Friday, December 3 9:00 A.M.

Summary Session - Reports by Each Group Leader

- Minutes of Meeting -

Subject: Susitna Hydroelectric Project Water Use and Quality and Fishery Resources Workshop (see attached agenda)

Location: Holiday Inn (Anchorage Room)
Anchorage, Alaska

Attendees: see attached

Date: Tuesday, November 30, 1982 9:00 A.M.

Minutes recorded by: Michael P. Storonsky

I. Baseline, Filling and Operational Flows and Water Levels - Wayne Dyok (Acres)

A) Summary

Mr. Wayne Dyok provided an overview of the existing, and the proposed filling and operational flows and water level conditions aided by the use of overhead view graphs.

B) Baseline Flow Conditions

(i) Flows

- location of gaging stations
- identified the process by which the 32 year flow scenario was developed from the available data
- various Susitna River basin flow contributions to Cook Inlet
- monthly flow duration curves
 - . winter low flow provided by ground water
 - . May - breakup occurs with substantial variation in flows
 - . August flows > 10,000 cfs approximately 97 - 98% of the time
- 1, 3, 7, and 14 day low flow frequency curves at Gold Creek for July and August
- 1, 3, 7, and 14 day high flow frequency curves at Gold Creek for July and August

- Annual flood frequency curve at Gold Creek
 - . mean annual flood 49,000 cfs

(ii) Water Levels

- cross-section near Sherman at River Mile (RM) 131
 - . water level elevation with various discharges

6,000 cfs	MSL 604'
52,000 cfs	MSL 611"

C) Construction - Watana

(i) Flows

- no interruption of flow
- a sill will be maintained during construction of the tunnels, then removed when the lower tunnel is complete
- lower tunnel diameter 38', between MSL elevations 1420' and 1458'
- thalweg of river MSL 1450'
- upper tunnel for higher flows only

(ii) Water Levels

- winter
 - . pool maintained at elevation 1470'
 - . backwater effect approximately 1/2 mile
- summer
 - . mean annual flood increase elevation from 1468' to 1520' at dam
 - . backwater effect 2 miles

D) Filling - Watana

- minimum flow requirements at Gold Creek
 - . November - April 1,000 cfs
- described expected downstream flows, based upon pre-project conditions for the three hydrological sequences: 10%, 50% and 90% exceedence
 - . little difference during winter
 - . October significant difference during 1992
- Gold Creek chosen as representation of Talkeetna to Watana reach

- water levels at River Mile 131
 - . during August, with 22,000 cfs pre-project average vs. 12,000 cfs filling average, there will be a 1 1/2 foot change
 - . approximately 3 foot change during early summer
 - . however, maintain at least 2 feet of water in river channel at all summer flows
- compared Gold Creek, Sunshine and Susitna Station and indicated that differences in both flows and water levels will be moderated as you progress downstream

E) Operation - Watana

- minimum downstream flows 5,000 cfs during winter
- post-project flows at Watana, Gold Creek and Sunshine
- Flow variability - Natural and Filling Conditions - Discharge at Gold Creek
- Summarized operational change expected
 - . substantially increase winter flows
 - . substantially reduce summer flows

Question Is there any upper limit to winter discharge and if so is it based upon fisheries requirements or power demand?

- Answer**
- Maximum Watana powerhouse flows will be 19,000 cfs.
 - no upper limit has been established yet
 - it may be desirable in future to establish maximum winter flow criteria
 - Gold Creek post-project winter flows will average 10,000
 - can probably establish a maximum winter flow of 14,000 cfs at Gold Creek
 - Sunshine post project flow
 - . still substantial winter increase from baseline
 - . May and summer much closer to baseline
 - Susitna Station post-project
 - . winter - substantial increase
 - . summer - very little difference

- Question** What is the difference between winter pre- project vs. operational flows at Susitna?
- Answer** 14,000 cfs operational flow vs. 7,000 cfs pre-project, therefore, winter flows will be doubled at Susitna Station
- Question** How will Watana operate if Devil Canyon is never built? Have impacts been assessed for Watana alone or with both dams operational?
- Answer** Watana will be base-load. Most of impact assessment has been concentrated with both dams on line.
- Answer** Consideration of peaking should not be ruled out. It is possible to peak if only Watana is built. May have sufficient attenuation of peaks downstream in a short distance if peaks are of short enough duration, with only minor impacts further downstream as a result of attenuation.

F) Filling - Devil Canyon

- 2 stage scenario
- 1st stage
 - . 76,000 ac-ft.
 - . fill within a couple of weeks
 - . maximum elevation 1,135'
- one year at constant elevation 1,135 to plug diversion tunnel and complete dam
- 2nd stage
 - . fill as quickly as possible
 - . filling will take approximately 5-8 weeks depending on energy demand
 - . 25 foot drop in Watana water level

6) Operation - Watana and Devil Canyon

- Watana peak
- Devil Canyon baseloaded
- Devil Canyon outflow similar to with Watana alone
- Devil Canyon will experience approximately a 1 foot daily drawdown with Watana peaking

H) Watana Drawdown and Flow Scenario Derivation

(i) Minimum flow requirements

- 7 scenarios studied
- no difference between winter flows; all 5,000 cfs
- different summer flows
- August was determined the critical time frame because of the need for salmon to gain access to the sloughs

(ii) Net benefit from project (\$) vs. August flows

- 10,000 cfs \$1,220 x 10⁶
- 12,000 cfs \$1,140 x 10⁶
- 14,000 cfs \$1,050 x 10⁶
- selected 12,000 cfs
 - . compromises economics somewhat
 - . provides a starting point upon which mitigation can be based

Question Are the economics of the project based upon the 1981 Batelle forecast?

Answer Yes

Question How would the benefits vs. flow scenario change if the Batelle load forecast is incorrect and the load is reduced?

Answer Not able to answer without further investigation. (Ed. note - shape of curve would basically remain the same. absolute value of benefits would decrease with lower demand forecast)

II. Baseline Slough Information - Woody Trihey (Acres Consultant)

A) Summary

Mr. Woody Trihey provided a description of a side slough in the Susitna River including morphological characteristics (cross sectional profile, gradients), flows, and water profiles with various flows.

B) Introduction - River System and Typical Slough

- river broken into 3 segments
- only discuss the Watana to Talkeetna segment
- will look at flow regime only, however, quality and availability of habitat may also be affected
- several different types of habitat in the river system
 - . mainstem
 - . tributary
 - . side channel
 - . side slough
- will talk about side slough habitat only, potential for most impact
- currently evaluating August as most important time of the year
- typical slough and river sketch
 - . interim channels have eroded from river to side sloughs
 - . very often no water through the interim channels
- flows
 - . sloughs typically clear water, low flows
 - . river turbid
 - . backwater effect at mouth of sloughs
- high flows
 - . heads of sloughs can be overtopped at high flows causing turbid flows
 - . flows up to 1,000's of cfs during flood conditions
 - . flush out the fines
 - . act as a side channel during flood

C) Slough 9

(i) Longitudinal profile

- noticeable gradient difference between upper and lower ends
 - . upper 18 ft/mile
 - . lower 5 ft/mile
 - . river 11 ft/mile

(ii) Flows and Stage

- irregular nature of the sloughs causes pools to occur at low water
 - . discharge of 3 cfs. creates three pools of approximately 0.7 feet, 1.5 feet and 3.0 feet.
- staff gage at mouth of slough
 - . 11,000 cfs 590' MSL
 - . 33,000 cfs 594' MSL
- slough profiles provided at various mainstem flows
 - . 12,500 cfs
 - . 16,000 cfs
 - . 18,000 cfs
 - . 22,000 cfs
 - . between 18,000 - 22,500 cfs remove barrier to upstream areas of the slough
 - . 16,000 cfs creates 0.25' depth for 140' length of slough
 - . 20,000 cfs creates 0.5' depth for 30' length

Question Where are the spawning areas in Slough 9?

Answer Some chum salmon were observed during 1982 above the first barrier, however many were observed attempting to spawn at the mouth of the slough. However, August 1982 had unusually low flows of 11,000 - 12,000 cfs and salmon had difficulty attaining access to sloughs. Normally, flows are in the 18,000 - 25,000 cfs and access is not usually a problem

- Question** It looks like 14,000 - 17,000 cfs is needed to obtain access to slough?
- Answer** Yes, if only looking at flow, however utilizing engineering techniques, backwater effects could improve access.
- Question** How did we arrive at 12,000 cfs? Don't we need flushing flows to clean out sloughs?
- Answer** We believe that this is a starting point and that we are progressing towards a set of unique flows for each month, not there yet.
- Question** Isn't the backwater effect going to change with reduced flows?
- Answer** Yes
- Question** What percentages of sloughs with 12,000 cfs flows will salmon have difficulty with access?
- Answer** Can't answer right now, but should have a better handle next summer.

III. Reservoir and Downstream Sedimentation - Mr. Brent Drage (Peratrovich, Nottingham and Drage)

A) Summary

Mr. Brent Drage provided a description of the anticipated sedimentation process in the reservoirs, among the major topics included were the mechanisms influencing sedimentation, the existing situation, and the expected changes in particle size distribution, suspended sediment concentrations and turbidity.

B) Sedimentation Process Factors

- if 100% trap efficiency assumed, over 100 years, only 5% of the reservoir volume lost, or 12% of active storage
- factors influencing sedimentation
 - . operational schemes
 - . mean monthly volume
 - . live storage volume
 - . dead storage volume
 - . change in surface elevation from the previous month
- driving mechanisms
 - . inflow
 - . outflow
 - . flow thru velocity
 - . detention time
 - . ice cover present
 - . mean ambient temperature
 - . mean reservoir temperature
 - . thermal trend
 - . inflow temperature
 - . flow pattern
 - . mixing potential
 - . thermal current velocity
 - . wind driven current velocity

C) Existing Conditions at Gold Creek

- (i) Suspended sediment concentrations at Gold Creek - May - Sept.
 - minimum range 10 - 200 mg/l
 - average range 200 - 1,000 mg/l
 - maximum range 2,000 - 3,000 mg/l
- (ii) Average monthly particle size distribution
 - May, June, July and August
 - fine silt and clay particles less than 12 microns most important

D) Expected Conditions

- (i) Particle size range passing through
 - 3 - 4 micron range particles will pass through during quiescent conditions
 - mixing action of wind and waves will allow up to the 12 micron size range to pass through the Watana Reservoir

- (ii) Settling rates - Stokes Law
 - assume quiescent conditions at 40°F
 - . 5 micron glacial particle, 3.7×10^{-5} ft/sec.
 - . 5 micron spherical particle, 4.3×10^{-5} ft/sec.

- (iii) Depth of particle settling over time - quiescent conditions
 - 2 micron particle - 400 days to settle 200 ft
 - 5 micron particle - 60 days to settle 200 ft
 - 10 micron particle - 20 days to settle 200 ft

- (iv) Settling column study
 - sample taken at Watana at flows of 17,200 cfs
 - 10 foot column
 - 350 mg/l at time 0
 - 10 - 20 mg/l after 72 hours

- (v) Effects of wind and waves
 - wind waves will significantly effect settling within 25' of surface
 - 10 - 12 micron particles will be re-entrained within the top 25 feet
 - wind waves will effect at 50' depth significantly less

- (vi) Prediction of particle size distributions - using Camp's (1943) solution
 - gives us an idea of the size of the particles that will settle and amount of sediment for different settling conditions
 - results for maximum mixing, minimum mixing and quiescent conditions

(vii) Results of deposit model runs

- maximum and average mixing

(viii) Turbidity vs. suspended sediment concentrations

- appears to be direct correlation
- maximum mixing 100 - 200 mg/l = 20 - 40 NTU
- normal mixing 80 - 120 mg/l = 15 - 25 NTU
- minimum mixing 10 - 30 mg/l = 2 - 5 NTU

(ix) Literature search

- extensive search conducted, but not much information available
- however Eklutna Lake appeared to have the most similar characteristics

Question What will the difference be between pre-project vs. post-project turbidities during winter?

Answer Probably safe to say it will be between 20 - 40 NTU post-project discharge.

Question Has input from other sources been included?

Answer They were considered, but not included in the model. It is expected that the material contributed from other sources will be coarser and settle out shortly, contributions should not be significant.

IV. Eklutna Lake Study - Steve Bredthauer (R&M Consultants)

A) Summary

Mr. Steve Bredthauer provided the following discussion regarding the Eklutna Lake turbidity studies that were conducted due to the lake's close similarities to the Watana Reservoir.

B) Information Collected

- Kamloops Lake, British Columbia, information available
- sampling scheme at Eklutna
- results
 - . April under ice 7-10 NTU
 - . May isothermal 7-10 NTU
 - . mid June starting to increase, 14 - 15 NTU at the lower end of reservoir
 - . mid July thermocline developing, plume was evident in the 10 - 30 meter range at head of lake, down the lake-turbidity diminished
 - . September - unusual turbidity at reservoir bottom - flows probably entering as underflow
- summary - Eklutna Lake data indicates the sedimentation process at Watana will be heavily dictated by densities of the river and reservoir waters

V. River Morphology - Steve Bredthauer (R&M Consultants)

A) Summary

Mr. Steve Bredthauer utilized overhead view graphs to facilitate his River Morphology presentation which highlighted the basic morphological systems of the river, a breakdown of the river by morphological reaches concentrating on the river downstream of Devil Canyon and the expected morphological changes.

B) Morphology of the River

(i) Four basic systems

- main channel
- side or split channel - (Sloughs)
- braided channel - floodplain 1 - 2 miles wide, large bedload movement
- Delta Islands 50 - 60 miles upstream of the mouth

(ii) Morphological reaches of the river

- upstream of Devil Canyon
 - . first 20 miles braided headwaters
 - . next 55 miles split channel
 - . west from Tyone River to Devil Canyon damsite-steep canyons
- Below Devil Canyon
 - . RM 144 - 149 - single channel
 - . RM 135 - 144 - valley broadens, with split channel
 - . RM 129.5 - 139 - well defined split channels, sloughs
 - . RM 119 - 129.5 - split channel configurations, stable shoreline
 - . RM 104 - 119 - well defined single channel
 - . RM 95 - 104 - Susitna-Chulitna confluence - braided system, aerial photo comparison shows this section to be a very dynamic area of the river
 - . RM 61 - 95 - braided, debris damming, very dynamic
 - . RM 42 - 61 - Delta Islands - rapid erosion evident
 - . RM 0 - 42 - Yentna River confluence, major tributary, 40% of river flow

(iii) Expected Changes

- bedload movement curves
 - . 10 - 30 mm size range moved with 10,000 - 20,000 cfs flow immediately downstream
 - . armouring will allow a well defined stable channel to occur
- tributaries
 - . analyzed 17 streams for degradation
 - . six were found to have potential problems with either perching or degradation
- in summary the river will be better defined, more stable and more deeply entrenched

VI. Eklutna Lake Water Temperature Study - Steve Bredthauer (R&M Consultants)

A) Summary

Following lunch, Mr. Steve Bredthauer provided a discussion of the results of the 1982 Eklutna Lake water temperature monitoring program and the Susitna River temperature data that is being and will be used to calibrate the DYRESM temperature model for Watana.

B) Results - Eklutna

May 25	isothermal 4 - 5°C
June 18	a little surface warming to 8°C
July 2	gradual warming
July 14	sharp thermocline in some areas, gradual temperature variation in others, 12°C - 5°C
July 28	same as above
August 10	sharp thermocline maximum 13°C
August 24	15°C maximum, lessening thermocline
Sept. 9	cooling
Sept. 21	isothermal 7 - 9°C
Oct. 14	isothermal 6 - 8°C
Nov. 4	isothermal 5°C

C) Susitna River Data

- average weekly temperatures at Watana gaging site
 - . October - April 0°C
 - . May starts to climb
 - . maximum of 12 - 14°C during summer
- 1981 temperature variations at Vee Canyon, Denali and Susitna Station
 - . warming with distance downstream
- 1981 Denali and Watana water temperature comparison
- 1982 Susitna River vs. Indian River and Portage Creek temperatures
 - . lower temperatures in tributaries than mainstem
 - . temperature varies between tributaries

VII. Reservoir Temperatures - Mr. Wayne Dyok (Acres American)

A) Editor's Summary

Mr. Wayne Dyok provided a generic description of expected reservoir and outflow temperatures during the filling and operation processes and the DYRESM model used to estimate the temperatures.

B) Filling - Watana

- 1st year fill from 1470' - 1800 ft
 - . outflow temperatures will be a composite of inflow temperatures
 - . low level outlet will not allow the normal temperature variation
- from autumn of the 1st year until powerhouse is available for use, 4°C temperature water will be discharged
 - . no mechanism for mitigation at this time

C) DYRESM Model

- investigated all available temperature models and found DYRESM to be as good as any
- used successfully in Australia and British Columbia

Question How close will DYRESM model the Watana temperatures?

Answer Currently working on it. We feel comfortable with the summer modeling that has taken place. Ice cover subroutine has some bugs but we are working with the author to correct them.

D) Temperatures

- (i) Reservoir temperature profile June 1 - September 30
 - Eklutna Lake inflow water temperature 3°C
 - . glaciers very close to head of lake
 - Watana inflow temperatures as high as 10°C
 - different thermal structures between the two reservoirs

- multi-level intake structures
 - . 4 intakes within upper 120' of the reservoir

(ii) Watana outflow temperatures

- July - mid September, we feel comfortable that we can maintain very close to natural temperatures
- mid-September - early winter, we will only be able to provide 4°C water
 - . 0°C water that naturally occurs will not be possible
 - . over the course of the winter, temperatures will drop to about 2°C

Question Where will the thermocline be during winter?

Answer Probably very close to surface as was observed at Eklutna. Within the first two meters the temperature was 3.6°C and virtually isothermal below.

Question Are these downstream temperatures at the immediate outlet of the project?

Answer Yes.

Discussed water temperatures at Williston Reservoir on the Peace River where a gradual winter profile varying from 0°C at the surface to 3°C at 300 feet existed.

Question Best guess when ice cover on reservoir will form?

Answer Depends on wind conditions, ambient air temperatures, and when an isothermal situation occurs.

Question Has the model been run for winter yet?

Answer No, but we are estimating that outflow temperatures will probably be between 2 - 4°C.

Question Investigations into the expected winds on the reservoir?
Will wind increase?

Answer Yes, Lake Ontario has 20% higher winds than adjacent lands.
A lake this small may have about a 3-4% increase in winds
over what currently exists.

(iii) Devil Canyon Temperatures

- temperatures will largely reflect Watana temperatures
- DYRESM model not run yet for Devil Canyon.

VIII. Downstream Temperatures - Mr. Tom Lavender (Acres)

A) Summary

Mr. Tom Lavender provided a description of the Heatsim heat budget model that is being used to describe expected downstream temperatures during the various phases of the project.

B) Heatsim - Heat Budget Model for River Reaches

- streamwise, daily heat balance, reach by reach from prescribed upstream boundary thermograph and inflow hydrograph
- uses: air temperature; vapor pressure; wind speed; solar radiation; cloud cover; albedo; i.e., a complete heat balance
- accounts for: heat content of rainfall and snowfall, insulating effect of ice cover on small (well mixed) reservoirs; hydraulic mean depth and velocity of stream in each reach
- yields: components of heat balance; net daily heat gain or loss to river reach; inflow and outflow temperatures for reach; length of ice-free reach (optional)
- based on (in large measure): J.M. Raphael, ASCE Journal of the Power Division, V88, No. P02, p. 157, July 1962.

C) Temperatures

- pre-project
- Watana alone
- Watana/Devil Canyon

Question Did you use the ice formation option of model to determine ice cover formation location?

Answer We will cover that in my next discussion

Question Analyzed temperature variations with mainstem discharge yet?

Answer We have not done a sensitivity analysis yet. During summer probably not significant variation during winter could be more significant.

Question If Watana peaks will it affect temperatures?

Answer No not on a daily average basis.

Question What flows is the model based upon?

Answer Normal operational flows expected, not minimum flow requirements.

Question Need for sensitivity analysis with various climatic and flow conditions?

Answer Yes

Question Why multiple intakes at Devil Canyon if temperatures will not be altered from Watana?

Answer Two month residence time will create slight variations, try to match outflow temperatures as close as possible to natural.

Question Will there be additional graphics in the report that further describe the expected minimum winter temperatures of 2°C+ when both projects are operating?

Answer Yes

IX. Ice Processes, Causes and Effects - Tom Lavender (Acres)

A) Summary

Mr. Tom Lavender presented a description of the major factors influencing the ice processes, namely the hydrologic and thermal regimes and their impacts upon the ice front location, water levels and the ice cover.

B) Hydrologic and Thermal Regimes

- described existing variations throughout annual cycle
- principal factor controlling the ice process is flows
- described proposed hydraulic and thermal regimes
 - . flows will be smoothed out throughout the year
 - . thermal energy will be transferred from summer to winter

C) Ice Front Formation

- (i) Natural lodgement points are a constriction in the river where the ice cover formation process begins
 - construction of the Watana dam will not affect the ice cover formation process since a natural lodgement point exists
- (ii) Temperature immediately downstream
 - water temperature
 - . when bulk water temperature reaches 0.1°C, ice will begin to form at surface of river
 - air temperature
 - . discussed ice front location with warm, average and cold climatic conditions and regulated discharges

(iii) Expected ice front location

D) Water Levels Leading Edge Stability (Froude No.)

- Froude No. will be between 0.08 and 0.154
- gives the range of the change in the water surface elevation given the discharge rate
 - . 3' - 4' increased river stage between Sherman and Talkeetna
- areas with an ice cover will experience increased stage levels
- areas without the ice cover may experience slightly lower stage levels than normal winter conditions

E) Ice Cover Thickness

- effects of discharge
 - . thickness dictated to a large measure by discharge at the time of freeze-up

F) Effects of Varying Discharges on Ice

- same processes govern spring break-up as govern freeze-up
- hinging of ice occurs with raised water level

Question Will there be an increased ice thickness at Susitna Station due to doubled winter flows?

Answer Yes

Question Will there be problems with ice breakup due to this increased ice thickness?

Answer No, due to the thermal degradation of ice in the upper Susitna and the regulated flows.

Question Will increased flows and staging cause flooding of sloughs during winter with accompanying increased ice thickness?

Answer It will depend upon the elevation of the upstream berm.

Question Will the magnitude of breakup in the downstream reaches be more severe or less severe?

Answer Magnitude unknown. (Ed. note - breakup should be less severe)

Question Do you know if ice will form and where between Devil Canyon and Talkeetna?

Answer It will depend upon climatic conditions.

Question What will the stage increases be?

Answer 3' - 4' increase between Sherman and Talkeetna.

Definitely have overtopping of sloughs with these increases.

Question Will erosion problems occur with these increased flows?

Answer None that don't already occur under natural flow conditions with ice jams. With ice jams, velocities can reach 9 - 10 ft/sec. Normally 3 ft/sec velocity under ice is required before the ice front can progress upstream.

Question Will any analysis be done of impacts to sloughs from ice processes?

Answer Talk to AEIDC, who will be handling the impact assessment.
No comment from AEIDC.

Question How will sloughs be affected morphologically from ice processes?

Answer Have to do a detailed analysis of existing conditions first.

LIST OF ADDENDEES

WATER USE AND QUALITY & FISHERY RESOURCES

Holiday Inn, Anchorage, AK

Tuesday, November 30, 1982

<u>Name</u>	<u>Organization</u>	<u>Telephone</u>
Wayne Dyok	Acres	276-4888
Woody Trihey	Acres Consultant	274-7583
Steve Bredthauer	R&M Consultants	279-0483
Tony Burgess	Acres	716-853-7525
Bill Lawrence	U.S. EPA	271-5083
Brad Smith	NMFS	271-5006
Len Corin	USFWS	271-4575
Mary Lu Harle	ADNR-Water Management	276-2653
Gary J. Prokosch	ADNR-Water Management	"
Ken Florey	Fish & Game	344-0541
Eric Myers	NAEC	276-4244
Tom Lavender	Acres	276-4888
Tom Arminski	Alaska Power Authority	276-0001
Steve Zrake	ADEC	274-2533
Gary Lawley	Harza/Ebasco	277-1561
John R. Bizer	Harza/Ebasco	"
Jack Robinson	Harza/Ebasco	"
Leslie Griffiths	Peratrovich, Nottingham, Drage	277-8633
Brent Drage	Peratrovich, Nottingham, Drage	"
Phil Brna	ADF&G	344-0541
Bill Wilson	AEIDC	279-4523
Ken Voos	AEIDC	"
Larry Moulton	Woodward-Clyde	276-2335
Jean Baldrige	Woodward-Clyde	"
Michael P. Storonsky	Acres	276-4888
Kevin Delaney	ADF&G	344-0541
David Wangaard	USFWS	263-3316

- Minutes of Meeting -

Subject: Susitna Hydroelectric Project Water Use and Quality and Fishery
Resources Workshop

Location: Holiday Inn (Anchorage Room)
Anchorage, Alaska

Attendees: see attached

Date: Wednesday, December 1, 1982 9:00 A.M.

Minutes recorded by: Michael P. Storonsky

I. Slough Access Mitigation Ideas - Woody Trihey

A) Summary

Mr. Woody Trihey presented some possible mitigation techniques that should be considered for maintenance of adequate slough water levels, namely increased mainstem discharges, amplification of backwater effects at the mouth of slough, increased flow through the sloughs, or modification of slough channel and entrance.

B) Introduction

- profile of slough discussed yesterday with flow effects on various barriers to upstream movement
- pre-project August flows
 - . 18,000 + cfs very common occurrence
 - . 10 - 12,000 cfs very rare occurrence, however these flows are natural occurrences in early September
- flows of 12,000 will provide problems for fish to gain access

C) Mitigation Ideas

(i) Increase mainstem discharge

- variability of tributary inflow
 - . Project should not have significant effect on weather patterns in river valley therefore, natural tributary variability would occur and create downstream flows of 20 - 25,000 cfs.
 - . Try to quantify the occurrence and magnitude of these
- use of controlled releases variable spikes
 - . duration and magnitude of variable spikes sufficient to avoid attenuation and provide access

(ii) Amplify mainstem backwater effect

- submerge a sill downstream of mouth of slough
- construct dike to protrude into mainstem and cause back water effect in slough

(iii) Increase flow in slough

- collect and concentrate local surface runoff and channelize
- divert water from mainstem
- withdraw water from a local storage pond
 - . stored via natural runoff
 - . pumped from river
 - . pond could contribute to local groundwater upwelling
- increase groundwater inflow

(iv) Modify slough channel and entrance

- deeper entrance of some sloughs
 - . have to be careful if deepening slough, spawning habitat could be degraded since most spawning is in riffle areas, need to maintain riffle/pool ratios
- constrict channel width, therefore deeper water levels
- submerged weirs, create pool and drop scenario

(v) Summary

- Mr. Trihey does not recommend any of above at this time,, but providing them as possibilities for everybody to think about.

Question How many sloughs are we talking about? number being used?
how many can we modify?

Answer Get a better answer if you ask later, Tom Trent's unit more familiar

- . 12 - 15 sloughs quite heavily used - similar to slough 9
- . trying to maintain the chum and sockeye fishery above Talkeetna
- . approximately 38 sloughs between Talkeetna and Devil Canyon

Question Are there problems with ice, with the use of weirs and submerged sills?

Answer Not advocating any of these alternatives, there could be problems with ice. We have to look at all the various sloughs more closely and evaluate the alternative mitigation more thoroughly before deciding. Just trying to emphasize that there are many ways to attain access to sloughs besides increasing flow. A lot of work still needed.

Emphasized that he was only talking about access to the sloughs and not the quality of habitat that will be available.

May get variations in slough morphology due to ice processes and flow. Look at the gradation of material and the rainfall events that might alter slough morphology.

Answer Not a lot of change in sloughs expected, cobble size substrate at most slough mouths, little change anticipated. However, significant changes in tributary mouth morphology expected.

Ice processes are probably the primary force causing slough formation.

Ice probably a major factor but flows can also work to form sloughs.

High flows move sand and silts, but there is larger substrate at the slough mouths and probably will not be greatly altered.

Larry Mculton's group will be discussing these thoughts in further detail.

II. Groundwater Upwelling and Water Temperature in Sloughs - Tony Burgess (Acres)

A) Summary

Mr. Tony Burgess presented a discussion on the various factors that influence slough groundwater regimes, the investigations that have occurred, the modeling that has been conducted, and the conclusions that have been drawn. In addition, he discussed the factors that influence ground water temperatures and the impacts expected.

9) Introduction

(i) Slough morphology

- bar separates slough from mainstem
- bar may be overtopped
 - . as ice front passes through
 - . during breakup jams
 - . under open water storm discharge

(ii) Stratigraphy

- silt/sand up to 6 feet deep
- sand/gravel/cobbles/boulders - possibly occur with depth

- bedrock at unknown depth
 - . drilling to 40' has not reached bedrock

C) Groundwater Investigation

(i) Techniques

- walk overs
- test pits and installation of standpipes
- soil drilling and installation of piezometers and glycol tubes
- observations of surface and groundwater elevations, water temperatures, slough discharge, seepage flux

(ii) Slough 9

- drill holes identified
- continuous monitoring
- Slough 9 overtops at approximately 20,000 cfs
- significant ice jam last winter - bulk of river flow went through Slough 9 rather than through the mainstem

(iii) Seepage flux measurements

- identified upwelling area
- estimate flux into sloughs
- haven't done many of these yet and haven't reduced data yet

(iv) Slough 8A

- groundwater gradient approximately the same as river gradient

(v) Slough 9

- general gradient in downstream direction

D) Groundwater Modeling

- geometry, boundary conditions and material properties all influence the constitutive relationships that in turn create a response
- constitutive relationships
 - . Laplace's equation
 - . Darcy's law
 - $Q = K i A$
 - flow = (Hydrologic conductivity) (gradient) (cross section)

- Flow lines orthogonal to and from river
- groundwater flows - 3 types
- geometry
 - . shape of area being modelled
 - . 3-D, 2-D (plan, cross section) 1-D (along flow line), thickness (D)
- boundary conditions
 - . values of dependent variables (head, flow) along boundaries
- material properties
 - . hydraulic conductivity (K) (permeability)
 - . porosity (n)
 - . transmissivity ($T = K \times D$)
 - . storage coefficient (S)
- hydraulic conductivity
 - . laboratory grain size analyses with empirical formula

$$K = (100 \text{ to } 150) \times d_{10}^2$$
 - . field tests in drillholes
 - constant head
 - falling head
 - pumping test
 - . flow net sketching and discharge measurement
 - . response of aquifer to well defined boundary event
- Grain size analysis of Slough 9 bank
 - . gravel and sand
- Slough 9 flow net
 - . identified flow lines
- Hydrographic Response
 - . sudden change in mainstem water level influences the aquifer
 - . looked at the response in the Slough 8 wells from a sudden change in water level. Reasonable response on the increasing limb of the hydrograph, however higher than expected water levels occurred on the decreasing limb of the hydrograph. We will continue to investigate.
- Summary of Results
 - . grain size analysis

$$K = 6 \times 10^{-2} \text{ cm/s}$$
 - . field tests
 - not yet completed

- . Flow net
 - $T = 9000 \text{ ft}^{-1} \text{ dm/x}$
 - for $D = 100'$ (assumed)
 - $K = 3.2 \times 10^{-2} \text{ cm/s}$
- . Hydrograph response
 - $T = 1200 \text{ to } 306000 \text{ ft}^2/\text{d}$
 - for $D = 100'$ (assumed)
 - $K = 4.27 \times 10^{-3} \text{ to } 1.05 \text{ cm/s}$
- Modelling
 - . Groundwater flow
 - flow net sketches and hand calculations
 - finite element analyses using computer
 - . Temperature
 - no flow thermal regime
 - coupled groundwater-thermal regime
- graphic slough model
- contours - boundary heads
- fluxes
- contours
 - . fixed heads in mainstem and sloughs
 - . identified high bedrock and valley side slope
 - . remainder of slough constant saturated thickness
- Conclusions
 - . General groundwater regime can be modelled using 2-D plan idealization. Locally, match not so good: may be due to variation in saturated thickness, variation in hydraulic conductivity, or boundary recharge.
 - . Flow is generally downstream and laterally towards slough from upland areas.

E) Thermal Processes and Modelling

(i) Baseline

- Susitna mainstem
 - . mid October to mid April 0°C
 - . maximum $+10^\circ\text{C}$ July
 - . Annual mean approximately 3°C
- Talkeetna air temperatures
 - . minimum mean monthly -13°C

- . maximum mean monthly +14.5°C
- . annual mean +0.5°C
- groundwater
 - . upwelling approximately +3°C
 - . wells 0.05°C (May) to 6 - 8°C (September), locally as high as 11°C

(ii) Preliminary conclusions

- Air temperature variations do not have a significant direct impact on groundwater
- Upwelling temperatures nearly constant but shallow well temperatures show seasonal fluctuation lagging main stem
- Upwelling temperature is approximately mean annual main stem temperature

(iii) Dispersion

- Dispersion theory developed for contaminant transport
- apply to thermal problems by making temperature equivalent to contaminant concentration
- dispersion occurs in all porous media. The extent of dispersion increases as the medium becomes more heterogeneous
 - . diagrams of dilution variations with different materials
 - . example cited

(iv) Conclusions

- upwelling temperatures can be explained in terms of dispersion (mixing) of mainstem seasonal variations within groundwater flow path
- but why do near surface groundwater temperatures show less mixing?

Possible factors:

 - . path length shorter
 - . gradient steeper
 - . materials more homogeneous
- recent deeper drilling, piezometer and glycol tube installations should provide important data

F) Project Impacts

(i) Geometry

May be some changes due to deposition and scour.

(ii) Material properties

Generally will not change except possibly due to scour/deposition effects.

(iii) Boundary Conditions

- River stage: higher in winter, lower in spring/summer with less variability
- Temperature: mean annual little change, slightly higher in fall and lower in summer.

(iv) Response to Stage Change

Based on data from September hydrograph, response is quite rapid, in near surface wells. Deeper wells may respond slower due to longer flow path.

(v) Effect of Stage Change on Extent of Upwelling

Could be modelled but unlikely that sufficient data (spatial variation of K) available. Field monitoring and observation preferred.

(vi) Mitigation

Not looked at yet

Question Will river stage be higher during winter or lower?

Answer There could be lower water levels without an ice cover depending on the particular circumstances. Ice cover will be variable.

Both upper and lower water levels would drop equally therefore the same gradients would still exist so groundwater flow will continue but at lower elevations.

Question Does the storage of water in the gravel from late summer flow provide winter groundwater flows?

Answer Some water is stored, but not alot. There were rapid responses observed in the wells due to mainstem discharges.

During October upwelling continued with a decreased discharge. If there is not much storage from late summer flow, this would indicate upwelling continues at low discharge.

A fair amount of upwelling occurred throughout February and March.

Freezing near the banks cold be concentrating upwelling towards the middle of the slough.

Question If you drop the invert elevation 3 - 4 feet would it intercept more groudwater?

Answer No, that only amounts to a small portion of the 2000 feet of head upstream of the slough.

Question Is there a monitoring program envisioned for groudwater upwelling?

Answer Recommended continuous temperature and flow monitoring in wells. Half-barrel technique to quantify seasonal variation. So far only 1 field trip to a half-a-dozen locations.

Question Isn't there variability between the sloughs? Why only slough 9 investigated?

Answer Trying to understand the processes, first. Now we can look at other sloughs and determine the variability.

Question With post-project winter flows of 10,000 cfs, will the location of ice formation dictate upwelling?

Answer Probably not change upwelling, upstream and downstream elevations experience equal change, therefore the gradient is the same.

Question Will absence of flushing flows cause disturbances to upwelling locations?

Answer Only affect near surface sediment, may move upwelling area slightly.

May shift location of upstream most upwelling areas.

III. Other Water Quality Concerns - Mr. Steve Bredthauer (R&M Consultants)

A) Summary

Following an intermission, Mr. Steve Bredthauer discussed the balance of the major water quality concerns including nitrogen supersaturation, eutrophication, leaching, and dissolved oxygen.

B) Nitrogen Supersaturation

- caused by high plunging spills
- measurements above and below Devil Canyon indicate supersaturation currently exists
- project will employ fixed-cone valves to avoid plunging spills that might create a problem

C) Eutrophication

- limited data available for the four nutrients, N, P, C, Si
- phosphorous is the limiting nutrient
- two methods available

- . Dillon and Rigler model - rejected due to the limited ability to estimate phosphorous retention coefficient
- . Vollenweider model chosen - used at Crescent Lake, Alaska with good results
- Vollenweider model used by Larry Pederson of Fairbanks
 - . predicted oligotrophic situation
 - . need approximately 115,000 residents dumping untreated waste into Watana reservoir to produce eutrophic situation

D) Leaching

- increased concentrations of metals and other parameters immediately after closure of dam
- decreased leaching with time - Watana
 - . buried with inorganic glacial sediment
 - . most readily dissolvable materials will dissolve first
- effects of leaching at Devil Canyon will remain longer
 - . little sedimentation expected
- effects expected to be confined to reservoir bottom
- no significant impacts anticipated

E) Dissolved Oxygen

- decreased potential for oxygen saturation with increased depth
- COD coming into reservoir is low
- no vegetative growth expected along shoreline during drawdown
- no dissolved oxygen problems expected in the upper levels of reservoirs or downstream

Question If you expect the reservoir to act as a nutrient trap, how will this effect the productivity downstream?

Answer You do not see organisms taking advantage of nutrients in the mainstem since the nutrients are so low. Most organisms taking advantage of nutrients in the system are in the backwater areas and tributary mouths.

Impacts from reduced nutrient concentrations should not affect the rearing that is taking place in the tributary mouths.

Most primary and secondary productivity is occurring in the side sloughs, side channels and tributary mouths.

Question Very high levels of hydrogen sulfide were observed at a hydro project in southern Alaska. Is a similar problem expected?

Answer No

IV. Summary of Water Quality Discussions Mr. Wayne Dyok (Acres)

A) Summary

Mr. Dyok provided a summary of the water quality discussions of the last day and one half including: flows and water levels, temperatures, ice, suspended sediment and turbidity, and sloughs.

B) Flows and Water Levels

1. Construction: Impacts limited to immediate area of damsites
2. Filling: Winter flows - similar to natural regime except for reduction in October and November 1992 at Gold Creek. Summer flows - substantial reduction at Gold Creek. Downstream - reduced percentage difference (maximum reduction 18 percent Susitna Station). Stage reduction up to four feet May through July. Stage reduction of about two feet during August, Talkeetna to Devil Canyon.

3. Operation: Winter flows increased to about 10,000 cfs at Gold Creek with extremes at 6,000 cfs and 13,400 cfs. Susitna Station flows increased by a factor of two. Summer Gold Creek flows reduced to 12,000 cfs during August. Susitna Station monthly flows reduced by maximum of 13 percent. Water levels - Watana reservoir maximum drawdown 120 feet. Devil Canyon drawdown up to 50 feet August and September. Summer water levels Talkeetna to Devil Canyon reduced by about two feet in August. Minimal water level changes downstream of Talkeetna during summer.

Question Where is the information on expected water level changes in the Report on Water Use and Quality?

Answer Not included, water levels changes will be addressed in final document.

B) Temperature

1. Construction: No impact.
2. Filling: 4°C water at outlet during second year of filling. Gold Creek temperatures could be as low as 6°C.
3. Operation: By selective withdrawal Watana outlet temperatures can be made to approximate natural regime during summer. Fall temperatures will be warmer than natural at outlet and for some distance downstream. Winter outlet temperatures will likely be between 2°C to 4°C.

C) Ice

1. Construction: No impact due to natural lodgement point near Watana damsite.

2. Filling: Minimal impact because natural flows are approximated during freeze up and natural temperatures are attained at Devil Canyon. Reduced ice jamming during spring breakup because of decreased flows from Devil Canyon to Watana and thermal decay.
3. Operation: Approximately three to four foot increase in stage during freeze up with effects to Cook Inlet. Reduced ice jamming during breakup Devil Canyon to Cook Inlet. Watana alone - ice front will be between Sherman and Portage Creek. Watana/Devil Canyon - ice front will be between Talkeetna and Sherman.

Question It was indicated that there will be a reduced ice breakup downstream nearer to Cook Inlet. Is this correct, since there will be an increase in ice thickness due to higher flows?

Answer Although there will be more ice, spring flows will be reduced and therefore ice jams should be fewer and less severe.

Ice will be gone above Talkeetna before the rest of the river breaks up, therefore no ice going downstream from the upper Susitna.

Question What effect will the change in flows and water levels have on the estuary?

Answer Resource Management Associates modeled the change in salinity. The model indicated a 1 1/2 part per thousand (ppt) maximum change from natural conditions. The salinity range under project conditions is expected to be less than which presently occurs. This change is not expected to be significant.

D) Suspended Sediment

Particle sizes of three to four microns will pass through reservoir. Approximately 80 percent of suspended sediment will be removed.

Turbidity at Watana outlet will be between 10 to 50 NTU. Lower summer turbidity. Higher winter turbidity. Downstream channel will remain stable because of armoring.

E) Sloughs

- Backwater effects
- Surface water runoff?
- Groundwater upwelling - dominant flow in direction of mainstem flow - upwelling flow rates basically unchanged although there is a potential for dewatering spawning areas in upper locations of some sloughs that are adjacent to ice free reaches of the mainstem Susitna.
- Groundwater upwelling temperature - function of long term average annual mainstem Susitna River temperature.
- Overtopping under post-project conditions where ice in mainstem is adjacent to sloughs.
- Morphological changes?

Question Have navigation and recreation impacts been addressed?

Answer Yes, River divided into sections above and below Talkeetna. Numerous cross-sections studied, no problems were immediately identified above Talkeetna. However, one site located between sloughs 8 and 9 was difficult to navigate this past summer with natural flow conditions. The area was navigable. During post-project conditions caution will be needed in this one section. The normal variations in river morphology that currently occur below Talkeetna - probably will not be as significant. Kayaking will be eliminated in the Devil Canyon reach. Recreational boating on the reservoirs will be available if the reservoirs are open to public. Additional information available in the Recreation Report.

V. Possible Flow Variations - Dr. John Hayden (Acres)

A) Summary

Dr. Hayden provided a brief impromptu discussion about possible variations in river flows that might be available to benefit salmon.

B) Selective Flow Spikes

- spring, 6 days at 20,000 cfs to facilitate outmigration and flush system
- summer, 12 days at 20,000 cfs to facilitate entrance to sloughs
- we have to learn more about the fishery system to determine the most desirable time frames for these spikes

Statement We also have to keep in mind the other uses of the river, i.e., recreation, when considering spikes.

Question The impacts of increased temperatures on over-wintering fish is not discussed in report. Increased temperatures will cause increased metabolic rates in the over-wintering salmon without an available food supply. As a result these fish could go into the next spring in a weakened condition.

Answer This will be addressed in the Fisheries Presentation.

We don't have enough information on the over-wintering locations to assess impacts and provide mitigation at this point in time.

LIST OF ATTENDEES

WATER USE AND QUALITY & FISHERIES WORKSHOP (2nd Day)

Holiday Inn, Anchorage, AK

Wednesday, December 1, 1982

9:00 a.m.	<u>Name</u>	<u>Organization</u>	<u>Telephone</u>
	Jean Baldrige	Woodward-Clyde	276-2335
	Michael P. Storonsky	Acres	276-4888
	Tom Lavender	Acres	"
	Tony Burgess	Acres	"
	Woody Trihey	Acres Consultant	274-7583
	Steve Bredthauer	R&M Consultants	279-0483
	Bill Lawrence	U.S. EPA	271-5083
	Brad Smith	NMPS	271-5006
	Len Corin	USFWS	271-4575
	Mary Lu Harle	ADNR-Water Management	276-2653
	Gary J. Prokosch	ADNR - Water	276-2653
	Chris Godfrey	U.S. COE-Reg. Function	552-4942
	Ken Florey	Fish & Game	344-0541
	Eric Myers	NAEC	276-4244
	John Wiles	State Parks	264-2115
	Dave Wangaard	USFWS	263-3316
	John Hayden	Acres	276-4888
	Wayne Dyok	Acres	"
	Bill Wilson	AEIDC	279-4523
	Ken Voos	AEIDC	279-4523
	John R. Bizer	Harza/Ebasco	277-1651
	Steve Zrake	ADEC	274-2533
	Stuart Burnell	Morrison Knudsen	263-3611
	Larry Moulton	Woodward-Clyde	276-2335

1:00 p.m. Additional Attendees:

Judy Zimicki	NAEC	277-2134
Larry Hechart	ADF&G	344-0541
Kevin Delaney	ADF&G	"
Mike Mills	ADF&G	"
Dan Wilkerson	ADEC	274-2533
Tom Trent	ADF&G	274-7583
Dana Schmidt	ADF&G	"
Bruce Barrett	ADF&G	"
Christopher Estes	ADF&G	"
Alan Bingham	ADF&G	"
Richard Fleming	Alaska Power Authority	276-0001

MEETING SUMMARY

EXHIBIT E

Water Use and Quality and Fisheries Resources Section
Holiday Inn, Anchorage, Alaska
December 1, 1982 Afternoon Session

Attendees

<u>Name</u>	<u>Organization</u>	<u>Name</u>	<u>Organization</u>
Judy Zimicki	NAEC	John R. Bizer	Harza/Ebasco
Woody Trihey	Acres	Steve Zrake	ADEC
Bill Lawrence	EPA	Larry Moulton	Woodward-Clyde
Brad Smith	NMFS	Jean Baldrige	Woodward-Clyde
Len Corin	USFWS	Larry Hechart	ADF&G
Mary Lu Harle	ADNR	Kevin Delaney	ADF&G
Gary J. Prokosch	ADNR	Mike Mills	ADF&G
Chris Godfrey	COE	Dan Wilkerson	ADF&G
Ken Florey	ADF&G	Tom Trent	ADF&G
Eric Myers	NAEC	Dana Schmidt	ADF&G
John Wiles	State Parks	Bruce Barrett	ADF&G
Dave Wangaard	USFWS	Christopher Estes	ADF&G
John Hayden	Acres	Alan Bingham	ADF&G
Wayne Dyok	Acres	Richard Fleming	APA
Ken Voos	AEIDC		

INTRODUCTION - Larry Moulton, Woodward-Clyde Consultants (WCC)

We have focused on habitat for impact assessment and mitigation planning. Although we cannot presently quantify impacts or present a detailed mitigation plan, we can discuss the general types and magnitudes of fisheries impacts likely to occur. Studies to quantify impacts and determine the level of mitigation necessary are either ongoing or in the planning stage.

We have divided the river into four general habitat types:

- o mainstem,
- o side channel,
- o slough, and
- o tributary.

We considered three general reaches of the river:

- o Impoundments Zone,
- o Talkeetna to Devil Canyon, and
- o Cook Inlet to Talkeetna.

Each reach will have different impacts associated with the various stages of the development.

We did select evaluation species based on the criteria developed by U.S. Fish and Wildlife (USFWS) and Alaska Department of Fish and Game (ADF&G). Because of expected impacts, we focused on salmon spawning activities in slough habitats between Talkeetna and Devil Canyon (Table 1).

1. Chum salmon are most abundant in these habitats.
2. Sockeye salmon are not as abundant as chums but sloughs provide almost all spawning habitat for sockeye in this reach.
3. Chinook and coho salmon do not spawn in the sloughs. So here we are mainly concerned about juvenile fish which rear in slough and mainstem habitats.
4. Pink salmon spawn mainly in tributaries with only slight use of slough habitats.

For the Impoundment Zone, we selected Arctic grayling as the evaluation species.

The different species occupy the river at slightly different times (presented phenology chart, Figure 1).

Q Could some of the differences from 1981 to 1982 could be due to differences in catchability of fish between the high and low flows experienced between 1981 and 1982.

A ADF&G (Su hydro) staff will be here shortly to answer your question.

CONSTRUCTION IMPACTS

Impacts expected during construction are expected to be similar to those experienced by other major construction projects. In the case of the two dams, the impacts are expected to be fairly localized. A construction practices manual will be prepared to assist the contractor in avoiding and minimizing environmental damage.

Major Impacts

1. Loss of habitat in mainstem due to river diversion.
2. Diversion tunnel will have high velocities and fish losses are expected to result.
3. Short-term turbidity problems.
4. Concrete batching operation will produce effluent requiring treatment.
5. Accidental spills are a consideration.
6. Material sites and borrow areas will be located within the impoundment with the exception of Borrow area E, known as the Tsusena Creek borrow area. This area will be rehabilitated to provide aquatic habitat.

FISHERIES BASELINE STUDIES

Tom Trent (ADF&G Su Hydro Project Manager)

ADF&G conducted reconnaissance during the winter of 80-81. We began full scale investigations in June 1981. Presently, we have completed two cycles of open-water season studies and are getting the winter 1982-83 program underway. Our program is divided into three areas:

- o Adult anadromous,
- o Resident and juvenile anadromous, and
- o Aquatic habitat and instream flow studies.

Our task is mainly one of data collection but we are doing some analysis to describe preproject relationships. Our reporting schedule includes our basic data reports which will be produced by Jan. 31, 1983. These will contain very little analysis. Our interpretive reports which will contain our analyses will be produced by June 30, 1983.

Christopher Estes (ADF&G Su Hydro - Aquatic habitat and instream flow program)

Discussed ADF&G 1981 reports and 1982 habitat report.

During the 1982 field season, the aquatic habitat program collected habitat data to assess the influence of the mainstem discharge on other habitat types. We established study sites in slough habitat and collected water quality, hydraulic, and substrate data in six side sloughs upstream of Talkeetna: 8A, 9, 11, 16, 19 and 21.

Downstream of Talkeetna we established study sites in two areas, Chum channel, a side channel and Rabideaux slough. We will evaluate the influence of mainstem discharge on these habitats.

The aquatic habitat program also provided support for the resident and juvenile anadromous studies.

Dana Schmidt (ADF&G Su Hydro - Resident and juvenile anadromous fish program)

In addition to the resident and juvenile anadromous program, I have also been involved in a dissolved gas study upon which I recently presented a paper at the American Fisheries Society meeting in Sitka. Devil Canyon has large plunge pools which cause entrainment of air resulting in nitrogen supersaturation. A continuous recorder was installed near the mouth of the canyon to measure nitrogen concentrations in the canyon. Measurements were collected to determine the downstream dissolved gas profile to assess the decay rate of nitrogen in the system. Peak concentrations of 117% were recorded in the canyon.

Resident and juvenile anadromous fish program.

The adult anadromous program is tracking the adult salmon. We will be following through with the incubation of the embryos. In conjunction with the USFWS, we will determine development rates under various temperature regimes. In addition we will be evaluating:

- o Rearing habitat in sloughs and side channels,
- o Timing of outmigration (smolt trap 6/18 to 10/10)
- o Population estimates of grayling in the impoundment zone.
(These estimates will be stratified by age classes and may be available by Jan. 31.)

We will be determining fish distribution and relative abundance, through electrofishing and minnow trapping. Telemetry studies are being conducted on rainbow and burbot.

We will be assessing changes in habitat in response to changes in flow.

We have begun a study of food habits and availability of invertebrate populations.

Bruce Barrett (ADF&G Su Hydro - Adult Anadromous Program)

Conducted adult anadromous investigations from the confluence of Devil Creek to the estuary mainly on eulachon, salmon, and Bering cisco.

Eulachon studies were conducted from May 15 to June 9 using gill nets and electrofishing units. Spawning activity was located from RM 4.5 to RM 48 primarily below the Yentna River confluence. There appears to be two populations of eulachon using the lower Susitna River. The size of the run is in millions of fish. The spawning run is mainly composed of 3 year old fish. The fish were spawning in riffle zones with unconsolidated sands and small gravel and relatively high velocities.

Salmon

5 stations with side-scan sonar and fish wheels were established. Milling activity and mainstem spawning were evaluated with electrofishing and gill nets. Spawning surveys were conducted from RM 100 to 160.

Chinook Studies

Population estimates were determined from tag and recapture. The escapement in 1982 was far greater than in 81. They were near the 1976 levels. There was lots of milling in the canyon. Chinook were found above the Devil Canyon Dam site in Cheechako and Chinook Creeks.

Sockeye Salmon

We had a larger escapement of sockeye salmon in 82 than in 81. Most of the sockeye were found in the sloughs. Sockeye did spawn in Chase Creek, a tributary to Indian River and Prairie Creek in the Talkeetna

Drainage. Sockeye spawned in 9 sloughs between Talkeetna and Devil Canyon. We did document an early run of sockeye in the Talkeetna Drainage.

Pink Salmon

The escapement was less than average for an even year. Pink salmon spawn mainly in the tributaries. We found pink salmon using mainstem spawning sites in addition to slough habitats.

Coho Salmon

Coho salmon spawn mainly in tributaries. One mainstem site was located and coho were found spawning in one slough.

No mainstem spawning areas were located below Talkeetna.

Bering Cisco

We had a much smaller run than last year. Fish were spawning in the same area (near Montana Creek) as they did last year. We had one repeat spawner from last year and fish were 3 and 4 years old.

QUESTIONS

Q Kevin Delaney (ADF&G) How many sloughs are there?

A We have located 33 sloughs, 10 are heavily utilized for spawning.

Q Kevin Delaney (ADF&G) How many are mapped?

A We have planimetric maps on 6 sloughs and will be able to assess access in these sloughs.

- Q Brad Smith (NMFS) How important are mainstem spawning sites?
A Some areas are heavily utilized. We may have 1000 fish in one area. The majority of the mainstem is not used.
- Q Ken Florey (ADF&G) How are the chum salmon spawning densities? Given the flow we had, how is the habitat utilization?
A We had good utilization of existing habitat. We are fairly close to capacity with 82 populations and flow conditions.
- Q Ken Florey (ADF&G) Is the utilization of the sloughs dependent on flow levels or are they density dependent?
A Our population estimates show an increased number of salmon in the system this year and fish moved faster in low water. Low levels kept fish out of the sloughs until late.
- Q Ken Florey (ADF&G) With regard to pulsing the discharge in the spring and during the spawning season, is there any evidence to support this concept? I realize that the studies are not complete enough to define pulses.
A We did observe fish passing into sloughs when flows came up in September, which lends some credibility to the pulse concept. However, both mainstem and slough flow increased.
- Q Are you going to do any winter food habitats study?
A We will be looking at the distribution of fish in slough and water temperatures will be monitored but we are not doing food habits. We will have some information on growth but the small number of fish scattered over the large channel makes sampling difficult.

Q Will you be able to tell turnover rate in overwintering habitats?

A No. We don't have the resources to determine the relationship between fish overwintering in sloughs and fish overwintering in the mainstem.

Q Brad Smith (NMFS) Does the large amount of milling behavior mean that fish will go upstream if they have the opportunity?

A We think they will as evidenced by the movement of chinook this year into Devil Canyon. We see a lot of interbasin movements and we have a sizeable population in Portage Creek.

Q Has anyone taken a look at the parent year to see what the flows were?

A We only had about 50 fish upstream of Devil Canyon and no scales were collected. We attempted to trap juvenile fish but didn't find any salmon.

Q Lenny Corin (USFWS) Will you generate a new estimates of the grayling population in the impoundment?

A Yes. We expect to have a substantial increase in the population estimate. We will have some information on Watana Creek and we have divided the Oshetna River into riffle pool reaches to refine our estimates.

Q Ken Florey (ADF&G) Were there any age differences relative to the two runs of smelt?

A Most fish were 3 yr old.

Q Ken Florey (ADF&G) Any repeat spawners?

A No way to tell. Males have a longer spawning period than females probably 5 day as opposed to 1 day. The two runs appear to be genetically different due to size and weight.

Q Ken Florey (ADF&G) How long is incubation?

A We could not recover eggs but it is probably 2 weeks. ADF&G Interpretive Report Dana Schmidt (ADF&G Su Hydro). Our June report will integrate data from the various programs into a common base to determine the relative importance of populations at risk and the response to changes associated with natural variation. The report will be confined to the lower river and will integrate by species data on:

1. Adult migration and spawning
2. Embryo development
3. Freshwater rearing
 - a. habitat selection
 - b. response to changes in discharge and water quality
4. Outmigration timing .

It will address:

- o Relationship of behavioral response and changes in flow
- o Hydraulic change in habitat
- o Change in surface area
- o Change in availability of cover and substrate
- o Response of chum and sockeye salmon embryos to thermal variation which presently exists in the habitat

END OF SESSION

MEETING SUMMARY
EXHIBIT E WORKSHOP

Water Use and Quality and Fishery Resources Section
Holiday Inn, Anchorage, Alaska

December 2, 1982

ATTENDEES

<u>Name</u>	<u>Organization</u>	<u>Name</u>	<u>Organization</u>
Jean Baldrige	Woodward-Clyde	Larry Rundquist	Woodward-Clyde
Larry Moulton	Woodward-Clyde	Eric Myers	NAEC
Brad Smith	NMFS	Bill Lawrence	EPA
Garry Stackhouse	USFWS	Dan Wilkerson	ADEC
Kevin Delaney	ADF&G	Paul Krasnowski	ADF&G
Michael D. Kelly	AEIDC	Bill Wilson	AEIDC
Mike Prewitt	AEIDC	Kevin Young	Acres American
Wayne Dyok	Acres American	Tony Burgess	Acres American
Dave Wangaard	USFWS	Gary Lawley	Harza/Ebasco
John Bizer	Harza/Ebasco	Paul Janke	ADNR
Tom Trent	ADF&G	Kevin Florey	ADF&G
Gary Prokosch	ADNR	Steve Zrake	ADEC
Nancy Blunck	APA	Tom Arminski	APA
Mary Lu Harle	ADNR	Dave McGillivray	USFWS
Patricia Lukens	Acres American		

MITIGATION FRAMEWORK - Larry Moulton (Woodward-Clyde Consultants)

Approach to mitigation was based on the USFWS and ADF&G mitigation policies which present the criteria and categories contained in Figure E 3.1 (Exhibit E). Keeping these criteria in mind let's review the impacts.

IMPOUNDMENT

Impoundment Impacts:

Lotic habitat will be inundated as a result of filling Watana Reservoir. Figure 2 shows the portions of the mainstem and tributaries inundated by Watana Reservoir. We believe that much of the grayling population presently occupying this habitat will be lost. The summer habitat in the streams seem to be fairly well occupied so few additional grayling could probably be accommodated in adjacent habitats. Grayling are not generally found in turbid lakes. In addition grayling may encounter difficulties in successfully incubating embryos spawned during reservoir operation. Spawning under reservoir operation will be difficult for most species. As the reservoir fills, sediments carried by the tributaries will settle out over the spawning areas, suffocating the eggs. Figure 3 illustrates how reservoir operation and biological activities overlap. The portion of the streams near the reservoir will be inundated by the reservoir filling schedule before the embryos hatch. The portion of the grayling population spawning in habitats above the 2135 ft level will not be affected by the reservoir filling schedule as these embryos would hatch before the habitat would be inundated. Table 1 indicated the miles of tributary inundated by the reservoir during the grayling spawning and incubation period. The amount of overwintering habitat is expected to increase.

A population of Lake trout may develop in the reservoir but again production is expected to be limited. Figure 3 shows that most of the available spawning habitat will be dewatered during the winter before the lake trout embryos have completed their development. The spawning depths for lake trout, whitefish and burbot were taken from Morrow's Freshwater Fishes of Alaska. Some deep spawning lake trout may survive. The probability of successful whitefish or burbot production appears slight. If these fish spawn in tributary channels the embryos may survive.

We expect a little different situation in Devil Canyon Reservoir. The reservoir will inundate riverine habitat and the grayling populations

occupying those habitats may be lost. However, grayling populations in these streams do not appear to be as large as those in the Watana Reservoir streams. The streams in Devil Canyon Reservoir are fairly steep and many appear to have migration barriers which will not be inundated by the reservoir.

Q Silt load covering deposited eggs interfering with success. Also, what will the fish be feeding on?

A Upwelling may clear some of the gravels. Loss of riverine habitat in impoundment zone with very little gained. Do not expect a productive littoral area and do not expect much food production.

Q Is there an access problem if fish overwinter in the reservoir?

A May actually improve accessibility as some fish barriers will be removed, e.g. falls on Deadman Creek will be inundated. Dollys have the best chance of surviving and may occupy reservoir habitats.

Mitigation for the Impoundment Zones - Larry Moulton (WCC)

Since the impacts for the reservoir can not be avoided, minimized or rectified, compensation is planned for the lost resource. The best way to compensate these losses is with inkind replacement of grayling. We propose investigating the possibility of implanting grayling in barren lakes in the project area or possibly other lakes in southcentral Alaska if none are found within the vicinity of the project. Grayling could be raised in a hatchery and released in suitable lakes. It may be effective to deepen some lakes to provide overwintering habitat.

Q Has the success of such a hatchery program been proven?

A ADF&G has a grayling program at Big Lake Hatchery

Agency Comment - I'm familiar with the ADF&G program which is at Clear Ak. and it is my impression that the technology is not all that dependable. I don't believe it can be done on this scale.

There were successful plantings in southeastern Alaska where the fish began reproducing on their own.

ACCESS ROADS - Larry Moulton (WCC)

The primary impacts to aquatic habitat expected to occur are related to road crossings and borrow pits. To the extent practical borrow areas for the access road have been moved to upland sites. Road crossings will be designed according to ADF&G fish passage criteria in accordance with the title 16 draft regulations. If desirable, the borrow areas near lake may be rehabilitated to provide aquatic habitat.

Access to this area may result in an impact from the additional fishing pressures. Natural populations in streams and lakes could be protected if more restrictive harvest techniques and bag limits were placed on areas such as Deadman Creek. The lakes that are stocked with grayling may provide a place for the guy who just wants to catch a lot of fish while the natural streams could provide more of a quality fishing experience. The road has been routed as far away from Deadman Creek as the corridor allows.

Q Do you expect people to drive 200 miles to fish in a gravel pit?

A Yes, they drive that far now. We expect people to leave Anchorage or Fairbanks with a camper or Winnebago, pull up to one of these areas and fish for the weekend.

Q Are you familiar with Copper Highway gravel pits?

A Yes.

Q Is this access discussion only for the Denali-Watana portion?

A No both segments are discussed.

Q What is the type of borrow material? Volume?

A The borrow material should be relatively easy to get. We need about 200 surface acres for Denali-Watana and about same for Watana-Devil Canyon portion. We feel we can get this from upland sites and will not need to use any streambed material.

Q If borrow areas are so easy to locate, how about alignment of the road?

A They have done some realignment.

Agency Comment - We have not yet quantified loss, but we don't think that there is any way to raise the number of fish that we are talking about. There is no compensation for unique experience that can be had today at the mouths of some of these streams.

DOWNSTREAM IMPACTS- Jean Baldrige (WCC)

Before we begin on the downstream impacts I would just like to take a few minutes to discuss our approach to assessing downstream impacts and where we are in the process. Our approach is based on habitat. We looked at areas where the project would alter habitat conditions. Then, we evaluated the changes to determine if they would impact the fishery resources. This is basically a sequential process. First we have to know what the project area is and how the system works. Then we can overlay the project operating scenario and determine the project impacts. After assessing the impacts we develop a mitigation plan to address the expected impacts.

Where are we in this process? Well, we have a good general understanding of how the basin works, what the processes are, the general distribution, and timing of the fishery resources. We know what habitats are important. We have identified generically, the type of impacts likely to occur and we have developed a conceptual approach to mitigation and established some priorities. We have some concepts regarding mitigation features. Larry Moulton will talk more about mitigation later today.

In reviewing the physical processes in the basin as Wayne Dyok and other talked about yesterday, most of the changes will occur in the Talkeetna to Devil Canyon section. We expect most of the changes to occur under the filling and operation of Watana. Devil Canyon Dam may result in slight increases in the types of impacts which will occur under development of Watana.

Q What is filling time for the Devil Canyon?

A About a month. Downstream flows would be maintained at 5000 cfs. (Ed. note - actual filling time from elevation 1135 to 1455 will be in the order of 5 to 8 weeks)

Q Why stick with a 5000 cfs value? Do we know enough to say that's what we need?

A That is what we have had to work with. We feel that in the 8-10 yr period in which Watana alone would operate, a new fishery habitat will develop and substantially changing the established regime will hurt that new fishery.

WATANA FILLING - Jean Baldrige (WCC)

Filling Watana Reservoir is expected to take three years. This figure presents a comparison of streamflows expected for filling Watana reservoir. I have combined parts of the second and third years to show the months of the greatest changes expected. Many of the changes expected

during the open-water season will occur during the initial filling of the reservoir. We expect changes in:

- o Streamflows
- o Water quality
- o Water temperature

Mainstem and Side-channel Habitat

Mainstem and side-channel habitats will be directed influenced by the project.

- o Outmigration

Break-up will be diminished which may affect outmigration. Sufficient water will exist to transport fry downstream but both the rising water levels and temperatures that may stimulate outmigration may not occur under post project condition.

Q Asked whether the reduced flows are indeed sufficient for the fish passage.

A Yes, for river migration.

- o Chinook inmigration

There should be sufficient water to pass fish upstream. Studies on navigation by the ADNR show that there will be depths of at least two feet in the shallowest cross-section which is located between sloughs 8 and 9. Chinook will also be able to gain access to tributary habitats under filling flows as R & M discussed yesterday. Chinook are also expected to be able to ascend the canyon and utilize tributary habitats below the Watana dam.

Q These effects during filling - what about operation?

A Similar effects.

Q Would you really get a decrease in velocity through Devil Canyon.

A Yes, due to the rectangular shape and the confined nature of the canyon, we expect that when we decrease the discharge, the velocities will be reduced. There will still be high velocities in the canyon but chinook should be able to pass.

o Spawning season

A few spawning areas were located in mainstem and side-channel areas. Lower flows during the spawning season may adversely affect some mainstem and side channel spawning areas. Many of these areas are located on the margins of the system in areas protected from high flows. Because these habitats are located on the periphery of the system they are more susceptible to dewatering.

o Water temperatures

During the second year of filling we expect water temperatures in the range of 5 to 6 °C during the summer time. Temperatures in this range may deter adults from entering the system. If they do enter the system, the cool temperatures may retard sexual maturity and delay spawning activity. Low water temperatures could affect resident and juvenile anadromous fish by retarding growth or by causing fish to move into warmer waters in the tributaries and sloughs.

Slough Habitat

Slough habitats will be slightly buffered from changes in the mainstem, but we expect some adverse impacts in these habitats. In the spring, under the filling flows we will not have the kind of break-up and flushing action we have now. However, we will still have some increase in slough discharge and stage from the increase in local surface runoff as the snow melts and the rains come. This may provide sufficient stimuli for the fry to outmigrate.

In August under 12,000 cfs we may have some passage problems as Woody Trihey discussed yesterday. This afternoon we will discuss ways to

rectify this situation. We may also see some reduction in the areal extent of upwelling and perhaps the rate of upwelling. As the backwater effects from the mainstem are reduced, some of the lower spawning areas may be affected. A decrease in depth may reduce the amount of spawning area available as well as affect holding areas.

Another result of regulated flows would come from increased beaver activity. Beaver dams have already caused some passage problems. At slough 8A, the beaver dams precluded upstream migration until the flow levels increased in September. Then with the additional stage and backwater effects the fish were able to pass.

Q What is the source of flow and ice formation in the slough.

A Right now the sloughs form a thin ice cover over much of their length. At the slough mouths, the ice may resemble the ice cover in the mainstem in its thickness. At slough 8A ADF&G observed that the slough was overtopped as the ice front proceeded upstream past the slough. The discharge increased to 150 cfs. In the spring, the ice melts off the sloughs earlier than break-up in the mainstem. In April the sloughs are open and free flowing.

Q Is there a spawning population in these sloughs? What velocities are we talking about?

A We don't expect that the velocities are high enough under ice formation to cause scouring.

Comment - Acres clarified the path length of the groundwater flow that influences upwelling on the slough picture.

Groundwater moves along the downriver gradient and not really cross wise through the island.

Tributaries

The only portion of the tributary which will be influenced by the project will be the tributary mouths. As in slough habitats, the mainstem causes a backwater to form which provides passage and rearing habitat for residents and juvenile anadromous species. R & M performed an analysis that indicates that, with an exception of three, the tributary mouth will not become perched. The backwater zone may be slightly reduced. Tributary habitat above Devil Canyon will become available to chinook salmon as we discussed earlier.

Q Of those streams that are going to be perched, why is it that they will perch.

A Size of stream bed material.

WATANA OPERATION

Under operation, the flows will be a bit higher in the spring and fall, definitely higher in the winter and about the same much of the summer. We will have greater control on the downstream temperatures. In addition we will reduce the number and magnitude of floods in the system. Presently we have an annual flood of 50,000 cfs. Under operation that annual flood will be about 13,000. We will also have a change in the sediment transport in the system. Right now the system carries lots of sand suspended in the water. You can hear it hit your boat. The reservoir will remove the sand. The river will pick up some sediments below the dam and will carry some sediment but it will be much clearer than the existing conditions.

Because of these physical changes we expect rearing conditions to improve in mainstem and side-channel habitats. We expect increased benthic production from improved light penetration and reduction of suspended sands which presently sandblast the substrate.

Q Is there a seasonal consideration of your discussion with regard to increased benthic production in mainstem habitats?

A Mainly summer.

Winter Conditions

Discharges will be higher in the winter. Water temperatures will also be increased. Upstream of Portage or Sherman, temperatures will be 2 to 4 °C at the dam outlet thus there would be no ice on that portion of the river. Warmer water temperatures are expected to benefit overwintering fish by reducing mortalities associated with freezing. Stable flows will prevent dewatering of overwintering habitat and spawning areas available under the postproject summer flows. Warmer water temperatures may alter the embryo development rates. Temperature increases may result in early emergence, which has been linked to decreased survival. If these fish move downstream, they will encounter 0°C water in the Chulitna and may experience thermal shock. Chum slamon would be less susceptible as they select areas with upwelling, which would buffer the embryos from mainstem temperature changes. The suspended sediments will increase slightly during the winter.

Downstream of Sherman, we will have an ice cover. Here again, increased winter discharge is not expected to adversely affect rearing fish. We may have some increased velocities but we expect there will be sufficient areas along the margins of the river and in pools for fish to overwinter. Juveniles spend much of their time in or near the substrate so mean column velocities may not be as important to them in the winter as they are in the summer.

Sloughs

The change in ice processes will affect slough habitats. Upstream of the ice front we will have open-water condition. As Tom Lavender discussed yesterday we will have less stage than under the present ice cover. Since winter and summer discharges are virtually the same, spawning

habitat available under the post project summer flows should be maintained by the winter flows.

Downstream of the ice front we expect an increase in stage over pre-project conditions. This stage is expected to increase sufficiently to overtop the sloughs at the head end which would allow cooler mainstem water to enter the slough system. This would reduce surface temperatures in the sloughs and may adversely affect the quality of overwintering habitat.

If this process causes aufeis formations in the upper portion of the sloughs, water temperatures in the sloughs may be reduced well into June. No flushing flow would be available to remove the ice and it would have to melt. If cooler water temperatures persist through the spring it could adversely affect nursery areas for emergent fry.

Q What river mile is Watana? So we are talking about 30-55 miles of open river under post-project winter ice conditions.

A Yes.

Q What temperature is causing this? I thought the ice front would be at Talkeetna.

A Under the operation of Watana we expect the ice cover to be between Portage Creek and Sherman. Under the operation of Devil Canyon we expect the ice cover to be somewhere between Sherman and Talkeetna.

Q Do we have any idea of relative percentages of overwintering in mainstem vs. sloughs.

A Do not have percentages but both habitats are being used.

Q Aren't we also seeing a lot of stranded river ice now?

A Yes, but they are much smaller than an aufeis field.

Q Juvenile fish coming out of tributaries - will there be enough water to get back into sloughs?

A Outmigration from tributaries occurs all summer long.

Q What do Indian and Portage contribute to flow.

A The contribution is relatively small.

A (Acres) Gave some numbers.

Q When we hear discharge at Gold Creek, that is not the discharge at Watana.

A That is correct. We will have immediate feedback of Gold Creek streamflow data to modify releases at the dam.

Q Trying to figure out slough access comments in FERC - Exhibit E (Chapter 2). What is most sloughs?

A Access not a well-defined factor on a slough-by-slough basis. Fish did get into many sloughs under 12,000 cfs but access was difficult.

Wayne Dyok (Acres) presented some information on ice processes in sloughs. Reiterated that presently the ice front causes mainstem water to flow through the slough and the mainstem ice cover progresses up the slough. This is probably of short duration.

Q Ground water seeps small - Will large flows cause scour?

A We don't expect they will but we don't know.

Q Won't this have an effect on changing the upstream berm?

A They may change the height of the berm at the upstream end. We will have to evaluate this.

DEVIL CANYON

Filling of Devil Canyon will be a short time, 5 weeks. We reported 5 months in the Exhibit E. Filling will be accomplished in the winter. Downstream discharges will be maintained at 5000 cfs. Under the operation of Devil Canyon you can see that we have small increases in the percent change of streamflow (Figure). We do not expect these changes to result in new impacts but the magnitude of impacts discussed under the operation of Watana will be slightly increased. One notable difference as we mentioned earlier, the ice front will be between Talkeetna and Sherman after Devil Canyon comes on line.

DOWNSTREAM OF TALKEETNA

Let's just take a brief look at the system below Talkeetna. You can see here at Sunshine station (Figure) that the changes are of a smaller magnitude. In addition we do not expect much difference in either the temperature regime nor the sediment transport processes. Moving down to Susitna station we see even a further dampening of project effects. The Eulachon will be in the system in May which has a decrease of about 10 per cent. Changes of this magnitude are not expected to significantly affect the Eulachon spawners.

Q Have you considered the relatively short time that the Eulachon are in the system and does mean monthly represent the situation?

A It may not but under peak flows the percent reduction would be less. This will be looked at when the data is available. We will be trying to get into daily and weekly streamflow values for all fish and the entire system if appropriate. AEIDC will be looking at this in their quantitative impact assessment.

Q Processes will remain the same as under Watana, just be more of it.

A Wayne Dyok (Acres) Yes.

Q During filling and operation may there be large slides into reservoir affecting water quality downstream.

A There will be some slumping especially under the initial filling, but we do not expect much effect downstream. The slide would contain large soil particles which would probably settle out in the reservoir.

Q With the loss of some sloughs can something be done to mitigate by making new sloughs or are they a total loss.

A We do have some ideas on slough mitigation which we will discuss now.

Q What level of turbidity do you expect downstream in winter months?

A Slightly higher than now.

Q What is that comparable to under present conditions up- and downstream of Talkeetna?

A Similar to those experienced in September.

Q How is this all going to be compiled into a composite impact?

A (WCC) (ADF&G-SuHydro) and (AEIDC) will be doing this in the next several months.

Q Will also have to integrate the terrestrial and other studies.

A There is coordination between the different groups.

Agency Comment - ADF&G had a good point on cumulative impacts.

Q I'm not happy with the philosophy of "We have only a 10 percent change and therefore we don't expect a lot of impact." Many of our species already at the edge of a range and 10% can push it over the edge.

A We are still trying to refine and define these problems.

Wayne Dyok (Acres) made announcement regarding handout.

Larry Moulton (WCC) announced typo changes on Table E34.

MITIGATION - Larry Moulton (WCC)

Water Temperature

The multiple level outlet will provide some temperature control during operation and the last year of filling. Temperatures during the second year of filling are still a problem. We may be able to solve this problem by including a low-level intake. This would also give us more temperature control during the spring and fall when we may want to provide warmer or cooler water. The engineers are presently looking into this.

Streamflow

Under the present operating scenario, we can't avoid all impacts to the fish, but we may be able to rectify some of these impacts through habitat modification. One concept is through slough modification. (Figure E 3.9). We would modify a slough using downstream control structures to increase the depth and allow fish passage. The upper end of the slough would be diked off to prevent the mainstem discharge from entering. A gate with a pipe would allow us to have flow through the slough for flushing or for outmigrants.

Q Do you have a generic price to go along with the generic design?

A \$3-\$4 x 10⁶ per 30 million eggs.

Q How many would be built.

A However many are required to mitigate the loss.

Q Have you compared this to hatchery costs.

A Yes, It appears to be about $\frac{1}{2}$ the cost.

Q Who would operate the valve?

A Manual operation.

Q You are thus proposing to design an artificial slough?

A We would use an existing slough.

Q Do the flow control weirs get removed for flushing?

A They will be dropped or laid back but we haven't worked out the details yet.

Q How would you get to these areas for maintenance?

A Most of these areas will be near the existing railroad.

Q Will the juvenile chinook and coho be able to use the sloughs for overwintering?

A We presently have no mechanism for them to get in but can consider it.

Q When holding the chum, do the coho and chinook feed on the chum?

A They probably would.

Agency Comment - I think they would really be able to chow down since the chum would be held in confined areas.

Agency Comment - Seems like these slough modifications are getting down to the bottom of the list.

Agency Comment - We have already covered flows. These plans are "a joke". I don't think they will work. We might as well be looking at hatcheries.

Q Do you know what the effects of time would have on these plans. River changes abandoning slough.

A We would not propose a mitigation that would be abandoned.

Acres Comment - Ice scour is not a problem under project operation and we do not expect the river to change its channel.

Q What is the objective of this slough modification program?

Q Are you trying to create new habitat or maintain existing habitat?

A We are trying to maintain the existing habitat.

Q Is the information that ADF&G and AEIDC will provide going to be helpful in defining which areas will need this mitigation?

Agency Comment - That's right - if it is not broken, don't fix it.

A Yes definitely, The information on habitat relationships and impacts will provide the basis for mitigation. This is a sequential process. We are going to undertake a feasibility study to determine if these concepts are practical. We need to understand better how specific sloughs work and then design a specific mitigation for each slough.

Q How is the time of emergence span going to be accounted for on the release schedule.

A We don't have that information yet as to when the emergence time is and what flows would be required.

Q We tried feeding chum in Cold Bay and the fish wouldn't leave. How are you going to get the fish out?

A We were proposing to feed the fry only if we had early emergence and downstream conditions were not suitable. With the recent results of groundwater studies it looks as though we will not have to feed the fry.

Project Comment - These are proposed mitigation measures and combined with flow regulation, we have some flexibility. We will probably use a combination of mitigation techniques. Some sloughs may not require modifications, others may require a structure at the entrance to help the fish get in, others may require only the berm at the head end. The goal is to maintain as natural and passive a set of modifications as possible.

Agency Comment - There are no spawning channels in operation in Alaska. The ones at Fourth of July Creek in Seward were washed out. I think you will probably have a lot of problems with these.

Agency Comment - Beaver will love these channels and will be hard to control.

Q Are we going to talk about priorities. I'd like to see more emphasis on alternative flows.

A We have been covering this.

1st is flow regimes

2nd is modification of sloughs

3rd is hatchery.

DEMONSTRATION SLOUGH - Jean Baldrige (WCC)

First, I would like to review the problems in slough habitat under operation of the project. Through slough modification we would attempt to resolve these problems:

- o Access for adult salmon
- o Winter thermal regime (overflow from mainstem)
- o Reduced upwelling
- o Sedimentation
- o Vegetation encroachment
- o Beaver activity

The objective of the demonstration project is to test the feasibility of slough modification as a mitigative measure for the Susitna Project. We propose to modify a slough to demonstrate that we can provide access and/or enhance upwelling.

We have started a site selection process to find a suitable area to use. At the end of October, Woodward-Clyde in conjunction with Fish and Game conducted a reconnaissance to find some candidate sloughs. We established some criteria to assist us in this selection.

- o Marginal fish use
- o Ground water upwelling
- o Suitable substrate
- o Surface water source
- o Adequate water quality
- o Accessibility for heavy equipment

We are in the process of screening the sloughs according to this criteria. We hope to identify likely candidates to begin a baseline data collection program on this next field season and we will then be able to actually modify a slough after that. Presently we don't understand [specific] slough processes well enough to be able to design a modification program that we know will work.

Acres Comment - With regard to the sloughs, we have a pretty good handle on the processes. The major missing link is applying the processes to each of the sloughs individually to get the impacts to each slough. A few sloughs have been studied and results will be available. We may find that no modification is necessary for some sloughs, minor modifications for others, and major modifications (artificial channels) to others. Is it worth doing the major channel modification? We don't know enough right now to decide.

ADF&G (Su hydro) Comment - Exhibit E Has been prepared on one flow regime. Mitigation is based on one operational flow. One problem to be dealt with is avoidance. Flow may be available for avoidance but it may not be prudent to go with that flow and the flow regime will still be under negotiation. Our studies and AEIDC's models will help address the question of flows.

Q Is slough modification a technique proposed to the agencies or is this the mitigation proposed in Exhibit E?

A This is a proposed mitigation for the project.

Q We aren't going to know until we try it. If it doesn't work what happens since the project will be well along the way?

A Most FERC licenses stipulate a certain acceptable limit of escapement or production that is monitored during construction and operation. If the mitigation does not work then we can undertake additional mitigation.

Agency Comment - Whenever we are mitigating, we have to mitigate whatever potential there is under natural patterns.

Agency Comment - Mitigation policy has been established but a program is needed to outline a plan for monitoring.

A It's included in the Exhibit E. Monitoring is part of the mitigation plan.

Q Is the slough modification project going to look at improving an existing slough.

A Yes.

Q Are you using the fish to see the effects of mitigation. You aren't doing anything about fish production to evaluate the impacts or effectiveness of these modifications. How is fish production being evaluated?

A We do not evaluate the habitat in terms of x number of coho units. We are constrained to use the physical parameters, we identify current conditions and try to maintain those conditions. The measure of success of those modifications would be in terms of escapement or fry production as gathered through a monitoring program. .

Q I didn't get the idea how conceptual are the mitigation plans that are proposed in the Exhibit E. Today's presentation has cleared this up. No one wants to see hatcheries on the Susitna River except as the last alternative but why aren't hatcheries mentioned in Exhibit E. Don't you want to include some hatchery program to address what can be done if the other mitigation prove not to work. What would be the senario with a hatchery?

A Krammer, Chin and Mayo have just completed a hatchery siting study. FRED division is looking at upper basin enhancement possibilities without the project.

Comment - We have already selected a case that allows release such that hatcheries are not required.

Q What is your perception as to how FERC looks at these mitigation approaches. What is your understanding of these approaches. Are they put in to placate the agencies?

A We can not state what FERC will do.

ACHS Comment - FERC has not reacted to anything proposed to them yet. That is the way FERC works - they will not plan the project for the Alaska Power Authority.

Alaska Power Authority Comment - We are dealing with a continuous series of mitigation schemes and a continuous series of flow regimes to deal with changes in a continuous series of habitat types.

Q Are we where we should be on the mitigation plans for the FERC process?

A Regs say that a workable design drawing is required, but definition of a design drawing is vague. Design drawings usually not required except where an integral part of the dam, though schematics for systems usually are included.

Agency Comment - It is a continuum; they may request more data or accept it as is. We may feel that we are not very far up on the continuum, but FERC may not be concerned about this. They may require that problems be worked out between the Alaska Power Authority and the agencies and return to FERC with resolution. How is FERC going to properly review the Exhibit in the short time frame?

A This is a Draft review.

Q What is FERC going to come back with.

A We don't know.

Wayne Dyok (Acres) gave a handout.

John Hayden (Acres) thanked everyone.

MEETING ADJORNED