Before The
Federal Energy Regulatory Commission

Application For License For Major Project

SUSITNA HYDROELECTRIC PROJECT

(PROJECT NO. 7114-000)

RESPONSES TO THE DEPARTMENT OF THE INTERIOR COMMENTS ON LICENSE APPLICATION

Volume I

February 15, 1984

ALASKA POWER AUTHORITY

FEDERAL ENERGY REGULATORY COMMISSION

SUSITNA HYDROELECTRIC PROJECT

PROJECT NO. 7114

RESPONSE OF THE

ALASKA POWER AUTHORITY

TO

COMMENTS

ON THE

ALASKA POWER AUTHORITY'S

APPLICATION FOR LICENSE FOR MAJOR PROJECT

February 15, 1984

VOLUME I

FEDERAL ENERGY REGULATORY COMMISSION
SUSITNA HYDROELECTRIC PROJECT
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TO COMMENTS ON
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FEBRUARY 15, 1984

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PREFACE

On December 12, 1983, the United States Department of the Interior, Office of the Secretary, filed a 108-page letter with the Federal Energy Regulatory Commission on the Alaska Power Authority's Application for License for the Susitna Hydroelectric Project, Federal Energy Regulatory Commission Project No. 7114-000. On or before November 28, 1983, eight other state and Federal agencies had each filed a letter with the Federal Energy Regulatory Commission on FERC Project No. 7114-000, as well. The Alaska Power Authority's response to the specific comments contained in the eight comment letters filed on or before November 28, 1983, was submitted to the FERC on January 19, 1984. The document in which this Preface appears (the "Comment/ Response Document") contains the Alaska Power Authority's detailed response to the more than 500 specific comments contained in the December 12, 1983 letter filed by the Department of the Interior, Office of the Secretary. Responses to Comments filed by other organizations within the Department of the Interior can be found in the Power Authority's earlier Response Document filed with the FERC on January 19, 1984.

In preparing its Responses to Comments, the Power Authority has assigned each commenting agency a letter tab. Those agencies filing comments on or before November 28, 1983, were assigned letter tabs "A-H." The DOI, Office of the Secretary has been assigned letter tab "I." A copy of the DOI comment letter is enclosed in this Comment/Response Document behind letter tab I.

To ensure the preparation of thorough responses to each of the nine agency comment letters, the Power Authority divided each comment letter into specific individual comments. Each individual comment has been assigned an alphanumeric comment code. The alphanumeric code simply identifies the commenting agency (alphabetically by letter tab) and the specific comment (by consecutive number). In this Comment/Response Document, alphanumeric comment codes are shown in brackets in the left-hand margin of the DOI comment letter.

Behind the December 12,1983 DOI comment letter are all of the specific comments--directly quoted from their corresponding comment letter--with comment codes, followed by corresponding Alaska Power Authority Responses. Some Power Authority Responses contain cross-references to other responses. Cross-referenced Responses to Comments with letter tabs A-H (e.g., A.1, B.10, C.25, etc.) can be found in the Alaska Power Authority's January 19, 1984 filing of Responses to Agency Comments on License Application before the Federal Energy Regulatory Commission. Cross referenced Responses to Comments with letter tab "I" (e.g., I.21, I.55 etc.) can be found in this Comment/Response Document.

Bibliographical references to the "I" series Comment/Responses can be found in this Comment/Response Document following the Subject Index.

SUBJECT INDEX

This Index classifies Comments and Responses by subject matter. Each Comment/Response combination is listed by an alphanumeric identifying code opposite a subject discussed in the Comment and its accompanying Response. If a Comment/Response deals with more than one subject, it is listed opposite each subject with which it deals.

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	I.313	48
	I.314	48
	I.323	51
	I.328	51
	I.331	52
	I.343	55
	I.346	56
	I.356	59
	I.366	58-59
	I.374	60
	I.375	60
	I.376	60
	I.377	60
	I.379	61
	I.380	61
	I.381	61
	I.384	62
	I.391	63
	I.394	64

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	I.400	65
	I.401	65
	I.402	66
	I.406	66
	I.409	66-67
	I.411	67
	I.419	68
	I.420	68
	I.421	68
	I.424	70
	I.490	88
	I.494	88
	I.497	90
	I.498	90
	I.514	93
	I.516	93
	I.522	94
	I.525	95
	I.526	95
	I.528	95
	I.536	98
	I.548	100

Subject	Comment/Response Code Nos.	Page of Each Agency's Original Comment Document on which Coded Comment Appears
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	C.3	2
	C.4	2
	C.6	2
	C.7	2
	C.11	4
	C.12	4
	F.53	17
	I.1	1(a)
	I.2	1(a)
Modeling (Environmental)	A.9	3
	A.10	3
	A.14	4
	B.6	4-5
	B.8	6-7
	B.15	10
	B.16	10
	B.22	12
	B.32	15-16
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Subject	Comment/Response Code Nos.	Page of Each Agency's Original Comment Document on which Coded Comment Appears
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	C.20	6
	C.34	9-10
	C.42	12
	C.58	15
	C.71	19
	C.86	23
	F.42	11-12
	I.2	1(a)
	I.3	1(a)
	I.10	2(a)
	I.16	1
	I.22	2
	I.38	5
	I.39	5
	I.41	5
	I.46	6
	I.47	6
	I.48	6
	I.49	6
	I.51	6-7
	I.52	7
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Subject	Comment/Response Code Nos.	Page of Each Agency's Original Comment Document on which Coded Comment Appears
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	I.62	8
	I.64	9
	I.66	9
	I.73	12
	I.100	17
	I.107	18
	I.130	21
	I.145	23-24
	I.168	28
	I.178	29
	I.186	30
	I.187	30
	I.188	30
	I.198	31-32
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	I.214	35
	I.229	37
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	F.13	3
	F.30	9
	F.42	11-12
	F.47	13
	F.74	19-20
	I.3	1(a)
	I.4	1(a)
	I.10	2(a)
	I.14	3(a)
	I.18	1
	I.34	4
	I.35	4
	I.46	6
	I.77	12-13
	I.78	13
	I.85	15
	I.89	15
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	I.171	28
	I.172	28
	I.178	29
	I.181	29
	I.185	30
	I.213	35
	I.242	39
	I.251	40
	I.265	41-42
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	I.267	42
	I.268	42
	I.269	42
	I.271	42
	I.272	42
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	I.313	48
	I.314	48
	I.315	50

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	I.334	54
	I.340	55
	I.351	57
	I.366	58-59
	I.374	60
	I.386	62
	I.391	63
	I.400	65
	I.401	65
	I.409	66-67
	I.410	67
	I.416	67
	I.490	88
	I.492	88
	I.494	88
	I.519	94
	I.524	95
	I.525	95
	I.547	100

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	C.86	23
	C.87	23-24
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	F.6	2
	F.30	9
	F.33	9
	F.36	10
	F.37	10
	F.38	10-11
	F.44	12
	F.50	14
	F.51	14
	F.52	14-15
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	I.79	13
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	I.237	38
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	I.249	40
	I.250	40
	I.272	42
	I.276	43
	I.277	43
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Oil Spills	C.51	14
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Subject	Comment/Response Code Nos.	Page of Each Agency's Original Comment Document on which Coded Comment Appears
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	C.61	16
	F.15	4
	F.16	4-5
	F.17	5
	F.18	5
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	I.150	26
	I.155	26
	I.190	30
	I.202	32
	I.233	38
	I.264	41
	I.291	44
	I.307	47
	I.502	91
	I.511	92
	I.538	98
Settlement Process	B.7	5-6
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Subject	Comment/Response Code Nos.	Page of Each Agency's Original Comment Document on which Coded Comment Appears
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	A.12	4
	A.13	4
	A.14	4
	A.15	4
	A.16	5
	A.17	5
	C.61	16
	F.4	1
	F.8	2
	F.14	3-4
	F.15	4
	F.17	5
	F.18	5
	F.19	5-6
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Subject	Comment/Response Code Nos.	Page of Each Agency's Original Comment Document on which Coded Comment Appears
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	F.61	17
	F.62	17
	F.64	17
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	F.66	18
	F.68	18
	I.6	2(a)
	I.91	16
	I.150	26
	I.155	26
	I.170	28
	I.176	29
	I.190	30
	I.203	32
	I.233	38
	I.264	41
	I.292	44
	I.495	89
	I.497	90

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	I.516	93
	I.517	93
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Soil Stability	I.109	18
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	I.126	20
	I.136	22
	I.336	54
	I.338	55
	I.344	56
	I.345	56
	I.355	57
	I.357	57
	I.361	58
Transmission Lines and Corridors	A.18	5
	A.19	5
	C.81	22
	D.1	11
	F.39	11
	G.1	1

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	I.227	37
	I.228	37
	I.231	37-38
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	I.254	40
	I.263	41
	I.277	43
	I.303	46
	I.305	46-47
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	I.327	51
	I.328	51
	I.329	51
	I.344	56
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	I.393	64
	I.394	64
	I.395	64
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	I.415	67
	I.419	68
	I.499	90
	I.539	98
	I.555	101
	I.556	101
	I.577	106
Vegetation	A.10	3
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	C.48	13-14
	C.87	23-24
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Vegetation (cont.)	F.51	14
	I.29	3-4
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	I.77	12-13
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	I.79	13
	I.80	13
	I.81	13
	I.82	14
	I.91	16
	I.110	18
	I.124	20
	I.151	26
	I.152	26
	I.180	29
	I.181	29
	I.192	31
	I.198	31-32
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	I.300	45
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	I.309	47
	I.311	48
	I.316	50
	I.317	50
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	I.319	50
	I.320	50
	I.321	50
	I.322	50
	I.323	51
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	I.326	51
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Subject	Comment/Response Code Nos.	Page of Each Agency's Original Comment Document on which Coded Comment Appears
Vegetation (cont.)	I.328	51
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	I.331	52
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	I.336	54
	I.337	54
	I.338	55
	I.339	55
	I.340	55
	I.341	55
	I.342	55
	I.343	55
	I.344	56
	I.345	56
	I.346	56
	I.347	56
	I.348	56
	I.350	57
	I.351	57
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Subject	Comment/Response Code Nos.	Page of Each Agency's Original Comment Document on which Coded Comment Appears
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	I.366	58-59
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	I.370	59
	I.372	60
	I.373	60
	I.378	60-61
	I.379	61
	I.383	61
	I.388	62-63
	I.392	63
	I.394	64
	I.396	64
	I.397	64-65
	I.402	66
	I.404	66
	I.405	66
	I.406	66
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Subject	Comment/Response Code Nos.	Page of Each Agency's Original Comment Document on which Coded Comment Appears
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	C.54	14
	C.55	14-15
	C.56	15
	I.20	1
Water Appropriation	F.3	1
	I.17	1
Water Quality	B.14	10
	B.17	10-11
	B.24	13
	B.38	18
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	C.35	10
	C.36	10
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	C.54	14
	C.55	14-15
	C.57	15
	C.58	15
	C.59	16
	C.72	19
	C.74	20
	I.17	1
	I.19	1
	I.20	1
	I.21	2
	I.28	3
	I.32	4
	I.34	4
	I.41	5
	I.43	6
	I.49	6
	I.54	7
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Subject	Comment/Response Code Nos.	Page of Each Agency's Original Comment Document on which Coded Comment Appears
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	I.112	19
	I.113	19
	I.116	19
	I.128	20
	I.342	55
	I.359	58
Water Temperature	A.9	3
	B.6	4-5
	B.15	10
	B.16	10
	B.22	12
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	B.29	14-15
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Subject	Comment/Response Code Nos.	Page of Each Agency's Original Comment Document on which Coded Comment Appears
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	B.58	24
	C.47	13
	I.22	2
	I.30	4
	I.31	4
	I.37	4
	I.38	5
	I.45	6
	I.51	6-7
	I.52	7
	I.54	7
	I.62	8
	I.63	8-9
	I.64	9
	I.66	9
	I.73	12
	I.100	17
	I.104	18
	I.139	23
	I.149	24
	I.278	43
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Subject	Comment/Response Code Nos.	Page of Each Agency's Original Comment Document on which Coded Comment Appears
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Wetlands	I.18	1
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	I.79	13
	I.92	16
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	I.322	50
	I.324	51
	I.325	51
	I.331	52
	I.332	52-53
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	I.335	54
	I.343	55
	I.346	56
	I.356	57
	I.358	58
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	I.566	103
Wildlife Impact	A.6	2
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	C.78	22
	C.79	22
	C.80	22
	C.81	22
	C.83	23
	C.84	23
	C.85	23
	C.86	23
	C.87	23-24
	C.88	24
	D.1	all
	F.6	2
	F.7	2
	F.9	2
	F.30	9
	F.31	9
	F.32	9

Subject	Comment/Response Code Nos.	Page of Each Agency's Original Comment Document on which Coded Comment Appears
Wildlife Impact (cont.)	F.33	9
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	F.36	10
	F.37	10
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	F.39	11
	F.41	11
	F.42	11-12
	F.43	12
	F.45	12-13
	F.46	13
	F.47	13
	F.50	14
	F.51	14
	F.52	14-15
	I.7	2(a)
	I.11	3(a)
	I.29	3-4
	I.39	5
	I.40	5
	I.77	12-13
	I.79	13
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Subject	Comment/Response Code Nos.	Page of Each Agency's Original Comment Document on which Coded Comment Appears
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	I.165	27
	I.166	27
	I.167	27
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	I.171	28
	I.172	28
	I.173	28
	I.174	28
	I.175	29
	I.177	29
	I.180	29
	I.182	29
	I.183	29
	I.184	29
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Subject	Comment/Response Code Nos.	Page of Each Agency's Original Comment Document on which Coded Comment Appears
Wildlife Impact (cont.)	I.190	30
	I.191	30-31
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	I.193	31
	I.194	31
	I.195	31
	I.196	31
	I.197	31
	I.198	31-32
	I.199	32
	I.200	32
	I.201	32
	I.202	32
	I.203	32
	I.204	32-33
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	I.206	33
	I.207	33
	I.208	33
	I.209	34
	I.211	35
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Subject	Comment/Response Code Nos.	Page of Each Agency's Original Comment Document on which Coded Comment Appears
Wildlife Impact (cont.)	I.216	35
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	I.226	37
	I.227	37
	I.229	37
	I.230	37
	I.231	37-38
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	I.235	38
	I.237	38
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	I.240	38
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	I.242	39
	I.243	39
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Subject	Comment/Response Code Nos.	Page of Each Agency's Original Comment Document on which Coded Comment Appears
Wildlife Impact (cont.)	I.249	40
	I.251	40
	I.252	40
	I.255	40
	I.256	41
	I.257	41
	I.258	41
	I.259	41
	I.260	41
	I.261	41
	I.263	41
	I.264	41
	I.267	42
	I.268	42
	I.269	42
	I.270	42
	I.271	42
	I.272	42
	I.274	42-43
	I.276	43
	I.280	43
	I.281	43
	I.282	43
	I.283	43
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Subject	Comment/Response Code Nos.	Page of Each Agency's Original Comment Document on which Coded Comment Appears
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	I.293	44
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	I.296	45
	I.297	45
	I.298	45
	I.299	45
	I.300	45
	I.305	46-47
	I.306	47
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For
Response of
Alaska Power Authority To
December 12, 1983 License Application Comments
of
United States Department of the Interior,
Office of the Secretary

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United States Department of the Interior

OFFICE OF THE SECRETARY
WASHINGTON, D.C. 20240

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ER 83/1034

Honorable Kenneth F. Plumb, Secretary
Federal Energy Regulatory Commission
825 North Capitol Street, N.E.
Washington, D. C. 20426

Dear Mr. Plumb:

The Department of the Interior has reviewed the application for major license for the Susitna Project (FERC No. 7114), Matanuska - Susitna Division, Alaska. We have the following comments and recommendations based upon our several jurisdictions and our special expertise. This cover letter outlines our major concerns. Enclosed are detailed comments organized by chapter.

[.1] The application suffers from outdated information, particularly in the areas of load forecasting, reservoir and river computer modeling effects, fish and wildlife studies, project design, and evaluation of alternatives.

The load forecasts included in the application reflect an economic evaluation that was conducted 2 years ago, prior to the severe drop in oil prices. The applicant, Alaska Power Authority (APA), recognizes these changed conditions and has updated its economic evaluation. This reevaluation, however, is not reflected in the application. The significant decline in projected load forecasts has large implications to many of the project assumptions which have constrained mitigation planning, for example: available water for downstream flows; mode, timing, and routing of construction access; and scheduling of work.

[.2] The computer modeling efforts would appear to be outdated since the models have either been replaced or modified. These changes make it extremely difficult to establish baseline impacts and address mitigation measures presented in Chapters 2 and 3.

[.3] Project studies will continue through the licensing process, and some of these studies will continue after license issuance as monitoring programs. Due to the ongoing nature of the studies and the time lag in information distribution, we consider it essential that the future studies referenced in the application be fully discussed in the application. A procedure should be established for updating the results and analyses from the ongoing and planned studies.

[.4] Many of the studies and reports that were planned for 1983 were not conducted (e.g., floristic surveys (p. E-3-193), wetlands mapping (p. E-3-201), detailed construction method (p. E-3-268), Design Criteria Manual (E-3-150), analysis of instream flows and temperatures (p. E-3-189) etc.). We consider it necessary that a study update be provided to our

[I.4] (cont.) Fish and Wildlife Service (FWS) indicating which studies have been canceled, delayed or modified and which are still planned.

[I.5] The intent of the Fish and Wildlife Coordination Act (16 U.S.C. 661, et seq.) and the National Environmental Policy Act (NEPA) (42 U.S.C.-4371 et seq.) is that environmental resources be given equal consideration with project features. Consistent with NEPA, as well as the applicant's Mitigation Policy (Appendix 3.A), avoidance of adverse impacts should be given priority as a mitigation measure. We have found this generally not to be the case, for example: mode, timing, and routing of construction access; scheduling of work; type and siting of construction airstrips, camps, villages, and permanent town; recreation development; and instream flow regime.

[I.6] Research of background information is frequently inadequate and incomplete. Examples, which we noted in our draft application review (included in Chapter 11 of Exhibit E), include discussions of subsistence (Chapters 3 and 5) and alternative power generation sources, specifically natural gas and geothermal (Chapter 10). The FWS provided the applicant with references and suggestions in these draft application comments.

[I.7] Potential major project impacts to fish and wildlife resources still lack an adequate level of quantification. Examples include: fishery resources and changes downstream of Talkeetna; changes in reservoir and river temperatures, water quality and ice processes; and wetlands impacts. Other examples are noted throughout our specific comments. The potential impacts to these resources should be quantified and then evaluated over the life of the project. Only after that is accomplished can specific, effective mitigation measures emerge. We consider quantification of existing resources and impacts and a specific, effective mitigation plan essential to the development of an acceptable environmental impact statement.

[I.8] In several of the chapters of Exhibit E we are confronted with mitigation options that are designed to address adverse impacts. For example, in Chapter 3 the potential value of spiking spring flows for salmon out-migration and the installation of a fifth portal on the multi-level intake structure are discussed. However, neither of these proposals are incorporated into the mitigation plan. If these options have validity, they should be incorporated into the project design and operational plan.

[I.9] Mitigation which is proposed should have proven success in Alaska, or in a similar environment. Examples include: the proposals to improve habitat through controlled burning; hatchery propagation of Arctic grayling; and various manipulations of the upper Susitna River sloughs.

[I.10] Project studies should begin to focus on identifying enhancement opportunities which the project provides. The present task is to identify those resources which would be adversely affected and attempt to "correct" these problems. For example, without examining water quality and quantity changes in terms of opportunities to improve habitat, we cannot satisfactorily examine whether there exists a realistic potential to trade-off losses to one species for another, and, as a by-product, identify enhancement opportunities.

[I.11] The FWS defines enhancement as the ". . .development or improvement of wildlife resource values of the area affected by the project beyond that which would occur without the project" (F.R. Vol. 44, No. 98, p. 29305). We consider enhancement to be habitat

[I.11] (cont.) improvements beyond mitigation and <u>not</u> synonymous with improvement of habitat for mitigation. We believe the applicant should adopt these definitions.

[I.12] We strongly support the applicant's proposed establishment of an interagency monitoring program (p. E-3-180). This program should be funded by the project, containing representatives from appropriate State, Federal and local agencies. On-site representation from the FERC would be highly desirable to maximize the responsiveness of the team. The board should have the authority to recommend modifications of how activities are conducted to assure that mitigation is effective. Recommended changes in the mitigation program should be adopted through a mechanism incorporated into the license as a binding article, mutually acceptable to all concerned bodies.

[I.13] Your attention is also called to Attachment A of our Chapter 3 comments in the enclosure. Attachment A represents those items which we believe should be conditions of any license issued based upon the current application documents.

Summary

[I.14] We conclude that the applicant's request poses serious environmental problems from a lack of quantification of natural resources and an inability to formulate proper mitigation and enhancement plans. We recommend that FERC carefully consider all of these aspects of the project when processing the application. The recommendations supplied above and in the accompanying detailed comments should be used in preparation of any environmental impact statement issued for this project and in any terms and conditions of any license issued.

Sincerely,

Bruce Blanchard

Bruce Blanchard, Director
Environmental Project Review

Enclosure

cc: Mr. Fred Springer
Mr. Robert A. Mohn, Project Manager
Ms. D. Jane Drennan

CHAPTER 2. WATER USE AND QUALITY

General Comments

[I.15] Chapter 2 has been vastly improved qualitatively from the draft we reviewed last year 2-1/, however, it still does not provide the quantification necessary for assessing project-related impacts or formulating a mitigation plan. In particular, Chapter 2 fails to fully discuss all of the six habitat types identified by the Alaska Department of Fish and Game (ADF&G) Susitna Hydro Aquatic Studies Program; impacts to riparian zones; resources and potential impacts downstream of the Talkeetna River; groundwater relationship between the sloughs and mainstem; and enhancement opportunities.

[I.16] The modeling efforts discussed in Chapter 2 suffer from lack of verification and/or insufficient input data (see our comments on pages E-2-62, E-2-87, E-2-88, E-2-114, E-2-117, E-2-118, E-2-119, E-2-121, E-2-123, etc.). Additional modeling efforts should be undertaken to address post-project conditions regarding sediment and bedload transport (see our comments on pages E-2-34, E-2-84, and E-2-96).

[I.17] The chapter should also describe studies, ongoing and proposed, which may address the concerns we have identified.

Specific Comments

[I.18] Page E-2-3: 2-BASELINE DESCRIPTION: The discussion divides the Susitna River into two habitat components between the dam sites and the Talkeetna River; the mainstem and the sloughs. Below the Talkeetna River, the discussion is non-specific regarding habitat sites. In contrast, the ongoing ADF&G studies 2-2/ have identified six habitat types utilized moderately to heavily by salmon. These are: tributaries, tributary mouths, upland sloughs, side sloughs, side channels, and mainstem. Each of these habitat types would undergo a different degree of impact due to the project. Some habitats could become less useful for one life phase but may become more valuable for another life phase. Only by examining potential impacts in all six habitat types can mitigation and enhancement opportunities be identified. In addition to the habitat types identified by ADF&G, the adjacent wetlands should be fully described and the potential impacts to these habitats discussed in latter sections, both upstream and downstream from the mouth of the Talkeetna River.

[I.19] Page E-2-19: 2.3-Susitna River Water Quality: Paragraphs 6 and 7: It is noted that 22 water quality standards are exceeded, under natural conditions. We disagree with the conclusion that, since these conditions are naturally occuring, they have an insignificant effect upon the aquatic organisms. We recommend a further examination of how changes in water quality would affect aquatic organisms. An examination of the available literature may be sufficient.

[I.20] Page E-2-32: 2.3.7-Nutrients: The communities of Cantwell, Trapper Creek, and Talkeetna would be affected by changes in water quality relative to sewage treatment, drinking water, etc. Baseline descriptions and, in latter sections, impacts attributable to the project should be provided.

[I.21] Page E-2-34: (e) pH: Due to the wide pH range (6.0 to 8.1) measured above Gold Creek, and the potential for increased acidity due to inundation of bogs by the reservoirs, we recommend that pH monitoring be continued.

[I.22] Page E-2-40: 2.4.4-Hydraulic Connection of Mainstem and Sloughs: The water temperature relationship between the mainstem and the sloughs (as well as other water quality parameters) must be established. To this end, one slough (#9) has been closely examined and a second slough, #8A, has been preliminarily examined. These examinations have focused on the groundwater relationship. According to Tony Burgess (Acres American), in his Susitna Hydro Exhibit E Workshop presentation (December 1, 1982) on groundwater upwelling and water temperature in sloughs, the groundwater regime can be modeled, but locally the match is not very good: The groundwater temperatures near the surface do not match the predicted temperatures. Continued study is indicated for slough #9. After an understanding is achieved for sloughs #9 and #8A the program needs to be expanded to other sloughs, possibly sloughs #11, #19, #20 and #21. These sloughs have been more intensively examined than other sloughs in this reach of the Susitna River. Please outline the studies for these slough investigations.

[I.23] Page E-2-44: 2.6.2-Fishery Resources: The recently conducted salmon incubation study 2-3/ indicated that chum salmon outmigrate after a particular number of degree-days are exceeded, coincidental with the receeding limb of the spring hydrograph. Further investigation is necessary to fully understand the need for peaking spring flows in relation to chum salmon outmigration.

[I.24] Page E-2-58: 3.4.1-Range of Flows: Paragraph 2: The assumption that Case D flows would result in "... essentially no impact to the downstream fishery during the anadromous fish spawning period," fails to recognize impacts other than flows (e.g. temperature, turbidity, water quality, etc.). In addition, the recent examination of access to nine sloughs 2-4/ indicated that the Case D maximum flow of 19,000 cubic feet per second (cfs) could create acute access problems in several sloughs. Five of the nine sloughs achieve unrestricted access at flows greater than 20,000 cfs. Evidence from the ADF&G studies indicate that the naturally-occuring 1982 summer flows resulted in a significant reduction of available habitat for chum salmon in sloughs. 2-5/ Case D flows could result in similar significant reductions in available habitat.

[I.25] Page E-2-59: 3.6.1-Susitna River Fishery Impacts: As indicated in Section 3.5-Energy Production and Net Benefits, the 12,000 cfs maximum August flow was established through a power production versus net economic benefits analysis. The flow level was established prior to an evaluation of access to sloughs in the Susitna River upstream of the Talkeetna River and is not biologically based. The 1982 ADF&G studies 2-6/ and Trihey's (1982) 2-7/ work on slough access indicate flows of 12,000 cfs would restrict access to six of the nine sloughs studied.

[I.26] Page E-2-60: 3.6.2-Tributary Fishery Impacts: According to ADF&G, 2-8/ the Gash Creek mouth (River mile (RM) 111.6) could become perched given the applicant's proposed post-project flows. Spawning coho salmon were observed in this creek during 1981 and 1982.

[I.27] Potential fishery impacts related to post-project flows above the mouth of the Talkeetna River are not limited to access to side sloughs (for chum salmon) or tributaries (for chinook, coho, and pink salmon). The analysis of impacts to salmon should be by life phase, i.e. adult passage, spawning, incubation, rearing, and outmigration. The habitats used moderately or heavily by salmon for at least one life phase are tributaries, tributary mouths, upland sloughs, side sloughs, side channels, and the mainstem. 2-8/ As a species proceeds from one life phase to another it frequently proceeds to a habitat type better suited for the next life phase. Access would need to be assured at times other than that which allows adult chums to pass into side sloughs. Post-project changes in water quality and quantity could severely degrade these habitats. Based upon the 1982 flows, ADF&G studies 2-9/ indicate that significant reductions in available spawning habitat in the side sloughs could occur post-project. Post-project flows could also significantly change the existing relationship between the mainstem and the other habitats previously mentioned. Post-project changes in other water quality parameters would affect the fisheries. For example, burbot show a high positive correlation with turbidity levels, while juvenile coho salmon are negatively correlated. 2-10/

[I.28] It should also be recognized that post-project changes in water quality and quantity would (given Case C) result in identifiable changes in the Susitna River down to the estuary. 2-11/ The Arctic Environmental Information and Data Center (AEIDC) 2-12/ concluded Case C would result in an increase in flows of 127.2% at Susitna Station (downstream of the Yentna River) during March. During July, flows below the Chulitna River would be decreased by 25%, and at Susitna Station by 12%. Identifiable changes in river temperature 2-13/ and other water quality parameters (e.g. turbidity) would also be predicted below the Chulitna River. These project-related changes would be attenuated downstream; however, our knowledge of the fishery resources and habitats downstream of the mouth of the Talkeetna River is considered to be an order of magnitude below that in the Devil Canyon to Talkeetna River reach. 2-14/ At present, escapement data are not available for the Talkeetna and Chulitna Rivers, thus, the number of salmon dependent upon the Susitna River below the mouth of the Talkeetna River, other than for migration, is not known. It is likely many more fish are dependent upon the lower reaches of the Susitna River than on the reach above the mouth of the Talkeetna River. In addition, the Susitna River downstream from the mouth of the Chulitna River is broad, and relatively shallow; a configuration which would lead one to expect greater impacts from smaller changes in flow. Dismissal of impacts downstream of the mouth of the Talkeetna River would be premature at this time, and should be fully discussed. 2-15/

[I.29] Page E-2-61: (d) Riparian Vegetation and Wildlife Habitat: The post-project instream flow regime has tremendous potential to impact the timing and extent of floods, freeze-up, and spring ice jams, as well as the riparian groundwater relationships. We do not understand how it can be stated that the regime, "...is unrelated to any of these factors." It is stated that, "...it may be desirable to maintain riparian vegetation by simulating spring floods for a short period of time. However, the spring runoff storage is a key element of the project. Large releases for even a few days would have severe economic impact on the project. Hence, no minimum flood discharges were considered." In response to our concern that the receeding limb of high spring flows may be important to stimulate smolt outmigration, it is stated in Chapter 11, [I.29] (cont.) Response W-3-026, "When the significance of flow-related stimuli to smolt out-migration is defined, the flow regime can be adjusted." The apparent conflict in the statements in the application should be reconciled and the environmental implications of this flow decision examined.

[I.30] Page E-2-62: (e) Water Quality: The pre-versus post-project temperature changes should be described throughout the year.

[I.31] At the present time reservoir release temperatures are available for only one year (1981). With only one year's data it is impossible to estimate the range of effects. In addition, the data indicate that 1981 temperatures were atypical when compared to computer-predicted temperatures for water years 1968 to 1982. Of the fifteen years examined by AEIDC 2-16/, 1981 was the only year in which temperatures declined from June to July.

[I.32] Other pre- versus post-project water quality changes should also be described (e.g. turbidity, sediment, metals, nutrients, etc.).

[I.33] Page E-2-64: Maximum Drawdown Selection: This section should discuss that in the event both reservoirs are drawndown to their minimum elevation, downstream flows would be provided such that outflow would equal inflow.

[I.34] Page E-2-69: (iii) Suspended Sediment/Turbidity/Vertical Illumination: Paragraph 9: The basis for the conclusion, "Downstream from Talkeetna, turbidity and suspended sediment levels should remain essentially the same as baseline conditions," should be provided for the winter clear water period. We recommend further investigation of post-project turbidity and suspended sediment levels due to impoundments in discontinuous permafrost regions. Several references are footnoted for your convenience. 2-17/

[I.35] Page E-2-78: (i) Minimum Downstream Target Flows: Project operations flows, where they differ from naturally occuring flows, should be provided during reservoir filling. It may be useful to gradually increase winter flows during the filling period so that changes in the river and fisheries due to increased winter flows can be monitored.

[I.36] Page E-2-84: (d) River Morphology: Sediment would be expected to aggrade (over a long period of time) at the Chulitna-Susitna confluence until a new equilibrium is reached. We are unaware of any data or study being initiated to attempt to quantify the distance at which downstream aggradation could occur or what changes are possible in bed elevation. Changes at the confluence could affect fish movement or boat navigation, exacerbate winter river ice conditions, and have unfortunate consequences for the village of Talkeetna. We recommend more thorough evaluation of sediment transport, bedload movement, and aggradation at the Chulitna-Susitna confluence.

[I.37] Page E-2-87: Watana to Talkeetna; Paragraph 5: It is our understanding that reservoir temperature outflows are currently available for water year 1981 only. Water year 1981 was atypical when compared to water years 1968 to 1982, and was the only year in which computer-predicted temperatures declined from June to July. 2-18/ We recommend that the temperature studies reflect at least two data.

[I.38] Page E-2-88: Talkeetna to Cook Inlet: Modeling by AEIDC 2-19/ based upon water year 1981 for Watana alone, and Watana and Devil Canyon together, indicates identifiable post-project temperature impacts below the confluence of the Chulitna River. We suspect this might also occur during filling of Watana. We recommend this potential impact be re-examined.

[I.39] Page E-2-88: Reservoir: We recommend that modeling be undertaken for reservoir ice formation and breakup during filling, as well as operation. The time of breakup has significant implications to potential crossings by animals (e.g. caribou). We expect this modeling may not be possible until several years of temperature data have been collected for the reservoir model.

[I.40] Page E-2-90: Talkeetna to Cook Inlet: The expected delay in ice cover formation downstream from the Talkeetna River should be discussed. This will have potential impacts to beaver caches, movement by animals such as moose, and recreational access.

[I.41] Page E-2-96: (vii) Total Dissolved Solids, Conductivity, Significant Ions, Alkalinity, and Metals: Long-term increases in mercury levels in fish are quite possible. This potential problem is inadequately researched in the application. We refer you to several references. 2-20/ Based upon available data, Bodaly and Hecky (1982) 2-21/ concluded that in cool-temperate North America high mercury levels in fish probably result from reservoir formation in a large proportion of cases. Bodaly, Hecky, and Fudge (1984) 2-22/ found fish mercury levels responded quickly to impoundment, increasing noticeably within two to three years. The elevated mercury levels appear to be long-term. Generally, they found mercury levels had not declined after five to eight years of impoundment. Data from Bodaly and Hecky (1982) 2-23/ suggest mercury concentrations in predatory fish is related to the amount of terrestial material flooded and not increased nutrients levels, increased suspended clay sediments, or changes in water exchange times. Bodaly, Hecky, and Fudge (1984) 2-24/ concluded, "The widespread nature of the high fish mercury level-new reservoir association makes it imperative that elevated fish mercury levels be considered in all impact assessments of proposed reservoirs."

The references cited 2-25/ discuss bioaccumulation of mercury in impoundment fisheries, not fisheries downstream from the reservoirs. The immediate implications would be for those fisheries in the reservoirs (e.g. arctic grayling) or for any evaluation of the fishery potential of the reservoirs. Prior to an investigation of the available literature (the reference section of Bodaly, Hecky, and Fudge (1984) 2-26/ is extensive) one should not dismiss the potential for bioaccumulation of mercury in downstream fisheries, particular given the high natural mercury levels in the Susitna River (see Table 2-17). We recommend that a predictive water quality model be incorporated into the overall AEIDC modeling effort and baseline mercury levels continue to be monitored in the future impoundment areas and downstream. Mercury levels in soils and fish should also be monitored.

[I.42] Page E-2-98: (ii) Sloughs: Please refer to our comments on page E-2-40. The relationship between mainstem surface flow, groundwater dynamics, upwelling in salmon spawning zones of side sloughs, and local runoff to these sloughs needs to be characterized.

[I.43] Page E-2-101: 4.1.3 - Watana Operation: The application should discuss the potential impacts on water quality and quantity parameters associated with the testing of the turbines at Watana.

[I.44] Page E-2-112: (b) River Morphology: Please refer to our comments on page E-2-84.

[I.45] Page E-2-114: Watana Reservoir: Paragraph 4: It is indicated that Watana, "...will be operated to take advantage of the temperature stratification within the reservoir." Basic assumptions underlying this statement should be discussed in detail.

[I.46] Page E-2-117: Eklutna Lake Modeling: The Eklutna Lake data collection program was important to the efforts to verify the applicability of the DYRESM computer model. The ability of DYRESM to correct the consistent one to two degree C underestimation should be demonstrated. We recommend meteorological data be provided for the period of record to show how the 1982 data compare to this record. The data collection program should be extended over a second year to lend confidence to the model's ability to mimic actual temperature releases.

[I.47] Page E-2-118: Watana Reservoir Modeling: Paragraph 1: It is indicated that meteorological data from June through December 1981 (seven months) were inputted to DYRESM. Page E-2-121 indicates that June through September (four months) data were used as DYRESM input. The November 15, 1982 draft license application indicates that data from June through October, 1981 (5 months) were used in DYRESM simulation modeling. These apparent discrepancies should be explained.

Please refer to our comments on page E-2-87 on reservoir temperature modeling. We continue to recommend two full years of data collection for input to DYRESM (see Comment W-2-048, Chapter 11).

[I.48] Page E-2-119: Watana Reservoir Modeling: Paragraph 7: It is important to have an understanding of the potential range of post-project occurrences. Examples would be the range of dates when reservoir ice formation would occur, ice thickness, and ice breakup. At the present time, since DYRESM has not been run for October to June (or January to June?) the time of reservoir ice breakup cannot be confidently predicted.

[I.49] Page E-2-121: Mainstem: Paragraph 1: Please refer to our comments on the reservoir modeling efforts, immediately above. In addition, tributary temperature and flow data and the influence of turbidity and suspended sediment should be determined and incorporated into the model.

[I.50] Page E-2-122: Sloughs: During the winter, ice formation in conjunction with much higher flows (compared to natural winter flows) could result in significant downstream staging and overtopping of the side sloughs. Overtopping would dramatically lower slough temperatures and adversely impact fish incubation and rearing. 2-27/ This potential impact should be thoroughly discussed.

[I.51] Page E-2-123: Talkeetna to Cook Inlet: AEIDC recently examined river temperature profiles for one and two dams for June through September. 2-28/

[I.51] (cont) Their computer models SNTEMP predicted identifiable temperature changes below the Chulitna River, ranging up to an approximately one degree C difference in June for the one dam senario. Post-project operations with two dams showed greater changes downstream from the Chulitna River.
When DYRESM has been input with data throughout the year, for a two-year period, the potential post-project temperature effects for the reach below the Chulitna River will need to be re-examined.

The application should explain why the discussion on river temperatures uses HEATSIM, and AEIDC uses a different model, SNTEMP.

[I.52] Page E-2-124: Watana Reservoir: It is indicated that DYRESM was run using 1981 data collected throughout the year. It is our understanding this was not the case. Please clarify this apparent discrepancy. Please refer to our comments on pages E-2-119 and E-2-121.

[I.53] Page E-2-124: Watana to Talkeetna: Please refer to our comments on pages E-2-119, E-2-121, E-2-123. When DYRESM is input with data collected throughout the year, and over a 2-year period, it would be appropriate to re-examine river ice dynamics.

The timing, ice thickness, and river staging due to the ice has large, obvious, implications in regard to severity of breakup, extent of freeze-up, ice jamming and the extent of open water (downstream from dam). Large amounts of ice deposited at tributary or slough mouths during spring could effect smolt outmigration and/or adult inmigration.

[I.54] Page E-2-127: Talkeetna to Cook Inlet: We recommend that the predicted post-project changes in ice processes be quantified and analyzed in this reach. At present, evidence points to identifiable post-project changes to flows, temperatures, ice conditions, water quality (e.g. turbidity and suspended sediment), and frequency of flooding. These would occur in a broad and shallow river system for which we have rather limited knowledge of the aquatic resources. The morphology of the reach downstream from the mouth of Talkeetna River would lead one to expect greater impacts to result from smaller changes.

[I.55] Page E-2-132: (vi) Total Dissolved Gas Concentration: The current natural level of dissolved gas in Devil Canyon exceeds the State water quality criteria of 110%. Further increases in gas downstream from the dam(s) could adversely effect juvenile and adult fisheries, in addition to resident fisheries. It is indicted the, "...fixed-cone valves will be used to discharge all releases with a recurrence interval of less than 1:50 years." We assume events greater than 1:50 years would, therefore, necessitate spilling. It should be clarified if this would occur, when it would occur, and how often (based upon the 32 years of record) we could expect spilling. Modeling of the formation of dissolved gas and downstream dissipation may be appropriate. We suspect supersaturated gas formed by spilling at the Watana dam may not sufficiently dissipate in the Devil Canyon reservoir. This could create releases of high dissolved gas through the Devil Canyon turbines and valves. This scenario should be fully analyzed.

.56] Page E-2-135: (viii) Total Dissolved Solids, Conductivity, Significant Ions, Alkalinity, and Metals: Please refer to our comments on pages E-2-34 and E-2-96.

:57] Page E-2-146: (f) Instream Flow Uses: During 1982, ADF&G documented chinook salmon spawning above the Devil Canyon dam site at the confluence of and within two small clear water tributaries. 2-29/

.58] Page E-2-152: (v) Total Dissolved Gas Concentration: Please refer to our comments on page E-2-132.

.59] Page E-2-154: 4.2.3 - Watana/Devil Canyon Operation: The anticipated testing of the Devil Canyon turbines should be discussed. Potential impacts on water quality and quantity, and mitigation for adverse impacts should be described.

.60] Page E-2-158 to 162: (iii) Floods: The discussions concerning floods up to the probable maximum flood (PMF) should examine the potential creation of supersaturated dissolved gas and, through modeling, examine the fate of the gas downstream. Please refer to our comments on page E-2-132.

[I.61] Page E-2-164: (b) River Morphology: It is stated, "...the occurrences of high flows capable of initiating gravel bed movement in the Susitna River above Talkeetna will be increased". To our knowledge the bedload and suspended sediment studies to date have only examined general morphological changes in post-versus pre-project conditions. These studies should be extrapolated quantitatively to existing, as well as potential fish habitats with regard to spawning and rearing substrates. An analysis of the potential reduction of spawning gravel with an examination of long-term effects of removing spawnable substrate sources above the dam sites should be initiated. The flows needed to maintain slough, side channel, tributary mouths, and mainstem spawning gravel should also be examined.

.62] Page E-2-164: Watana and Devil Canyon Reservoirs: Paragraph 1: It is stated, "Since the available simulation data ended at the end of FY 1981 (September 30, 1981), mean weekly flows from the Case C, 2010 demand simulation were used for the October to December period." If it is possible to simulate temperatures from flows in this manner we recommend that flows and temperatures be simulated using the inflow/outflow data for the 32 years of record. It should be noted that the year modeled (water year 1981) was an unusual year from several aspects. First, it was the only year of the 15 simulated by AEIDC, through SNTEMP, displaying a decrease in temperature from June to July. 2-30/ Also, on page E-2-167 it is cited as the worst case of the 32 years of record in terms of frequency of release and discharge through Devil Canyon. This confirms our view that we need at least two years of input to DYRESM to allow some understanding of post-project temperature impacts.

.63] Page E-2-167: Watana and Devil Canyon Reservoir: Paragraph 12: We gain the impression that releases of 12,000 to 15,000 cfs would be provided at Devil Canyon when temperatures of 8^{0} C occur. This would mean flows downstream of Gold Creek of perhaps 13,000 to 17,000 cfs during July and August; comparable to Case C-1, or Case C-2 flows. We had previously understood this was not considered acceptable by the applicant. The applicant should clarify this apparent discrepancy.

[I.63] (cont) Figures E-2-215 and E-2-216 display the predicted ability of the Devil Canyon intake facilities to match outflow temperatures to inflow temperatures. It would be helpful to also display pre-project temperatures on these figures.

[I.64] Page E-2-167: Mainstem: The downstream temperature predictions in this section do not agree with the recent work by AEIDC. 2-31/ We assume since AEIDC is responsible for this analysis, the model they are using is current and the model in the application, HEATSIM, has been discontinued. If this is the situation, we recommend that those sections evaluating pre- versus post-project downstream temperature shifts be revised to reflect the current AEIDC work using SNTEMP. Additionally, replacement of HEATSIM with SNTEMP should also mean a total replacement of the ICESIM input data.

[I.65] Page E-2-169: Sloughs: Please refer to our comments on page E-2-40. We believe the relationship between the side sloughs and the mainstem needs to be better defined. This position is supported in the ADF&G Synopsis Report, 2-32/ "Mainstem influence upon the side slough habitats...is not presently well defined. Such influences are most likely related to indirect impacts such as influences on rates of upwelling water sources and winter overflow of the slough heads caused by ice processes."

[I.66] Page E-2-169: Talkeetna to Cook Inlet: The expected downstream temperature changes should be discussed as well as the downstream limits of these changes, by month.

[I.67] Page E-2-171: (v) Total Dissolved Gas Concentration: According to the ADF&G Synopsis Report, 2-33/ "The relatively low rates of dissipation of the naturally entrained dissolved gas in the reach of river below the [Devil Canyon] rapids suggests that higher levels of supersaturation that may be created by water spillage at either of the proposed dams would not dissipate sufficiently to reduce the hazard to either adult or juvenile chinook salmon as well as other species of salmon". Please refer to our comments on page E-2-132.

[I.68] Page E-2-172: (vii) Total Dissolved Solids, Conductivity, Alkalinity, Significant Ions and Metals: Please refer to our comments on pages E-2-34 and E-2-96.

[I.69] Page E-2-186: 6.3 Mitigation-Watana Impoundment: Paragraph 4: The potential for, and anticipated extent of, aggradation at the Chulitna-Susitna confluence must be better defined, along with many other parameters we have identified, prior to discussions of mitigation needs at this site.

Chapter 2 Footnotes

2-1/ See FWS letter dated January 14, 1983 to Eric P. Yould, APA. Included in Chapter 11.

2-2/ ADF&G 1983. Synopsis of the 1982 Aquatic Studies and Analysis of Fish and Habitat Relationships. Prepared for the APA.

2-3/ Wangaard, D.B. and C.V. Burger. 1983. Effects of Various Temperature Regimes on the Incubation of Susitna River Chum and Sockeye Salmon. FWS. Prepared for the APA.

2-4/ See Footnote 2-2, supra.

2-5/ See Footnote 2-2, supra.

2-6/ See Footnote 2-2, supra.

2-7/Trihey, E.W. 1982. Preliminary Assessment of Access by Spawning Salmon to Side Slough Habitat above Talkeetna. Prepared for the APA.

2-8/ See Footnote 2-2, supra.

2-9/ See Footnote 2-2, supra.

2-10/ See Footnote 2-2. supra.

2-11/ AEIDC. 1983. Examination of Discharge and Temperature Changes due to the Proposed Susitna Hydroelectric Project. Prepared for the APA.

2-12/ See Footnote 2-11, supra.

2-13/ See Footnote 2-11, supra.

2-14/ See Footnote 2-2, supra.

2-15/ See Footnote 2-11, supra.

2-16/ See Footnote 2-11, supra.

2-17/ Bodaly, R.A., D.M. Rosenberg, M.N. Gaboury, R.E. Hecky, R.W. Newburg, and K. Patalas. 1983. Ecological Effects of Hydroelectric Development in Northern Manitoba, Canada: The Churchill - Nelson River Diversion. IN Sheehan, P.J., Miller, D.R., Butler, G.C., and Bourdeau, Ph. (Eds). Effects of Pollutants at the Ecosystem Level. John Wiley & Sons. New York.

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Hecky, R.E. and H.A. Ayles. 1974. Summary of Fisheries-Limnology Investigations on Southern Indian Lake. Lake Winnipeg, Churhill and Nelson Rivers Study Board Report. Winnipeg, Manitoba.

Newbury, R.W., K.G. Beaty, and G.K. McCullough. 1977. Initial Shoreline Erosion in a Permafrost Affected Reservoir, Southern Indian Lake, Canada. Dept. Environ., Fish and Marine Serv. Winnipeg, Manitoba.

2-18/ See Footnote 2-11, supra.

2-19/ See Footnote 2-11, supra.

2-20/ Bodaly, R.A. and R.E. Hecky. 1979. Post-Impoundment Increases in Fish Mercury Levels in the Southern Indian Lake Reservoir, Manitoba, Can. Fish. Mar. Serv. Manuscript Rep. 1531: iv + 15 pp.

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Bodaly, R.A. and R.E. Hecky. 1982. The Potential for Mercury Accumulation in Fish Muscle as a Result of the Proposed Peace River Site C Reservoir Can. Dept. Fish and Oceans. Winnipeg, Manitoba.

Bodaly, R.A., R.E. Hecky, and R.J.P. Fudge. 1984. Increases in Fish Mercury Levels in Lakes Flooded by the Churchill River Diversion, Northern Manitoba, Can. J. Fish. Aquat Sci. Suppl. (in Press).

2-21/ See Footnote 2-20, supra.

2-22/ See Footnote 2-20, supra.

2-23/ See Footnote 2-20, supra.

2-24/ See Footnote 2-20, supra.

2-25/ See Footnote 2-20, supra.

2-26/ See Footnote 2-20, supra.

2-27/ See Footnote 2-2, supra.

2-28/ See Footnote 2-11, supra.

2-29/ See Footnote 2-2, supra.

2-30/ See Footnote 2-11, Supra.

2-31/ See Footnote 2-11, supra.

2-32/ See Footnote 2-2, supra.

2-33/ See Footnote 2-2, supra.

CHAPTER 3. FISH, WILDLIFE AND BOTANICAL RESOURCES

General Comments

[I.70] Chapter 3 generally fails to quantify the existing resources, quantify the potential impacts, and provide specific mitigation measures to deal with identified, quantified, adverse impacts.

[I.71] Through consultation, the FWS can advise the applicant as to the breadth of our responsibilities. In the area of botanical resources, recent budget cutbacks have precluded in depth analysis of existing data.

[I.72] Proposed mitigation measures should have proven success in Alaska, or in a similar environment. If proposals are not proven, they should be demonstrated effective in the project area. For example, hatchery propagation of grayling needs to be demonstrated as an effective mitigation option since previous grayling hatchery programs have not been particularly successful in Alaska. Likewise, the proposed slough modifications are unproven and should be demonstrated effective in the Susitna River system. Proposed vegetation manipulations have not been tested. The viability of providing alternative raptor nest sites in presently unoccupied areas has not been proven. The legality of such measures to mitigate for bald eagle nests is untested.

Fishery Resources of the Susitna River Drainage:

[I.73] The current problems with the water quality computer modeling efforts invalidates much of the fisheries discussions. For example, if we lack a valid river temperature model and/or ice process model, we cannot confidently discuss potential impacts nor discuss viable mitigation for these concerns.

[I.74] We continue to lack specificity on the mitigation proposals. Mechanical manipulation of sloughs is being proposed. This section should describe specifically being proposed and which sloughs, side channels, and mainstem reaches are proposed for alteration. There is no indication as to the overall effectiveness of such measures.

[I.75] The significance of the reach below the Chulitna River confluence should be determined. At present, the number of fish using this lower reach, other than for migration, is unknown. We do not believe the fishery impacts will cease at the Chulitna River (please refer to our comments on page E-3-100). Studies should be undertaken to examine the resources of this lower reach and to examine potential impacts and determine mitigation needs.

Botanical Resources

[I.76] This section has been considerably improved over the November 15, 1982 draft license application. We appreciate the incorporation of our comments on the draft, most notably with regard to baseline sections.

[I.77] Although the impacts section now identifies the full range of vegetation impact issues, there is no estimate of the size of areas which may be potentially affected by <u>changes</u> in vegetation cover. Refinement of the vegetation map to better relate it to wildlife habitat is necessary before the

[I.77] (cont) impacts analysis can be completed. Information is then needed on the tradeoffs relative to fish, wildlife, and botanical impacts, as well as cost and design considerations in the siting of project support facilities, roads, and transmission lines.

[I.78] Three other concerns with the impacts section are:

(1) Incorrect assessment of wetlands (see comments on Section 3.2.3, 3.3);
(2) Incompatibility of vegetation typing within the different transmission corridor segments (see comments on Section 3.2.2(e), and 3.3); and
(3) Calculation errors in summing areas of each vegetation type affected by the transmission corridor (see comments on Table E.3.86).

[I.79] The Mitigation Plan is considerably improved over the draft license application; however, it is still incomplete and too general. Implementation, construction, and operation schedules are not clear for many recommended mitigation measures (e.g. land acquisition and management). Incorporation of recommended mitigation measures into project plans is uncertain (e.g. construction techniques, limitations on spoil areas, etc.). Neither replacement lands nor habitat manipulations have been identified as to suitable size, location or type. Moreover, replacement lands and habitat manipulations cannot be realistically identified until:

(1) Moose carrying capacity as well as associated browse, and vegetation mapping studies are completed;
(2) Appropriate wetlands interpretations are made;
(3) Possible mitigation lands are identified, their potential mitigation benefits calculated, and their availability determined.

[I.80] Numerous general references are made to browse habitat impovement techniques, land acquisition for habitat management, and increasing browse by clearing or prescribed burning of forests. However, specific information on the potential benefits, time-frames, and suitable vegetation cover types for controlled burning, clearing, and crushing are not provided. The applicant had indicated that such information would be included in Section 3.4.2 in response to our original comments (Chapter 11, W-3-183).

[I.81] We believe that mitigation agreements should be worked out with applicable landowners and incorporated into project licensing. Otherwise, there is no guarantee that necessary management polices (e.g. restrictions on use of project access roads and off-road or all terrain vehicles, habitat manipulations, control of other uses, etc.) will be adopted. Our main concern with the Mitigation Plan stem from its development within a short time period which allowed no agency consultation before the formal license review. There is need for joint efforts by the resource agencies and principle study investigators, in conjunction with the applicant's consultants, to: (1) clarify issues; (2) analyze mitigation options; (3) agree on remaining data gaps and how to fill them; and (4) modify this proposal into a mutually acceptable, effective Mitigation Plan. Such a procedure and useful dialogues among the different resource study groups were initiated during the August 1982 Adaptive Environmental Assessment (AEA) workshop and February 28 - March 2, 1983 follow-up modeling session. Much of the progress made then relative to identifying data gaps has since been lost due to delays and budget cuts.

.82] We remain concerned that the cumulative impacts of both reservoir sites, borrow and spoil sites, access roads, transmission corridors and potential indirect vegetation losses are not addressed in accordance with our comments on the draft (Chapter 11, W-3-114 and W-3-149).

Wildlife Resources

.83] A concern that we have with the discussion of impacts is the repeated inference that wildlife will generally move to adjacent areas as project area habitats are altered or destroyed. Little is known of adjacent habitat values and whether those habitats are already fully utilized or even suitable for the species of interest are minimal. A further problem is that no source is provided for many of the conclusions presented here.

.84] The majority of recommended compensation measures are generally insignificant and unsubstantiated. For example: increases in ungulates through browse improvement would compensate for losses to their predators (bears and wolves); carrion from increased road mortality and impoundment hazards would compensate for wolverine habitat losses; salmon benefitting through slough modifications would compensate for decreases in other bear foods; flow regulation resulting in downstream habitat improvement compensates for upstream losses of moose and beaver habitats; and general habitat improvements for larger species would compensate for small birds and small mammal losses.

Specific Comments

2-FISH RESOURCES OF THE SUSITNA RIVER DRAINAGE

[I.85] Page E-3-24: - Incubation and Emergence: Based upon their apparent inability to distinguish upper Susitna River sockeye salmon stocks from Talkeetna or Chulitna River drainage stocks, Bernard et al. (1983) 3F-1/ concluded that fry do not rear above Curry Station (River Mile (RM) 120.5). The outmigration data from 1982 appears to support this hypothesis. However, outmigration may have been substantially complete when the outmigration trap was installed (June 18). Growth exhibited by juveniles collected in the trap throughout the summer and the observations of outmigrants during the spring of 1983 at slough #11 indicated important sockeye salmon rearing habitat may be found in the upper Susitna River. 3F-2/ Further investigation appears warranted in regard to sockeye salmon rearing.

[I.86] Page E-3-32: Junvenile Behavior: Juvenile chum salmon are generally thought to outmigrate quite soon after emerging. Data collected by ADF&G in 1982 3F-3/ indicate chum salmon juveniles spend up to three months in the Susitna River. This rearing period may be important since the Susitna River estuary is very turbid and may not provide adequate rearing habitat. The density patterns observed by ADF&G suggests juvenile chums prefer lower velocity areas and are associated with backwater areas near the mouths of sloughs and clear water tributaries. 3F-4/ The report should be expanded to include a discussion of chum salmon rearing. The implications of the ADF&G finding should be discussed in the analysis of post-project impacts.

[I.87] Page E-3-41: (v) Burbot: The ADF&G Synopsis Report 3F-5/ states that burbot habitat shows a strong correlation with turbidity. These findings should be discussed in light of the post-project implications on turbidity.

[I.88] Page E-3-42: (vi) Round Whitefish: The ADF&G data indicate that significant numbers of round whitefish remain in the mainstem of the Susitna River. They are associated with the mouths of tributaries and turbidity mixing zones of clear water sloughs. 3F-6/

[I.89] Page E-3-62: (i) Mainstem and Side Channels: We suspect the Susitna-Chulitna confluence area is important to the anadromous fisheries for rearing and milling. We suspect chinook, coho, sockeye, and chum rearing and/or overwintering may occur here. The importance of the confluence area to the fisheries of the Chulitna and the Talkeetna Rivers are not known since fishery runs into these two river systems were not included in the ADF&G studies. Post-project winter flows would be approximately four times greater than pre-project flows; winter turbidity would be noticeably higher (affecting feeding and predator-prey relationships); aggradation is probable; and temperature and ice processes would probably be dramatically changed from pre-project conditions. We recommend that the value of this area be evaluated and the post-project impacts assessed.

[I.90] Page E-3-62: Salmon: The importance of the reach between the Yentna River and the Susitna River above the Chulitna and Talkeetna Rivers to anadromous fisheries is presently unknown. The Yentna River Station allows ADF&G to separate out the Yentna River run from the Susitna River run upstream from this point. Lack of stations on the Chulitna and Talkeetna Rivers prevents determining the importance of these two river systems to the overall Susitna River run. We recommend that stations be established on the Chulitna and Talkeetna Rivers.

[I.91] Page E-3-80: (ii) Construction and Operation of Watana Camp, Village and Airstrip: Paragraph 1: Justification for separating the construction camp, construction village and permanent townsite should be provided. Combining these developments would help to minimize adverse impacts, particularly to botanical and wildlife resources but also to aquatic resources. We suggest that serious consideration be given to combining these facilities.

[I.92] Page E-3-80: (ii) Construction and Operation of Watana Camp, Village and Airstrips: Last Paragraph: We understand that current plans call for expanding the 2500-foot temporary airstrip to 6000 feet in length rather than constructing two airstrips. 3F-7/ We concur with this proposal.

[I.93] Page E-3-84 to 86: Mainstem Habitats: We believe that the knowledge of potential post-project water quality impacts is inadequate. Please refer to our comments on Chapter 2, pages E-2-19, E-2-34, E-2-69, and E-2-96. Post-project reservoir fisheries should be re-examined after the reservoirs' water quality parameters are assessed.

[I.94] Page E-3-96: Slough Habitats: Paragraph 4: According to the ADF&G Synopsis Report 3F-8/, unrestricted access to slough #9 does not occur until the mainstem discharges at Gold Creek exceeds 20,000 cubic feet per second (cfs). Acute access problems occur at flows less than 18,000 cfs. The applicant should revise the discussion to reflect the more current ADF&G assessment.

Nine sloughs were examined by ADF&G 3F-9/; Whiskers Creek Slough, and sloughs #6A, #8A, #9, #11, #16B, #20, #21, and #22. Five of the sloughs (#9, #16B, #20, #21, #22) show acute access problems below 18,000 cfs, and unrestricted access is not achieved until flows exceed 20,000 cfs to 26,400 cfs.

[I.95] Page E-3-97: Slough Habitats: Paragraph 5: Please refer to our comments on page E-3-24. The conclusion that the Susitna River sockeye salmon upstream of the Talkeetna River are strays from the Chulitna and Talkeetna Rivers stocks is presently unsubstantiated.

[I.96] Page E-3-97 to 98: Slough Habitats: Paragraph 6: The relationship between mainstem flows and slough upwelling should be further examined (see paragraph 3 of this section and our comments on Chapter 2, page E-2-98).

[I.97] Page E-3-98: Slough Habitats: Paragraph 7: Please refer to our comments on Chapter 2, page E-2-44, and the recently completed salmon incubation study. 3F-10/ It is unfortunate that the incubation study was not continued through smolt stages. Pre- versus post-project temperature changes could

[I.97] (cont) result in significant differences in outmigration timing and/or survival. We recommend that the study be re-initiated to determine timing and survival through smolting.

[I.98] Page E-3-100: (iii) Cook Inlet to Talkeetna: It is stated that the Chulitna River contribution is 39% and the Talkeetna River contribution is 18%. We assume the upper Susitna River contribution is the remaining 43%. Lacking hydrological, modeling and biological data to the contrary, it could be assumed that greater impacts would occur upstream of the mouths of Talkeetna and Chulitna Rivers than to downstream.

However, given that our understanding of the fishery use in the lower reach is a magnitude below that for the upper Susitna River, and the river is broad and relatively shallow, we would not dismiss significant project-related impacts in this reach. Although we do not know the level of fishery use in this reach, we suspect this reach contains important spawning and rearing habitat.

In a report prepared for the APA, the Arctic Environmental Information and Data Center (AEIDC) 3F-11/ concluded, "The effort to delineate river reaches where post-project flows differ significantly from natural flows has been unsuccessful. The purpose of this effort was to limit the area where flow-related impacts (other than water quality issues) need to be considered. Being unable to establish these limits, it appears necessary to include the entire length of river when considering aquatic habitat effects."

It appears that an aquatic studies program is necessary to examine post-project impacts downstream of the Chulitna River. We request the applicant provide the FWS with a copy of the downstream studies program proposed to be undertaken in 1984 by APA.

[I.99] Page E-3-101: Mainstem Habitats: Paragraph 1: We believe that the information on fish use downstream of the Chulitna River is due to the very limited data gathering efforts expended in this reach rather than limited fish use. Please refer to our comments on page E-3-100, immediately above, and on Chapter 2, page E-2-60.

[I.100] Page E-3-101: Mainstem Habitats: Paragraph 2: Regarding water temperature changes, we have commented throughout Chapter 2. Please refer to our comments on pages E-2-60, E-2-62, E-2-87, E-2-88, E-2-119, E-2-123, E-2-124. To summarize, due to insufficient data and the recent changes in computer temperature models we believe that the predictions in the application are inadequately supported. Identifiable temperature changes are predicted by AEIDC below the Chulitna River confluence. 3F-12/

[I.101] Further analysis should be made of potential aggredation at the Chulitna River confluence (see our comments on Chapter 2, page E-2-84), and of sediment transport and bedload movement (see our comments on Chapter 2, page E-2-164).

[I.102] Page E-3-101: Mainstem Habitats: Paragraph 3: Reduction in the occurrence of the 1-in-2 year flood event so that it becomes a 1-in-5 or 1-in-10 year event could result in dramatic changes in habitats of particular importance, such as sloughs. Information from the ADF&G Aquatics Studies Program from the last

[I.102] (cont) two low flow years may provide valuable insight. For instance, observations of successional processes and beaver activities should provide indications of post-project impacts due to decreased flows and flood events.

[I.103] Page E-3-106: (i) Reservoir Habitats: Please refer to our comments on Chapter 2, pages E-2-69, and E-2-96. We believe the issues of reservoir turbidity and suspended sediment in discontinuous permafrost need further investigation.

[I.104] Page 114: Winter/Ice Season: Paragraph 7: According to the ADF&G Synopsis Report 3F-13/, chum salmon may rear in the Susitna River for up to three months rather than just the one month indicated in this section. The significance of this information is that it may indicate the Susitna River estuary, being very turbid, does not provide good rearing habitat. The dependance of chum salmon on the Susitna River environments, thus, may be much greater than first thought.

The incubation study conducted by the FWS showed the timing of chum and sockeye salmon development to yolk absorption in 4° C water compared to the slough #8A temperature regime to be nearly identical. We recommend the studies be continued, comparing chum smolt development with anticipated post-project to pre-project temperature conditions.

[I.105] Page 114: Winter/Ice Season: Paragraph 8: It is stated that gas supersaturation would not be a problem because of the use of cone valves in the spilling design. According to Chapter 2, the cone valves would be frequently used, particularly in the early years of project operation. One of the conclusions of Acres American in their design of cone valves 3F-14/ is that: "In view of the nature of analyses and lack of precedence for the proposed valves arrangement, it is recommended that a physical model study be carried out to confirm the performance of the valves."

[I.106] Page E-3-124: (iii) Operation Impacts: Last Paragraph: Please refer to our comments on pages E-3-100 and E-3-101.

[I.107] Page E-3-131: Mainstem Habitats: Paragraph 3: The discussion on the ice front with both dams operating is inconsistant with the discussion on ice formation in Chapter 2, page E-2-169. Neither explanation appears to reflect current modeling of post-project conditions. Please refer to our comments on the reservoir, river, and ice modeling efforts in Chapter 2 (page E-2-124).

[I.108] Page E-3-136: In-Stream Activity: Use of heavy equipment could also result in destruction of stream banks.

[I.109] Page E-3-136: Erosion: Access to upstream habitat could also be limited.

[I.110] Page E-3-136: Fill Placement: The severity of fill placement impacts would also be related to timing. Streams used by grayling in summer may be dry in winter.

Sheetflow discharge, when concentrated through culverts, may tear the vegetative mat and result in thermokarst in permafrost areas.

[I.111] Page E-3-136: Changes in Water Quality: Road maintenance activities, such as blading and clearing of berms, could lead to erosion. Runoff from these areas would adversely impact water quality and could fill in culverts and drainage ditches.

[I.112] Page E-3-139: Changes in Water Quality: Fuel should be banned within 100 feet of a flowing water course.

To facilitate cleanup, the project oil spill plan should contain project area maps with all water drainages, direction of flows, and sites and access points identified where cleanup actions could be initiated.

[I.113] Page E-3-142: Alteration of Waterbodies: Paragraphs 1 and 8: It is stated, "Permanent roads may be built to provide all-season access." The discussion in these sections should be limited to the proposed project development. This would consist of access to the transmission line corridor via trails from existing access routes at intermittent points along the corridor. A more detailed description of the transmission line access proposal is found on page A-4-6.

If the towers are to be set in concrete, excavations will be required and provisions for pumping of silty water needed.

[I.114] Page E-3-144: Alterations of Waterbodies: Paragraph 6: Use of ramps rather than bank cuts would help to minimize impacts to the aquatic habitats.

[I.115] Page E-3-144 to 145: Alterations of Waterbodies: Last Paragraph: We recommend that dredging, if required, be timed so that it does not occur during periods of salmon spawning.

[I.116] Page E-3-145: Changes in Water Quality: What is considered long-term should be defined. For example, a 24 hour increase in sediment and turbidity could result in an identifiable delay in grayling spawning.

[I.117] Page E-3-148: 2.4.2 Selection of Project Evaluation Species: We recommend rainbow trout, Dolly Varden, and burbot be included as evaluation species by the applicant, since these species meet the criteria established in this section. For additional justification please refer to our January 24, 1983 letter.

[I.118] Page E-3-149: 2.4.2 Selection of Project Evaluation Species: Paragraph 6: Please refer to our comments on pages E-3-24 and E-3-100 to 102.

Page E-3-150: 2.4.3 Mitigation of Construction Impacts Upon Fish and Aquatic Habitats: We have not received the design criteria manual or the construction practices manuals. 3F-15/ Both manuals should be provided to resource agencies for a minimum of 30 days for review and approval. The manuals should then be incorporated into the license as binding articles.

[I.119] We support the establishment of a monitoring program funded by the project, and a board of representatives from appropriate State, Federal, and having the authority to recommend project modifications to assure that mitigation is

[I.119] (cont) effective. The procedure by which this would occur should be incorporated into the license as an article.

Costs would be incurred for the mitigation identified. We recommend specifications pertaining to environmental protection contain provision for payment at rates similar to that payable for regularly scheduled production work. When the licensee's contract goes out to bid, those competing for the contract should be aware of monies specified for environmental protection tasks.

[I.120] Page E-3-152: (ii) Mitigation: Beaver control measures related to fish passage should be controlled by ADF&G.

[I.121] Page E-3-152: Presence or Absence of Fish/Fish Habitats: Provisions should be included in the mitigation plan for modifications if fish are discovered upstream at a later date.

[I.122] Page E-3-153: Flow Regime: All culverts should be armored at both ends with rip-rap at the time of installation, or flared-end culverts should be used.

[I.123] Page E-3-153: Methods of Installation: Intermittent water courses should be surveyed in summer and staked for culvert installations.

[I.124] Page E-3-154: (ii) Mitigation: Paragraph 1: Revegetation measures should be undertaken immediately after surface disturbance, or as soon as use ceases.

[I.125] Page E-3-155: (ii) Mitigation: Paragraph 4: The settling ponds should be maintained by cleaning them out when one-half of their original capacity is lost.

[I.126] Page E-3-155: (ii) Mitigation: Paragraph 1: The references mentioned should be incorportated into the erosion control manual.

[I.127] Page E-3-156: (ii) Mitigation: Paragraph 3: Stockpiling in the floodplain may be preferable to moving the material outside of the floodplain. This would depend upon the timing and location of the intended activity.

[I.128] Page E-3-156: (ii) Mitigation: Paragraph 1: The Spill Prevention Containment and Countermeasure Plan (SPCC) should be provided to the resource agencies for a minimum 30-day review period and, following approval, be incorporated into the license application. The SPCC should be a part of the licensee's construction contract for the project.

[I.129] Page E-3-161: (ii) Measures to Avoid Impacts: Paragraph 2: The project may affect all three of the factors mentioned, rather than just mainstem stage. We suspect channel geometry is related, in the side sloughs, to frequency and severity of breaching of the slough's upstream berm. This process is directly related to mainstem stage, and in the winter, location of the ice front. If the river does not freeze, as is predicted for the river downstream from the dams for an unknown distance, then this major influence on slough geometry and succession would be eliminated.

[I.129] (cont) The relationship between mainstem stage and slough flows has been an assumed, yet unproven, assumption. Please refer to our comments on page E-3-98 and on Chapter 2, page E-2-98.

[I.130] Page E-3-162: (ii) Measures to Minimize Impacts: In the FWS letter on the Susitna hydroelectric project pre-application 3F-16/, the ongoing AEIDC modeling efforts were summarized. The FWS continues to support the AEIDC modeling efforts. The AEIDC study should provide the basis for determining project instream flow impacts and a reasonable assessment of mitigation alternatives.

Page E-3-162: Winter Flow Regime (October-April): Paragraph 2: It is unclear as to what project stage is being discussed. The discussion appears to be restricted to pre-Devil Canyon conditions, based upon the assumption that the ice front would be upstream of Sherman RM 130. With Devil Canyon operating, it was assumed that the ice front would form between Talkeetna (RM 99) and Sherman (RM 130) (see page E-3-134) or downstream of Talkeetna (see Chapter 2, page E-2-169). Discussion should be provided as to: how the sloughs needing a protective berm were selected; how it was established which sloughs would be overtopped more frequently than once every five years; and how these sloughs would be managed after Devil Canyon is operating.

[I.131] The benefits of establishing maximum winter flows should be discussed. If staging due to ice formation in the upper Susitna River occurs only prior to the initiation of operations at Devil Canyon, the overtopping of sloughs could be controlled by maintaining flows below a maximim level. Disturbance of the ten sloughs due to the construction of protective berms may, therefore, be avoided. Flows to cleanse the sloughs could also then be provided, if needed. Again, it is premature to establish an instream flow regime since the AEIDC study is not complete.

Winter flows, downstream of the Chulitna River, are expected to be up to 373% higher under post-project than pre-project conditions. 3F-17/ The ice front would probably form downstream from Talkeetna (Chapter 2, page E-2-169) and be delayed for an indeterminent period of time (Chapter 2, page E-2-170). Downstream from the Chulitna River confluence, the Susitna River is broad and relatively shallow. We consider this reach more susceptible to impacts due to this channel geometry. Impacts and mitigation needs in this lower reach should be included in this section.

Page E-3-163: Winter Flow Regime (October - April): Paragraph 3: The process which led to the selection of the ten sloughs should be fully described. The location of slough B should be indicated. It is not shown on Figures E.3.12 to E.3.17.

[I.132] With the construction of the protective berms, the ice cover formed on the sloughs would not be flushed out in the spring. Ice could remain in these protected sloughs well into June. The impact of this phenomenon upon the fishery should be included in this section along with a discussion of mitigative measures for any potential impacts. Adverse impacts may be related to changes in timing of outmigration, early inmigration, and quality of rearing habitat.

[I.133] Page E-3-165: Summer Flows: The term "rectifying measures" should be clarified, as should the manner in which the listed sloughs were selected. According to the ADF&G Synopsis Report [3F-18/], slough #11 (RM 135) has unrestricted access at flows greater than 6,700 cfs while slough #9 has an acute access problem with flows of less than 18,000 cfs. We are unable to locate slough B and, apparently, sloughs #8, #8A, #8B, #8C, Moose, A^1, #9A, #9B, and #17 have not been examined by ADF&G to determine whether an access problem exists. [3F-19/] We assume that different measures are proposed for the different sloughs. Since Table E.3.39 lists a specific number of sloughs which would receive a particular rectification, we assume specific mitigation plans for each slough are being proposed. we would like to review any such plans along with an explanation of the selection process and reasons as to why flow manipulations could not be utilized to avoid and/or minimize the adverse impacts. Also, it is unclear as to whether short-term augmenting flows are being proposed or not.

.134] Page E-3-165: Access Mitigation: Eight sloughs are indicated as needing restructured mouths. These sloughs should be identified.

In the third paragraph it is indicated that lowering the slough mouths by 1.5 feet would provide unrestricted access. Please refer to our comments on page E-3-163. It is not specified which sloughs would undergo the proposed modifications. We would expect lowering of all the sloughs by the same amount would result in different post-modification access conditions. We would like to review the analysis which lead to the conclusion that the decrease in elevation by the specified 1.5 feet would allow unrestricted access to specified sloughs.

[I.135] Page E-3-166: Access Mitigation: Last Paragraph: Sloughs which would be restructured should be identified and the specific proposals described. We are not cognizent of what is being proposed in this section, or where it is being proposed.

.136] Page E-3-166: Spawning Habitat Mitigation: Please refer to our comments on page E-3-98.

The referenced ongoing aquatic studies should be described.

[I.137] Page E-3-167: Scarifying Side-Channels: This section should identify the four side channels proposed to be scarified. We are interested in the analysis of the specific side channels, including timing, volume, and duration of the proposed high-flow release, the maintenance schedule proposed (if needed), the species (by life stage) that are expected to benefit due to the proposed modification for each side channel, and the number of each species the specific side channels would be expected to produce.

.138] Page E-3-168: Slough Gravel Cleaning: The utility of a high-flow release to cleanse sloughs should be discussed.

The location of the mainstem spawning sites should be provided and gravel sources identified. An analysis as to which species are expected to benefit, and the anticipated production should be provided.

Page E-3-170 to 171: (iii) Measures to Minimize Impacts: Once the reservoir temperature model is reflects two years of data, an examination of post-project temperature impacts should be made. It is our understanding that the river temperature model used in this application, HEATSIM, has been replaced with SNTEMP (see our comments on Chapter 2, pages E-2-123, E-2-167).

[I.139]

In the last paragraph it is unclear whether the temperature discussions are for Watana alone, or for both dams. Temperature impacts are expected to change during the filling and opration of Watana, the construction of Devil Canyon, operation of the two dams under low and high power needs, and operation during dry and wet years. The potential benefits of a low level intake port in the Watana dam should be discussed as a mitigation measure for adverse temperature impacts during filling.

[I.140] Page E-3-173: Grayling Propagation Technology: Last Paragraph: We recommend that the viability of a grayling propagation program be established prior to license issuance since it is a major element of the proposed mitigation program.

[I.141] Page E-3-173: Hatchery Propagation of Grayling or Other Resident Species: Paragraphs 2 and 3: The lakes and/or streams to be stocked should be determined through consultation and approval of the appropriate resource agencies, and land owners or managers.

[I.142] Page E-3-174: Introduction of Rainbow Trout into Devil Canyon Reservoir: The potential of the Devil Canyon reservoir as fishery habitat should be re-examined in light of our comments on Chapter 2, pages E-2-69, and E-2-96.

Page E-3-174: (ii) Measures to Avoid Impacts: The impacts of greater than 1-in-50 year floods should be fully evaluated, and mitigation proposed. Given the expected life of the project, the potential for a flood event greater than this project design is high.

[I.143] The referenced test of the Lake Comanche cone valves was evaluated for the applicant by Acres American. 3F-20/ Please refer to our comments on page E-3-114.

Given the lack of a strong endorsement by the applicant's consultant, the anticipated frequent use of the valves, and the potential magnitude of supersaturation as a fisheries problem, we recommend that the physical model study be undertaken.

[I.144] Page E-3-176: (i) Mitigation of Access and Impoundment Impacts: Paragraph 2: Final decisions on the distribution of grayling should be made through consultation with, and approval of the appropriate resource agencies and land owners and/or managers.

[I.145] Page E-3-177: (ii) Mitigation for Downstream Impacts: The modeling effort by AEIDC is in an embryonic stage and could not have been the basis of either the impacts analysis or mitigation mitigation proposals in this section. The forthcoming AEIDC report should demonstrate that their system of models is functional. One of the initial findings of AEIDC's work is that, contrary to

[I.145] (cont) the assumption of the mitigation plan, project impacts do extend downstream of the Chulitna River. 3F-21/ We recommend that the impact assessment include effects downstream of the Chulitna River, and appropriate mitigation for any adverse impacts identified.

[I.146] <u>Page E-3-179: 2.5.2 Construction Phase</u>: The mitigation planning related to pre-construction and construction phases, should occur prior to license issuance.

[.147] <u>Page E-3-180: 2.6 Monitoring Studies</u>: We agree that an interagency mitigation monitoring team must be established to ensure the proper and successful execution of the mitigation plan and to determine its effectiveness. The composition, funding, mandate, and authorities should be specified as a license article. We look forward to the anticipated discussions which will lead to establishing this team.

[.148] <u>Page E-3-188: 2.8.1 U.S. Fish and Wildlife Service: Recommendation at Bottom of Page</u>: To ensure its effectiveness as a mitigation measure, a slough modification demonstration should be undertaken in the Susitna River. The demonstration slough should display, prior to modification, the anticipated post-project conditions for sloughs for which mitigation is proposed. For example, the slough selected for demonstration should be characterized by inadequate access, silt accumulation, insufficient groundwater flow, and limited spawning habitat. Preferably, the demonstration slough should be a slough which does not currently support spawning and/or rearing salmon.

[.149] <u>Page E-3-189: 2.8.2 Alaska Department of Fish and Game: Second Recommendation</u>: The response states a report analyzing instream flows and temperatures required to maintain existing populations would be available after June 30, 1983. We request that the applicant provide the FWS with a copy of the report.

<u>Chapter 3, Section 2 Footnotes</u>

<u>3F-1/</u> Bernard, D.R., et al. 1983. Comparision of Scale Patterns from Sockeye Salmon Sampled from Different Rivers within the Susitna River Watershed in 1982. ADF&G. Div of Com. Fish.

<u>3F-2/</u> ADF&G. 1983. Synopsis of the 1982 Aquatic Studies and Analysis of Fish and Habitat Relationships. Prepared for the APA.

<u>3F-3/</u> See Footnote 3F-2, <u>supra</u>.

<u>3F-4/</u> See Footnote 3F-2, <u>supra</u>.

<u>3F-5/</u> See Footnote 3F-2, <u>supra</u>.

<u>3F-6/</u> See Footnote 3F-2, <u>supra</u>.

<u>3F-7/</u> See Footnote 3F-2, <u>supra</u>.

<u>3F-8/</u> See Footnote 3F-2, <u>supra</u>.

3F-9/ See Footnote 3F-2, supra.

3F-10/ Wangaard, D.B. and C.V. Burger. 1983. Effects of Various Temperature Regimes on the Incubation of Susitna River Chum and Sockeye Salmon. U.S. FWS. Prepared for the APA.

3F-11/ AEIDC. 1983. Examination of Discharge and Temperature Changes due to the Proposed Susitna Hydroelectric Project. Prepared for the APA.

3F-12/ See Footnote 3F-11, supra.

3F-13/ See Footnote 3F-2, supra.

3F-14/ Krishnan, G. September 13, 1982. Gas Concentration and Temperature of Spill Discharge Below Watana and Devil Canyon Dams. Acres American. Prepared for the APA.

3F-15/ Personal communication on September 30, 1983 with Thomas J. Arminski, APA Deputy Project Manager, Susitna Hydroelectric Project.

3F-16/ See FWS letter dated January 14, 1983 to Eric P. Yould, APA. Included in Chapter 11.

3F-17/ See Footnote 3F-11, supra.

3F-18/ See Footnote 3F-2, supra.

3F-19/ See Footnote 3F-2, supra.

3F-20/ See Footnote 3F-14, supra.

3F-21/ See Footnote 3F-11, supra.

Specific Comments

4 - WILDLIFE

[I.150] Pages E-3-295 and E-3-296: 4.1.3 - Species Contributing to Recreation, Subsistence and Commerce: The section should be expanded to reflect that not only birds, but many wildlife species in the project area contribute to non-consumptive forms of recreation. Incidential viewing of wildlife in conjunction with other activities is an unquantifiable but well documented value. These non-consumptive values, the subsistence and commerce values and the ecological values mentioned in the Introduction, Section 4.1, were all considered in selecting evaluation species within the FWS Mitigation Policy (46 F.R. No. 15, January 23, 1981) and Resource Category determinations for this project (FWS letter to Eric P. Yould, January 24, 1983).

[I.151] Page E-3-304: - Cover Requirements: Paragraph 7: Proposed remapping of vegetation to better reflect moose habitat components should be described here. Please also refer to our previous comments, Section 3.2.2(a).

[I.152] Page E-3-305: Habitat Use in the Middle Susitna Basin: Paragraph 1: The evaluation of moose use of different vegetation types by month would be improved by considering the comparative availability of these types and subareas important to moose throughout the middle Susitna basin. Vegetation mapping, including understory characteristics did not occur in 1983 as had been indicated by the applicant in response to our comments on the draft license application (Chapter 11, W-3-204). Once vegetation is retyped we recommend that this and other baseline data be reevaluated. The availability, of different vegetation types and understory values of those types should be considered within the constraints described on page E-3-304.

[I.153] Page 307: - Food Habits: Paragraph 3: While we support attempts to quantify moose winter carrying capacity as a first step in simulation modeling tjos sectopm sjpi;d a;sp ;ost references and reflect concurrence of principal moose investigators. The assumptions included in Appendix E.3.H should be validated. Please refer to our comments on Section 4.3.1(a)(iii) and on the Mitigation Plan.

[I.154] Page E-3-310: . Lower Susitna Basin; Paragraph 2: The applicant should confirm that all biotelemetry data indicated here as being available in June 1983 is contained in the ADF&G report provided to the FWS in September 1983. 3W-1/ We have similarly assumed that other information to be supplied in June 1983 is also in the September report (e.g., responses to our comments on the draft, Chapter 11, W-3-209).

[I.155] Page E-3-315: . Mortality Factors: We reiterate our draft application recommendation that this discussion include hunting as a mortality factor. Although the applicant's response indicated that the subject was covered in Chapter 3, Section 5, we find no such section (Chapter 11, W-3-216). Please also see our comments on Chapter 5, Section 3.7.2. Treatment of hunting should be better coordinated between Chapters 3 and 5, given the effect that both recreational and subsistence hunting can have on wildlife population size, structure, and distribution.

[I.156] Page E-3-325: (c) Dall Sheep: Paragraph 1: The preliminary nature of information presented here should be stated in view of ADF&G's proposal for intensive ground observations and sheep studies which were conducted from March through July, 1983.

[I.157] Page E-3-327: (ii) Mineral Lick Use: Paragraph 1: The Jay Creek mineral lick area should be better described and defined by elevation range and special area.

[I.158] Page E-3-328: (ii) Mineral Lick Use: Paragraph 5: During ADF&G's intensive 1983 summer studies, moose were not observed using the lick itself (Nancy Tankersley, personal communication). ADF&G now considers previous observations of moose use to be incidental.

[I.159] Page E-3-328: (d) Brown Bear: Paragraph 1: Current study delays and funding cutbacks are preventing collection of valuable information and may make later comparisions of year-to-year variations difficult. 3W-2/

[I.160] Page E-3-331: - Seasonal Movements: Paragraph 4: Given the large home range sizes of brown bear documented on page E-3-323 (last paragraph through page E-3-334, paragraph 1), we do not believe that bear use of the Susitna River area has been overestimated as indicated here.

Page E-3-335: Home Ranges: Paragraph 5: Our proceeding comments apply here.

[I.161] Page E-3-337: (c) Black Bear: Paragraph 1: Funding cutbacks and study delays are precluding necessary study progress and will make later data analyses needlessly difficult and incomplete.

[I.162] Page E-3-341: - Food Habits: Paragraph 2: The applicant should describe ongoing studies which address the importance of ungulate prey to black bear (page 236; paragraph 1 of the draft application).

[I.163] Page E-3-342: Home Range: Paragraph 2: It should be clarified how overlaps in home ranges with the impoundment area can be greater than 100%.

[I.164] Page E-3-342: Population Size: Funding cutbacks prevented the 1983 spring recensusing of black bear.

[I.165] Page E-3-344: (f) Wolf: Funding cutbacks have curtailed monitoring. Since May 1983 only 2 relocation flights have been made for radio-collared wolves.

[I.166] Page E-3-347: - Food Habits: Paragraph 6: Given the habitat losses, disturbances, and other project impacts discussed in Section 4.3, it would seem doubtful that the caribou population will increase, thus benefitting wolves and relieving some moose predator mortality as suggested here.

[I.167] Page E-3-349: (g) Wolverine: As with other big game species, funding cutbacks are interfering with needed data collection. No funds have been available since spring of 1983 to track the six wolverine radio-collared for the project.

[I.168] Page E-3-354: (a) Beaver: There have been no further beaver studies or model development since March 1983. Additional data have not been provided as indicated in response to our comments on the draft license application (Chapter 11, W-3-237). We are particularly disappointed that the opportunity has been lost to verify and expand upon 1982 cache counts and to better evaluate beaver habitats and populations which could be affected by the proposed project.

[I.169] Page E-3-356: (ii) Population Characteristics: At present there is no reliable estimate of the beaver population below Talkeetna (Phil Gipson, personal communication). Such an estimate would serve as a baseline for evaluating upstream habitat losses and downstream habitat improvement. Fall cache counts, marking of those caches, and later spring surveys to determine overwinter survival are necessary to assess impacts. Surveys could help identify the movement patterns of young animals and downstream habitats which may be improved due to project construction. Coordination between furbearer biologists and hydrologists to assess icing conditions was not accomplished in spring, 1983 as agreed to at the February 28 - March 2, 1983 follow-up AEA workshop. 3W-3/

[I.170] Page E-3-357: (ii) Population Characteristics: Paragraph 3: The need for trapper surveys was agreed to at the February 28 - March 2, 1983 follow-up AEA workshop. 3W-4/ Since no such work has been undertaken, we recommend that a trapping survey be made of residents along the railroad, in Talkeetna, in Cantwell, along the Denali Highway, and in the Watana area.

[I.171] Page E-3-357: (b) Muskrat: Sufficient water depth below ice is a habitat requisite for muskrat as well as beaver. Measurement of lake depths in the middle Susitna River basin would allow assessment of which lakes are critical overwintering areas. Shallower lakes where pushups may be visible but muskrats do not successfully overwinter could also be then identified (Phil Gipson, personal communication).

[I.172] Page E-3-358: (c) River Otter: Paragraph 2: We suggest that furbearer and aquatic researchers determine whether areas where otter track concentrations were observed in November 1980 correspond with grayling movements to overwintering areas.

[I.173] Page E-3-365: (h) Coyote: An addition to the information provided here is an observation of a coyote feeding on remains of a moose on ice in the Susitna River, about 7 miles downstream from the mouth of Portage Creek during March, 1983 (Phil Gipson, personal communicatation).

[I.174] Page E-3-369 (a) Raptors and Raven: Paragraph 1: Definitions for raptor "nesting locations" and "nest sites" were found in Section 4.3.1 (n) (i), page E-3-443, paragraph 1; not in Appendix 3.I as indicated here.

The draft report stated "...precise elevations of nests and cliff-tops relative to maximum impoundment fill levels are integral to a sound mitigation plan..." (Chapter 11, W-3-251). That information is essential to several of the recommended mitigation plans (e.g. Section 4.4.2(a)(9),and (b)(10),(20), and [21]). The applicant should confirm that these data were obtained, and by whom, and how the data will be incorporated into the Mitigation Plans.

[I.175] Page E-3-385: (v) Middle Basin Bird Communities: We appreciate inclusion of Table E.3.139 and the expanded discussion on avian habitat types and densities. Once the proposed vegetation and wetland maps are completed, these data should be reexamined for further understanding of middle basin bird communities and project impacts.

[I.176] Page E-3-396: 4.3 Impacts: Paragraph 1: While we agree that acceleration of secondary development in the Susitna River basin is an indirect rather than direct project impact, the potential for such development should be fully assessed within the intent of NEPA (42 U.S.C. 4321 et seq.)

[I.177] Page E-3-396: 4.3 Impacts Paragraph 2: Please refer to our comments on Table E.3.144 regarding inconsistencies with data presented elsewhere and to additional comments on the species - specific impact tables.

[I.178] Pages E-3-396 to E-3-397: Moose: The qualitative statements which characterize this section confirm the need to aggressively pursue development of the moose carrying capacity model and completion of necessary background studies. Please refer to our previous concerns with the validity of these numbers (Section 4.2.1(a)[ii]).

[I.179] Page E-3-396: (a) Moose: Paragraph 1: Details on specific locations and the magnitude of benefits from the Watana project should be provided here.

[I.180] Page E-3-405: - Permanent Loss of Habitat: Paragraph 1: In addition to describing how increased moose densities could cause a decline in habitat quality adjacent to project impact areas, consideration should be given to existing utilization of those areas by moose and whether displaced moose could ultimately survive.

[I.181] Page E-3-406: . Upper Susitna Basin: Please refer to our previous comments on altered habitats, including needed quantification of these areas (Section 3.3.1(a)(ii) and (iii), (b)(ii),(iii), and [iv]). We are concerned that due to decreased funding, plant phenology data obtained in 1983 may not be analyzed. These data and analyses are essential to assess implications of the reservoir impoundment and potential values of proposed habitat improvements. See our comments on Section 3.3.1(b)(iv).

[I.182] Page E-3-409: - Blockage of Movements: To better understand potential movement blockages, we recommend that concentration areas and timing of moose crossings of the Susitna River be analyzed relative to slopes in the drawdown zone.

[I.183] Page E-3-410: - Blockage of Movements: Paragraph 2: As we commented on Chapter 2, page E-2-90, the expected delay in ice cover formation downstream from Talkeetna should be re-evaluated and the results provided to allow better quantification of the potential for interference with moose movements.

[I.184] Page E-3-410: Blockage of Movements: Paragraph 5: The applicant should provide the schedule and scope for the additional information.

[I.185] Page E-3-411 - Mortality: Paragraph 1: The need to provide baseline data on hunting demand and harvest was previously identified, as was the need to coordinate consideration of hunting between Chapter 3 and Chapter 5 (Section 4.2.1(a)[iii]). Whether hunting will remove displaced animals and thus prevent overbrowsing of remaining habitats will depend on the magnitude of that displacement and regulation of hunting by the Alaska Board of Game.

[I.186] Page E-3-412: (iii) Quantification of Project Effects: We support efforts to model moose carrying capacity and subsequently simulate the cumulative effects of habitat loss, habitat alteration, and various mortality factors. This model will also allow a quantitative evaluation of the habitat values of alternative replacement lands. It should also be used to evaluate habitat values of alternative habitat improvement methods, e.g., burning, clearing, crushing, etc. Budget cutbacks and study delays are, however, interfering with the timely completion of this habitat quantification. Contrary to information presented here and responses to our previous recommendations concerning vegetation values (Chapter 11, W-3-203 and W-3-204), the necessary vegetation mapping may not be available until State fiscal year 1985.

[I.187] Page E-3-414: (iii) Quantification of Project Effects: Paragraph 6: The scope and timing of preliminary model analyses to be available in 1983 should be described.

[I.188] Page E-3-416B: (ii) Filling and Operation: Paragraph 7: Please refer to our previous comment on page E-3-409 that slopes within the drawdown zone be analyzed relative to wildlife crossings (Section 4.3.1(a)[ii]). We again recommend modeling of reservoir ice formation and break-up during filling as well as operation (see our comments on Chapter 2, page E-2-88). The time of break-up has significant implications with regard to potential crossings by animals such as caribou.

[I.189] Page E-3-417: (c) Dall Sheep: Sheep studies, particularly in the Jay Creek mineral lick area, were not undertaken until March through July, 1983. Information presented here should be qualified as preliminary.

[I.190] Page E-3-418: (i) Construction: Paragraph 2: Disturbance of sheep at the Jay Creek mineral lick may be more immediate than lick inundation. However, disturbance from recreationists could extend through the project life. The cumulative impacts should be evaluated.

[I.191] Pages E-3-419 to E-3-420: (i) Construction: Paragraphs 2 through 4: The Jay Creek mineral lick area is apparently more extensive than it was originally thought to be. Additional downstream lick areas discovered during ADF&G's recent work in the area would also be fully or partially inundated (Nancy Tankersley, personal communication). While erosive water action could cause exposure of additional mineral soil, it will more likely cause loss of the steep rocky cliffs resulting in added stress and exposure to predators when sheep use the area.

Given the apparent elevation range of the Jay Creek lick area, it is uncertain that the lick was originally created or is maintained by the water action along the creek.

[I.191] (cont) The discussion should consider impacts from proposed reservoir clearing activities and provide information on how access for those activities is to be provided. Timber clearing and associated access are further sources of disturbance and could impact sheep use of the Jay Creek lick area.

[I.192] Page E-3-421: (i) Construction: Potential disturbance and loss of habitat from borrow area activities should be discussed. 3W-5/

[I.193] Page E-3-426: (ii) Filling and Operation: Paragraph 3: While brown bears could physically cross the reservoir, they would likely be inhibited by adjacent human activities. 3W-6/

[I.194] Page E-3-427: (i) Construction: Paragraph 3: According to Figure E.3.37, borrow area E is more extensive than it was originally thought to be and represents a significant source of disturbance to the high density black bear denning in the area (Sterling Miller, personal communicaton).

[I.195] Page E-3-428: (i) Construction: Paragraph 4: The ADF&G Phase II Annual Report (April 1983) shows the Watana impoundment area to be more important to black bear denning than previously realized. Thirteen of 24 black bear dens found within the project area will be flooded. 3W-7/

[I.196] Page E-3-431 to E-3-432: (f) Wolf: Last Paragraph: We agree that wolves may temporary increase as a result of increased availability of prey due to displacement adjacent to the reservoir area. Those initial benefits may later mean more significant impacts to wolves as hunters and predators eliminate prey.

[I.197] Page E-3-435: (ii) Filling and Operations: Paragraph 3: Line 1: A more accurate statement would be that no beavers are known to overwinter in the river reach between Watana and Devil Canyon (Phil Gipson, personal communitation).

[I.198] Pages E-3-435 to E-3-436: (ii) Filling and Operation: Paragraph 4: The value of sites occupied by beaver in the winter depends on water stability. Thus, flow fluctuations for even a few days could affect downstream beaver. Beaver could be frozen out of their lodges and/or food caches if water levels suddenly drop. Alternatively, their lodges and food caches could be destroyed should sudden flow releases cause ice movements or flooding out of beaver sites. The potential for daily flow fluctuations in winter should be described.

As we commented on Chapter 2, page E-2-90, the expected delay in ice cover formation downstream from Talkeetna should be described here and the implications discussed in regard to beaver habitat improvement proposals. We recommend using hydrologic data in conjunction with revised vegetation maps and with information on vegetation succession to quantify downstream areas likely to be affected under different flow regimes. Please refer to our previous comments on the uncertainties in existing reservoir temperature and icing models which make these conclusions on downstream vegetation succession and icing processes questionable (Section 3.3.1(b)[iii]).

[I.198] (cont.) An explanation should be provided of when, how, and by whom, "...available hydrologic data will be used to determine the most likely locations for enhancement [habitat improvement] in downstream sections," as indicted in the applicant's response to our previous comments on this subject (Chapter 11, W-3-324).

We question whether beaver habitat can be improved. Other than to create stable but higher winter flows and deeper water in some sloughs and side-channels for beaver use, there may be other physical manipulations which could improve beaver habitat. These would be to: (1) dig out sloughs to increase their depth; (2) put in berms at upstream channel openings to slow down flows; or (3) put a dam at downstream channel mouths to deepen the water in the channel. These are all drastic measures whose values have not been proven in Alaska, and which potentially conflict with management and mitigation plans for other species.

[I.199] Page E-3-436: (j) Muskrat: Paragraph 1: The effectiveness of proposed downstream improvements to muskrat habitat should be demonstrated.

[I.200] Page E-3-436: (i) Muskrat: Paragraph 2: Because of the above concern we question the certainty of the conclusion that, "Improved downstream habitat will compensate for ... [the impoundment area] loss."

[I.201] Page E-3-436: (i) Muskrat: Paragraph 3: The potential for negative impacts to muskrat from daily flow fluctuations should be fully addressed.

[I.202] Page E-3-440: (l) Coyote and Red Fox: Paragraph 5: Red fox habituation to human activity may be overemphasized. The referenced studies were in areas protected from hunting and where vehicle use may be less frequent and at slower speeds than it will be during project development activities.

[I.203] Pages E-3-441 to E-3-442: (m) Other Furbearers: Paragraphs 4 and 5: The difficulties with the marten model described here are sufficient to suggest that the attempted quantification of marten populations, although eventually desirable, is premature. In addition to seasonal differences in trapability, the fact that a professional trapper worked in that area the previous winter further negates the validity of this estimate. We suggest that the trapper be contacted for further information on Watana area marten populations.

[I.204] Page E-3-442: (n) Raptors and Ravens: Section discussions leave the unproven impression that raptors and ravens will be displaced to downstream and adjacent areas. For example, on page 445, paragraph 5, it is inferred that downstream cliffs may increase in importance to golden eagles who lose upstream cliff nesting locations; however no analysis is made of comparable foraging habitat at downstream locations. On page 448, paragraph 1, it is similarly concluded that raven use of areas downstream from the Watana damsite will increase after filling and before development of Devil Canyon. Response W-3-339 (in Chapter 11) to our comments on the draft license application and page 446, paragraph 3, includes no reference or criteria for assuming that bald eagles now inhabiting nests to be inundated by the Watana impoundment could later nest in adjacent areas upstream on the Susitna or Oshetna Rivers or downstream along Portage Creek, Prairie Creek, or near Stephan Lake.

[I.204] (cont.) Little consideration has been given to the relative habitat values of these other areas, and why it is concluded that these areas are presently not fully utilized. If food is unobtainable after project completion, it would be meaningless to provide alternative nesting locations. Where alternative nesting habitat values are described, the potential mitigation values from manipulating those habitat areas or otherwise attempting to provide alternative nesting locations are unproven, and primarily speculative. For example, the one documented case where a bald eagle nest was successfully reestablished involved an existing site which was restored, not establishment of a nest in an area currently uninhabited and unsuitable for nesting by bald eagles. The viability of such measures in Alaska or similar environments must be shown before they can be found acceptable.

[I.205] Page E-3-443: - Nesting Habitat: Review of Appendix 3.I shows that successful provision of artifical nest sites in Alaska remains unproven and untried. While we agree that lack of opportunity rather than lack of knowledge may be limiting such applications, we believe that such experiments do not serve as mitigation for raptor nest loss from project activities. Lack of opportunity is no reason to readily accept such measures without first demonstrating their viability within the project area.

Information sources cited in the artificial nest examples 1,3, and 9 are not included in the references listed for the Wildlife Section. Although nesting parameters are thoroughly described here, no information is provided on whether manipulated nesting locations are in areas with adequate foraging habitat for additional eagles. The usefulness of providing or manipulating nesting locations has not been proven for Interior Alaskan raptors.

[I.206] Page E-3-445: Paragraph 4 through Page E-3-447: Paragraph 1: As cited in the following section, (ii), on disturbance, bald and golden eagles are protected under the Bald Eagle Protection Act (16 U.S.C. 668-668c). That protection makes it generally illegal to take bald or golden eagles, including any part, nest, or egg of either species. Under a recent amendment, the Secretary of the Interior may permit the taking of golden eagle nests which interfere with resource development or recovery operations (16 U.S.C. 668a). The Act provides for the taking of bald eagles or their nests only for certain specific exhibition or scientific purposes when compatible with the preservation of this species. That taking may be permitted by the appropriate FWS Regional Director under eagle permit regulations (50 C.F.R. 22). "Take" is defined to include molest or disturb.

[I.207] Page E-3-448: Paragraph 2: through Page E-3-451: Paragraph 1: Hunting and Perching Habitat: Supporting references should be provided for this discussion. Only a brief subjective assessment has been made of hunting and perching habitat which would be available near artificially provided nesting locations and nest sites. Nests without perches are of limited value to bald eagles. Nesting habitat is useless without sufficient sources of food.

[I.208] Page E-3-449: - Hunting and Perching Habitat: Paragraph 6: We question the validity of this discussion. Bald eagles hunt very close to the nest site and probably always within line of sight, especially during the early part of the nesting season.

[I.209] Page E-3-450: Bald Eagles: Last Sentence: The text should clarify whether the assessment that food will, "...be adequate for those eagles that remain after construction and filling of the Watana reservoir," includes the potential new nests and eagle population to be provided in those areas by the Mitigation Plan.

Page E-3-451: Paragraph 2 through Page E-3-454: Paragraph 1: (ii) Disturbance: The APA has initiated "consultation" with the Alaska Regional Director of the FWS with regard to the taking of eagle nests. The applicant's initial February 3, 1983 and subsequent May 23 and June 21, 1983 letters request information on the FWS's legal obligations and advice on how the apparent conflict can be resolved. Our June 9 and June 30, 1983 responses included a copy of the Bald Eagle Protection Act and appropriate regulations. We have described how the recent amendment to the Act does not allow indiscriminate destruction of nests but could allow nests to be moved on a case by case basis, under the appropriate conditions of a permit issued by the Secretary. There are no provisions for issuing permits to take or move bald eagles nests for other than, "...the scientific or exhibition purposes of public museums, public scientific societies, or public zoological parks" (16 U.S.C. 668a). That the act merely prevents taking "without a permit" is an incorrect description of the Act by the applicant, in Section (ii) Disturbance, paragraph 1, and in the Chapter 11 response (W-3-344, paragraph 1).

[I.210] In their letter to the FWS Regional Director and in the Wildlife Resources section of the Exhibit E, the applicant has explained no such scientific or exhibition purposes for the taking of bald eagle nests in the project area; nor have any steps been taken by the applicant to obtain a case by case permit for the similar taking of golden eagle nests. The applicant has seemingly accepted the fact that up to five bald eagle and eight golden eagle nests will be destroyed with project construction. An additional bald eagle nest and up to seven additional golden eagle nests will be subject to disturbance from project access, construction. and associated activities. The Exhibit E Mitigation Plan assumes that provision of alternate nesting locations and nest sites will adequately mitigate for these impacts. The previously cited response to our comments on the draft application suggests that the Bald Eagle Protection Act will be met by implementing the Mitigation Plan:

> "...in a manner that should satisfy taking of bald eagle nests as part of a scientific study to learn about the effectiveness of several possible mitigation methods useful as evaluative and mitigation tools should similar conflicts arise between this species and other future developmental or industrial projects" (Chapter 11, W-3-344).

We have not agreed to the need for such a study. Nor have we reached agreement with the applicant on this subject. Successive comments on portions of the license application which deal with bald and golden eagles concern biological rather than legal aspects of this problem. We anticipate that the applicant will initiate discussions with the FWS Regional Director for resolving the project's apparent conflict with the Bald Eagle Protection Act.

[I.211] Page E-3-453: (ii) Disturbance: Paragraphs 8 and 9: Recognition of the eventual inundation of at least five of the seven golden eagle and two of the four bald eagle nests due to the Watana impoundment makes the issue of disturbance from reservoir clearing operations somewhat of a moot point.

[I.212] Page E-3-461: (q) Non-game (Small) Mammals: Paragraph 4: The text should explain how the estimated 5% decrease in northern red-backed vole numbers was derived.

[I.213] Page E-3-465: - Alteration of Habitat: Please see our previous comments and references on altered habitats under impacts from the Watana development (Section 4.3.1(a)[ii]).

[I.214] Page E-3-469(i) Beaver: References in support of the conclusions drawn here should be provided. Please refer to our previous comments regarding uncertainties in the potential for downstream habitat improvement (Section 4.3.1[i]). We are concerned that, although modeling of hydrology, floodplain vegetation, and beaver populations is highly desirable, it is not now occuring as indicated in the response to our previous recommendations on this subject (Chapter 11, W-3-367).

[I.215] Pages E-3-471 through E-3-474: (n) Raptors and Ravens: Please refer to our comments on Section 4.3.1(n) regarding the potential for conflict with the Bald Eagle Protection Act.

Impacts of operating the Devil Canyon dam should be described.

[I.216] Page E-3-474: (o) Waterbirds: Paragraph 1: We question the attributed benefits to migratory waterbirds from project-induced open water areas. We would not expect birds to arrive in the area any earlier. Birds which remain in the area longer may have problems finding food when encountering frozen waterbodies once they do leave. No data have been provided on any supplemental food values in the reservoir area; the discussion indicates shorebird feeding habitat would not be created.

[I.217] Page E-3-476: (o) Waterbirds: Paragraph 2: Data should be provided to support the contention that "distributional shifts" would occur and downstream habitats can support additional waterbirds.

[I.218] Page E-3-476: 4.3.3 - Access Roads and Railway: Please refer to our previous comments and correspondence for any recommendations; those include dropping of the proposed Denali Highway-to-Watana access road segment (Sections 3.4.2(a), pages 256-262, and letters from the FWS to Eric P. Yould, APA, August 17, 1982 and January 14, 1983). A description of the proposed access plan should be included here for clarity.

[I.219] Page E-3-477: (i) Mortality: Paragraph 2: While we agree with the statement "...carefully managed hunting may effectively mitigate for the indirect project effect of overutilization of remaining forage," such management is the responsibility of the Alaska Board of Game and cannot be determined by the applicant. As proposed, the project will result in impacts which may foreclose some of the Board's options and desires for managing area game resources.

[I.220] Page E-3-481: (b) Caribou: Paragraph 7: We can find no Table E.3.162 which includes estimates of vehicle traffic.

[I.221] Page E-3-487: (h) Furbearers: Paragraph 1: First Sentance: Lack of accurate wetlands maps precludes a full assessment of project impacts.

[I.222] Page E-3-487: (h) Furbearers: Paragraph 3: Potential use of material sites along Deadman Creek conflicts with assurances in the Botanical Resources section that use of such areas will be avoided through use of side-borrow and balanced cut-and-fill techniques for road development (Section 3.4.2[i]). This apparent discrepancy should be corrected.

[I.223] Page E-3-489: (i) Raptors and Ravens: Please refer to our previous comments on Section 4.3.1(n) regarding requirements of the Bald Eagle Protection Act.

[I.224] Page E-3-489: (i) Denali Highway to Watana Damsite: Paragraph 3: Inconsistencies regarding which bald eagle nesting locations will be destroyed by which project access features should be addressed. According to this section, one bald eagle nesting location, BE-6, in Deadman Creek, "...will be physically destroyed by access road construction." The same statement, without the identifying location number, is repeated in Table E.3.159 under item (1). It is unclear whether the nest identified in that table is the same as the one previously described.

In Table E.3.160, it is said that nest BE-6, "...may be affected by the access corridor in Deadman Creek," and nesting location BE-8, "...may be affected by the construction of the railroad between Devil Canyon and Gold Creek." These statements appear to contradict earlier descriptions in the Botanical Resources Mitigation Plan and Figure E.3.81 that, "A balsam poplar stand near Deadman Creek at access milepost 37.5 has been avoided by a one-half-mile route realignment to protect a bald eagle nest in the stand" (page E-3-258, paragraph 2). While such road realignment is also described in Wildlife Resources Mitigation Plan (20), Section 4.4.2(b), the affected bald eagle nest is described as BE-8 (page E-3-537). No mention is made of BE-6 or mitigation for a bald eagle nesting location which would be disturbed by the railroad between Devil Canyon and Gold Creek. These apparent inconsistencies should be corrected.

[I.225] Page E-3-492: 4.3.4 - Transmission Lines: We have previously described the problems with comprehensively assessing transmission line impacts in view of: (1) different vegetation classification schemes used for different segments of the line; (2) apparent inaccuracies in sums provided for affected vegetation types (e.g. Table E.3.86); and (3) inconsistent references to existence of a 69kv, 34kv, or no temporary service transmission line adjacent to the Denali Highway-to-Watana access road. Please see Section 3.4.2(a)(i), page 269.

We recommend that the resource agencies be consulted during detailed engineering design with regard to on-ground siting of the line and any maintenance access trails. Access trails to the line should be limited to reaches between major river crossings or topographical barriers. Locked gates or other impassible barriers should be placed at intersections of the maintenance access trails with public roadways. Please refer to our proposed

[I.225] (cont.) Biological Stipulations, Attachment A, and Wetlands Construction Methods, Attachment C for further recommendations.

Page E-3-493: 4.3.4 - Transmission Lines: Paragraphs 2 and 3: To minimize clearing requirements along the transmission corridor, we recommend that the 25-foot maintenance access trail be adjacent to the towers, in the area where vegetation will be kept to a minimum height. The applicant should provide the anticipated schedule and height criteria for safely maintaining vegetation clearing along the line. Opportunities to alter the schedule to maximize production of early successional vegetation types for moose and black bear should remain an option throughout project life. Clearing should be done after the ground has frozen and a snow cover is present to minimize the potential to damage soil and vegetation ground cover, assuming no bear dens are in the area.

[I.226] The referenced map of the transmission corridor (Figure E.3.37) is incomplete. We suggest addition of an overview map showing the locations of Figures E.3.48 through E.3.52.

Changes in vegetation diversity will vary depending on which types are cleared, the existing interspersion of vegetation types and existing wildlife uses in specific areas.

[I.227] Page E-3-494 through E-3-495: (a) Big Game: The contention that animals will relocate during construction and later return to the area should be scientifically supported or dropped. No information is provided on the availability and current wildlife use of areas immediately adjacent to the line. During detailed transmission line siting we would expect that additional bear denning areas would be located and efforts made to site the line away from those areas. At a minimum, restrictive time-frames should be set during which construction of those segments would be allowed. This section fails to indicate that the "temporary effects" of disturbances caused by human activities during construction will be repeated during as-yet-undefined periods of maintenance. Where increased browse production along the transmission line attracts moose, there is a potential negative effect if the transmission line is adjacent to roads or railways.

[I.228] Page E-3-495: (iii) Willow to Healy: Paragraph 1: The text should indicate whether widening of the Intertie between Willow and Healy will be immediately adjacent to the existing line throughout that corridor.

[I.229] Page E-3-496: (b) Furbearers: Paragraph 2: Please refer to our previously described concerns with the marten model, Section 4.2.1(m).

[I.230] Page E-3-497: (c) Birds: Paragraph 3: Reasons as to why the 34kv construction transmission line could not be built to avoid the possibility of electrocution should be discussed. Electrocution is another reason why this should not be the power source for project construction. Please also refer to our previous comments on the construction of transmission lines, Section 3.4.2(a)(i).

[I.231] Page E-3-498: (c) Birds: Paragraph 7: Because of potential disturbance to golden eagle and raven nesting locations (GE-18, R-13, and R-21), we recommend

[I.231] cont.) that construction of the transmission line between Watana dam and the Intertie occur before March 1 and after May 10 (per Table E.3.128) if those nests are inactive, or before March 1 and after the interagency monitoring team confirms that the young have fledged and left (in July for ravens and in September for golden eagles) if the nests are active.

[I.232] Page E-3-499: 4.3.5 - Impact Summary: Paragraph 1: Criteria used to determine whether impacts on wildlife populatons were, "...of sufficient magnitude to influence mitigation planning," should be provided. We are concerned that emphasis appears to be on impacts for which mitigation measures can later be recommended. Uncertainties in predicting project impacts on the basis of existing information are evident here. The general and incomplete nature of the resulting Mitigation Plan are due to these uncertainties.

[I.233] Page E-3-499: 4.3.5 - Impact Summary: Paragraph 2: We previously commented on the need to integrate discussions of hunting with those in the Socioeconomic and Recreation Chapters of the Exhibit E. Hunting demand and harvest data presented throughout Section 4.3 are minimal and not up-to-date. The location of the section on socioeconomic/wildlife relationships, which has apparently been added to Chapter 3 in response to our comment (Chapter 11, W-3-424), should be noted.

[I.234] Page E-3-499: (a) Big Game: Paragraph 2: The preliminary estimate of 300 moose which winter in the Watana impoundment should be indicted here; also see our comments on Section 4.2.1(a)(ii). Apparently more recent censuses by ADF&G have found over 600 moose wintering in the impoundment zone (Warren Ballard, personal communication).

[I.235] Page E-3-500: Paragraph 2: Estimated moose losses to other project facilities should be qualified as above. The last sentence in this paragraph is unsubstantiated and subjective. The amounts of existing vegetation types and the vegetation succession expected for each of those types, over time, should be quantified.

[I.236] Page E-3-500: Paragraph 3: Although it may not be possible to accurately predict downstream habitat changes, alternative scenarios should be presented for different flow regimes, snow depths, and river morphologies. Such information would allow assessment of the range of possible impacts and thus necessary mitigation.

[I.237] Page E-3-500: Paragraph 4: Whether alternative areas can support displaced moose or whether those moose will alter their movements in response to specific habitat alterations is unknown throughout the project area.

[I.238] Page E-3-502: Paragraph 1: We concur with the ADF&G's concern.

[I.239] Page E-3-502: Paragraph 2: Loss of escape cover and disturbance from reservoir clearing activities in the vicinity of the Jay Creek mineral lick area should be discussed.

[I.240] Page E-3-502: Paragraphs 3 and 4: Increased access and developments near Prairie Creek are a further source of disturbance to brown bears using those salmon food resources.

[I.241] Page E-3-504: (b) Furbearers: Paragraph 1: and Page E-3-505: Paragraph 2: Please refer to our comments on Section 4.3.1(i)[ii].

[I.242] Page E-3-504: Paragraph 3: Work on the beaver habitat model has been at a standstill since the February 28 -n March 2 1983, follow-up AEA workshop. With no additional data collection or modeling efforts funded in the State's fiscal year 1984 budget, we question how this model will be developed.

[I.243] Page E-3-506: Paragraph 1: The quantification of marten losses provided here (also see Section 4.3.1[m]) is inconsistent with the discussion under Devil Canyon impacts, Section 4.3.2(m), where losses are predicted to be 14 marten. The discrepancy should be corrected.

[I.244] Pages E-3-506 through E-3-507: (c) Birds and Non-game Mammals: Taking of bald and golden eagles is generally prohibited under the Bald Eagle Protection Act (see Section 4.3.1[n]).

[I.245] Page E-3-508: 4.4 - Mitigation Plan: This is a good first step in developing a comprehensive plan for mitigating project impacts. Presentation of the plan in the license application is the first opportunity for interagency scrutiny and review by principal investigators. Studies must be completed, measures refined, numerous details added, and implementation assured before the plan can be approved. We suggest that the applicant works closely together with appropriate agencies to develop a detailed, mutually acceptable mitigation plan. The intent of this comment is to initiate and encourage continuation of studies to close data gaps identified in previous sections of the license application.

Since many wildlife mitigation measures are identical to botanical mitigation measures, our concerns and mitigation recommendations on Section 3.4 are thus applicable to Section, 4.4; e.g., facility siting, reclamation, access regulation, habitat acquisition and improvement, etc. Please also refer to Attachments A through C.

[I.246] Page E-3-508: 4.4 - Mitigation Plan: Paragraph 2: In addition to the vegetation and wetlands mapping and vegetation data analysis described previously (Section 3.2.2), other requried studies include: (1) moose food habits and browse information necessary to complete the moose carrying capacity model; (2) continued radio-tracking of collared big game, including moose downstream, and recollaring of animals whose collars will soon become nonfunctioning (also see footnotes 3W-5 and 3W-8); (3) fall cache counts and marking of beaver lodges for follow-up, (4) use of snow transects to census marten tracks, in and adjacent to the impoundment area, (5) examination of otter tracks for concentration in late fall relative to grayling overwintering areas, (6) continued development of species models through both small, single discipline work sessions and larger interdisciplinary workshops to ensure that objectives are coordinated, a common base of project assumptions are used, and plans are complimentary; and (7) testing of recommended mitigation measures, e.g., disturbed site reclamation, habitat improvement (completion and follow-up of the proposed Alphabet Hills burn, follow-up on disturbed logging and mining areas near Palmer, etc.).

[I.246] We recommend that the Environmental Guidelines included as Appendix E.3.B to
cont.) the Exhibit E, "...be incorporated by the Alaska Power Authority," (Chapter 11, W-3-437). We have attached to our comments a more complete set of Biological Stipulations. We recommend that Attachment A be incorporated into the license and the construction contracts.

[I.247] Page E-3-509: (a) Reduction in Carrying Capacity: Our previous comments on minimizing disturbed areas, consolidating features, and using mitigative construction techniques apply here (see Section 3.4.2).

[I.248] Page E-3-509: (i) Moose: Paragraph 1: Calculations of losses in vegetated habitat should be corrected. An additional 406 ha will be permanently lost to roads and railways. Neither borrow sites nor spoil areas for road construction were included in the 1875 ha calculated for temporary facilities and borrow sites (also see our comments on Tables E.3.83 and E.3.84).

[I.249] Page E-3-510: (i) Moose: Paragraph 6: We agree with the concept of transmission corridor clearing to maximize browse production for moose. The potential benefits should be quantified and then discussed in terms of adjacent moose uses, movements and limiting factors.

[I.250] Page E-3-510: (i) Moose: Paragraph 7: Hunting is controlled by the Alaska Board of Game. To the extent that the need for a controlled hunt is caused by the project, then the project has foreclosed management options of the Board.

[I.251] Page E-3-511: (ii) Caribou: Given the unknown nature of project impacts to caribou, provisions must be included in the license to later compensate for impacts found thru project monitoring.

[I.252] Page E-3-512: (iii) Dall Sheep: Lowering the Watana dam height would minimize or avoid impacts to sheep. If the dam were about 185 feet lower than now proposed, physical loss of the Jay Creek mineral lick and escape cover would be largely avoided and disturbance would be somewhat minimized.

[I.253] Page E-3-513: (iv) Brown Bears: Paragraph 6: Cooperative management agreements to mitigate potential impacts of secondary development and access should be reached among the APA, resource agencies, and private landowners and incorporated into the project license. We recommend that public access not be allowed on the project spur road across the Watana dam. Such access prohibitions are necessary to prevent disturbance to bear concentrating on Prairie Creek during salmon runs.

[I.254] Page E-3-513: (v) Black Bears: Paragraph 2: Aligning transmission corridors through tundra areas may not minimize impacts to black bears, and may disturb brown bears; thus we question the rational for this alignment.

[I.255] Page E-3-514: (vi) Wolves: Wolves may ultimately be negatively affected by reductions in prey populations and increased harvest pressures (page E-3-432, paragraph 1 and page E-3-518, paragraph 3). The text should acknowledge these impacts.

[I.256] Page E-3-514: (viii) Beavers and Muskrat:and (ix) Mink and Otter: The APA should clarify the magnitude and certainty for downstream habitat improvements (see our comments on Section 4.3.1(i)(ii)).

[I,257] Page E-3-515: (x) Marten: Please refer to our previous comments on the preliminary nature of quantified of marten losses (Section 4.3.1[m]).

[I.258] Page E-3-515: (xi) Raptors and Raven: Paragraph 2: The potential for the project to be in conflict with the Bald Eagle Protection Act was previously detailed (Section 4.3.1[n]).

[I.259] Page E-3-515: (xi) Raptors and Raven: Paragraphs 3 and 4: While the total golden eagle population will not be greatly affected, limited nesting habitat and sparse populations in the interior make project impacts locally significant.

[I.260] Page E-3-517 through E-3-520: (i) Hunting and Trapping Mortality: Please refer to Section 4.4.1(a)[i]).

[I.261] Pages E-3-518 to E-3-519: (i) Hunting and Trapping Mortality: Paragraph 5: We have previously commented on the need to improve downstream sloughs for aquatic furbearers (Section 4.3.1(i)[ii]). It is currently unknown which lakes are deep enough to allow successful overwintering and dispersal for beaver and muskrat.

[I.262] Page E-3-520 through E-3-522: (ii) Additional Mortality: An environmental orientation program should be requisite at a worker's initiation of employment (see Attachment A). Animal control measures should be coordinated. For example, beaver control efforts at culverts or sloughs may be desirable for salmon yet beaver colonization may be encouraged in other project areas.

[I.263] Page E-3-522: (c) Disturbance Impacts: Paragraph 2: Disturbance of denning bears from transmission corridor, reservoir clearing, and reservoir filling activities is potentially a significant problem. Efforts should be made to locate dens before undertaking such activities. Transmission line routing and clearing schedules could be designed to avoid such impacts. Where dens within the impoundment area are to eventually be lost, it may be desirable to keep bears from denning rather than to disturb them while denning. Consultation with the resource agencies is necessary to plan these activities so as to minimize impacts.

[I.264] Page E-3-522: (c) Disturbance Impacts: Paragraph 3: Disturbance from on-ground recreational activities could further disturb sheep in the Jay Creek mineral lick area.

[I.265] Page E-3-523: (a) Continued Monitoring and Study Needs: Overall, we endorse the intent and substance of continuing studies (1) through (11) described here. Monitoring is essential to determine additional mitigation needs. This section should include data needs for continuing impact assessment and mitigation planning efforts (see notes from the AEA modeling efforts) 3W-9/ Those efforts must be completed prior to project construction and concurrent with project design. A mechanism should be outlined for determining and implementing additional study and mitigation needs. The length of time or desired results of post-construction monitoring should be discussed.

Key components of a monitoring program are that it: (1) include appropriate Federal, State, and local agency participation; (2) be fully supported by project funding; and (3) be utilized to modify, delete, or add to the Mitigation Plan in response to both information from ongoing studies and needs which become apparent as project impacts are realized.

[.265 cont.) Another general recommendation on the Mitigation Plan is that consultation between the license applicant and resource agencies include of working sessions with project design engineers to fully incorporate wildlife mitigation plans.

[.266] Page E-3-523: (2): We recommend that low-level aerial photographs be made in both summer and winter and at least biannually to better quantify project impacts to determine downstream changes in vegetation cover.

[I.267] Page E-3-524: (3): Results of caribou monitoring may require further restrictions on access as recommended by the interagency monitoring team.

[.268] Page E-3-524: (6): Surveys of active dens for brown bear, black bear, wolf, and fox dens should continue during operation.

[.269] Page E-3-525: (8): Downstream beaver surveys should extend to the Yentna River to establish a baseline control for assessing upstream losses and downstream habitat modifications (see Section 4.3.1[i]).

[.270] Page E-3-525: (9): We concur with the need for annual raptor nest surveys. Should surveys identify the presence of the endangered peregine falcon, Section 7 consultation should promptly be initiated with the FWS.

[I.271] Page E-3-525: (10): If swan nesting is identified in areas where there is possibility for disturbance, surveys should continue through operation and maintenance.

[.272] Page E-3-525: (11): Monitoring of moose habitat improvement efforts should begin now by evaluating disturbed areas in applicable vegetation types. Candidate sites easily accessible for a low cost analysis include recently logged and chained area near Palmer, Alaska.

Annual big game counts and compilation of harvest records by location should be continued so that long-term changes can eventually be evaluated.

[.273] Page E-3-525: (b) Mitigation Plans: Expected mitigation benefits should be more adequately quantified. The potential effectiveness of many recommendations is unknown.

[I.274] Page E-3-525 to E-3-526: (1): Delaying reservoir clearing a few years may aid a few individuals, but will have minimal long-term affects on wildlife populations. Access as well as schedules for clearing should be planned in consultation with the resource management agencies. Clearing activity in the

[I.274] (cont.) Jay Creek mineral area should be restricted to the period August 15 to May 1 to prevent disturbance to sheep using the area.

[I.275] Page E-3-526: (2): Please refer to our previous comments, Section 3.4.2(a)(i) pages E-3-254 through E-3-268. To prevent significant habitat losses, disturbance, and loss of the remaining delta tributary to be unaltered by the Watana or Devil Canyon impoundment, we recommend that no borrow activities occur in the portion of borrow site E at the confluence of Tsusena Creek with the Susitna River.

[I.276] Page E-3-526: (3): Information on existing vegetation cover and wildlife uses is necessary to assess the extent to which revegetation will provide forage desired by moose and bears. Black spruce may revegetate areas cleared of black spruce; terrain features, interspersion with other vegetation types, and habitual movements may stimulate or interfere with moose and bear use of revegetated areas. Please also see our comments on Section 3.4.2(a)(i), pages E-3-275 through E-3-281.

[I.277] Page E-3-525: (4): Anticipated forage gains from clearing of the transmission corridor should be compared with anticipated forage losses due to permanent project facilities. Also see Section 3.4.2(a)(i), pages E-3-269 through E-3-274.

[I.278] Pages E-3-526 and E-3-527: (5): This statement is inconsistent with previous statements about expected downstream areas of open water and frosting of vegetation (e.g., page E-3-408, paragraph 2; page E-3-435, paragraph 4). Also, refer to our comments on the uncertainty of reservoir temperature and river icing models (Section 3.3.1(b)(iii) and pages E-2-119, E-2-121, E-2-123, and E-2-124).

[I.279] Page E-3-527 through E-3-530: (6): The lands to be managed must be examined to determine whether desired plant species will revegetate the areas. In evaluating the mitigation potential of candidate management lands, the management options foregone should be identified.

[I.280] Page E-3-529: Paragraphs 3 and 4: Projected improvement of bear habitat should be quantititively supported through controlled burns and revegetation. It was stated earlier that permanent loss of bear habitats can be mitigated only through compensation (see page E-3-512, last paragraph). Provision of one seasonal food has little benefit if another seasonal food is the limiting factor to bears.

[I.281] Page E-3-531: Paragraph (3): During 1983 field studies, ADF&G found the Jay Creek mineral lick area to be larger than they had previously believed. Thus, we recommend that the applicant consult with the ADF&G in defining the actual dates, and, and vertical distances from the lick in which aircraft activities may be prohibited.

[I.282] Page E-3-531: Paragraph 5: Restrictions on aircraft activity near active fox dens should be established through consultation with ADF&G.

[I.283] Page E-3-532: Paragraph 4: Ground activity near the Jay Creek mineral lick should be prohibited between May 1 and July 30.

[I.284] Page E-3-532: Paragraph 5: The text should clearly indicate that sensitive areas include brown bear and black bear dens and the Jay Creek mineral lick area.

[I.285] Page E-3-532: Paragraph 8: Active fox dens should be included here.

[I.286] Page E-3-533: Paragraph 3: Final siting and scheduling of construction and use of the Watana to Devil Canyon access road near nesting location GE-18 should be decided in consultation with the FWS to ensure compliance with the Bald Eagle Protection Act.

[I.287] Page E-3-533: Paragraph 4: Our previous comment on siting in consultation with the FWS also holds for the railroad alignment near nesting location BE-8.

[I.288] Page E-3-533: (11): In areas of permafrost, higher road profiles may be required.

[I.289] Page E-3-534: (12): We recommend that the APA consult with resource agencies in reviewing options for reducing traffic volume. If our recommendation to drop the proposed Denali Highway to Watana access road is not adopted, then we recommend that the road not be maintained following project construction. Rehabilitation of this link would inhibit public access and thus minimize impacts to all species from continued disturbance and habitat loss. Continued access for project maintenance could be through the railway and Devil Canyon to Watana road.

[I.290] Page E-3-534: (13): The criteria for establishing a population-level effect on Dall sheep should be provided. Since loss of escape cover may be as critical as loss of portions of the lick, exposing new mineral soil may be of little value as mitigation (Nancy Tankersley, personal communication).

[I.291] Pages E-3-534 through E-3-535: (14): Mitigation of project impacts through regulation of hunting will occur independently of project activities. When such regulation is determined necessary by the Alaska Board of Game, it will be at the expense of other managewment options (see Section 4.4.1(a)[i]).

[I.292] Page E-3-535: (15): Environmental briefings should also be developed for workers' families who will be residing in the construction village.

[I.293] Page E-3-536: (16): Please refer to our previous comments as to the uncertainty that downstream slough modifications will effectively compensate for upstream impacts to salmon and bear (Section 4.4.1(a)[iv]). Anticipated reductions in predator populations are somewhat inconsistent with Mitigation Plan. Before compensation can be made, quantification is necessary for the timing, locations, and quality of seasonal forage gained at revegetated sites compared to areas where it will be lost.

[I.294] Page E-3-356: (17): Please refer to our previous comments on access road borrow areas (Section 3.4.2(a)[i]).

[I.295] Page E-3-537: (18): Development of the beaver model will not, "...mitigate for residual impacts on furbearers." Use of the model will provide

[I.295] (cont.) information for developing and implementing mitigative flow releases or other habitat manipulations.

[I.296] Page E-3-537: (19): Please refer to our previous comments on the unproven nature of slough modification for beaver (Section 4.3.1(i)[ii]). The text should indicate which sloughs are to be managed for beaver and which for salmon and then define exactly what is meant by "...slough enhancement measures." Existing beaver populations in all sloughs should be assessed. Coordination between aquatic and furbearer investigators is necessary to resolve potential conflicts between salmon and beaver uses and to determine how best to exclude beaver from sloughs which are to be managed for salmon.

[I.297] Pages E-3-537 through E-3-539: (20) and (21): Please refer to Section 4.3.1(n).

[I.298] Pages E-3-540 through E-3-544: (c) Residual Impacts: While this section generally identifies additional mitigation needs, it lacks any procedures or mechanisms for implementing mitigation measures. There is no quantification to statements that most impacts will be mitigated - primarily though increasing moose browse. The value of proposed browse manipulation is unknown, yet these measures are claimed as out-of-kind mitigation for several other species.

Alternative mitigation scenarios not yet developed may be foreclosed by dependence of the mitigation plan on increasing moose browse. The benefits of such measures will not be known for 10 to 20 years, by which time it may be too late to do anything else.

The overall objectives of the Mitigation Plan are aimed primarily at moose and salmon. Other proposals are generally of unproven value (e.g. exposing new mineral soil for sheep; providing artificial nesting locations for raptors). A possible effect of this narrow approach is a decrease in species diversity.

Out-of-kind mitigation proposals under (ii) Caribou, (iv) Brown Bears, and (vi) Wolves conflict with FWS designation of those species as being within Resource Category 2 and requiring in-kind mitigation under the FWS's Mitigation Policy (see Section 4.1.3).

[I.299] Page E-3-541: (iv) Brown Bears: The losses of food resources are viewed as the most significant project impact. 3W-10/ It has not been shown that burning will increase berry production. The statement that improved caribou recruitment will provide out-of-kind mitigation is inconsistent with previous information on the unknown and potentially negative nature of project impacts (see Section 4.4.1(a)(ii), page E-3-511, and Section 4.4.2(b)(16), paragraph 2, page E-3-536).

[I.300] Page E-3-543: (x) Raptors and Ravens: Potentially additive impacts of disturbance, loss of nesting locations, loss of foraging habitat, etc. remain unknown. The value and existing use of foraging areas near proposed artificial nesting locations has not been shown.

[I.301] Pages E-3-544 through E-3-545: Cost Analysis and Scheduling: To provide for unforseen contingencies, we recommend that a trust fund be established at the start of license construction. Unspent monies would revert to the project sponsor at the end of the license period.

It should not be assumed that appropriate habitat management lands will be available through the State or Federal government. The applicant should initiate discussions with resource and land management agencies as soon as possible to identify potential management lands.

[I.302] Page E-3-548: While we support monitoring, as well as plans to consult with the resource agencies, we believe that an interagency team should be established to oversee monitoring with some follow-up through project operation and maintenance.

[.303] Pages E-3-549 through E-3-550: Transmission Corridor Recommendations: Access could be better controlled by signs, zoning (to prohibit off-road vehicle use), monitoring, and enforcement of fines.

Specific Comments on Tables for Wildlife Resources Section

[I.304] Table E.3.87: Problems with the comparison of aerial habitat with Viereck and Dyrness vegetation classifications should be noted here as discussed in Section 4.2.1(a)(ii), page E-3-304, paragraphs 3 and 4.

Table E.3.92: The very preliminary nature of this data should be indicated in the table title.

Table E.3.144: This table is a useful, preliminary assessment of overall project impacts. However, we have identified the following errors:

1. Permanent Habitat Loss:

According to Table E.3.83, the Watana impoundment area is 14,736 ha. There is some confusion with the area calculated for the access corridors. The applicant should clarify how borrow sites included here correlate with figures given in Table E.3.85 and the discussion in the text which states that use of [.305] borrow areas for access road construction will be minimal (Section 3.4.1(a)[i]). Figures for a permanent village of 27 ha and temporary village of 49 ha are inconsistent with the 70ha village (8ha of which is a lake) listed in Table E.3.83. We find no description in the text or drawing in Plates F70 or F71 of a 9 ha airstrip for the Devil Canyon development.

2. Habitat Alteration and Temporary Habitat Loss:

As above, the figures given here for impoundment clearing, temporary village and temporary camp do not agree with figures in Table E.3.83. Figures for the Devil Canyon temporary village and temporary camp given here do not agree with figures given in Table E.3.84. The figures given for the transmission corridor are not consistent with Table E.3.80. According to Table E.3.80, the Devil Canyon to Gold Creek segment will alter 131.7 ha; no information or additional clearing for the Intertie is given here; and the source for the 209 ha of additional transmission corridor with Devil Canyon is unclear from Table E.3.80.

Potential alterations in ice staging, scouring, etc. are further impact mechanisms which will result from hydrologic alterations.

[I.305] (cont.) 3. Barriers, Impediments, or Hazards to Movement:

The permanency of these features should be mentioned.

4. Disturbance Associated with Construction Activities and 5. Increased Human Access:

While we agree that project studies resulted in initiation of these impacts in 1982, increases in impacts that will result from the onset of project construction should also be noted.

[I.306] Table E.3.146: The comparison presented here is of little value until vegetation is retyped to reflect understory values and geographic units corresponding to moose movements and habitat requirements. The larger the study area boundary, the smaller the proportionate loss will be, irrespective of what seasonal ranges are limited in a particular area.

[I.307] Table E.3.148: Anticipated and Hypothesized Impacts to Dall Sheep: (2) and (3): Borrow areas and roads in the vicinity of Tsusena Creek are an additional potential impact.

(5): Float plane landings and on-ground disturbance from recreational hikers and campers are an additional recreational disturbance to be considered.

[I.308] Table E.3.149: Anticipated and Hypothesized Impacts to Brown Bear: (3): Roads have been found to affect movement of bears and could inhibit crossings. 3W-9

(4): Because of altered movements due to roads and construction activity, young bears may not learn about available food resources in certain areas. Thus, the project could influence the way future bear generations utilize the area.

[I.309] Table E.3.150: Anticipated and Hypothesized Impacts to Black Bear: Please refer to our comments under Table E.3.146 about misleading comparisions of the proportion of conifer forest to be lost because of the project. The proportion of conifer forest to be lost in the Watana dam area, as compared to the entire basin, is much higher. Moreover, the even more limited areas of deciduous forest may be the sites most preferred by black bears. 3W-10

[I.310] Table E.3.153: Anticipated and Hypothesized Impacts to Aquatic Furbearers (beaver and muskrat): (1): The text should indicate the source for numbers of muskrats estimated in the impoundment area.

(2): Confirmation of those lakes supporting overwintering muskrats could be obtained by measuring water depths. Lakes of greater than 2 meters would likely be suitable for either overwintering muskrats or beaver (Phil Gipson, personal communication). Potential downstream improvements have not been quantified nor spacially identified in coordination with fish mitigation plans.

[I.311] Table E.3.157: Anticipated and Hypothesized Impacts to Marten, Weasel, and Lynx: (1) and (2): Please refer to our previous comments on problems in quantifying marten losses (Section 4.3.1[m]). Figures for areas of spruce forest to be impacted by the project do not agree with information in Tables E.3.83 and E.3.84. As we commented on Table E.3.150, figures for proportions of conifer forest to be lost are misleading.

[I.312] Table E.3.159: Anticipated and Hypothesized Impacts to Raptors and Ravens: (1): The text should indicate whether destruction of the bald eagle nest in Deadman Creek will be avoided by access road rerouting shown in Figure E.3.81. According to the text, an additional golden eagle nest may be lost at borrow site E (Section 4.3.1(n)[i], page E-3-445, paragraph 4).

(2): Claimed benefits of increased availability of small mammal prey appear doubtful when considering the length of time those areas would have been out of production during construction.

[I.313] Tables E.3.171 through E.3.175: Estimated Mitigation Costs: Costs for follow-up monitoring to evaluate the effectiveness of the recommended programs should be included. Provisions for funding additional measures, should initial mitigation prove ineffective, should also be included.

[I.314] Table E.3.178: Wildlife Mitigation Summary: Estimated costs for Monitoring Study 2 and Mitigation Plans 6 and 21 should be included in project capital costs, as should costs of any other mitigation necessary because of the project.

Chapter 3, Section 4 Footnotes

3W-1/ Modafferi, Ronald D. April 1983. Susitna Hydroelectric Project, Phase II Progress Report, Big Game Studies. Volume II. Moose-Downstream. Submitted to the APA by the ADF&G.

Ballard, Warren B., Jackson S. Whitman, Nancy G. Tankersley, Lawrence D. Aumiller, and Pauline Hessing. April 1983. Susitna Hydroelectric Project, Phase II Progress Report, Big Game Studies. Volume III. Moose Upstream. Submitted to the APA by the ADF&G.

3W-2/ APA. September 8, 1983. Appendices 2 and 3 to Agenda Item IV, Action Item No. 1, FY 1983 Program Changes and Their Impact on the FY 1984 Program and Current Proposed FY 1984 Budget Allocations, Susitna Hydroelectric Project. Prepared for the APA Board of Directors.

3W-3/ Everitt, Robert R., Nicholas C. Sonntag, Gregory T. Auble, James E. Roelle, and William Gazey. October 22, 1982. Susitna Hydroelectric Project Terrestrial Environmental Workshop and Preliminary Simulation Model. LGL Alaska, Anchorage and Fairbanks.

Everitt, Robert R., Nicholas C. Sonntag, Gregory T. Auble, James E. Roelle, and William Gazey. April 27, 1983. Susitna Hydroelectric Project, Draft Report, Terrestrial Environmental Mitigation Planning Simulation Model. ESSA Ltd., USFWS and LGL Alaska for Harza/EBASCO, Anchorage.

3W-4/ See Footnote 3W-3, supra.

3W-5/ Miller Sterling D. and Dennis C. McAllister. 1982. Susitna Hydroelectric Project. Phase I Final Report. Big Game Studies. Volume VI, Black Bear and Brown Bear, page 60. Submitted to the APA by the ADF&G.

3W-6/ See Footnote 3W-5, supra.

3W-7/ Miller, Sterling D. April 1983. Susitna Hydroelectric Project, Phase II Progress Report, Big Game Studies. Volume VI: Black Bear and Brown Bear. Submitted to the APA by the ADF&G.

3W-8/ Modafferi, Ronald D. March 1982. Susitna Hydroelectric Project, Phase I Final Report, Big Game Studies. Volume II. Moose-Downstream. Submitted to the APA by the ADF&G.

Ballard, Warren B., Graig L. Gardner, John H. Westlund, and James R. Dau. March 1982. Susitna Hydroelectric Project, Phase I Final 1 Report, Big Game Studies. Volume III. Moose-Upstream. Submitted to the APA by the ADF&G.

Also see Footnotes 3W-1 and 3W-3, supra.

3W-9/ See Footnote 3W-3, supra.

3W-10/ See Footnote 3W-5, supra.

Specific Comments

3-BOTANICAL RESOURCES

[I.315] Page E-3-191: 3.1 - Introduction: Paragraph 1: It is our understanding the downstream study area extended only to the Deshka River, not all the way to Cook Inlet. 3B-1/

[I.316] Page E-3-193: (a) General: Last Paragraph: Floristic surveys were not completed in 1983 as described here and under (c) Summary, page E-3-198. A current schedule of when the surveys will be conducted, and when the information will be distributed, should be provided by the applicant.

[I.317] Page E-3-195: 3.1.3 - Contribution to Wildlife, Recreation, Subsistence, and Commerce: More specific information on different wildlife species' uses of various vegetation communities throughout the project area should be included in this section.

[I.318] Page E-3-196: 3.2.1 - Threatened or Endangered Plants: Thirty-three, not 37, plant taxa are currently under review as candidate threatened or endangered species. Although the proposed surveys for candidate endangered plants were not done in 1983, it is felt that the likelihood of finding these species in those areas is very low.

[I.319] Page E-3-196: (a) Watana and Gold Creek Watersheds: The word "candidate" should be added before "endangered plant taxa" in the last sentence on the page.

[I.320] Page E-3-198: (a) Methods: Paragraph 1: The comparative widths of the different access and transmission corridor segments which were mapped and used for calculations in Tables E.3.77 and 78 should be stated. Also, see our comments on all of Section 3.2.2 (e) and Tables E.3.79 and E.3.86. Please see our more detailed comments under Wetlands, Section 3.2.3, regarding the inaccuracies of typing wetlands solely from a vegetation-type map.

[I.321] Page E-3-199: (a) Methods: Paragraph 3: The 1982 browse inventory, plant phenology, and Alphabet Hills pre-burn inventory and assessment studies should be briefly described.

[I.322] Page E-3-201: (a) Methods: Paragraphs 2,3, and 4: We support the proposed vegetation and wetlands mapping programs. An additional objective is to produce more realistic impact assessments by better integrating wildlife and botanical studies. For the vegetation maps, the necessary detail should be to Level V of Viereck, et al. for forests and Level IV for other types. 3B-2/ Wetlands should be mapped directly from aerial photographs, and incorporate soils and drainage characteristics, according to Cowardin et al. (please also see our Comments on Section 3.2.3). 3B-3/ The application should be updated to include current mapping plans and information on how delays may affect the proposed permitting schedule. Continued mapping delays could lead to difficulty in re-siting facilities for environmental considerations. The preliminary mapping scheduled for completion by June 30, 1983 was not accomplished.

[I.323] Page E-3-204: (b) Watana and Gold Creek Watersheds: Information on the seasonal values of vegetation types for food, cover, etc., should be related to specific wildlife species to document the importance of vegetation in wildlife habitat. This would allow better integration of vegetation as wildlife baseline data for impact assessment and clarify mitigation planning efforts.

[I.324] Page E-3-211: (v) Aquatic Vegetation: The relationship of the aquatic vegetation surveys to wetland types, and values of these areas to specific wildlife species, should be described.

[I.325] Page E-3-214: (c) Devil Canyon to Talkeetna: A comparison should be made of: (1) characteristics of the Viereck et al. vegetation types as classified in the upper and middle Susitna River Basins; and (2) the successional stages into which vegetation along downstream portions of the Susitna River were classified. Prevalence and association of wetlands types to downstream successional types should also be covered here.

[I.326] Page E-3-217: (d) Talkeetna to Cook Inlet: An analysis of early, middle, and late successional stages above Talkeetna compared to the area below Talkeetna should be provided. We suggest that the unvegetated islands and braided channels of this section of the Susitna River indicate a more dynamic, rather than stable, character as compared to the river upstream of Talkeetna. Because of significant flow changes which can be expected with project construction, separate vegetation mapping should be undertaken of the 10-year floodplain downstream from Talkeetna (e.g. Table E.2.49 in Chapter 2 documents an expected doubling of mean flows at the Susitna Station (RM 26.0) from December through March with project operation).

[I.327] Page E-3-2.7: (e) Transmission Corridors: The applicant's response to our comments on the draft license application indicates that, because of different mapping resolutions, vegetation types quantified in Table E. 3.79 cannot be correlated with other segments of the transmission corridor beyond Level I of Verreck et al. (Chapter 11, W-3-112). Different map scales and corridor widths prevent a comparision or cumulative assessment of vegetation types to be impacted by the four transmission corridor segments.

(We have previously commented on the interdependence of the Anchorage-Fairbanks Intertie and Susitna hydroelectric project, recommending these projects be analyzed as one (January 5, 1982 and January 14, 1983 letters to Eric P. Yould, APA).

[I.328] Page E-3-219: (iii) Willow to Healy: We recommend remapping so that this corridor can be compared to other sections mapped in greater detail by McKendrick et al. This would allow an assessment of cumulative transmission line impacts and mitigation needs.

[I.329] Page E-3-220: (iv) Dams to Intertie: Figures E.3.39 and E.3.40, showing vegetation types crossed by this transmission corridor segment and other project facilities, are unreadable due to reduction for publication.

[I.330] Page E-3-220 and 221: 3.2.3 - Wetlands: Color infrared aerial photograph portions of the maps identified as Figures E.3.46, E.3.47, E.3.69 and E.3.70 were stereoscopically examined. The FWS found wetland and non-wetland areas were inaccurately distinguished. Large areas of upland are included in the map units classified as wetland. Many of these areas are greater than 100 acres in size. In addition, areas that have been designated as upland include many wetlands, some of which are larger than 50 acres. A reasonably accurate assessment of the amount of wetland to be impacted by the project cannot be made with the information provided in the license application. Another problem involves the use of only five broad wetland categories. The many wetland types that are known to occur in the area have been lumped into these categories. Wetland types vary considerably in their value as fish and wildlife habitat. The impacts of the project on wetland types that have high values are difficult to determine with the present wetland inventory information. A more detailed classification using lower levels of the Cowardin et al. (1979) system 3B-4/ would provide much of the needed data. The existing wetland maps break down wetlands to the class level (e.g. forested, scrub-shrub, and emergent wetlands). We recommend that wetlands be classified to the subclass and water regime level. We should be contacted for assistance prior to additional wetland mapping efforts in the project area.

[I.331] Page E-3-221: 3.2.3 - Wetlands: Paragraph 4: The application defines wetlands as "areas at least partly characterized by hydrophytic vegetation and the presence of standing water or sheet flows." This definition needs clarification. It implies that wetland types that do not have standing water, but nevertheless exhibit saturated soil conditions throughout the growing season, are not addressed in the discussions. These saturated wetlands include many of the bog, floating-mat, and muskeg type wetlands in the project area. Since some of these types are of concern to the FWS, and since the U.S. Army Corps of Engineers (CE) extends permit authority to many of these wetlands, they should be included in mitigation and impact discussions.

[I.332] Pages E-3-221 and 222: 3.2.3: (a) Methods: Table E.3.81 attempts to display Viereck and Dyrness (1980) types which are interchangeable with Cowardin et al. (1979) system wetland types. The table points out several major problems. Enough information is presented in most of the Viereck and Dyrness (1980) vegetation types to allow for more detailed classification in the Cowardin et al. (1979) wetland categories. For example, open black spruce can be correlated to Palustrine, needle-leaved forests instead of Palustrine forests. Willow shrub can be correlated to Palustrine, broad-leaved deciduous scrub-shrub, not just Palustrine scrub-shrub. In addition, field data gathered during the initial vegetation mapping phase probably could provide enough information to add water regime modifiers to some of the Cowardin et al. (1979) wetland types. Open black spruce in wetland situations in the project area is nearly always characterized by a saturated water regime. The open black spruce vegetation type could be correlated with Palustrine needle-leaved evergreen, saturated. The wetland classes used in the license application are too broad. Assessments of project impacts wetland types of concern cannot be made with these lumped wetland categories. Some of the Viereck and Dyrness (1980) vegetation types that appear in Table E.3.81 would seldom occur in a wetland situation. This is especially true of the closed white spruce category. That category should have been classified as

[I.332] (cont.) non-wetland (upland). With the mapping procedures described in the application, closed white spruce areas would be classified as wetland unless the mapping personnel excluded them due to the "presence of steep slope and likely good drainage."

The process of classifying the vegetation types into wetland categories, and then excluding those areas that meet the ambiguous criteria of having "steep slope and likely good drainage," results in an inaccurate depiction of the wetlands in the project area.

Separation of wetland and non-wetland portions of each of the Viereck and Dyrness (1980) vegetation types has to be done on the original aerial photography that was used to map the vegetation. Preferably this should be done during the initial photo interpretation. If a Viereck and Dyrness (1980) vegetation type appearing on the photo is only partially wetland, the wetland area should be made a separate polygon and given a modifying code that designates it as a wetland. To derive the wetland map, only those polygons containing the modifying code would be transferred. The Viereck and Dyrness (1980) classification would then be converted to the appropriate wetland classification.

<u>Page E-3-222: (a) Methods: Paragraph 3:</u> The application states that "Because the system of Cowardin et al. (1979) requires additional data on hydric soils and periodic ambient water conditions to characterize wetlands completely, the mapping is liberal and indicates areas which potentially qualify as wetlands under that system." This implies that detailed soil and water permanancy data need to be available if wetlands are to be mapped accurately using the Cowardin et al. (1979).

In most areas, however, such data are not necessary if the wetland types are interpreted directly from aerial photography. The hydric soil and hydrologic conditions that are an important component of the Cowardin et al. (1979) system can be inferred from the information present on an aerial photograph. The experienced photointerpreter who is mapping wetlands synthesizes information on vegetation, slope, landform, drainage, etc. that is present on
[I.333] the imagery to derive a line that represents the boundary of a wetland. Soil and water permanancy data are only collected at sample field sites where the photointerpreter is determining the boundaries of representative wetland types on the ground, and comparing these boundaries to the tones and textures that appear on the aerial photography.

The wetland mapping methodology described in the application does not involve direct interpretation of wetland types on aerial photography. An attempt was made to derive wetland maps from the existing vegetation maps. If efforts to refine the wetland maps does not involve additional photointerpretation, then collection of extensive soil and water data would be necessary. The FWS recommends that any wetlands map refinement involve direct interpretation of aerial photos. The Viereck and Dyrness (1980) vegetation units on the original aerial photography could be analyzed so that wetland portions are differentiated, or entirely new wetland mapping could be done with delineation and classification of the wetland types on the aerial photos being done in accordance with the Cowardin et al. (1979) system. Costs and time involved to perform either method would be approximately the same.

The FWS does not agree with the baseline report conclusion that detailed wetland maps in the project area would be extremely difficult to produce using standard photointerpretation techniques. The primary reason for this difficulty, according to the report, is the conclusion that "wetlands are highly integrated with non-wetlands," and plant species composition in wet and non-wetland is similar, differing only in the quantities of individuals. Analysis of the high altitude aerial photography covering the project area by
[I.333 cont.) FWS personnel indicates that detailed wetland maps can be produced, and the wetlands can be accurately classified to the subclass and water regime levels of the Cowardin et al. (1979) classification system. Although there are some wetland types that will initially be difficult to distinguish from adjacent upland areas, a moderate amount of ground truthing can provide the photointerpreters with enough information to draw the wetland boundaries with reasonable accuracy. The intricate pattern of mixing between wetland and non-wetland areas that occurs in portions of the project area would result in some generalizing, but the generalizing would be far less than that in the existing wetlands mapping. A minimum mapping size of approximately four acres could be displayed if the wetland maps were produced at a scale of 1:63,360.

We suggest that site-specific field confirmation of wetlands be undertaken in coordination with concerned agencies (e.g. CE, FWS, EPA, and Alaska Department of Environmental Conservation). Particular concern would be where preliminary design shows potential conflict between project facilities and wetlands. Support and preliminary plans for such agency coordination were established at the December 2, 1982 wetlands meeting (please refer to notes from APA's license application workshop included as Appendix E11.H to Chapter 11).

<u>Page E-3-223: (b) General Description</u>: Discussion should be provided on successional patterns and fire predominance in wetland types.

[I.334] We question the wetlands classification of mapped vegetation types without use of other factors or field verification. Please refer to our two previous comments.

[I.335] <u>Page E-3-223: (b) General Description: Paragraph 2</u>: It should be indicated on wetland maps (Figures E.3.45 through E.3.47, and E.3.66 through E.3.73) that the areas depicted are potential wetlands.

[I.336] <u>Page E-3-225: (a) Construction</u>: Other than the direct vegetation losses due to inundation, and construction of camp, village, and borrow areas described here and in Tables E.80, E.82, E.83, and E.85, there is no quantification of types and areas to be potentially impacted by erosion, permafrost, melting, etc. Several of those impacts can and should be analyzed based on information in Chapter 6, Geological and Soils Resources, and Figures E.6.30 through E.6.45.

[I.337] <u>Page E-3-225: (i) Vegetation removal: Paragraph 1</u>: We concur with intentions to confine spoil deposition to areas within the impoundment or areas already disturbed. We siggest that the potential size and locations of spoil areas be mapped and quantified in the discussion and accompanying tables.

[I.338] Page E-3-226(ii) Vegetation Loss by Erosion: We recommend quantifying the permafrost and unstable slope areas mapped in Chapter 6, Figures E.6.30 through E.6.45, by vegetation type. Overlay maps of a readable size are necessary to fully assess botanical impacts and resultant implications to food, cover, movements, and other habitat needs of key wildlife species. An explanation should be given as to how the cited 1379 acres of unstable slopes were derived.

[I.339] Page E-3-226: (iii) Vegetation Damage by Wind and Dust: Paragraph 1: We find it difficult to quantify the miles of shoreline and the anearby area where blowdown of trees may occur. Tree blowdown could be critical with regard to loss of nest trees and wildlife cover adjacent to the reservoir. Please also refer to our comments on Wildlife Sections X and Y.

[I.340] Page E-3-226: (iii) Vegetation Damage by Wind and Dust: Paragraph 2: As above, we suggest that: (1) quantification be made of the areas likely to be affected by dust accumulations, (2) time frames be outlined within which such areas are likely to be affected, and (3) correlation be made with wildlife uses in those areas.

[I.341] Page E-3-227: (vii) Effects of Increased Fires: We concur with this description and note that fires occuring near populated areas will likely be repressed. Thus, the potential for using precribed burns to stimulate natural successional patterns may be reduced.

[I.342] Page E-3-228(b): Filling and Operation: Another impact which should be fully assessed is the potential for increases in fish mercury levels. Canadian studies have found reservoir impoundment to cause mobilization of natural soil mercury to occur, even where natural mercury levels in soil and vegetation are not high [3B-4/] We recommend that baseline mercury levels be measured in soils and vegetation. Such measurements should be made in similar areas which will and will not be inundated. Mercury levels should be monitored during and following project construction. Please also refer to our more detailed comments and references cited on Chapter 2, Section 4.1.1(e)(vii), Page E-2-96.

[I.343] Page E-3-228: (i) Vegetation Succession Following Removal: Natural plant succession may also be inhibited or precluded following disturbance unless topsoil is restored and steps taken to minimize erosion, changes in area drainage, etc.

Please refer to our comments on the Mitigation Plan, Section 3.4 Attachment A, Biological Stipulations, XI and to the restoration plans and analyses prepared for the Alaska Natural Gas Transportation System.

The discussion has not been expanded to include wetland types as the applicant had indicated it would be in response to our comment on the draft application (Chapter 11, W-3-122). We are concerned that the browse nutritional study referred to in that response has been reduced in scope, some aspects have been delayed, and others, such as the vegetation remapping, will probably be completed too late to optimize sampling.

[I.344] Page E-3-229: Tundra: The areal extent of permafrost relative to vegetation cover types and project features should be quantified and figuratively represented here for the dam, impoundment, and associated construction facilities, and in the following sections for access and transmission corridors. Please also refer to our previous comment on Section 3.3.1 (a)(iii), Vegetation Loss by Erosion (page E-3-226).

[I.345] Page E-3-230: (ii) Effects of Erosion and Depositon: Paragraph 2: Unstable slopes and permafrost areas are mapped in Chapter 6. However, because there is no interpretive description correlating those areas to vegetation cover types, it is difficult to analyze potential wildlife impacts. We recommend such an analysis.

Page E-3-231 through E-3-235: (iii) Effects of Regulated Flows: This discussion generally neglects consideration of the potential range and frequency of daily flow fluctuations in response to peak power needs.

[I.346] Several other potential project impacts relative to altered downstream flows have not yet been clarified, particularly with regard to wetlands and floodplains. These include impacts to floodplian areas which: (1) are now subject to annual, 5-year, 10-year, etc. flooding, and (2) will become exempt from flooding with project construction. Given the successional information depicted in Figure E. 3.78 and revised vegetation maps, it should be possible to quantify expected changes in vegetation, over time, for a variety of flow regimes. Such information is necessary to fully determine project impacts to wildlife and to make mitigation recommendations.

We appreciate the thorough qualitative discussion of project impacts throughout this section. Once the recommended vegetation remapping is undertaken and analyzed in conjunction with hydrologic information, the information included here should be the basis for examining positive and/or negative impacts to wildlife of potential vegetation changes, over the life of the project. We recommend quantifying the maximum and minimum areas which may become available for the establishment of vegetation under alternative icing scenarios.

[I.347] Page E-3-232:-Watana to Devil Canyon: Paragraph 4: We appreciate the discussion of rime ice formation in response to our previous comments (Chapter 11, W-3-125), but note omission of Wood et al. (1975) from the document's reference list. An important concern with rime ice formation would be potential impacts to birch adjacent to the impoundment and winter use of those areas by moose.

[I.348] Page E-2-234: Talkeetna to Yentna River: The project is expected to alter flows to the extent that mean winter flows at the Sunshine Station (RM 84) will be three times pre-project flows (Chapter 2, Table E.2.47). Scouring of vegetated banks resulting from river staging due to ice formation could be extensive and should be discussed.

[I.349] Page E-3-235: Yentna River to Cook Inlet: We are concerned that minimal downstream impacts have been assumed even though a doubling in mean winter flows has been predicted at Susitna Station (RM 26) (Chapter 2, Figure E.2.49); and ice staging and break-up impacts are unknown.

[I.350] Page E-3-236: (iv) Climatic Changes and Effects on Vegetation: The areas in which vegetation changes will occur must be known to fully assess implications to wildlife habitats.

[I.351] Page E-3-236: (iv) Climatic Changes and Effects on Vegetation: Paragraph 2: Although phenology studies were undertaken in spring, 1983 to obtain data for better assessing project-induced temperature/vegetation/wildlife impacts, funding for analysis of that data cannot be assumed before State fiscal year 1985. We recommend that a list of available botanical data compiled by the University of Alaska be included as Attachment B to our comments, be critically scrutinized with regard to further study needs. Funding should be provided to complete analyses of critical information.

[I.352] Page E-3-236: (iv) Climatic Changes and Effects on Vegetation: Paragraph 5: As with the discussion on temperature changes adjacent to the reservoir, the importance of fog banks and resultant ice formation relates to plant species, time of year, and wildlife uses which will be affected. In addition to providing such information, we recommend describing the period when area temperatures may be below -9.4°F and steam fog creation is likely.

[I.353] Page E-3-237: (v) Effects of Increased Human Use: We concur with this assessment and again cite the opportunity for minimizing project impacts on fish and wildlife by carefully siting and regulating access. Please refer to our comments on Sections 3.3.3 and 3.4.2(a)(i) and previous letters to the APA on the issue of access dated August 17, 1982 and January 14, 1983 (the latter letter is included in Chapter 11).

[I.354] Page E-3-238: - Fires: Paragraph 2: An additional point which should be considered in assessing the values to wildlife of post-fire regrowth is whether productivity, as well as density, of berry producing plants increases.

[I.355] Page E-3-240: (a) Construction: There is no quantification of vegetation types and geographic areas to be potentially impacted by erosion, permafrost, melting, etc. other than for direct vegetation losses due to inundation and construction of camp, village, and borrow areas described here and in Tables E.3.80, E.3.82, E.3.84, and E.85. Several of those impacts can and should be analyzed in conjunction with information in Chapter 6, Geological and Soils Resources, and Figures E.6.21 through E.6.29.

[I.356] Page E-3-240: (i) Vegetation Removal: Natural vegetation of disturbed sites will occur only with proper site preparation, including storage of topsoil. Analysis of the figures given shows that, at most, no more than 10 percent of the vegetation to be lost from the Devil Canyon development will be replaced by reclamation. We again recommend prompt mapping of wetlands, reinterpretation of vegetation in a manner that is meaningful to wildlife, and consultation with resource agencies such as the FWS to confirm optimum siting of camp, village, and borrow areas.

[I.357] Page E-3-240: (ii) Vegetation Loss by Erosion: Please refer to our previous comments on the need to quantify permafrost and unstable slope areas mapped in Chapter 6, Figures E.6.21 through E.6.29, by vegetation type (Section 3.3.1(a)[ii]).

ATTACHMENT B

Agricultural Experiment Station
Palmer Research Center
Box AE
Palmer, Alaska 99645

UNIVERSITY OF ALASKA

January 24, 1983

Dr. Robin G. B. Sener
Susitna Program Manager
Wildlife & Botanical Resources
LGL Alaska Research Associates, Inc.
1577 C Street
Anchorage, Alaska 99501

Dear Robin:

Attached are two lists of data, with brief descriptions, available on the Susitna drainage. This was prepared in response to our telephone conversation of December 16, 1982, when we were concerned about data being forgotten. The first list summarizes data that the Alaska Power Authority has funded to at least some degree. The second list summarizes Susitna drainage data collected by other projects and incomplete data where the field sampling was funded by the Power Authority. In some cases, samples need to be ground or have laboratory analysis performed but in other cases the data only need to be analyzed statistically. The descriptions of old studies were not meant to be detailed, but rather to make people aware of the depth of data collected in the past.

One thing becomes apparent from these lists: There is an enormous amount of vegetation data and smaller amounts of soils data and soils-vegetation data that could be available if we had funds and time to analyze and integrate the data. Even though some of the data may not be exactly what is needed now, the data could certainly be used as a foundation for future experimental design, assessing impacts, and making revegetation recommendations. The wheel's already been invented a couple times; maybe these lists will help produce a better wheel in the future.

Sincerely,

Dot Helm

Dot Helm
Plant Synecologist

de

cc: Richard Fleming, Alaska Power Authority

Study	Location	Yr	Who	Field Funding	Status
egetation mapping	Middle, upper basin	1980	Plant Ecology	Susitna	Vegetation means in annual rep (variances calculated, not reported) Maps of vegetation, potential lands produced
egetation inventory	Middle, upper basin	1980	USFS SCS Plant Ecology	Cooperative River Basin Study	Some vegetation (timber) anal; other (understory) being processed; not sure about s Some soil & vegetation sample collected
ownstream succession	Delta Is.-Chase	1981	Plant Ecology	Susitna	Vegetation means in annual re (variances calculated, not reported) Soils collected
ertilizer trials	Watana Base Camp	1980	Plant Ecology	Partly Susitna	Data need to be summarized.
elicopter transects	Delta Is.-Gold Cr.	1981	Plant Ecology	Susitna	Crude vegetation analysis - % of vegetation types on floo Referenced in Final Report
ransmission corridor mapping	N, S transmission corridors	1981	Plant Ecology	Susitna	Maps produced; no ground-trut
rowse	Middle basin	1982	Range Ecology	Susitna	Vegetation means, variances f level V given to LGL Vegetation samples, some litt samples collected
henology	Middle basin	1982	Range Ecology	Susitna	Vegetation, tree cores, tempe tures taken; being analyzed Photos taken each week.
urn	Alphabet Hills	1982	Range Ecology USFS BLM	Susitna USFS BLM	Crude vegetation statistical analysis performed by USFS Litter samples collected Permanent photo plots.
Downstream succession	Curry-Devil Canyon	1982	Range Ecology	Susitna	Shrub cores collected; no ri counted

Study	Location	Year	Who	Field Funding	
Vegetation mapping	Upper basin	pre 1980	BLM	Denali Project	Map produced. Cover, frequency ana
Vegetation inventory	Lower basin	pre 1980	USFS SCS	Cooperative River Basin Study	Not sure Some vegetation samples collected
Vegetation mapping	Middle, upper basin	1980	Plant Ecology	Susitna	Soil chemical analysis performed a expense
Vegetation inventory	Middle, upper basin	1980	USFS SCS Plant Ecology	Cooperative River Basin Study	Some plant species ground & analyz soils analyzed at AAES expense Other plant species collections ar available, but not ground Data partly analyzed by USFS.
Fe..ilizer trials	Watana Base Camp	1980	Plant Ecology	Logistics-Susitna	Materials provided at AAES expense Data collected, chemical analysis AAES expense Data unanalyzed
Downstream succession	Delta Is.-Chase	1981	Plant Ecology	Susitna	Vegetation height class informatio available, not reported Soil chemical analysis performed a expense Soil texture need to be obtained
Browse	Middle basin	1982	Range Ecology	Susitna	Soil, litter samples laboratory an at AAES expense Data are unanalyzed
P' iology	Middle basin	1982	Range Ecology	Susitna	Vegetation samples collected, but ground or analyzed Tree rings need to be counted. A nutrition data need to be analy:
Burn	Alphabet Hills	1982	Range Ecology USFS BLM	Susitna USFS BLM	Soil, litter samples laboratory ar at AAES expense Vegetation samples collected, but ground or analyzed Vegetation field data summarized t
Downstream succession	Curry-Devil Canyon	1982	Range Ecology	Susitna	Rings need to be counted. Need tc bine this information with hydrc

Description of Susitna Vegetation Data Sets

Vegetation inventory - Cooperative River Basin Study - USFS, SCS

Fairly intensive permanently located vegetation plots

Measurements include:

timber inventory
ground cover % - below & above 4 1/2 ft. basal, moss, lichens, residue, bare ground, rock, water, total
wildlife signs-hedging, browsing, number and type of trails, nesting trees
wildlife habitat data - slope, aspect, vegetation structure
tall shrub - productivity, available browse by species
habitat - height, canopy, density by plant species
range production - weights by plant species
soils - SCS descriptions

Vegetation Mapping - Susitna 1980

Qualitative vegetation cover estimates
Some soils data

Fertilizer trials 1980

Annual ryegrass was planted in factorial design using NPK treatments with 3 levels of each
Responses measured included height, production, n~~utrient analysis~~ and photos of individual plots. *Baseline soil laboratory analyses were determ*

Downstream succession 1981

Vegetation cover by height class; density by size class; ages, heights, dbh's of shrubs, trees. Belt transects were used.
Soil pits sampled by horizons or fluvial layers

Helicopter transects 1981

Vegetation types at systematic points along transects

Downstream succession 1982

Shrub cores collected in early-middle successional types along hydrology transects.

Range ecology studies 1982

Detailed descriptions and data formats have been provided previously (December 14, 1982, to Steve Fancy, LGL)

[.358] Page E-3-241: (iv) Effects of Altered Drainage: Please see our comments on Table E.3.82 regarding the likely overestimation of wetlands as described here.

[.359] Page E-3-241: (b) Filling and Operation: Please refer to our previous comments and study recommendations on the potential for soil/vegetation/reservoir interactions which result in increased mercury levels in fish (Section 3.3.1(b) and in Chapter 2, Section 4.1.1(e)[vii]).

[.360] Page E-3-242: Filling and Operation: Paragraph 3: We find no delineation of the large landslide at RM 175 on Figure E.3.3. as referenced here.

[.361] Page E-3-242: (ii) Erosion and Deposition: This statement is inconsistent with the previous discussion of erosion, Section 3.3.2(a)(ii), the proceeding paragraph which assumes some soil losses following clearing [Section 3.3.2(b)(i)], the description of the large landslide at RM 175, and the steep area topography.

[.362] Page E-3-242: (iii) Effects of Regulated Flows: Frost build-up on vegetation adjacent to the reservoir could result in a significant changes in vegetation. Wildlife would subsequently be affected, as we commented under Section 3.3.1(b)(iii). Please also see comments there regarding the need to quantify the range of areas which may become available for successional vegetation development.

[.363] Page E-3-243: (a) Construction: Additional impacts from access road construction and use include thawing of adjacent permafrost and associated drainage and vegetation changes.

[.364] Page E-3-244: (b) Operation: Use and management of access routes in addition to those required for project construction will determine the magnitude of impacts to area fish, wildlife, and socioeconomics.

[I.365] Page E-3-244: (a) Construction: Paragraph 1: In addition to the botanical impact analysis of individual transmission line segments described here and in Tables E.3.79, E.3.80 and E.3.86, we recommend a cumulative assessment of these impacts utilizing the same vegetation and wetlands classification systems for each segment. Please refer to our previous comments that existing analyses cannot be compared (Section 3.2.2 [e]).

Please also note apparent calculation errors in Table E.3.86 which double the estimate of total areas to be impacted by the Healy-to-Fairbanks and Willow-to-Cook Inlet transmission corridors. Subtotaled areas of forest, tundra, shrubland, and unvegetated cover types crossed appear to have been added to the individual sixteen forest, three tundra, four shrubland, and two unvegetated types in arriving at an overall total.

Reference should be made to our comments on Table E.3.86 regarding potential inaccuracies in recalulation of transmission line right-of-way widths from 400 to 300 feet.

[I.366] Page E-3-244: (a) Construction: Paragraph 2: Please explain whether vegetation impacts were recalculated where the currently proposed route

[I.366] (cont.) extends outside the corridor in which vegetation was originally mapped (e.g., see Figure E.3.52). Quantification of potential increases in browse should be based on eventual remapping of vegetation, succession models, and proposed vegetation studies. Such quantification is needed to compare overall losses and thus mitigation requirements for the project.

[I.367] Page E-3-245: (b) Operation: According to the project description in Exhibit A, Section 4.2(d), page A-4-6, a 25-foot wide access strip is to run along the entire length of the corridor, "except at areas such as major river crossings and deep ravines where an access strip would not be utilized for the movement of equipment and materials." Please clarify whether low shrub and tundra types will be cleared within the access strip and the anticipated schedule for maintaining that access.

We recommend that the applicant consult with the CE, FWS and ADF&G in siting of the proposed access strip to ensure that potential adverse impacts to wetlands and fish streams are avoided.

During planning for the Intertie, the applicant assured the resource agencies that all access for construction and maintenance would be by helicopter to minimize the size of the area disturbed, length of time of disturbances, and potential off-road vehicle (ORV) use. However, pressure from the public utilities, who will eventually take over operation of the Intertie, resulted in design changes allowing on-ground access. Thus we are concerned that access plans for other segments of the transmission line not be similarly changed to the detriment of aquatic and terrestrial resources.

[I.368] Page E-3-245: 3.3.5 - Impacts to Wetlands: The application states that the estimates of wetland acreage to be impacted by the proposed project "are extremely liberal and all values should be considered preliminary." Acreage data for more specific wetland types are needed. Evaluation of the project's impact on those specific wetland types of special interest to the FWS cannot be made with the generalized information that is now available (see comments on Secton 3.2.3 - Wetlands). Thus, we recommend that impacts from access and transmission corridors not be assessed by applying the applicant's current wetlands classification by vegetation type system.

[I.369] Page E-3-246: 3.3.6 - Prioritization of Impact Issues: In order to quantify project impacts over the life of the project, further details are needed on the anticipated length of time for each impact discussed here.

[I.370] Page E-3-246: (a) Direct Loss of Vegetation: This section is repeated verbatim from the November 15, 1982 draft license application, thus, figures given here do not reflect the latest routing or project design as reflected in the accompanying tables. For example, Table E.3.83, shows direct vegetation losses from the dam, impoundment, and spillway as 14,829 ha; Section 3.3.1(a)(i), page E-3-225 lists those losses as 14,329 ha; yet this section cites a 12,667 ha loss. Similar inconsistencies are found in the Devil Canyon, Access Roads, and Transmission Corridors summaries.

[I.371] Page E-3-247: (iv) Transmission Corridors: Please refer to our previous comments under Section 3.3.4(a) and Table E.3.86 on apparent errors in the

[I.371] calculation of transmission line impacts. Inconsistencies between the
(cont.) description of access trails in Exhibit A, Sections 4.2(d), Section 3.3.4(b), and the applicant's response to our question on the draft license application that, "Transmission corridor design has been revised and no longer incorporates a longitudinal access strip" (Chapter 11, W-3-152), should be removed.

[I.372] Page E-3-248: (b) Indirect Loss of Vegetation: The cumulative impacts of project features described under the previous section and here should be considered. Many identified losses will be in riparian habitat important to wildlife species.

[I.373] Page E-3-249: (c)(i) Downstream Floodplain: Please refer to our previous comments (Section 3.3.1(b)(iii)) on the uncertainties underlying current downstream analyses, particularly downstream of Talkeetna. We again recommend quantification of potential vegetation changes over the life of the project for a variety of possible flow and ice scouring scenarios.

[I.374] Page E-3-251: (a) Item 3: Where information for determining the extent to which mitigation will be achieved is unavailable, requisite studies, including monitoring, should be outlined and their implementation assured.

[I.375] Page E-3-251: Item 8: We are concerned that illustrations of mitigative design features are minimal and generally limited to road construction without specific data on the extent to which area materials will allow implementation of the side-borrow or balanced cut-and-fill techniques. Location maps should also be included for all mitigative design features.

[I.376] Page E-3-251: (b): The FWS supports funding and implementation of mitigation concurrently with project planning and construction. We are concerned that outlined mitigation studies are generally limited to planning studies with some follow-up monitoring (Table E-3-177). Provisions are lacking for implementing measures that will be recommended through these study efforts. Please also see our comments on Table E.3.177.

[I.377] Page E-3-252: Paragraph 1 to 4: We recommend that the Biological Stipulations included with our comments as Attachment A be made conditions of the FERC license and incorporated in any project contracts and bid specifications.

With the exception of wetlands mitigation planning, we concur with the mitigation objectives and framework outlined here. As stated previously in Sections 3.2.3 and 3.3.5, inadequate identification of wetlands means that higher priority mitigation options to avoid and minimize impacts may now be more difficult to incorporate in project planning.

We believe that a mechanism and responsible parties should be identified for ensuring that, "features of this mitigation plan will be correspondingly refined with respect to specific locations, procedures, and costs" as project design and planning proceeds.

[I.378] Page E-3-252: (a) Direct Loss of Vegetation: We question the estimated area for access borrow areas. According to the following Section, (i), (page

[I.378] (cont.) E-3-265, paragraphs 2 and 4) borrow needs could run from 90 to 180 acres for the Denali Highway-to-Watana road segment and from 50 to 100 acres for the road between the Watana and Devil Canyon Dams. Potential borrow needs for the railroad link, work pads, airstrips, and camps/villages are not clearly identified, and the size of potential spoil disposal areas are not quantified. Our specific comments on the five mitigation options follow under Sections (i) through (v).

[I.379] Pages E-3-254 through E-3-275: (i) Minimization: The discussion is limited by the: (1) inadequacy of wetlands mapping (see our comments on Sections 3.2.3 and 3.3.5), and (2) vegetation classification which cannot be usefully integrated with the wildlife impact analyses and mitigation determinations. Without these items, it is impossible to assess the adequacy of minimizing impacts through siting.

[I.380] Page E-3-254 Last Paragraph through Page E-3-256: Paragraph 2: We recommend that the proposed temporary airstrip be sited so that it can later be expanded to become the permanent airstrip. This suggestion is compatible with the applicant's recent request to fund a 2500-foot temporary airfield at the Watana base camp which would subsequently be expanded to the 6000-foot airfield necessary during project construction 3B-5/.

[I.381] We also recommend consolidation of the Watana constuction camp, village, and townsite. We note these facilities (Exhibit F, Plate F35) are spread out compared to the Devil Canyon camp and village (Exibit F, Plate F70). We also note the Watana facilities are close to the environmentally sensitive Deadman Creek area. Following remapping of wetlands, the siting of Watana facilities should be reviewed.

[I.382] The purpose and scheduled use of the circular road system outlined in Exhibit F, Plate F35, between the emergency spillway, Susitna River, and Tsusena Creek should be explained. As we commented on the draft license application, we have not had input into the decisions regarding the type, administration or siting of the construction camp,village, and townsite (Chapter 11, W-3-046). We concur with the concept of common corridor routing for the Watana-to-Gold Greek access and transmission corridors although the map scale represented in Figures E.3.39 and E.3.40 makes it difficult to evaluate those project features. Consultation with resource agencies during the on-ground planning of detailed project design may indicate areas where winter movement of construction equipment and materials is preferable to prevent impacts in biologically sensitive areas. Please refer to our previous comments on access for line maintenance, Section 3.3.4(b).

[I.383] Page E-3-256: Paragraph 3: and Page E-3-258: Paragraph 2: Facility sitings presently are located in low biomass areas. It is important that these areas be not only economically advantageous to clear, but that such areas be of low value to wildlife, as acknowledged on page E-3-260, paragraph 2. For example, a low birch/mixed shrub area may be more important in providing moose forage, particularly if cover is available nearby, than the higher biomass of a tall alder area which provides cover but no food.

.384] Paragraph 3 through Page E-3-258, and Pages E-3-260: Paragraph 4 through 262: We reiterate our recommendation to drop the Denali Highway-to-Watana access segment because of big game resource values described here, as well as area furbearer, raptor, and wetland values. Moreover, significant secondary impacts of increased disturbance will result from the increased access allowed by that route. Please refer to our letters dated August 17, 1982 and January 14, 1983 to Eric P. Yould, APA. Eliminating the Denali Highway-to-Watana access road is the design change with the greatest potential for mitigating access road impacts to wildlife.

.385] Page E-3-258: Paragraph 1: Although the Watana-to-Devil Canyon transmission and access routes share a common corridor, it does not appear that they have adjacent or combined rights-of-way. Higher resolution mapping and field verification should be used to evaluate the viability of combining rights-of-way to minimize adverse impacts.

I.386] Page E-3-256: Paragraphs 1 and 2 and Pages E-3-261 through 266: We concur with the objective of siting borrow areas adjacent to the access road and with the recommended side-borrow or balanced cut-and-fill techniques. These methods will work only where suitable materials exist within the proposed access corridor or when it is stipulated in project licensing requirements and contractor specifications and then monitored throughout project development.

For side-borrow construction, we recommend that the project engineers work with interagency monitoring team in the selection of temporary overburden and topsoil stockpile locations. Schedules should be provided for use and reclamation of access borrow and spoil areas. Borrow areas which would remain open for maintenance of roads, workpads, or other facilities should also be indicated. Necessary reclamation, whether simply recontouring, scarification, and fertilization to promote reestablishment of native species, or seeding and possibly sprigging of willows in more erodable areas, should be detailed in project reclamation plans and receive concurrence of the monitoring team. Site preparation should be undertaken as soon as construction use of an area is completed; seeding should be done by the first growing season after site disturbance has been completed. Please refer to the Biological Stipulations we have included as Attachment A and our comments on Section 3.4.2(a)(ii) Rectification.

.387] Page E-3-263: Paragraph 4: This section should explain how the transmission corridor in the Jack Long Creek area will be maintained since "temporary" bridging of the creek will be accomplished for construction. We recommend transportation of construction materials and equipment via helicopter in this area to minimize potential disturbance, erosion, and loss of fish and wildlife habitats.

Please refer to Attachment C, for additional recommendations.

.388] Page E-3-264: Paragraph 1: We concur with realignments and improved siting of the railhead facility to further minimize project impacts to furbearers, eagles, and wetlands. The discussion should include how such siting will minimize disturbances to big game. Until additional assessment data can be incorporated into moose, black bear, and brown bear models, it is not possible to compare habitat values of alternative locations.

[I.388] (cont.) Paragraph 3: A road crown of 2 to 3 feet above original ground level may not provide an adequate thermal blanket in areas of permafrost.

Page 266: Paragraph 3 through Page 268: We recommend that resource agency concurrence be obtained during detailed engineering design for final site selection and procedures for spoil disposal. Spoil should be armored with rock and/or gravel to stabilize the soils against wave action and prevent sedimentation during reservoir drawdown. Spoil which may be unsuitable for disposal because of cost, composition, or proposed construction schedules should be identified. Settling ponds may be necessary in conjunction with temporary construction berms or borrow pits. No spoil should be placed upon snow, even for temporary disposal, and overburden should not be pushed onto areas adjacent to roadways which cross tundra vegetation.

[I.389] Additional recommendations for settling ponds, should they be used in spoil disposal, follow:

1. Settling ponds should be sized for gravel processing quantities, and fines. 38-67.
2. Generally, when half the capacity of settling ponds are filled with silt, they should be cleaned out.
3. If the settleable fines are to be deposited between the flood pool's high and low water marks, they should be covered with a rock blanket for stabilization.

The length of time and potential areas to be covered by any "temporary" spoils disposals should be designated.

[I.390] Page E-3-267 Last Paragraph through Page E-3-268: Paragraph 1: This section should explain the proposal to deposit spoil above the 50-year flood level for the Devil Canyon Reservoir. We recommend that all disposal be within the impoundment area and that vegetation slash be burned to preclude debris accumulations in water entrainment systems.

[I.391] Page E-3-268: Paragraph 3: Accurate wetlands maps should be used in geotechnical alignment studies so that wetlands and ice-rich soils can be avoided. Involvement of the environmental monitors should help further minimize sitings or drainage crossings potentially detrimental to fish and wildlife.

[I.392] Page E-3-269: Paragraph 2: It is unclear what portion of the Anchorage to Fairbanks transmission corridor to "be widened to accomodate an additional single-tower right-of-way 190 feet (58 m) wide" has been included in the previous vegetation assessment (Section 3.3.4(a) and Tables E.3.79, E.3.80 and E.3.86). The statement that this alignment "may depart from the previously established corridor" substantiates our previous concerns that by not evaluating the Intertie as an integral part of the Susitna project, further impacts could result from later needs to upgrade the line.

[I.393] Page E-3-269: Paragraph 4: The referenced 69 kilovolt (kv) service transmission line has not been previously mentioned and appears inconsistent the statement that diesel generators will be used to maintain the camp and village and construction activities (Exhibit A, Section 1.13(d)(i), page A-1-27). Please clarify the purpose of this line, proposed right-of-way, height of utility poles, distance of the centerline from the access road, and connections at the Denali Highway end. According to the APA, three alternatives are under consideration for supplying power during project construction; (1) a 69kv service transmission line from Cantwell along the Denali Highway-to-Watana access route; (2) a transmission line from the Intertie near Gold Creek along the railroad and access road which follow the Susitna River; and (3) use of diesel generators (Thomas A. Arminski, APA Deputy Project Manager, personal communications of September 30, 1983). The existence of those three alternatives should be described in detail in the license application. We recommend that alternative (3), diesel generation, be used to avoid impacts of an additional transmission line.

[I.394] Pages E-3-269 through E-3-274: The mitigative practices that are described here should be part of Biological Stipulations included in project licensing and contract bid specifications. Once the moose carrying capacity model and more detailed vegetation mapping is completed, an analysis should be undertaken of the potential to optimize browse production by additional transmission line clearing or varying vegetation heights by changing maintenance schedules within constraints of safe line operation. Follow-up studies should be initiated to confirm the value of expected browse enhancement and aid planning and implementation of such vegetation manipulations.

[I.395] Page E-3-273: Paragraph 4: Potential policy conflicts should be identified in conjunction with access road and transmission line siting studies. Agreements with public and private landowners which provide for the mitigation determined necessary by the applicant should be confirmed prior to project licensing. Unless such agreements are incorporated into the license, there is no guarantee that mitigative managment policies will be adopted. The record on negotiation settlement proceedings for the Terror Lake hydroelective project now under construction by the applicant on Kodiak Island supports such careful planning.

[I.396] Page E-3-274: Paragraph 4 and Page E-3-275: Paragraph 1: The text should explain: (1) inconsistencies between these figures and those in Section 3.4.2(a); and (2) calculations of areas where vegetation removal will be minimized.

[I.397] Pages E-3-275 through E-3-281(ii) Rectification: A preliminary assessment should be made of vegetation cover type losses from the standpoint of how long each area will be disturbed. As reclamation and revegetation take effect and disturbance by construction activities decreases, some habitat values would be expected to slowly increase. We agree that predictions of how plant succession will proceed on these lands over time are difficult to justify. However, we suggest that the information presented here, coupled with the successional information presented earlier (Section 3.3.1(b)[i] and in Table E.3.144) will allow an assessment of the range of possible vegetation

[I.397] (cont.) restoration over time. The typical 10-year time frames within which each area will be completely out of production must be coupled with the up to 150 year time spans necessary for revegetation in order to thoroughly assess project impacts. Although these losses may be "temporary", they are significant within the average life-spans of area wildlife.

[I.398] Page E-3-276: Construction Camp: The text should clarify the double listing for dismantling and redraining the 78 acres involved here.

[I.399] Page E-3-277: Borrow Area D: It appears that an additional 70 acres should be listed under the excavation and reclamation category for 1986.

[I.400] Pages E-3-279 to 280: (ii) Rectification: Refer to our Attachment A, Biological Stipulations, additional references, and ongoing revegetation work of the Alaska Plant Material Center for further guidance on site restoration.

Individual site restoration plans should be developed with the concurrence of the monitoring team. We recommend prompt site restoration (i.e., site preparation) upon concluding use of a construction site. This includes recontouring, replacement of the organic mat/topsoil, fertilization, and scarification and seeding and willow sprigging where necessary during the first growing season following conclusion of construction activities at a given site.

We recommend that the resource agencies have the opportunity to review and comment on the reclamation plans at least one year prior to construction. The successful implementation of reclamation plans would be facilitiated by limiting surface disturbances as the application has indicated.

An essential step to achieving reclamation will be to develop a monitoring program which assigns monitoring responsibilities, and includes funding for yearly operation and maintenance. The plans must include criteria for measuring the relative successes of reclamation activities and a procedure for implementing additional measures if initial reclamation objectives are not achieved.

The text should clarify the process by which "slopes will be serrated."

[I.401] Pages E-3-281 through E-3-282: (iii) Reduction: By itself, monitoring is not mitigation. It should provide data on which to base mitigation recommendations, impact evaluations, and assess mitigation effectiveness. Monitoring can result in improvements to ongoing mitigation efforts, by leading to modification or additions to measures already implemented. For example, schedules for clearing to enhance browse production may be changed or additional acreage acquired or manipulated for wildlife uses as a result of monitoring findings.

We concur with the assessment of additional impacts on page E-3-281, last paragraph. A mechanism for promptly implementing results of the monitoring program is needed here.

[I.402] Pages E-3-282 through E-3-285: (iv) Compensation: We support the chosen option for compensation of vegetation losses. The incremental habitat values gained from selectively altering vegetation or acquiring and/or managing lands which would otherwise be developed or used represent a mitigation potential which can be used as compensation. Please note that location, interspersion with other vegetative cover types, and other habitat characteristies also affect the wildlife habitat values of potential "replacement lands."

[I.403] Page E-3-283: Paragraph 4: and Page E-3-285: Paragraph 2: We certainly support the efforts of the ADF&G, the University of Alaska, and the APA, in conjunction with the FWS, to develop "a habitat-based model for moose carrying capacity based on moose bioenergetic requirements and browse nutritional value." Unfortunately that program has been jeopardized by stop-work orders, budget cutbacks, and study delays. While progress has recently been made in some of the necessary vegetation data collections, no interagency modeling work has occurred since the workshop on February 28 to March 2, 1983. We are aware of no allocations within the state fiscal year 1984 project budget for further modeling work.3B-8/

[I.404] Page E-3-284: Paragraph 1: We have encouraged the Bureau of Land Management to widen the time-frame within which they would undertake the prescribed burn at the Alphabet Hills site. This would increase the possibility of obtaining suitable weather, soils, etc. for burning. Specifically, we recommend that a spring 1984 burn be undertaken. A spring burn would facilitate an assessment of revegetation and subsequent wildlife uses.

[I.405] Page E-3-284: Paragraph 2: We support proposed vegetation mapping and integration of that mapping with modeling efforts.

Please note that periodic maintenance should be an integral part of any enhancement programs.

[I.406] Pages E-3-285 through E-3-289: (b) Indirect Loss of Vegetation: While we appreciate efforts to describe areas subject to erosion, blowdown, and other vegetation losses, it is impossible to fully assess replacement lands or enhancement needs without some quantification of these cumulative impacts. We suggest that impact areas be modeled. For example, information from Chapter 6 and this chapter should be used to measure the areal extent of each vegetation type within the 10-mile reach near the headwaters of the Watana Reservoir.

[I.407] Page E-3-286: Paragraph 5: Please refer to our Attachment A, Biological Stipulations, I. Environmental Briefings, for further guidelines.

[I.408] Page E-2-289: Paragraph 2: We recommend that the APA determine and pursue agreements on necessary regulatory options in coordination with Federal and state resource management agencies as well as private landowners.

[I.409] Pages E-3-289 through 291: (c) Alteration of Vegetation Types: Wetlands mapping referred to in this section has not been initiated (see our comments on Sections 3.2.3 and 3.3.5). Other than mitigative siting and a few general construction practices outlined in Section, 3.4.2(a)(i), we find no specific examples here of measures for minimizing drainage alterations in wet

[I.409] (cont.) sedge-grass tundra as refered to on page E-3-259, paragraph 3. As previously mentioned, we do, however, agree with proposed procedures for mapping and agency coordination.

We support plans for aerial and on-ground investigations to finalize mitigative transmission corridor siting upon the assumptions that: (1) the more detailed vegetation and wetlands mapping efforts will have been completed and will be available for use, and (2) resource agency concurrence will be obtained.

[I.410] Page E-3-290 Last Paragraph through Page E-3-291: Paragraph 1: Reference to monitoring and "ongoing studies of moose, raptors, and other wildlife by the ADF&G and USFWS" is confusing. While we heartily endorse post-and pre-construction monitoring and studies, and will continue raptor and swan surveys within our funding constraints and legislative responsibilities, we caution that responsibility for funding and implementing project impact studies lies with the project sponsor. We will provide technical assistance to the maximum extent possible.

[I.411] Page E-3-291: Section 3.4.3 - Mitigation Summary: This section lacks a comprehensive analysis of overall project impacts, potential for achieving mitigation priorities, and tradeoffs among mitigation options for various area resources.

Specific comments on tables from the Botanical Resources Section follow:

[I.412] Table E.3.49: The taxa, Papaver alboroseum, was withdrawn from consideration as a candidate threatened or endangered species (FR 45, December 15, 1980).

[I.413] Table E.3.51: The text should indicate whether the mesic sedge-grass classification here and in Table E.3.71 and E.3.72 is the same as the sedge-grass classification in Tables E.3.52, E.3.77, E.3.80, and E.3.83 through E.3.86.

[I.414] Tables E.3.71 and E.3.72: There is an apparent inconsistency between the text which says that 1% of the study area is open spruce and these tables which show nearly 8% of the Watana Watershed and over 2% of the Gold Creek watershed to be open spruce forests (Section 3.2.2(b)(i), paragraph 1).

[I.415] Table E.3.79: The vegetation classification is not directly comparable to that used for other transmission line segments, Tables E.3.77, E.3.78, E.3.80, and E.3.86.

[I.416] Table E.3.81: Please refer to our comments on the inadequacy of this correlation, Section 3.2.3.

[I.417] Table E.3.82: Please refer to our comments on the inaccuracies in wetland typing which make this table meaningless, Sections 3.2.3 and 3.3.5.

[I.418] Tables E.3.83 and E.3.84: Potential spoil areas outside of the impoundment or already disturbed areas should be quantified here.

[.419] Table E.3.86: Please refer to our comments under Section 3.3.4(a) regarding calculation errors which apparently result in double counting of forest, shrub, tundra, and unvegetated cover types. Mosaics of two or more vegetation cover types may sometimes be the optimum mapping unit. However, no explanation is provided for the four mosaic vegetation types included in this table, but not in any other botanical resources tables or discussions. Where Table E.3.86 refers to an adjustment of right-of-way width, there is no explanation of how that adjustment was made. It appears that recalculation of transmission line impacts on the basis of a 300-foot clearing width used in Table E.3.86 as compared to the 400-foot clearing width used in McKendrick et al. (1982) was by a straight proportion. 3B-9/ As the line is finalized and assuming vegetation is remapped in a manner more meaningful to wildlife, the affected vegetation types should be recalculated. Quantification of potential increases in browse should be possible on the basis of remapping, succession models, and continuing vegetation studies. Such quantification is needed to compare overall losses for a determination of mitigation requirements.

ATTACHMENT C

[.420] Recommended Construction Methods for Mitigating Impacts to Wetlands which cannot be Avoided by Project Development

The first step in outlining mitigation recommendations pertinent to activities affecting wetlands is to define "wetland." This has been descriptively done in Chapter 3 of Exhibit E. However until the wetlands mapping proposed and commented upon in Section 3.2.3 and 3.3.5 is completed, wetlands will not have been defined geographically or in the field. Where wetlands are underlain by permafrost, construction activities may need to be further altered.

The following is based on options outlined by the applicant in the Supplemental Submittal to FERC, Volume IIA of III. We are here providing further information and recommendations.

(A) Construction methods in wetlands:

1. Clearing and construction should be undertaken when the ground is frozen; access should be by ice roads. Excavated spoil should not be wasted in wetlands. The workpads and access roads should be consturcted so as to prevent thermal degradation while providing structual integrity.
2. [I.421] Hand clearing should be utilized to avoid scalping or removal of the vegetative mat.
3. Slash disposal in wetlands should be prohibited.
4. Fill material for roads or pads should be placed over the original surface without stripping vegetation and organic layer. The objective is to minimize surface disturbance and prevent siltation of wetlands and waterbodies.
5. Geotechnical fabric should be utilized to minimize the need for stripping, and reduce settlement of finished road surface. Fabric use areas should be field staked so the fabric is not ripped up during road maintenance of blading operations.
6. Wetlands should not be used for material or disposal sites.

(B) Techniques for minimizing alterations to wetland drainage patterns:

1. Hydrologic assessments of quantity, direction, and timing of surface drainage should be conducted in the field in late spring/early summer when flow patterns are readily visible. Culvert locations should be staked, sketches made of culvert locations, elevations of culvert inverts determined, and direction of water flow noted and culvert size determined.

2. Sufficient numbers of culverts of adequate size should be installed in the proper locations to prevent uphill ponding and downslope dewatering, avoid erosion from lateral flow along embankments, and minimize flow velocity and flow concentration in culverts. Areas should be evaluated for any fish passage needs. Temporary culverts (i.e. for two years or less) should be designed to handle a five-year flood event and permanent culverts (i.e. to remain in use for more than two years) should be designed to handle a 50-year flood event.

3. Install culverts with sufficient camber to prevent settlement. The
[I.422] camber may also be dependent upon fish passage requirements.
4. Install culverts low enough to intercept sheet flow. The culverts should maintain natural cross drainage patterns. Discharge should be diffused to preclude washing away of vegetative mat (of particular importance in permafrost areas to preclude thermokarst).
5. Install steam pipes in culverts where icing is likely to occur. The steamfitted uprights should be installed to provide access in snow and ice conditions. Guide markers to the steam pipes will need to be able to withstand the rigors of road maintenance. Maintenance will need to be in accordance with a schedule.
6. After construction, monitoring will be necessary to determine if additional or improved drainage structures are required. In addition to assessing further mitigation construction practices, a monitoring schedule for maintenance of fish passage effectiveness should be developed.

(C) Additional recommendations for mitigating impacts of road construction on wetlands are:
1. Any placement of fills in a watercourse should be perpendicular to the stream flow.

2. Roads should be maintained in a crowned configuration and maintenance activities should be accomplished so as to prevent material being pushed into drainages, blocked culverts, or roadside berms along the
[I.423] driving surface.
3. Road fills at fish streams less than 50 feet wide should not exceed a 30-foot top width through the stream crossing.
4. There should be no storage of fuel in floodplains or wetlands.
5. Refueling and equipment servicing should be restricted to gravel fill areas and confined to preclude any product from reaching wetlands.

(D) Case by case exemption to the above recommendations may be granted by the
.424 interagency monitoring team.

Chapter 3, Section 3 Footnotes

3B-1/ McKendrick, J. W. Collins, D. Helm, J. McMullen and J. Koranda. 1982. Susitna Hydrelectric Project, Phase 1 Final Report, Environmental Studies, Subtask 7.12: Plant Ecology Studies. University of Alaska Agricultural Experiment Station, Palmer. Prepared for the APA.

3B-2/ Viereck, L.A., T.T. Dyrness and A.R. Batten. 1982. Revision of Preliminary Classification for Vegetation of Alaska. Unpublished Report from Workshop December 24, 1981, Anchorage. Workshop on Classification of Alaskan Vegetation: 77 pp.

3B-3/ Cowardin, L.M., V. Carter, F.C. Golet and E.T. LaRoe. 1979. Classification of Wetlands and Deep Water Habitats of the United States. Publication FWS/OBS-79-31. U.S. FWS.

3B-4/ See Footnote 3B-3, supra.

Office of Environment, Office of the Federal Inspector. 1981. Revegetation Philosophy for the Proposed Gasline. June 26, 1981. Anchorage, Alaska. 3 page mimeo.

Kubanis, S.A. 1982. Revegetation Techniques in Arctic and Subarctic Environments. Office of the Federal Inspector, Alaska Natural Gas Transportation System, Office of Environment, Biological Programs. Anchorage, Alaska. 40 pp.

3B-5/ Construction of Temporary Airfield at Watana. Appendix 4 to Agenda Item IV, Action Item No. 1, prepared for the APA Board of Directors.

3B-6/ U.S. Forest Service. Guidelines for Reducing Sediment in Placer Mining Wastewater. No date, available from Alaska Resources Library, Anchorage, Alaska. 31 pp.

3B-7/ Office of Environment, Office of the Federal Inspector. 1981. Revegetation Philosophy for the Proposed Gasline. June 26, 1981. Anchorage, Alaska. 3 page mimeo.

3B-8/ APA. September 8, 1983. Appendices 2 and 3 to Agenda Item IV, Action Item No. 1, FY 1983 Program Changes and Their Impact on the FY 1984 Program and Current Proposed FY 1984 Budget Allocations Susitna Hydroelectric Project. Prepared for the APA Board of Directors.

3B-9/ See Footnote 3B-8, supra.

ATTACHMENT A

Biological Stipulations

[I.425] By incorporating the Environmental Guidelines of Appendix E3.B, Chapter 3, Exhibit E of the draft Susitna Hydroelectric Project Federal Energy Regulatory Commission (FERC) License Application with other stipulations applicable to Alaska construction projects, a set of project stipulations has been compiled. It is our recommendation that these stipulations be incorporated into the FERC license as a binding exhibit. They should then become part of project contracting agreements.

Preamble

Implementation of these stipulations are appropriate during the construction, operation and maintenance, and termination of the Susitna Hydroelectric Project. Sound engineering practices shall be employed to preserve and protect fish and wildlife resources and their habitats.

The Licensee, through guidance and direction to the Designer, Engineer and construction Contractor, shall balance environmental amenities and values with economic considerations and technical capabilities to be consistent with State and National policies. This evaluation shall include benefits or detriments to people, property and environmental resources which may result from a course of conduct.

I. Environmental Briefings

1. The Licensee shall develop, in consultation with concerned resource agencies, and provide environmental briefings for all supervisory and field personnel directly related to the project either prior to the commencement of construction or during new hire orientations.

2. [I.426] The Environmental Briefings Program shall familiarize project personnel with environmentally sensitive features of the project area, Federal and State regulations, agency permit stipulations, and specific project policies and restrictions regarding protection of vegetation, fish, wildlife, and cultural resources. The Environmental Briefings Program shall be combined with the project Safety Program and involve continuing updates and reviews through regularly scheduled weekly meetings. The Environmental Briefings Program shall be positive and informative in nature and use visual aids to stimulate interest. The program shall strive to explain why a certain feature or organism is vulnerable to disturbance, and therefore why protective measures are needed in each case.

II. Pollution Control

1. [I.427] The Licensee shall construct, operate, maintain and terminate the project in a manner which adheres to all State and Federal air, land and water quality standards, laws and regulations relating to pollution control or prevention.

2. [I.428] The liquid waste treatment system shall be operated by State of Alaska accredited personnel. Grey water must be treated along with

[I.428] (cont.) other liquid wastes. A regular effluent sampling and testing program shall be followed to ensure compliance with National Pollutant Discharge Elimination System (NPDES) and State of Alaska Wastewater Disposal Standards (18 AAC 72). Effluent testing shall be conducted by a State of Alaska certified water quality laboratory. Effluent discharge to streams shall be located to achieve maximum dilution.

[I.429] 3. Mobile ground equipment shall not be operated in wetlands and/or other bodies of water.

[I.430] 4. The temperature ranges of natural surface or ground waters, as determined by pre-project baseline studies, shall not be changed by the project or any construction related activities.

[I.431] 5. The Licensee shall use only non-persistent and immobile types of pesticides, herbicides and other chemicals. Each chemical, including any fuels and oils, to be used in project construction, operations and maintenence, its storage, applications and clean-up shall be addressed in the project Oil and Hazardous Substances Control plan prior to the arrival of such substances and chemicals on site.

[I.432] 6. All hazardous substances utilized and wastes generated in construction, operation, maintenance and termination of the project shall be removed or otherwise disposed of in accordance with State and Federal standards, rules, and regulations.

[I.433] 7. Solid waste disposal sites shall be established in stable, well-drained locations. Siting shall utilize existing excavations such as depleted upland borrow pits. Intermittent drainages, ice-rich soils, or other erosion-susceptible features shall not be used. Deposited material shall be covered daily with non-silty excavation spoil stockpiled for this purpose at the site. Solid waste disposal site design and operation shall conform with guidelines established by the Alaska Department of Environmental Conservation.

[I.434] 8. Incinerators for the daily burning of putrescible and combustible wastes must be at each camp location and be in operating condition before construction camps are occupied.

[I.435] 9. To minimize scavenging by birds and mammals, with resultant adverse contacts between people and animals, all putrescible kitchen waste shall be stored indoors in sealed containers and incinerated on the same day they are produced.

[I.436] 10. Camp incinerators shall be properly sized and operated by trained personnel to ensure that all putrescible wastes are completely burned to mineral ash. Incinerator capacity shall be carefully specified to accommodate peak camp occupancy.

[I.437] 11. Camp perimeters and incinerators shall be protected with animal-resistant fencing designed and built to specifications provided by the environmental consultant and subject to State and Federal resource agency review and approval.

I.438 12. Open burn pits for the disposal of putrescible waste shall not be used.

III. Buffer Strips

1. Unless determined on a site specific permitted basis that a wider buffer strip is warranted a 500-foot minimum width buffer of undisturbed vegetation shall be maintained between a facility and any stream, lake, or wetland.

2. Undisturbed buffer strips at least 500 feet wide will be maintained between borrow areas, disposal sites and other project appurtenances and any State of Alaska Department of Transportation and Public Facility (ADOT/PF) highway and/or Alaska Railway. Buffer strips wider than 500 feet may be required on a site specific permitted basis.

I.439 3. A minimum distance of 1/2 mile shall be maintained between any facility and the following:

-- Fish spawning area;
-- Bald eagle nest;
-- Golden eagle nest;
-- Bear den;
-- Wolf den;
-- Dall sheep lambing area; and
-- Mineral lick

IV. Erosion and Sedimentation Control

I.440 1. The design of the project shall provide for the control of erosion and sediment production, transport and deposit in accordance with State of Alaska "Water Quality Standards".

I.441 2. Erosion control measures, including the use of erosion control structures shall be implemented on the project to limit induced and accelerated erosion, limit sediment production and transport and limit the formation of new drainage channels. The design of such measures shall be based on the rainfall and snowmelt combination characteristic of the region, the effects of thawing produced by flowing or ponded water on permafrost and the effects of ice. Permanent erosion control structures shall be designed to accommodate a 50-year flood.

I.442 3. Specific erosion control methodologies shall be delineated within a project Erosion Control Plan developed by the Licensee that shall be approved by concerned State and Federal agencies prior to initial construction activities. The approved project Erosion Control Plan shall be incorporated into project technical specifications by reference.

I.443 4. If otherwise permitted, crossings of wetlands, other bodies of water, and active (25-year flood event) floodplains shall neither cause nor result in erosion and/or sedimentation in excess of the State of

[I.443] (cont.) Alaska "Water Quality Standards." Temporary access over stream banks shall be made through use of fill ramps rather then by cutting through streambanks. Such ramps shall be removed upon termination of seasonal and/or final use and disposed of in accordance with the project Erosion Control Plan.

[I.444] 5. Excavated material in excess of the amounts required for backfilling and restoration shall be disposed in a manner as delineated in the project Erosion Control Plan.

[I.445] 6. Excavated materials shall not be stockpiled in wetlands or in other bodies of water.

[I.446] 7. Overburden and excavated materials from the construction of access roads shall not be side cast on road side slopes exceeding a grade of 10 percent.

[I.447] 8. Where gravel pads must be used, provision for cross-drainage shall be made to prevent impoundment of sheet flow.

[I.448] 9. Facility siting shall not be located in thaw susceptible areas (discontinuous permafrost zones) capable of slumping or thermal erosion.

V. Fish and Wildlife Protection

[I.449]

1. All project associated personnel shall be governed by appropriate State and Federal rules and regulations pertaining to fish and wildlife resources; such rules and regulations shall be incorporated into project technical specifications by reference.

2. A condition of employment for all project personnel will be immediate termination with no chance of rehire on the project for violating said rules and regulations.

[I.450]

3. The Licensee shall design, construct, operate, maintain, and terminate the project in a manner to assure free passage and movement of fish. Temporary blockages of fish, not to exceed 24 hours in a calendar week, necessitated by instream activities, may be allowed provided the proposed design and construction plans include the times and places such temporary blockages may occur.

4. Pump intakes shall be screened to prevent harm to fish. Screening requirements as provided by the Alaska Department of Fish and Game (ADF&G) shall be incorporated into project design.

[I.451] 5. When abandoned, water diversion structures shall be removed or plugged at both ends and stabilized.

[I.452] 6. The Licensee shall not disturb fish spawning beds, fish rearing areas and overwintering areas. Where disturbances are included in project design, proposed modifications and mitigation measures shall be included as a portion of the project bidding documents.

[I.452] (cont.) 7. The Licensee, in accord with State of Alaska "Water Quality Standards," shall protect fish spawning beds, fish rearing areas and overwintering areas from sedimentation and/or siltation resulting from construction activities. Settling basins or other sediment control structures, as included in the project Erosion Control Plan, shall be constructed and maintained to intercept such sediments and silts before they reach designated areas.

[I.453] 8. The Licensee shall not take water from fish spawning beds, fish rearing areas and overwintering areas of waters that directly replenish those areas during the critical periods as identified by ADF&G.

[I.454] 9. The Licensee shall design the project to accommodate the times and areas of fish and wildlife breeding, nesting, spawning, rearing, lambing, calving, overwintering, denning and migrating. State and Federal resource managing agencies shall review and approve the fish and wildlife periodicity charts as prepared by the Licensee to be used in construction-related scheduling.

10. The Licensee shall design, construct and maintain the project to assure free passage and movement of big game animals.

[I.455] 11. Project construction and operation activities shall be planned and scheduled to not disturb fish streams. Where activities affecting fish streams cannot be avoided (e.g., construction of stream crossings), activities shall be scheduled for periods when fish are not present. Where stream crossings are planned for winter construction, the thalweg, banks, and other locational features shall be identified and staked in the field prior to snowfall or freeze-up.

VI. Acquisition and Disposition of Materials

[I.456] 1. The Licensee shall make application to the United States for the purchase of mineral materials on Federal lands in accordance with 43 CFR Part 3610 and shall submit a mining plan in accordance with 43 CFR Part 23. No materials, regardless of land ownership, may be removed by the Licensee until a given mining plan is reviewed and approved by concerned resource managing agencies.

[I.457] 2. Material site boundaries and mining techniques shall blend with surrounding natural land patterns. Regardless of the layout of material sites, primary emphasis shall be placed on the prevention of soil erosion, the preclusion of damage to vegetation, and the protection of fish and wildlife habitat.

[I.458] 3. The Licensee shall make application to the United States for the purchase of merchantable timber on Federal lands in accordance with 43 CFR Part 5400.

[I.459] 4. Design shall minimize gravel requirements by avoiding wet areas or permafrost zones, consolidating structures, and balancing cuts and fills.

5. A detailed, site-specific mining plan shall be prepared for each borrow operation. Design shall be an interdisciplinary team effort involving civil engineers and environmental specialists experienced in design, construction, and permit requirements. Mining plans, as a minimum, shall include all roads, facilities, mining techniques, schedules, rehabilitation procedures, the kind or type of borrow material and quantities expected to be mined.

6. Dependent upon material quality and availability, borrow areas required for dam and ancillary facility construction shall be sited
[I 460] in the future impoundment area of the dam under construction.

7. Siting of borrow areas outside the impoundment zone shall place first priority on well-drained upland locations. Second priority consideration shall be given to first-level terrace sites. Active floodplain and streambed sites shall not be used unless they are within the impoundment area of the dam under construction. Stockpiling within active floodplains shall be prohibited. Floodplain gravel mining shall follow the guidelines set forth in the U.S. Fish and Wildlife Service "Gravel Removal Guidelines Manual for Arctic and Subarctic Floodplains," 1980.

8. All material sites shall be developed in phases by aliquots as presented in the site specific mining plan. The phases shall be prioritized to save until last those portions of the site which are more sensitive from an environmental standpoint.

[I 461] 9. First-level terrace sites outside the impoundment zone shall be located on the inactive side of the floodplain and mined by pit excavation rather than by shallow scraping. Excavations shall be separated from the active (25-year flood event) floodplain by a 500-foot buffer of undisturbed, vegetated terrain.

[I.462] 10. Excavation spoil shall be disposed of in the future impoundment area of the dam under construction, or spoil shall be used in the rehabilitation of depleted or non-operational material sites, or for solid waste disposal site maintenance. Spoil retained for these applications shall be stockpiled in stable, well-drained locations, and bermed to contain runoff. Spoil shall not be placed upon snow, even for temporary disposal.

[I 463] 11. Abandoned access roads, camp pads, and airstrips shall be used wherever feasible as material sources for operation in lieu of expanding existing sites or initiating new ones. Where riprap is required, material produced during excavation of the powerhouse, galleries, and tunnels shall be used.

[I 464] VII. Clearing

1. The Licensee shall identify clearing boundaries on the ground for approval by State and Federal resource managing agencies prior to initiating clearing operations. All timber and other vegetative material outside clearing boundaries and all blazed, painted or posted trees which are on or mark clearing boundaries are reserved from cutting and removal with the exception of danger trees or snags.

2. All trees, snags and other wood material cut in connection with clearing operations shall be cut so that resulting stumps shall not be higher than six (6) inches measured from the ground on the uphill side.

[I.464] (cont.)

3. All trees, snags and other wood material cut in connection with clearing operations shall be felled into the area within the clearing boundaries and away from water courses.

4. All debris resulting from clearing operations and construction that may block streamflow, delay fish passage, contribute to flood damage, or result in streambed scour or erosion shall be removed immediately.

5. All slash shall be disposed of in construction pads or roads as directed by the Engineer. Slash shall be disposed of prior to the end of the first winter after cutting.

6. Disposal of vegetation, non-merchantable timber, overburden and other materials removed during clearing operations shall be in accordance with the project Erosion Control Plan.

7. Siting shall minimize requirements for clearing removal of vegetation.

8. Where removal of vegetation is required, organic overburden shall be segregated and stockpiled for use in subsequent rehabilitation. Stockpiles shall be placed in well-drained locations and bermed to contain runoff. Depleted or non-operational borrow pits shall be used as overburden storage areas.

9. Structures shall be consolidated to disturb the minimum necessary area of ground surface.

VIII. Disturbance or Use of Natural Waters

[I.465]

1. All activities of the Licensee in connection with the project that may create new lakes, drain existing lakes, significantly divert natural drainages and surface runoff, permanently alter streams or groundwater hydrology, or disturb areas of streambeds are prohibited unless such activities along with mitigation measures are reviewed and approved by State and Federal resource managing agencies.

[I.466]

2. Wells shall be established for potable water withdrawal. If wells are not feasible at a given location, water shall be withdrawn from lakes. Streams shall be considered only as a last resort, and only after determination is made on a case-by-case basis that fish or wildlife will not be adversely affected by water withdrawal, particularly during overwintering and reproductive periods. Intake structures shall be designed to preclude entrapment or entrainment of fish eggs and small fish.

[I.467]

3. If wet processing is required for borrow material, water withdrawal and discharge locations shall be sited to preclude fish and wildlife disturbance. Drawdown in overwintering pools used by fish or aquatic mammals and any disturbance to spawning areas must be avoided. Water

[I.467] cont.) intake structures shall be designed to preclude entrapment or entrainment of fish eggs and small fish. Gravel washing shall employ recycled water. If pit dewatering is required because of ponding or wet processing, settling ponds shall be designed, operated, and monitored to ensure that NPDES standards for discharge are achieved. Settling ponds shall be designed and sited to avoid fish entrapment. Water discharge shall be directed in a manner that will preclude erosion. Energy dissipators shall be used.

IX. Off Right-of-Way Traffic

[I.468] 1. The Licensee shall not operate mobile ground equipment off the right-of-way, roads or authorized areas except as necessary to prevent immediate harm to any person or property.

X. Use of Explosives

1. No blasting shall be done under water or within one quarter (1/4) mile of streams or other bodies of water with identified fish and wildlife resources.

[I.469] 2. Blasting shall avoid times and locations which are sensitive to fish and wildlife. These times and locations shall be determined on a case-by-case basis by the environmental consultant and in accordance with State and Federal resource agency guidelines. Proper sizing and sequencing of blasting charges can minimize fish and wildlife impacts. Streamside excavation shall not be done by blasting. Blasting procedures and schedules must be sufficiently flexible to allow alteration at short notice for the protection of wildlife. ADF&G blasting guidelines shall be followed.

XI. Restoration

[I.470] 1. Specific restoration and revegetation methodologies shall be delineated within a project Restoration/Revegetation Plan that shall be approved by concerned State and Federal agencies prior to initial construction activities. The approved Restoration/Revegetation Plan shall be incorporated into project technical specifications, by reference.

2. Upon completion of use, the Licensee shall restore all lands disturbed by project activities in accordance with the Restoration/Revegetation Plan.

[I.471] 3. Restoration includes erosion and sediment control, revegetation, re-establishment of native species and stabilization. All disturbed areas shall be left in such stabilized condition that erosion will be controlled through such means as waterbars, berms, ditching, revegetation, and other techniques included in the Erosion Control and Restoration/Revegetation Plans. Culverts and bridges shall be removed and slopes shall be restored.

4. Revegetation of disturbed areas shall be accomplished in accordance with the Restoration/Revegetation Plan and approved schedules. The

[I.471] (cont.) parameters to determine the success of revegetation shall be included in the plan.

[I.472] 5. The Licensee shall dispose of all materials from roads, haul ramps, berms, dikes and other earthen structures in accordance with the project Restoration/Revegetation Plan.

[I.473] 6. Pending the restoration/revegetation of a disturbed area, the Licensee shall contour grade and stabilize each area prior to the end of the growing season and/or prior to the onset of the freezing season immediately following the time of disturbance.

[I.474] 7. Upon completion of restoration/revegetation of an area, the Licensee shall remove all equipment and material from the area in accordance with approved plans.

[I.475] 8. Slopes shall incorporate a diversity of contours created during actual excavation, rather than during restoration.

[I.476] 9. Where ponding will occur, as in first-level terrace sites, irregular boundaries and slope contours shall be accentuated. Islands of undisturbed vegetated terrain shall be left within the perimeter of the operational site.

[I.477] 10. Organic overburden, slash, and debris stockpiled during clearing shall be distributed over the excavated area prior to fertilization.

[I.478] 11. Once operational material sites are depleted or no longer required, they shall be rehabilitated by the end of the next growing season following last use.

[I.479] 12. Erosion-prone slopes shall be fertilized and dry seeded with a fast-growing native grass.

XII. Oil and Hazardous Substances

[I.480] 1. The Licensee shall submit an oil and hazardous substance control, cleanup and disposal plan that shall be approved by concerned State and Federal agencies prior to initial construction activities. The approved Oil and Hazardous Substances Plan shall be incorporated into project technical specifications by reference. As a minimum the plan shall address fuel distribution systems, storage and containment, containerized products, leak detection systems, handling procedures, training programs, provisions for collection, storage and ultimate disposal of waste oil, cleanup methods and disposal sites. The plan shall outline all areas where oil and/or hazardous substances are stored, utilized, transported, or distributed. The Licensee shall demonstrate its capability and readiness to execute the plan to the satisfaction of the Engineer and concerned State and Federal agencies.

2. Storage containers for fuels and hazardous substances shall be located at least 1,500 feet from water bodies and bermed to contain 110 percent of the maximum volume to be stored. Containment areas shall be lined with impervious material.

[I.480]
(cont.)

3. The Licensee shall update the plan and methods of implementation as appropriate, but at least annually will submit a revised plan to the Engineer and concerned State and Federal agencies for approval.

XIII Cultural Resources

[I.481]

1. The Licensee shall undertake the affirmative responsibility to identify, protect and preserve cultural, historic, prehistoric and archeological resources that may be impacted by related activities in the overall construction project on lands consistent with the National Historic Preservation Act of 1966, as amended, 16 U.S.C. 470, et seq. the Archeological and Historic Preservation Act of 1974, 16 U.S.C. 469, et seq., and the implementing procedures of the Advisory Council on Historic Preservation, 36 CFR Part 800.

XIV. Standards for Roads

1. The Licensee shall submit a layout of each proposed road for approval by the resource agencies and the Engineer. As a minimum, the layout shall include areas of fills and cuts, the locations of culverts, bridges and low water crossings, spoil disposal, dimensions and roadside ditching necessary for runoff water control.

2. The maximum allowable grade shall be 12 percent.

3. Maintenance grading of road surfaces shall be done in such a manner that berms of material left on the road shoulder will not cause surface runoff water to flow parallel to the road alignment.

4. Road design shall provide for runoff drainage on the road surface to be perpendicular to the road alignment.

[I.482]

5. Maintenance grading shall be done in a manner that cross drainage culverts and side ditches will not be blocked with road material. Drainage ditches and culverts shall be inspected weekly and cleaned out as needed during the seasons of surface grading and snow removal.

6. Road design speeds shall be kept to the minimum consistent with project requirements and shall not exceed 40 miles per hour. Lower design speeds allow greater flexibility for alignment adjustments to avoid environmentally sensitive features and reduce requirements for major road cuts. Lower design speeds also enable routing to follow higher, drier terrain, thereby reducing requirements for gravel extraction and fill placement in wetlands. A 40-mile-per-hour design speed will increase road safety and enhance recreational resource potential.

7. Routes shall avoid wetland and riparian areas, and minimize stream crossings and encroachments.

8. Road design shall keep gravel extraction requirements to a minimum by avoiding wet areas and emphasizing balanced cut and fill.

9. Where stream crossings cannot be avoided, they shall be aligned at right angles to the stream and located to preclude bank cutting and streambed disturbance. Fish spawning and overwintering areas within streams shall be avoided by route adjustments.

[I.482] (cont.) 10. Where stream crossings are planned for winter construction, the thalweg, banks, and other locational features shall be identified and staked in the field prior to snowfall or freeze-up. Overwintering areas of fish or aquatic mammals must not be disturbed during winter construction.

11. All access roads not required for project operation or recreational purposes, shall be "put to bed" as soon as they are no longer required, if possible during the same season. Drainage structures shall be removed and the roadbed recontoured to a stable configuration providing proper drainage. Rehabilitation shall include scarification, fertilization, and blockage with a berm followed by a cut. Erosion-prone locations shall be stabilized by contour grading, water control structures or seeding with fast-growing native species. Where impoundment of sheet flow has occurred, non-operational roads shall be structurally altered to restore normal flow.

12. Road dust control shall utilize water rather than oil or other synthetic compounds. Water withdrawal procedures and sources for dust control shall be approved on a case-by-case basis by environmental personnel following site-specific inspection.

XV. Culverts, Bridges, Low Water Crossings

[I.483] 1. Low water crossings (fords across moving waters where any mobile ground equipment is moved on the water course) shall be designed, constructed, maintained and restored to standards contained in the project Erosion Control Plan.

2. Culverts and bridges necessary for operation and maintenance of the project shall be designed at a minimum to accommodate a 50-year flood in accordance with criteria established by the American Association of State Highway Officials and the Federal Highway Administration and endorsed by the ADOT/PF.

[I.484] 3. Culverts necessary for construction or operation of the project shall be installed with the culvert invert a minimum of six (6) inches or 20 percent of the culvert diameter, whichever is greater, below the thalweg in fish streams.

4. All bridge abutments and culvert inlets and outlets will be rip-rapped or armored at the time of installation.

5. Culverts installed in fish streams shall be designed to provide fish passage at the Q_2 flood, with the following parameters:

a) No fish passage culvert shall exceed 100 feet in total length.

b) Maximum average allowable velocity of water flow through a fish passage culvert shall not exceed 4.52 feet per second for culverts up to 40 feet in length. Additional data not to be exceeded are:

[I.484] (cont.)

Ave. Velocity (FPS)	Culvert Length (Ft)
4.0	50
3.6	60
3.3	70
3.0	80
2.8	90
2.5	100

6. All culverts installed in fish streams shall be inspected and maintained to allow fish passage in accordance with the design specifications above. The inspection and maintenance schedule shall be subject to approval by ADF&G.

[I.485] 7. Bridges shall be installed in preference to culverts or low-water crossings (fords). Bridge supports shall be located outside of active channels.

[I.486] 8. Low-water crossings shall be used only where a stream will not be subject to construction traffic. Such crossings shall conform to the slope of the undisturbed streambed and shall be constructed of materials that will preclude water percolating through rather than over them.

XVI. Transmission Corridors

[I.487]

1. Where they are not adjacent to an existing road, transmission corridors shall be constructed by helicopter support to avoid unnecessary clearing of vegetation. In all locations where clearing is not required for access, winter construction or access shall not commence until a frost depth of six inches (6") has occurred and vehicles not exceeding four (4) psi shall be used. Transmission corridor development shall not create an alternate access route for all-terrain vehicles.

2. Transmission line additions shall be made adjacent to established transmission corridors. Where transmission lines have a common destination, they shall follow a common route.

3. Transmission towers shall not be placed in active floodplains and shall avoid streams and lakes by a minimum of 500 feet.

4. Herbicides shall not be used for vegetation control along transmission corridors.

5. Transmission corridors not adjacent to an existing road or railway shall follow the forest edge (i.e., the transition zone between forest and shrub or forest and tundra) and avoid crossing wetlands.

I.488 XVII Implementation

1. Nothing contained in the preamble and body of stipulations shall prohibit the Licensee from applying for a waiver or modification to any stipulation on a site specific, case-by-case basis. Such application shall be submitted in writing to the concerned State and Federal resource managing agencies for review and action.

I.489 - see entire Attachment A - pgs. 71-82

ATTACHMENT B

Agricultural Experiment Station
Palmer Research Center
Box AE
Palmer, Alaska 99645

UNIVERSITY OF ALASKA

January 24, 1983

Dr. Robin G. B. Sener
Susitna Program Manager
Wildlife & Botanical Resources
LGL Alaska Research Associates, Inc.
1577 C Street
Anchorage, Alaska 99501

Dear Robin:

Attached are two lists of data, with brief descriptions, available on the Susitna drainage. This was prepared in response to our telephone conversation of December 16, 1982, when we were concerned about data being forgotten. The first list summarizes data that the Alaska Power Authority has funded to at least some degree. The second list summarizes Susitna drainage data collected by other projects and incomplete data where the field sampling was funded by the Power Authority. In some cases, samples need to be ground ~~or~~ have laboratory analysis performed but in other cases the data only need to be analyzed statistically. The descriptions of old studies were not meant to be detailed, but rather to make people aware of the depth of data collected in the past.

One thing becomes apparent from these lists: There is an enormous amount of vegetation data and smaller amounts of soils data and soils-vegetation data that could be available if we had funds and time to analyze and integrate the data. Even though some of the data may not be exactly what is needed now, the data could certainly be used as a foundation for future experimental design, assessing impacts, and making revegetation recommendations. The wheel's already been invented a couple times; maybe these lists will help produce a better wheel in the future.

Sincerely,

Dot Helm

Dot Helm
Plant Synecologist

de

cc: Richard Fleming, Alaska Power Authority

Study	Location	Year	Who	Field Funding	Status
ɜgetation mapping	Middle, upper basin	1980	Plant Ecology	Susitna	Vegetation means in annual re; (variances calculated, not reported) Maps of vegetation, potential lands produced
ɜgetation inventory	Middle, upper basin	1980	USFS SCS Plant Ecology	Cooperative River Basin Study	Some vegetation (timber) anal; other (understory) being processed; not sure about s Some soil & vegetation sample collected
ɔwnstream succession	Delta Is.-Chase	1981	Plant Ecology	Susitna	Vegetation means in annual re (variances calculated, not reported) Soils collected
ertilizer trials	Watana Base Camp	1980	Plant Ecology	Partly Susitna	Data need to be summarized.
elicopter transects	Delta Is.-Gold Cr.	1981	Plant Ecology	Susitna	Crude vegetation analysis - % of vegetation types on floo Referenced in Final Report
'ransmission corridor mapping	N, S transmission corridors	1981	Plant Ecology	Susitna	Maps produced; no ground-trut
ʼrowse	Middle basin	1982	Range Ecology	Susitna	Vegetation means, variances f level V given to LGL Vegetation samples, some litt samples collected
'henology	Middle basin	1982	Range Ecology	Susitna	Vegetation, tree cores, tempe tures taken; being analyzec Photos taken each week.
ɜurn	Alphabet Hills	1982	Range Ecology USFS BLM	Susitna USFS BLM	Crude vegetation statistical analysis performed by USFS Litter samples collected Permanent photo plots.
)ownstream succession	Curry-Devil Canyon	1982	Range Ecology	Susitna	Shrub cores collected; no ri counted

Study	Location	Year	Who	Field Fund	Status
Vegetation mapping	Upper basin	pre 1980	BLM	Denali Project	Map produced. Cover, frequency an
Vegetation inventory	Lower basin	pre 1980	USFS SCS	Cooperative River Basin Study	Not sure Some vegetation samples collected
Vegetation mapping	Middle, upper basin	1980	Plant Ecology	Susitna	Soil chemical analysis performed a expense
Vegetation inventory	Middle, upper basin	1980	USFS SCS Plant Ecology	Cooperative River Basin Study	Some plant species ground & analyz soils analyzed at AAES expense Other plant species collections ar available, but not ground Data partly analyzed by USFS.
Fertilizer trials	Watana Base Camp	1980	Plant Ecology	Logistics-Susitna	Materials provided at AAES expense Data collected, chemical analysis AAES expense Data unanalyzed
Downstream succession	Delta Is.-Chase	1981	Plant Ecology	Susitna	Vegetation height class informatio available, not reported Soil chemical analysis performed a expense Soil texture need to be obtained
Browse	Middle basin	1982	Range Ecology	Susitna	Soil, litter samples laboratory an at AAES expense Data are unanalyzed
Phenology	Middle basin	1982	Range Ecology	Susitna	Vegetation samples collected, but ground or analyzed Tree rings need to be counted. Al nutrition data need to be analy:
Burn	Alphabet Hills	1982	Range Ecology USFS BLM	Susitna USFS BLM	Soil, litter samples laboratory ar at AAES expense Vegetation samples collected, but ground or analyzed Vegetation field data summarized I
Downstream succession	Curry-Devil Canyon	1982	Range Ecology	Susitna	Rings need to be counted. Need t bine this information with hydr

Description of Susitna Vegetation Data Sets

Vegetation inventory - Cooperative River Basin Study - USFS, SCS

Fairly intensive permanently located vegetation plots

Measurements include:

- timber inventory
- ground cover % - below & above 4 1/2 ft. basal, moss, lichens, residue, bare ground, rock, water, total
- wildlife signs-hedging, browsing, number and type of trails, nesting trees
- wildlife habitat data - slope, aspect, vegetation structure
- tall shrub - productivity, available browse by species
- habitat - height, canopy, density by plant species
- range production - weights by plant species
- soils - SCS descriptions

Vegetation Mapping - Susitna 1980

Qualitative vegetation cover estimates
Some soils data

Fertilizer trials 1980

Annual ryegrass was planted in factorial design using NPK treatments with 3 levels of each
Responses measured included height, production, n~~utrient analysi~~s and photos of individual plots. Baseline soil laboratory analyses were deter...

Downstream succession 1981

Vegetation cover by height class; density by size class; ages, heights, dbh's of shrubs, trees. Belt transects were used.
Soil pits sampled by horizons or fluvial layers

Helicopter transects 1981

Vegetation types at systematic points along transects

Downstream succession 1982

Shrub cores collected in early-middle successional types along hydrology transects.

Range ecology studies 1982

Detailed descriptions and data formats have been provided previously (December 14, 1982, to Steve Fancy, LGL)

CHAPTER 3. SUPPLEMENTAL COMMENTS

[I.490] **Access Roads**

Page E-3-256 Side Borrow adjacent to or access balanced cut and fill techniques will minimize certain impacts, however, materials must be available in the access corridor. It should be stipulated the construction will have to be closely monitored. Monitoring will ensure contractors comply with licensing requirements and contract specifications.

Page E-32-264 is two to three feet of road crown, enough in areas of permafrost?

We have the following additional comments on fish and wildlife resources.

[I.491] **Fish:** We submit that the quality of the fisheries is highly dependent on water use and quality. The Chapter 2 analysis has some deficiencies most notably a valid temperature model and the lack of data on fish use downstream of Chulitna River.

[I.492] **Vegetation:** Vegetation section lacked quantification of areas which could be affected by changes in cover. A given species may benefit by vegetation cover changes whereas other species may be adversely affected. The vegetation map should be improved to better analyze moose and bear habitat.

[I.493] **Wildlife:** The Jay Creek mineral lick for Dall Sheep will be impacted. Mitigation by exposing new soil in the area is suggested. No mention of an alternative, such as lowering the dam height to reduce the amount and escape route from being inundated, is mentioned. The dam will inundate Bald Eagle and Golden Eagle nest sites, which is in violation of the Bald Eagle Protection Act.

[I.494] In summary, mitigation agreements should be arranged with landowners prior to licensing and incorporated in the license to ensure they will be adopted. Also, we concur with the applicant's proposal to establish an interagency monitoring team which should include monitoring construction activities to ensure compliance. The team should be funded by the project.

CHAPTER 4. HISTORIC AND ARCHEOLOGICAL RESOURCES

[I.495] BLM will consider any archeological sites in this project that are under its jurisdiction and that have tephra chronology to have cumulative research potential (36 CFR 60.6(d)). We view these items as represneting part of a significant entity, whose components may lack individual distinction (36 CFR 60.6(c)).

The Advisory Council on Historic Preservation must be given the opportunity to comment on this project and the cultural resource reports.

BLM agrees with the applicant's approach to inventory and systematic testing since we are in the process of developing an agreement with the State Historic Preservation Officer that incorporates an analogous approach.

[I.496]

It is expressed several times that the project area "holds excellent potential for addressing many long standing anthropological questions." What these questions are is not specified. If sites are important for their ability to answer these questions, which sites answer which questions, and why, should be specified.

CHAPTER 5. SOCIOECONOMIC IMPACTS

General Comments

[I.497] This evaluation should include: (1) a widely accepted projection of future population and economic growth (increasing user groups) or, if there is substantial uncertainty as to the validity of key assumptions (as we believe there is), then a multiple scenario model should be pursured examining at least high, medium, and low projections; and (2) a tradeoff analysis examining the competing mitigation proposals for the different interests. Chapter 5 fails in respect to both points.

Specific Comments:

[I.498] Page E-5-6: (b) Population: The population projections are outdated. Impact analyses and mitigation planning are tied to population projections with and without the project. We recommend that the population projections be updated.

[I.499] Page E-5-6: (b) Population: Paragraph 5: The Knik Arm crossing should not be considered a foregone conclusion. The Alaska Department of Transportation and Public Facilities (ADOT/PF) has only recently begun their assessment of this project. The alternatives being given serious consideration by ADOT/PF for the draft environmental impact statement would result in minimal savings in driving time to the communities indicated.

[I.500] Page E-5-24: (b) Population: Paragraph 2: We concur with the underlying assumption that, in Alaska, population growth is strongly associated with natural resource development projects. An updated evaluation of the projects which are expected to be developed should be provided in this section.

Page E-5-27: 3 - EVALUATION OF THE IMPACT OF THE PROJECT: The evaluation of project-related impacts ignores the State's most recent experiences with large development projects; population and related impacts are due to the number of people the project attracts, not the number of people, with dependents, the project employs. We would agree that establishing a number, or narrow range, for this potential impact would be difficult. However, to ignore this potentially overwhelming factor would render much, if not all, of the fine-tuning in the socioeconomic models irrelevant. Recent large hydropower projects in Canada may provide case examples, in addition to the Trans-Alaska Pipeline System and Terror Lake hydropower project.

[I.501] We recommend that the impacts of the project be reassessed in light of an updated Base Case.

We expect that a high percentage of those attracted to the region would become fish and wildlife resource users. This would result in increased demand for the resources at the same time and in the area of more direct project-related impacts to these resources. Activities such as trapping, fishing, hunting, berry-gathering, and disruptive uses of fish and wildlife habitats would be expected to increase, possibly resulting in greater regulation of consumptive fish and wildlife uses.

[I.502] Page E-5-79: (a) Natural Resource - Dependent Businesses: We recommend that guides registered for Game Management Unit (GMU) 13 be surveyed to determine their reliance on GMU 13. Since most of these guides are also registered for other (up to three) GMU's it is difficult to determine, without a survey, the present reliance of these guides on GMU 13 and thus the potential impact of the project on this group.

[I.503] Page E-5-80: (a) Natural Resource - Dependent Businesses: Based upon the present status of the fish and wildlife studies, we consider the most likely potential impacts of the project on these resouces to be unknown.

With respect to furbearers, the increased accessibility may not result in greater trapping success should habitat losses result in significant population decreases. Changes in quality of consumptive fish and wildlife uses from potential shifts and concentrations of hunting and fishing activity should also be discussed.

[I.504] Page E-5-80: 3.7 - Local and Regional Impacts on Fish and Wildlife Groups: Please refer to the above comments and our remarks on Chapters 2 and 3.

[I.505] Page E-5-96: (a) Methodology: We consider it premature to conclude that impacts downstream of Talkeetna would be "limited" to the extent that they can be dismissed. The number of fish utilizing the reach downstream of Talkeetna is much higher than the number using the reach between Talkeetna and Devil Canyon. Thus, a smaller adverse impact, resulting in a loss to a small percentage of this fishery could mean a greater loss of fish. The examination also appears to consider spawning access to sloughs between Talkeetna and Devil Canyon to be the sole determinant of fish losses. Temperature changes, ice regime changes, chemical changes, impacts to tributary mouths, and access to sloughs for rearing, are changes which could also influence the future viability and productively of the Susitna River in regard to fishery resources. AEIDC's report for Alaska Power Authority (APA), scheduled for completion in October, 1983, should provide insight as to the interactions of some of these factors.

[I.506] Page E-5-98: (1) Specific Impacts: The discussion again fails to recognize the potential impact to fisheries downstream of Talkeetna (reference our comments immediately above), the potential of the river above Devil Canyon to support salmon (future opportunities lost), the importance of commercial fishing in terms of secondary and induced job creation, and the value of the fishery lost over the life of the project (based upon the same economic assumptions as the rest of the project).

[I.507] Page E-5-100: (c) Non-Commercial Use - The Sport Fishery: We recommend that this section provide an examination of impacts for the resident fisheries of the impoundment zones.

In conjunction with identifying potential impcts to the sport fishery, impacts to the sports fisherman should be evaluated. Efforts to evaluate these impacts, as stated above, have been dropped (reference response W-5-020 in Chapter 11). We recommend that these studies be reinstated. The type of evaluation necessary should be discussed with the appropriate resource agencies.

[.508] Page E-5-100: (d) Non-Commercial Use - Subsistence Fishing: The impact of the project on subsistence fishery use has not been evaluated. The importance of the Susitna River system to subsistence, potential losses of subsistence resources, and how mitigation proposals affect subsistence use should be addressed. The data currently provided is not applicable to the project.

The discussion skirts the issues of economic, cultural, social, and recreational values of the subsistence fishery. Those issues should be clarified by defining subsistence use, clearly distinguishing between sport and subsistence fishing. As we have previously stated (see Chapter 11, response W-10-038), additional references are available on this subject. 5-1/

[.509] Page E-5-101: 3.7.2-Game: The nutritional, cultural, religious, and other socioeconomic factors which make the non-commercial taking of fish and wildlife essential to the livelihood and lifestyle of many Alaskan residents should be discussed and quantified here.

Quantification of impacts to game species (reference our comments on Chapter 3 of the Exhibit E) and of the subsistence use of those resources is inadequate. Analysis of economic impacts to hunters, subsistence users, and associated businesses should occur after quantification of wildlife impacts and formulation of mitigation proposals.

[.510] Page E-5-102: (i)Guides and Guide Services: Please refer to our comments on page E-5-79.

[.511] Page E-5-103: (i) Guides and Guide Services: Last Paragraph on Page Through Page E-5-104: The availability and quality of guide services and current use of alternative hunting areas should be discussed. These factors, together with the remote nature of project and alternative hunting areas, will determine the magnitude of project impacts on area guiding and of secondary impacts on alternative areas. The suggestion that guides and their clients can move to other hunting areas is analogous to the suggestion that wildlife may move to adjacent areas when their habitats are altered or destroyed.

Page E-5-104: (1) Guides and Guide Services: Paragraph 2 on page: The potential for blocking of caribou movements remains unknown. Chapter 3, Sections 4.3.1 (b) and 4.3.3(b)) described possible significant decreases in caribou subherd populations. Potential population losses will affect hunting quality and should be acknowledged here.

[.512] Page E-5-104: Last Paragraph through Page E-5-105: (i) Guides and Guide Services: The non-resident proportion of guided hunts should be evaluated. Additional information should be provided on the schedule and scope of suggested user interviews.

[.513] Page E-5-107: (ii)Lodge Operators: Please refer to our comments on the previous section. The quality, availability, location, and present utilization of alternative hunting areas should be discussed here. Inundation and the presence of project features will result in decreased quality and restrictions in areas used by lodge clients even if the lodges themselves are not directly affected.

[I.513] (cont.) The draft license application referred to ongoing studies and planned interviews which were to address project impacts on lodges (page E-5-75 of the draft). The applicant should provide information on the status of those studies particularly as they relate to evaluations of disturbance and use of wildlife.

[I.514] Page E-5-108: The Hunter: The fact that harvest statistics, other than for caribou, do not distinguish between subsistence and recreational taking of game is no reason to omit a discussion or quantified study into the subsistence use of such resources. The number of people dependent on subsistence uses of fish and wildlife resources should be estimated. Alternative use areas are generally not an option for people who have homesteaded in remote or semi-remote areas.

Page E-5-109: The Hunter: Last Paragraph: An explanation should be given for the large increase in subsistence caribou permits allotted in 1982. Present and future management plans and options should be discussed.

[I.515] Page E-5-109: (ii)Resources and Use Patterns: The discussion provides some quantification for the importance of GMU 13 relative to state-wide game harvests. Quantification of the economic importance of consumptive wildlife uses should include consideration of travel costs, lost work time, support equipment, food, lodging, etc. Limitations to the data available on this subject are described, but no plans for overcoming these limitations are provided.

Pages E-5-112 and 113: Supply and Demand for Hunting Opportunity: Given fluctuating harvests, demands, and populations in recent years, a clearer picture of caribou hunting pressure would be obtained with the addition of
[I.516] 1981 and 1982 data.

Potential impacts to the caribou herd and related harvest opportunities should be evaluated inlight of existing information available from the Alaska Department of Fish and Game (ADF&G). Tjos omc;ides present and future management plans, projected demand forecasts, likely behavioral responses of caribou to the reservoirs, access routing and control, alternative reservoir filling and operation schemes, construction and public use of the access routes, and the tradeoffs of different mitigative proposals which conflict among user groups.

Page E-5-115: Transportation To and From Hunting Grounds: Figures showing
[I.517] both present access points and proposed project access should be correlated to current harvest intensities.

Page E-5-115: Hunting Pressure: The discussion should explain why hunting
[I.518] pressure in GMU 13 has generally decreased in the last decade while the Railbelt region population has increased nearly 50 %. The influence of changing regulations, lifestyles of area residents, or quality of the hunt on hunting pressure should be examined. Better understanding of the moose harvest issue would come from inclusion of comparable demand, harvest, and population data for GMU's 14 and 16, as well as GMU 13.

.519 Page E-5-117: Importance of Regulations: Access routes, restrictions on access, and construction schedules will greatly influence opportunities to hunt in the project area. Impacts should be evaluated under at least two scenarios: 1) severely restricted public access and hunting permits, and 2) unrestricted access and permits. Such evaluation should be coordinated with ongoing big game studies and discussed in Chapter 3. Given resource agencies recommendations to omit any project access from the Denali Highway, and the importance of those recommendations as a wildlife mitigation measure, we recommend the impacts on hunter access and harvest distribution both with and without that road corridor be evaluated. Additional consideration should be given to impacts both with and without restrictions on worker access and hunting. Again, regulation of such use can be a significant mitigation measure.

Other game species (black bear, brown bear, Dall sheep, wolf, and wolverine) should be discussed. Harvest and (if applicable) permit information should be provided, with projected demand and access discussed. For example, bear harvest data and statistical analysis is contained in ADF&G annual reports.5-2/ Harvest data on other species is similarly available. 5-3/ Annual hunter surveys for all big game include questions on harvest locations. While the data are not exact, they do indicate approximate take locations relative to existing access, proposed access, and project features. Such information should be evaluated and descriptive maps provided for this section of the license application.

Future study plans for filling data gaps on these species and incorporating those data into project planning should be discussed.

I.520 Page E-5-120: (a) Data Limitations: Studies necessary to fill data gaps should be pursued by the applicant. Need for a survey of trapping pressure and estimates of socioeconomic impacts from increased trapping due to the project were two of the study recommendations from the Susitna Modeling Workshop held February 28 - March 4, 1983. That workshop involved agency representatives, principal investigators, consultants, and the project sponsor.

I.521 Pages E-5-120 and 121: (b)Trapping Activity: The issue of future opportunities lost or gained as a result of the project should be examined in determining project impacts. Consideration should also be given to the number of additional trappers the area could support under alternative access and management scenarios.

I.522 Pages E-5-122 and 123: (ii) Impacts of the Project: The extent to which negative impacts will be "partially offset" should be described.

For mitigation planning, coordination between project study components should include an assessment of the number, sizes,and potential habitat values of sloughs which are to be managed for salmon mitigation as compared to the number, size, and habitat values of those which are now and will remain available as beaver habitat. Tradeoffs in mitigation for one species over another should be clarified in terms of overall objectives for project mitigation. The potential for overharvest and need for regulation as a result of increased project access should be considered here.

[I.523] Page E-5-124: (f)Fox: Please provide comparative information on the commercial value of fox pelts as was provided for other furbearers.

[I.524] Page E-5-125: 4.2 - Background and Approach: The last sentence in the first paragraph should be clarified, elaborated on, or eliminated.

We are concerned that no outline or schedule is provided for the development of fish and wildlife use information referred to in the last paragraph here. Under current reduced project funding, we are unaware of additional studies or information which will be provided during the proposed licensing schedule.

[I.525] Page E-5-128: 4.4.1 - Mitigation Measures That Would Help Avoid Significant Adverse Project-Induced Impacts: The proposals lack specificity and adequate oversight. The mitigation plan should contain specific mitigation proposals in response to specific identified adverse impacts. We concur that close monitoring of the effectiveness of the mitigation plan would be necessary. However, no details on the recommended monitoring are provided, e.g., responsibility, participation, schedule, criteria for determining "significant adverse impacts" and then modifying mitigation measures, etc. Furthermore, supplemental information provided in response to FERC's questions deletes parts of the mitigation proposed in the license application without offering any alternatives (Vol. IIA of III, Supplemental Information from page 5-30-1). The Supplemental Information was not distributed with the license application nor made generally available.

We recommend the establishment of a monitoring panel, at project expense, consisting of representatives of appropriate local, State, and Federal agencies to carry out the functon of assessing the extent of actual impacts and recommending modifications to the mitigation program. Modification of the mitigation plan included in the license would be through license amendment.

[I.526] Page E-5-132: 4.4.2 - Mitigation of Significant Adverse Impacts that Remain in Communities: Clarification is needed on whether costs of technical and financial assistance referred to here have been estimated and included in overall project costs. The potential magnitude of those costs should be described.

Page E-5-133: 4.5.1 - Developing Impact Information: Please refer to our comments on page E-5-125. No details are provided on proposed or ongoing of impact assessments. It is our understanding that no community surveys are funded for State fiscal year 1983, contrary to the Supplemental Information,
[I.527] Vol. II A of III, pages 5-29-3 and 5-34-3.

Page E-5-134: 4.5.1 - Developing Impact Information: Paragraph 3: An outline and schedule of studies necessary to obtain more detailed fish and wildlife use data should be included here. Need for this information was agreed upon by project investigators, the APA, and resource agency representatives during the February 28 - March 4 1983, mitigation planning workshop, as well as earlier workshops on resource modeling and project licensing.

[I.528] Page E-5-135: 4.5.3 - Refining and Implementing Mitigation Measures: Please refer to our comments under Section 4.4.1 on the need to establish a monitoring panel and describe responsibilities and criteria for adjusting mitigation measures.

Chapter 5 Footnotes

5-1/Foster, Dan. November 1982. The Utilization of King Salmon and the Annual Round of Resource uses in Tyonek, Alaska. ADF&G, Division of Subsistence, Anchorage. 62 pp.

Darbyshire and Associates. December 1982. Socioeconomic Impact Study of Resource Development in the Tyonek/Beluga Coal Area. Anchorage, Alaska.

5-2/ADF&G. 1982. Susitna Hydroelectric-Project Phase I Final Report, Big Game Studies, Volume VI, Black Bear and Brown Bear. Prepared for APA.

ADF&G. 1983. Susitna Hydroelectric Project Phase II Progress Report, Big Game Studies, Volume VI, Black Bear and Brown Bear. Prepared for the APA.

5-3/ ADF&G. 1982. Susitna Hydroelectric Project Phase I Final Report, Big Game Studies, Vol. V, Wolf; Vol. VII, Wolverine, and Vol. VIII, Dall Sheep. Prepared for the APA.

CHAPTER 5. SUPPLEMENTAL COMMENTS

[I.529] It appears that regional-statewide impacts or effects of the project are understated since as the State's oil revenue decreases, a higher percentage of available capital and/or financing may be concentrated on the project, at the expense of other projects or programs. Other regional energy development may be adversely affected, as an example.

[I.530] The effects of in-migration on the economy are understated. Migration may include individuals travelling to speculate on employment, especially if employment or economic conditions in other parts of the State or Nation are unfavorable. A large in-migration affects the demand for road maintenance and public works expenditures, for example.

[I.531] The cost of bringing the existing Alaska Railroad up to the operating level and line capacity which would be required for project use is not discussed. There is additional uncertainty surrounding railroad operation costs or charges due to the uncertain status of rail ownership.

[I.532] Access will be opened to private lands when the State purchases the rights to build the necessary roads. The cost of access could perhaps be mitigated by landowner participation, being a potential recipient of economic benefit of the roads themselves. The cost of access road construction may not be 100% related or attributable to the hydro project alone.

[I.533] Access development, if exaggerated, will cause development of the region in general, not only development of a powersite. The effects of increased use and development, cannot be underestimated in effect upon the existing resident human population and local living conditions.

CHAPTERS 6,7,8, AND 9. GEOLOGY AND SOILS, RECREATION, AESTHETICS, AND LAND USE

Geology and Soils

[I.534] There is no mention of the impact of the impoundment on Federal mining claims located, for example, along Jay Creek.

[I.535] Section 2.1 - Regional geology, seismic geology, and geologic conditions appear to be well written, accurate, and concise.

[I.536] Sections 2,5,8 and 3.7 - Borrow pits and quarry sites - planning for eventual inundation of borrow pits, or their rehabilitation is sufficient unless the impoundment area is altered due to a change in project design. It is unclear where the borrow sites or material sources for the entire Denali access roadway are located.

Recreation, Aesthetics, and Land Use

[I.537] Sites 3.1.3 and 3.1.4 infer that access roads will be open to public use. Such decision, when made by the responsible land managers, should detail policy governing use and also the extent of facilities necessary to control or enhance public use and public safety. Public Access is not a foregone conclusion.

[I.538] The Denali Highway is a scenic attraction to the touring public. Therefore, all facilities and developments required by the project in relation with the Denali access corridor should be planned for minimum visual impact. This is to include temporary power lines, borrow pits, and staging locations as well as the roadway and its eventual operation and maintenance.

[I.539] The transmission line rights-of-way may eventually be used as access corridors for ORV or other unplanned uses.

CHAPTER 10. ALTERNATIVE LOCATIONS, DESIGNS, AND ENERGY SOURCES

General Comments

[I.540] This chapter should assess the effect of time delays in project construction. Listing various types of alternative energy sources does not allow an evaluation of what would, or should, occur in the event the Susitna hydroelectric project is delayed for a period of years, or is never built. We recommend that this type of planning effort be carried out to examine the effects of short-term and long-term delays.

[I.541] In the assessments provided on hydropower alternatives, the proposed Susitna project and alternative basin developments are not evaluated on an equitable basis. There are explanations and tables (e.g. Tables E.10.6 and E.10.7) which compare alternative hydropower sites relative to the types and significance of environmental, cultural, recreational, and land use constraints, as well as power supply potentials. Yet, since the strengths and weaknesses of Susitna River proposals are not similarly included here, it is not possible to directly compare the Susitna project with other power alternatives. This is particularly unfortunate since the detailed evaluation of Susitna (e.g. Chapter 3) would leave one with the initial impression that it would have significant adverse impacts to many of the environmental criteria, including: (1) big game, (2) anadromous fish, (3) de facto wilderness, (4) cultural (subsistence), (5) recreation (existing), (6) restricted land use, and (7) access. Moreover, combinations of hydropower alternatives or hydropower with other power sources which would provide equivalent power are not contrasted directly with the Susitna project.

[I.542] Previously, we recommended that further details on alternative power sources be provided. We reiterate that recommendation here while agreeing that, in some cases, information may be lacking. Where assessments of environmental, cultural, social, land use, and other constraints can be compared among non-hydropower alternatives, as well as with the Susitna project and other hydropower alternatives, a more systematic and complete evaluation of alternatives will result. We have noted the applicant's disagreement with our recommendations to include fish, wildlife, social, and land use assessments in comparisons among non-hydropower and hydropower alternatives (e.g. comments W-10-024, W-10-027, W-10-029, W-10-031, W-10-032, W-10-034 and responses to those comments included in Chapter 11, Exhibit E). It is our view that without such information, the license application does not provide an adequate basis for preparation of an environmental impact statement (EIS) under the National Environmental Policy Act (NEPA).

Such information would complement the environmental comparison of Susitna River hydropower alternatives, Tables E.10.16 and E.10.19, as well as the overall summary evaluation of those alternatives (Table E.10.20).

[I.543] Alternatives to the proposed construction camps, village and permanent town should be assessed in this Chapter. These construction facilities have large implications for the fish and wildlife resources and users. At a mimimum, the alternative of combining the three Watana facilities should be discussed. The alternative of a Prudhoe Bay type camp should also be considered. In

[.543] addition, project design includes three airstrips (two at Watana, one at Devil (cont.) Canyon). The alternatives of consolidating two of the airstrips, and all three of the strips, should be discussed. Construction facilities alternatives should be discussed in terms of minimizing adverse impacts to fish and wildlife resources and their use. Resource agencies have not been consulted in regard to project facilities.

Specific Comments

[.544] Page E-10-1: 1 - ALTERNATIVE HYDROELECTRIC SITES: We recommend that all evaluation matrices include the project as proposed and other Susitna River basin alternatives.

[I.545] Page E-10-6: 1.1.5 - Plan Formulation and Evaluation: The tables referenced in this section should include the proposed project and other Susitna River basin alternatives. If the Susitna project proposal is superior to the various alternatives, incorporating the proposal into the tables would help to demonstrate this conclusion.

[.546] Page E-10-7: 1.2.1 - Description of Chakachamna Site: The accompanying tables should be corrected to indicate that the potential installed capacity would be 330 megawatts (MW), rather than the indicated 500MW.

[.547] Page E-10-9: (d) Aquatic Ecology: Paragraph 2: The low number of spawning salmon observed in the mainstem and side-channel habitats was possibly a result of the methods utilized. Data were previously gathered through counts from helicopters with ground verification. This type of methodology is appropriate for the clear water tributaries but not for the glacial flow mainstems and side-channels.

[.548] Page E-10-14: 1.2.4 - Environmental Impacts of Selected Alternatives: Paragraph 7: The tunnel alternatives are in conjunction with a dam to raise the Chakachamna Lake level. The impacts to the aquatic system could, potentially, be lessened through the alternative of restricting the project to the Chakachatna River system instead of diverting flows to the McArthur River. Fish passage facilities have been proposed by the Alaska Power Authority (APA) as a component of the preferred Chakachamna project plan.

[I.549] Page E-10-18: 1.3.3 - Formulation of Susitna Basins Development Plans: The subplans should be corrected to indicate the current proposed Watana dam installed capacity of 1020MW.

[.550] Page E-10-31: 2.1.1 - Diversion/Emergency Release Facilities: Paragraph 1: The Case C flows (minimum flows of 12,000 cfs) were not established as proposed ". . .to avoid adverse affects on the Salmon [sic] fishery downstream." The Chapter 11, Exhibit E, W-10-008 Response states that avoidance flows (i.e. flows necessary to avoid adverse effects on the salmon fishery downstream), "...would be 19,000 cfs in August." According to the Alaska Department of Fish and Game (ADF&G) Synopsis Report prepared for the Susitna project, five of nine sloughs examined do not achieve unrestricted access until flows exceed 20,000 cfs. 10-1/ In addition, the applicant's

[I.550] (cont.) letter, dated May 16, 1983, to the Regional Director, U.S. Fish and Wildlife (FWS), stated that the applicant's analysis of flows versus habitat would not be available until September 1983. Given the preliminary status of the instream flow studies, the FWS believes that recommendation of an appropriate flow regime, at this time, is premature (please reference the May 27, 1983, FWS letter to Eric P. Yould, APA).

[I.551] Page E-10-32: 2.1.3 - Power Intake and Water Passages: Paragraph 2: The statement is made that a multi-intake structure would be used, "...in order to control the downstream river temperatures within acceptable limits." Since temperature changes are inevitable, it is important that "acceptable limits" be established and agreed upon by resource agencies.

Page E-10-32: 2.1.3 - Power Intake and Water Passages: Paragraph 3: Please reference our comments on page E-10-31 concerning minimum flows.

[I.552] Page E-10-33: 2.2.1 - Installed Capacity: Paragraph 1: It is stated that the Devil Canyon facility would be operated, "...primarily as a base loaded plant..." The circumstances and anticipated operating regimes under which peaking operations at the Devil Canyon dam are envisioned need to be explained. The potential impacts of peaking operations at the Devil Canyon dam on the aquatic resources should be discussed.

[I.553] Page E-10-34: 2.3 - Access Alternatives: Please refer to our letter dated August 17, 1982 to Eric P. Yould, APA (included in Chapter 11) for our comments and recommendations specific to access routing. With the elimination of the Denali Highway to Watana roadway link, the FWS would endorse the access routing corridors and mode. Timing of access route construction is very important to avoiding or minimizing adverse environmental impacts.

[I.554] Page E-10-43:(v) Denali Highway to Watana: Paragraph 1: Impacts to caribou would be largely avoided by eliminating the Denali Highway-to-Watana access road. This would be consistent with the APA Mitigation Policy, the recommendations of the resource agencies, and Access Plan Recommendation Report (August 1982) which states:

> "From a caribou conservation viewpoint, the Denali access route is far less desirable than proposed routes originating on the Alaska Railroad and Parks Highway. The Denali route would most certainly have immediate detrimental impacts on the resident subherd and future negative impacts on the main Nelchina herd although these impacts cannot be quantified."

[I.555] Page E-10-54: 2.4 - Transmission Alternatives: Please refer to our letter dated January 5, 1982, to Eric P. Yould, APA (included in Chapter 11) for our comments and recommendations specific to transmission corridors.

[I.556] Page E-10-83: 2.4.11 - Conclusions: We concur with the recommended transmission corridors.

[I.557] Page E-10-83: 2.5 - Borrow Site Alternatives: Except in situations where no practicable alternatives exist, borrow sites should be restricted to areas within the future impoundments and/or to upland sites. Guidance on minimizing

[I.557] specific adverse environmental impacts are contained in the Biological
(cont.) Stipulations provided in the FWS comments on Chapter 3, Appendix E3B.

Page E-10-105: 3.1 - Project Operation and Flow Selections: The effects of various reservoir releases on fishery habitats between Talkeetna and the reservoir(s) is currently insufficient for recommending flow releases. The relationship of mainstem and groundwater flows must be understood. The interrelated effects of ice, sediments, stream flow, and temperature changes which will accompany construction, filling, and operation of the dam(s) must be understood for predictive purposes.

[I.558] The Arctic Environmental Information and Data Center (AEIDC) is under contract to the APA to develop a linked system of simulation models which will rely on data from other project studies, available literature, and professional judgement. The AEIDC study is intended to: 1) predict system-wide stream flow and temperature effects of the dam(s), and 2) interprete the effects of such changes in terms of aquatic habitats and fish populations. An AEIDC report scheduled for completion in October, 1983, is expected to demonstrate how the model functions. If the model proves satisfactory, and the appropriate level of baseline information is made available, we will be able to examine the relationship between flows and aquatic habitat. Much of the discussion on flows as they relate to habitat is speculative.

[I.559] Page E-10-106: 3.1.2 - Pre-project: The impacts of the 1969 water year (extreme drought) should be fully addressed, not dismissed. The effect of this naturally occurring event should be described in regard to project operations and how biological resources would be affected. We recommend this analysis continue through water year 1970, which was also dryer than average.

[I.560] Page E-10-108: 3.1.4 - Energy Production and Net Benefits: It is our understanding that the power demand projections, alternative fuel costs, and economic growth evaluation included in the application are considered to be high and have been re-evaluated by the applicant. We recommend that the net benefits versus flows discussions utilize the current economics evaluation.

[I.561] Page E-10-109: 3.2.1 - Susitna River Fishery Impacts: Please refer to our comments on page E-10-105.

[I.562] Page E-10-110: 3.3.4 - Riparian Vegetation and Wildlife Habitat: The post-project instream flow regime has tremendous potential to impact the timing and extent of floods, freeze-up, and spring ice jams, as well as the riparian groundwater relationships. We do not understand how it can be stated that the regime, "... is unrelated to any of these factors."

[I.563] Page E-10-111: 3.3.4 - Riparian Vegetation and Wildlife: It is stated that, "...it may be desirable to maintain riparian vegetation by simulating spring floods for a short period of time. However, the spring runoff storage is a key element of the project. Large releases for even a few days would have severe economic impact on this project. Hence, no minimum flood discharges were considered." In response to our concern that the receeding limb of high spring flows may be important to stimulate smolt outmigration, it is stated in the Chapter 11, Response W-3-026, " When the significance of flow-related

[I.563] (cont.) stimuli to smolt out-migration is defined, the flow regime can be adjusted." The apparent conflict in the statements in the application should be reconciled and the environmental implications of this flow decision examined.

[I.564] Page E-10-112: 3.5 - Maximum Drawdown Selection: This section should be reexamined in light of the most recent economic evaluation.

The environmental impacts implications of water year 1969 alone, and in conjunction with water year 1970, should be examined. This is a naturally occurring sequence and could repeat during the life of the project.

[I.565] Page E-10-115: 4.1 - Coal - Fired Generation Alternative: The Nenana and/or Bering River coal fields are potential sources of coal for power generation. The Usibelli mine is expected to double its coal production in the next year for export to Korea. The proximity of that mine to the Railbelt area, the ongoing nature of mine operations, and indications that with a market the Usibelli mine could be further expanded to produce 4 million tons per year for the next six decades, suggest that greater attention should be given to this potential power supply and its comparative environmental impacts.

Although less accessible, Bering River coal should also be considered here as an alternative generating resource. Exploratory work on Bering River coal development is currently being undertaken by a joint venture of the Chugach Native landowners and Korean interests. Preliminary environmental and engineering work for the associated transportation infrastructure is being supported by the State.

Although specifics of Beluga plant design and location are not available, existing Beluga lease-areas are well-defined. A tentative 30-year mine pit and alternative transportation corridors have been outlined by Diamond Shamrock-Chuitna Coal, a major area leaseholder. General environmental data on the Beluga area, as referenced in Chapter 3 of this Exhibit (Alaska Department of Natural Resources (ADNR), 1982b), are available. Baseline environmental studies are in their second year. Preliminary reports on the 1982 studies are now available and should be incorporated into the discussions. 10-2/

We note that the referenced economic and technical feasibility analysis is included in Exhibit D, not Exhibit B as stated here. Please also see our General Comments on this Chapter's failure to directly compare non-hydropower alternatives with the Susitna proposal, even to the general extent that those comparisons are provided for other hydropower alternatives.

[I.566] Page E-10-116: 4.1.1(d) Terrestrial Ecosystem: (i) Flora: More detailed vegetation type maps of the area have been developed by the U.S. Soil Conservation Service and Forest Service. The FWS has completed National Wetland Inventory maps which are available for the area's coastal wetlands. Those wetlands are important habitats for the bird life described under section (f) Marine Ecosystem.

[I.567] Page E-10-117: (ii) Fauna: Nests of trumpeter swan in the Beluga and Susitna areas have been mapped and the location data computerized. This information is readily available from the FWS for comparative analyses.

[I.568] Page E-10-118: (c) Aquatic Ecosystem: Preliminary quantitative baseline data are now available on Beluga area resources. 10-3/

Page E-10-120: 4.1.2 - Environmental Impacts: With recent acceptance of the Alaska Surface Coal Mining Control and Reclamation Program by the Federal Office of Surface Mining, a comprehensive regulatory program for Beluga, Nenana, and other Alaska coal development exists and should be mentioned here. We assume that the intended reference in paragraph 5 is to the Clean Air Act.

[I.569] To fully compare alternative power developments within the NEPA process as described previously, a comparative discussion on environmental impacts should be provided here. For example, Susitna hydropower development will result in significant and irreversible habitat losses, with primary habitat impacts occuring within a concentrated time frame, and a work force of several thousand individuals during the first several years of project development. In comparison, Beluga coal development would result in small but continual annual habitat losses, potentially reversible habitat impacts, and an initially smaller work force which would remain for the project life. Quantitative estimates of these habitat impacts, work force needs, and transportation requirements, should be provided and compared here for the Beluga development, the incremental impacts of expanding the Nenana coal mine, and the proposed Susitna project.

[I.570] Page E-10-122: Aquatic and Marine Ecosystems: We appreciate inclusion of quantitative estimates on area fishery resources and potential impacts to them. Similar estimates for consumptive use and for Susitna area resources should also be included.

[I.571] Page E-10-141: 4.3.1 - Natural Gas: Since natural gas is considered by many to be the best single energy source alternative to the Susitna project 10-4/ it is disconcerting to see so minimal an effort expended examining this alternative. The effort should be at least equal to that provided for assessments of alternative hydropower sites and of coal. Anything less must be considered inadequate. No specific examination is made of natural gas and potential environmental impacts nor is a tradeoff examination made of natural gas and other alternatives.

[I.572] Page E-10-143: 4.3.4 - Environmental Considerations of Non-Coal Thermal Sources: We do not consider the potential environmental impacts of burning natural gas to be the same as for diesel, oil, or coal. We recommend that environmental considerations be examined separately for each of these fuel alternatives. Then they should be examined through a tradeoff analysis which would include the proposed Susitna project, within basin alternatives, hydropower projects outside the Susitna basin, and non-hydropower alternatives to the proposed Susitna project.

[I.573] Page E-10-162: 4.6.3 - Potential Application in the Railbelt: Greater emphasis should be given to the Mt. Spurr geothermal site. This site was the first geothermal lease sale made by the Alaska Department of Natural Resources (ADNR). Although the interest level (as reflected by the bids offered) was low, the ADNR considered this the best potential geothermal development site

[I.573] (cont.) within their jurisdiction. The lease sale was undertaken because the site: 1) has high potential (until exploratory drilling occurs, the viability of the site will be unknown); 2) is located on State land; and 3) is close to existing transmission lines (Beluga Station). In addition, it is located between the Chakachatna River and the Beluga Coal fields, an area already being explored for power development, and crisscrossed by logging roads. It would also seem logical to explore the possibility of a West Cook Inlet power generation alternative to the Susitna project. This combination could include: Mt. Spurr geothermal, Chakachamna hydropower, Beluga coal, and West Cook Inlet natural gas. Obvious advantages would be found in the restriction of adverse environmental impacts to a relatively small area which already has transmission facilities.

[I.574] Page E-10-173: 5 - ENVIRONMENTAL CONSEQUENCES OF LICENSE DENIAL: The evaluation should assess the timing and probable mix of alternatives if the license is denied. The objective should be to examine the enviromental consequences of meeting the incremental increases in power demands as they occur, in light of current economic and power demands projections. The analysis should be directed at: 1) short-term planning, in the event that the Susitna project is delayed for various lengths of time; and 2) long-term planning so that the Railbelt region does have a fall back plan in the event that the Susitna project is not licensed. We recommend that such planning be undertaken.

Chapter 10 Footnotes

10-1/ ADF&G. 1983. Synopsis of the 1982 Aquatic Studies and Analysis of the Fish and Habitat Relationships. Prepared for the APA.

10-2/Environmental Research and Technology, Inc. April 1983. Surface Hydrology and Water Quality, Interim Report, Volumes I-IV. Fort Collins, Colorado Environmental Research and Technology, Inc. April 1983. Preliminary Analysis of Terrestrial Biology Data Collected in the Diamond Chuitna Study area, May 3, 1982 through February 13, 1983, Interim Report, Volumes I and II. Fort Collins, Colorado. Environmental Research and Technology, Inc. and OTT Water Engineers, Inc. April 1983. 1982 Data Report Aquatic Biology, Diamond - Chuitna Project Baseline Studies. Fort Collins, Colorado.

10-3/ See Footnote 10-2, supra.

10-4/ Erickson, G.K. March 1981. Natural Gas and Electric Power Alternatives for the Railbelt. Legislative Affairs, State of Alaska, 9 pp.

Tussing, A.R. and G.K. Erickson. August 1982. Alaska Energy Planning Studies: Substantive Issues and the Effects of Recent Events (Draft). Institute for Social and Economic Research, University of Alaska, 15 pp.

See Footnote 10-1, supra.

CHAPTER 10. SUPPLEMENTAL COMMENTS

[.575] The total proposed access plan is duly influenced by the preferences of private landowners in the Susitna project area. However, the more complete the project area is opened, the more significant attendant impacts on natural values and resources of the area will result.

[I.576] It is indicated that bridges are preferred (to culverts) but specific locations or limits of use are not specified.

[.577] The transmission corridors are acceptable if state of the art siting and construction practices are employed.

[.578] Section 4.3.1 infers that there is a supply of natural gas far exceeding expected demand in Cook Inlet. This source of fuel for energy generation was abruptly discussed and insufficiently weighed as an alternative.

POWER SITE CONSIDERATIONS

From the standpoint of resource utilization we note potential flaws with the plan formulation and selection methodology. Two basic assumptions were made which limited full consideration of the hydroelectric potential of the basin.

The first assumption made was that rockfill dams should be used for comparison purposes at all damsites evaluated. We believe that valid comparisons can only be made if the type of dam that best suits the particular site is used for evaluation. To emphasize this point, it is noted that final designs use a thin arch dam at Devil Canyon and an earth fill dam at Watana rather than rockfill.

The second assumption is that hydroelectric power sites can be compared on an individual basis when evaluating the potential of a river system. This simply is not so. The entire river system must be evaluated. The four principal local factors that determine the value of a power site are flow, head or water drop, damsite characteristics and storage which determines the percentage of flow that can be regulated so that it will pass through the turbine rather than over the spillway. Alaska hydroelectric sites need a large amount of storage because most of the streamflow is in the summer months and the heaviest electric loads are usually in the winter. An excellent damsite such as Vee would receive a low rating on an individual basis because of low storage unless it is combined with a site such as Denali which develops a large amount of storage with a low, relatively inexpensive dam. All of the upper Susitna sites except Denali have inadequate storage. Adequate storage can be developed at Vee and Watana only by building very high dams
[I.579] that are very expensive because it is necessary to extend the dam above the existing canyon.

All of the sites on the upper Susitna River, i.e., Devil Canyon, Watana, Susitna No. 3, Vee, Maclaren and Denali could be developed at a cost that should be at least $1 billion less than the proposed plan by limiting Watana height to the tailwater of Susitna No. 3 and not submerging Susitna No. 3 and Vee. This would permit utilizing the full available head of about 1,550 feet versus about 1,300 feet in the proposed plan. Power could also be developed at Denali. A past decision not to install a powerplant at Denali was made when crude oil cost about $2 per barrel. Further cost reduction may be possible by utilizing either a rockfill or thin arch dam at Watana after the height reduction brings the dam back within the natural canyon.

The application appears to have rejected Denali solely on economic grounds with the single dam evaluation methods employed. The Corps of Engineers in its 1975 report on the Upper Susitna Basin also decided not to investigate Denali further because of geologic considerations. It does not appear that a thorough geologic examination was conducted to reach this conclusion.

In 1958-59, our Bureau of Reclamation drilled five holes and excavated fourteen test pits and trenches at the Denali site. Samples were sent to the laboratory at the E&R Center, Denver Colorado. After the geologic examination was complete, it was concluded that

Denali was a physically suitable damsite. Even if considerable foundation work is required, it would appear that this key damsite should not be abandoned without a thorough
[I.579] (cont. investigation. It offers the only low-cost storage in the Upper Susitna Basin.

Full system development offers the advantage of staging whereas the applicant's proposal does not. Its proposal is saddled with the enormous initial costs required for the first stage which would be the high Watana Dam. In contrast, Denali, Maclaren and Vee, along with all transmission facilities, could all be built for half the cost of Watana.

PROJECT NO. 7114
RESPONSE OF ALASKA POWER AUTHORITY TO COMMENTS OF UNITED STATES DEPARTMENT OF THE INTERIOR, OFFICE OF THE SECRETARY

COMMENT I.1 (underlined text):

"The application suffers from outdated information, particularly in the areas of load forecasting, reservoir and river computer modeling effects, fish and wildlife studies, project design, and evaluation of alternatives.

"The load forecasts included in the application reflect an economic evaluation that was conducted 2 years ago, prior to the severe drop in oil prices. The applicant, Alaska Power Authority (APA), recognizes these changed conditions and has updated its economic evaluation. This reevaluation, however, is not reflected in the application. The significant decline in projected load forecasts has large implications to many of the project assumptions which have constrained mitigation planning, for example: available water for downstream flows; mode, timing and routing of construction access; and scheduling of work.

"The computer modeling efforts would appear to be outdated since the models have either been replaced or modified. These changes make it extremely difficult to establish baseline impacts and address mitigation measures presented in Chapters 2 and 3."

RESPONSE:

The conclusion that the FERC License Application includes load forecasts that reflect economic evaluations that were conducted two years ago and that a decline in load projections has large implications on availability of water for downstream flows is incorrect.

More current load forecasts and economic evaluations, representative of available data and conditions in the spring of 1983, were used in the evaluations presented in License Application Exhibits B and D, submitted to the FERC on July 11, 1983.

The estimates of future world oil price presented in the exhibits are based on the 1983 OPEC benchmark price of $28.95/bbl and the reasoning, methodology and experience of well-known forecasters. Nine estimates of world oil price were used in the spring of 1983 to estimate Railbelt

RESPONSE TO COMMENT I.1 (cont.):

electrical energy demand, and four of the forecasts were carried through the generation expansion planning studies. FERC License Application Exhibit B, Table B.90 identifies the forecasts selected and the level of analysis to which each forecast has been carried. FERC License Application Exhibit D, Table D.24 shows present worth of system costs and net benefits of the forecasts carried through the generation planning studies.

Water for downstream flow regimes agreed to with agencies will be made available regardless of the energy demand forecast.

The most current information will continue to be provided to the FERC as available.

COMMENT I.2 (underlined text):

"The application suffers from outdated information, particularly in the areas of load forecasting, reservoir and river computer modeling effects, fish and wildlife studies, project design, and evaluation of alternatives.

"The load forecasts included in the application reflect an economic evaluation that was conducted 2 years ago, prior to the severe drop in oil prices. The applicant, Alaska Power Authority (APA), recognizes these changed conditions and has updated its economic evaluation. This reevaluation, however, is not reflected in the application. The significant decline in projected load forecasts has large implications to many of the project assumptions which have constrained mitigation planning, for example: available water for downstream flows; mode, timing and routing of construction access; and scheduling of work.

"The computer modeling efforts would appear to be outdated since the models have either been replaced or modified. These changes make it extremely difficult to establish baseline impacts and address mitigation measures presented in Chapters 2 and 3."

RESPONSE:

River and Reservoir Modeling Efforts

The HEATSIM and ICESIM models used in the License Application were adequate for estimating potential project impacts. Those models, however, are proprietary to Acres

RESPONSE TO COMMENT I.2 (cont.):

American, Inc. and are not available to be used for the current study. Therefore those models have been replaced by the SNTEMP and ICECAL models developed respectively by the U.S. Fish and Wildlife Service and Darryl Calkins of the Cold Regions Research and Engineering Laboratory of the U.S. Army Corps of Engineers.

For a more thorough discussion of hydrological, hydraulic and thermal modeling, refer to the Responses to Comments B.6, B.22, B.29 and C.31.

COMMENT I.3:

"Project studies will continue through the licensing process, and some of these studies will continue after license issuance as monitoring programs. Due to the ongoing nature of the studies and the time lag in information distribution, we consider it essential that the future studies referenced in the application be fully discussed in the application. A procedure should be established for updating the results and analyses from the ongoing and planned studies."

RESPONSE:

The Power Authority does not anticipate revising the FERC License Application to "fully discuss" referenced studies. The Power Authority will, however, continue with its approach of annually presenting study programs to agencies and other interested parties. Results of studies and analyses will continue to be provided in the form of study documents and workshops. The Power Authority anticipates that scientific environmental monitoring programs may be reflected in appropriate FERC license conditions.

COMMENT I.4:

"Many of the studies and reports that were planned for 1983 were not conducted (e.g., floristic surveys (p. E-3-193), wetlands mapping (p. E-3-201), detailed construction method (p. E-3-268), Design Criteria Manual (E-3-150), analysis of instream flows and temperatures (p. E-3-189) etc.). We consider it necessary that a study update be provided to our Fish and Wildlife Service (FWS) indicating which studies have been canceled, delayed or modified and which are still planned."

RESPONSE TO COMMENT I.4:

This Comment summarizes several concerns that are addressed more explicitly elsewhere. Responses to the specific Comments may be found as follows:

(a) Floristic surveys (FERC License Application page E-3-193) - see the Response to Comment I.316;

(b) Wetlands mapping (FERC License Application page E-3-201) - see the Responses to Comments I.322 and I.330;

(c) Detailed construction methods (FERC License Application page E-3-268) - see the Responses to Comments I.391, B.42 and I.425;

(d) Design construction manual (FERC License Application page E-3-150) - see the Responses to Comments I.119 and B.42;

(e) Analysis of mainstem flows and temperatures (FERC License Application page E-3-189) - see the Response to Comment I.149.

COMMENT I.5:

"The intent of the Fish and Wildlife Coordination Act (16 U.S.C. 661, et seq.) and the National Environmental Policy Act (NEPA) (42 U.S.C. 4371 et seq.) is that environmental resources be given equal consideration with project features. Consistent with NEPA, as well as the applicant's Mitigation Policy (Appendix 3.A), avoidance of adverse impacts should be given priority as a mitigation measure. We have found this generally not to be the case, for example: mode, timing and routing of construction access; scheduling of work; type and siting of construction airstrips, camps, villages, and permanent town; recreation development; and instream flow regime."

RESPONSE:

The Power Authority feels that the proposed Project reflects a realistic balancing of engineering, economic and environmental considerations. In this context, environmental considerations include not only fish and wildlife aspects, but also consideration of archaeological resources, socioeconomic impacts, current and future

RESPONSE TO COMMENT I.5 (cont.):

recreation and land use plans. In short, the incorporation of environmental considerations is deeply embedded in basic project development and design. Please also see Responses to Comments I.346, I.542 and I.552.

The Power Authority's response to the January 14, 1983 USFWS letter provides examples of project features that have been modified in response to environmental concerns.

The Power Authority anticipates that the DEIS will describe reasonable mitigation and alternatives.

REFERENCES

Alaska Power Authority, Susitna Hydroelectric Project FERC License Application Project No. 7114-000 (1983) Volume 10B, U.S. Fish and Wildlife Service Letter on the Draft License Application (January 14, 1983), previously submitted to the FERC on July 11, 1983.

Alaska Power Authority, Susitna Hydroelectric Project FERC License Application Project No. 7114-000 (1983) Volume 10B, Response to U.S. Fish and Wildlife Service Letter on the Draft License Application, previously submitted to the FERC on July 11, 1983.

COMMENT I.6:

"Research of background information is frequently inadequate and incomplete. Examples, which we noted in our draft application review (included in Chapter 11 of Exhibit E), include discussions of subsistence (Chapters 3 and 5) and alternative power generation sources, specifically natural gas and geothermal (Chapter 10). The FWS provided the applicant with references and suggestions in these draft application comments."

RESPONSE:

It is believed that the subject of alternative power generation sources, particularly natural gas and geothermal, has been adequately researched as may be concluded from a review of the references contained in Volumes 2A and 9 of the License Application. Although not readily noticeable in the listings, we refer to Battelle Pacific Northwest Laboratories' Candidate Electric Energy Technologies for

RESPONSE TO COMMENT I.6 (cont.):

Future Application in The Railbelt Region of Alaska, Volume IV, October 1982 which is one of the 17 volumes referred to in the Volume 2A listing of references.

We anticipate refining our information about the Project's potential impacts on fish and wildlife resource users, including subsistence users. Recently completed household surveys of Talkeetna, Trapper Creek and Cantwell residents will help supplement the information presented in the License Application. The survey included questions on the number of persons in each household who hunt, fish and trap; where and how often they hunt, fish and trap; what species they hunt, fish and trap; and the importance of hunting, fishing and trapping for recreation, food, income and cultural pursuits. The results of the survey are being tabulated and the results will be available in March 1984.

REFERENCES

Battelle Pacific Northwest Laboratories, Railbelt Electric Power Alternatives Study, Volume 1-17, prepared for the Office of the Governor, State of Alaska (1982), previously submitted to the FERC on July 11, 1983.

Volume IV, Candidate Electric Energy Technologies for Future Application in the Railbelt Region of Alaska (October 1982).

COMMENT I.7:

"Potential major project impacts to fish and wildlife resources still lack an adequate level of quantification. Examples include: fishery resources and changes downstream of Talkeetna; changes in reservoir and river temperatures, water quality and ice processes; and wetlands impacts. Other examples are noted throughout our specific comments. The potential impacts to these resources should be quantified and then evaluated over the life of the project. Only after that is accomplished can specific, effective mitigation measures emerge. We consider quantification of existing resources and impacts and a specific, effective mitigation plan essential to the development of an acceptable environmental impact statement."

RESPONSE TO COMMENT I.7:

The Power Authority feels that the current level of quantification is more than adequate for mitigation planning. Past reports have specifically addressed the habitat relationships between fish and flow for existing and post-project conditions (ADF&G 1981). See Response to Comment I.14. Of course, quantification is still ongoing with the objective of finalizing mitigation plans.

The mitigation plan presented in the License Application did provide, however, for specific measures to maintain the existing resources. For example, in addition to proposing operating flows that represent a compromise between optimum economic operation and minimum environmental impact, to maintain slough habitat for spawning salmon, the Power Authority has proposed specific modifications (use of protective berms, structural modifications for access and enhanced groundwater flow, etc.). The Power Authority has also proposed a monitoring program to assure that these measures achieve their goals. Based on other studies and projects in the Pacific Northwest, Canada and Alaska, the measures described for slough modification are expected to have a high level of success (see Response to Comment B.9). Alternative mitigation measures to maintain the productivity of the Susitna system that may potentially be impacted were also proposed in the License Application.

Furthermore, the applicant will be working closely with resource agencies throughout the next year in the Settlement Process to arrive at mutually acceptable final mitigation plans.

REFERENCES

ADF&G, Susitna Hydro Aquatic Studies, Subtask 7.10 - Phase I Final Draft Report, Aquatic Habitat and Instream Flow Project (1981).

COMMENT I.8:

"In several of the chapters of Exhibit E we are confronted with mitigation options that are designed to address adverse impacts. For example, in Chapter 3 the potential value of

COMMENT I.8 (cont.):

spiking spring flows for salmon out-migration and the installation of a fifth portal on the multi-level intake structure are discussed. However, neither of these proposals are incorporated into the mitigation plan. If these options have validity, they should be incorporated into the project design and operational plan."

RESPONSE:

The reason that these options (and other similarly mentioned options) have not been incorporated into the Mitigation Plan is that they are currently under consideration by the Power Authority. For example, the Alaska Department of Fish and Game (1983) has attempted to establish the relationships between habitat variables and outmigration, particularly for chum salmon. Results thus far indicate that outmigration is most highly correlated with time of year. However, this correlation is not strong. Therefore, ADF&G is continuing studies to better understand these relationships. When completed, measures to avoid or minimize any potential impacts will be incorporated into the mitigation plans, if necessary.

The option of adding a mid-level intake should be evaluated in light of the temperatures anticipated during the second year of filling. See also Response to Comment B.30.

The Power Authority anticipates that the DEIS will reasonably describe feasible mitigation options, including those described in the License Application and perhaps new options developed in the EIS process.

REFERENCES

ADF&G, Susitna Hydro Aquatic Studies, Phase II Basic Data Reports for 1982, 5 Volumes (1983), previously submitted to the FERC on October 31, 1983.

Synopsis of the 1982 Aquatic Studies and Analysis of Fish and Habitat Relationship (1983).

COMMENT I.9:

"Mitigation which is proposed should have proven success in Alaska, or in a similar environment. Examples include: the proposals to improve habitat through controlled burning; hatchery propagation of Arctic grayling; and various manipulations of the upper Susitna River sloughs."

RESPONSE:

Please refer to the Responses to Comments C.88, F.50 and F.51 for a discussion of terrestrial mitigation feasibility and Responses to Comments B.8, I.72, I.133, I.134, I.135 and I.148 for a discussion of slough modification.

COMMENT I.10:

"Project studies should begin to focus on identifying enhancement opportunities which the project provides. The present task is to identify those resources which would be adversely affected and attempt to 'correct' these problems. For example, without examining water quality and quantity changes in terms of opportunities to improve habitat, we cannot satisfactorily examine whether there exists a realistic potential to trade-off losses to one species for another, and, as a by-product, identify enchancement opportunities."

RESPONSE:

The Power Authority feels that project studies are adequate for the evaluation of the existing conditions and the potential impacts that the Project may create.

The Power Authority is reviewing the potential for aquatic enhancement along with mitigation. The Power Authority's mitigation policy is to have "no net loss to the resource," thus mitigating the impacts of the Project. There may be various enhancement opportunities and the Power Authority intends to identify and quantify these as appropriate. The system of models and supporting analyses developed by the Power Authority should identify various trade-offs between

RESPONSE TO COMMENT I.10 (cont.):

species, if any significant trade-offs are anticipated, with alternative flow regimes. Some of these trade-offs will provide enhanced habitat for some species/life stages. Thus, in establishing flow regimes, enhancement for different species/life stages will be one of the options available to decisionmakers.

The Power Authority anticipates that the DEIS will summarize and incorporate models, supporting analyses and basic information regarding enhancement opportunities.

COMMENT I.11:

"The FWS defines enchancement as the '* * * development or improvement of wildlife resource values of the area affected by the project beyond that which would occur without the project' (F.R. Vol. 44, No. 98, p. 29305). We consider enhancement to be habitat improvements beyond mitigation and <u>not</u> synonymous with improvement of habitat for mitigation. We believe the applicant should adopt these definitions."

RESPONSE:

The Power Authority used the term "enhancement" in the same context as employed by the Department of the Interior in their Comment I.394.

The Power Authority anticipates that the DEIS will utilize the appropriate definitions under NEPA.

COMMENT I.12:

"We strongly support the applicant's proposed establishment of an interagency monitoring program (p. E-3-180). This program should be funded by the project, containing representatives from appropriate State, Federal and local agencies. On-site representation from the FERC would be highly desirable to maximize the responsiveness of the team. The board should have the authority to recommend modifications of how activities are conducted to assure that

COMMENT I.12 (cont.):

mitigation is effective. Recommended changes in the mitigation program should be adopted through a mechanism incorporated into the license as a binding article, mutually acceptable to all concerned bodies."

RESPONSE:

The Power Authority anticipates continuing to work with interested resource agencies (see Responses I.119B and I.147). Suitable mitigation mechanisms will be developed in the Susitna Settlement Process (see Response to Comment F.1).

COMMENT I.13:

"Your attention is also called to Attachment A of our Chapter 3 comments in the enclosure. Attachment A represents those items which we believe should be conditions of any license issued based upon the current application documents."

RESPONSE:

See Response to Comment I.425.

COMMENT I.14:

"We conclude that the applicant's request poses serious environmental problems from a lack of quantification of natural resources and an inability to formulate proper mitigation and enhancement plans. We recommend that FERC carefully consider all of these aspects of the project when processing the application. The recommendations supplied above and in the accompanying detailed comments should be used in preparation of any environmental impact statement issued for this project and in any terms and conditions of any license issued."

RESPONSE:

As stated elsewhere (see Response to Comments C.34, F.44 and F.46), the Power Authority feels that sufficient quantitative information has been provided to permit an independent analysis of the project by the FERC, and to enable the FERC to prepare the Draft EIS, a decision-making document. The CEQ NEPA Regulations, 40 C.F.R. § 1500.1(c), state that "[t]he NEPA process is intended to help public

RESPONSE TO COMMENT I.14 (cont.):

officials make decisions that are based on understanding of environmental consequences, and take actions that protect, restore and enhance the environment." Thus, as with other FERC licenses for major hydroelectric projects, the Power Authority anticipates that the FERC License for this Project will include license terms and conditions reflecting environmental matters.

Quantitative assessments of baseline conditions and project impacts were provided in the Application and supporting documents. Specific mitigation programs and their construction and operating costs were also proposed.

COMMENT I.15:

"Chapter 2 has been vastly improved qualitatively from the draft we reviewed last year 2-1/, however, it still does not provide the quantification necessary for assessing project-related impacts or formulating a mitigation plan. In particular, Chapter 2 fails to fully discuss all of the six habitat types identified by the Alaska Department of Fish and Game (ADF&G) Susitna Hydro Aquatic Studies Program; impacts to riparian zones; resources and potential impacts downstream of the Talkeetna River; groundwater relationship between the sloughs and mainstem; and enhancement opportunities."

"2-1/ See FWS letter dated January 14, 1983 to Eric P. Yould, APA. Included in Chapter 11.

RESPONSE:

The Power Authority anticipates that the DEIS will describe these matters with reasonable qualitative and quantitative detail. See the Response to Comment I.10.

FERC License Application Chapter 2 provides information necessary for assessing project-related impacts and formulating a mitigation plan. See the Responses to Comments C.63, C.64 and C.65.

COMMENT I.16:

"The modeling efforts discussed in Chapter 2 suffer from lack of verification and/or insufficient input data (see our comments on pages E-2-62, E-2-87, E-2-88, E-2-114, E-2-117, E-2-118, E-2-119, E-2-121, E-2-123, etc.). Additional modeling efforts should be undertaken to address post-project conditions regarding sediment and bedload transport (see our comments on pages E-2-34, E-2-84, and E-2-96)."

RESPONSE:

Please refer to the Responses to Comments I.30, I.37, I.38, I.39, I.46, I.47, I.48 and I.51. Also, please refer to the Responses to Comments B.6, B.16, B.22, B.23, B.26, B.29, B.31, B.32, B.33, B.38, C.43 and C.44 for discussions of stream and reservoir temperatures and temperature modeling.

DOI Comments I.21 and I.41 refer to pH and total dissolved solids, conductivity, significant ions, alkalinity and metals, and do not refer to sediment and bedload transport. Please refer to the specific Response to Comment I.36 and to the Response to Comments B.14 and C.38, for a description of sediment and bedload transport.

COMMENT I.17:

"<u>CHAPTER 2.</u> <u>WATER USE AND QUALITY</u>

"The chapter should also describe studies, ongoing and proposed, which may address the concerns we have identified."

RESPONSE:

Please refer to the Responses to Comments B.6 through B.9 for discussions of temperatures, flow regimes, lower river and mitigation. Also, please refer to Responses to Comments C.32, C.34, C.39, C.40 and C.41, regarding availability of information from additional and on-going studies for inclusion in the EIS process.

COMMENT I.18:

"Page E-2-3: 2-BASELINE DESCRIPTION: The discussion divides the Susitna River into two habitat components between the dam sites and the Talkeetna River; the mainstem and the sloughs. Below the Talkeetna River, the discussion is non-specific regarding habitat sites. In constrast, the ongoing ADF&G studies 2-2/ have identified six habitat types utilized moderately to heavily by salmon. These are: tributaries, tributary mouths, upland sloughs, side sloughs, side channels, and mainstem. Each of these habitat types would undergo a different degree of impact due to the project. Some habitats could become less useful for one life phase but may become more valuable for another life phase. Only by examining potential impacts in all six habitat types can mitigation and enhancement opportunities be identified. In addition to the habitat types identifed by ADF&G, the adjacent wetlands should be fully described and the potential impacts to these habitats discussed in later sections, both upstream and downstream from the mouth of the Talkeetna River."

"2-2/ ADF&G 1983. Synopsis of the 1982 Aquatic Studies and Analysis of Fish and Habitat Relationships. Prepared for the APA."

RESPONSE:

As part of ongoing studies for the proposed Project, the Alaska Department of Fish and Game (ADF&G) has provided additional detail to the habitat classification for areas between Talkeetna and Devil Canyon. The ADF&G has done this to further examine and refine the analysis of potential impacts on each habitat type as a result of the Project.

The Arctic Environmental Information and Data Center (AEIDC) is using this information in combination with other information (reservoir operations, modeling studies, temperature modeling studies, etc.) to further provide a detailed examination of the potential changes within each habitat in response to the Project. The results of this examination will be incorporated into the mitigation planning efforts. The AEIDC has already completed (in January 1984) a final report which demonstrates the methodology to achieve this goal.

RESPONSE TO COMMENT I.18 (cont.):

Potential impacts to wetlands adjacent at the lower Susitna River will be addressed during impact assessment refinement efforts. See also Responses to Comments B.9, I.7, I.22, I.50, I.84, I.85, I.278 and I.591.

REFERENCES

Arctic Environmental Information and Data Center (AEIDC), Susitna Hydroelectric Project Aquatic Impact Assessment: Effects of Project-Related Changes in Temperature, Turbidity and Stream Discharge on Upper Susitna Salmon Resources During June Through September (January 1984), previously submitted to the FERC on January 20, 1984.

COMMENT I.19:

"Page E-2-19: 2.3-Susitna River Water Quality: Paragraphs 6 and 7: It is noted that 22 water quality standards are exceeded, under natural conditions. We disagree with the conclusion that, since these conditions are naturally occuring, they have an insignificant effect upon the aquatic organisms. We recommend a further examination of how changes in water quality would affect aquatic organisms. An examination of the available literature may be sufficient."

RESPONSE:

The Power Authority anticipates that the DEIS will incorporate available literature. See also Responses to Comments C.31 and C.34.

COMMENT I.20:

"Page E-2-32: 2.3.7-Nutrients: The communities of Cantwell, Trapper Creek, and Talkeetna would be affected by changes in water quality relative to sewage treatment, drinking water, etc. Baseline descriptions and, in latter sections, impacts attributable to the project should be provided."

RESPONSE TO COMMENT I.20:

It is impossible to respond to this Comment in a specific manner as the commentor does not specify which water quality parameters are felt to be of concern. Please also note that all point discharges will be constrained by NPDES and all non-point discharges by Alaska DEC Water Quality Standards.

The community of Cantwell, Alaska lies outside the drainage basin of the Susitna Hydroelectric Project and, therefore, should not be significantly affected by changes in water quality related to the Project.

Residents of Trapper Creek and Talkeetna dispose of household sewage via individual septic systems and obtain potable water from individual water wells (see FERC License Application page E-5-13). Project-related changes in water quality which might affect the sewage treatment of drinking water of Trapper Creek or Talkeetna are not anticipated.

COMMENT I.21:

"Page E-2-34: (e) pH: Due to the wide pH range (6.0 to 8.1) measured above Gold Creek, and the potential for increased acidity due to inundation of bogs by the reservoirs, we recommend that pH monitoring be continued."

RESPONSE:

Flooding of acidic bogs is not anticipated to cause significantly increased acidity in the proposed reservoir system. The Susitna River drains thousands of square miles of mountains and highland tundra. Much of the tundra is underlain by glacial till and covered by acidic, saturated, peaty soils. Acidic bogs (*Sphagnum* bogs commonly have pH less than 4.5) are common on the tundra terrain and perhaps in the reservoir inundation zone. However, the waters of the river basin maintain moderate to high (46-88 mgl^{-1} $CalO_3$) alkalinity during all seasons. The pH of the project reservoirs are expected to be largely regulated by the carbonate-bicarbonate buffering system of the waters in the Susitna River and smaller peripheral tributaries. The alkalinity of the tributaries and therefore the reservoirs reflects the biogeochemistry of the entire drainage basin and not merely the relatively small, recently inundated impoundment areas.

RESPONSE TO COMMENT I.21 (cont.):

pH monitoring is not anticipated to be necessary relative to acidity changes caused by inundation of bogs. See also Responses to Comments C.48 and C.59.

COMMENT I.22:

"Page E-2-40: 2.4.4-Hydraulic Connection of Mainstem and Sloughs: The water temperature relationship between the mainstem and the sloughs (as well as other water quality parameters) must be established. To this end, one slough (#9) has been closely examined and a second slough, #8A, has been preliminarily examined. These examinations have focused on the groundwater relationship. According to Tony Burgess (Acres American), in his Susitna Hydro Exhibit E Workshop presentation (December 1, 1982) on groundwater upwelling and water temperature in sloughs, the groundwater regime can be modeled, but locally the match is not very good: The groundwater temperatures near the surface do not match the predicted temperatures. Continued study is indicated for slough #9. After an understanding is achieved for sloughs #9 and #8A the program needs to be expanded to other sloughs, possibly sloughs #11, #19, #20 and #21. These sloughs have been more intensively examined than other sloughs in this reach of the Susitna River. Please outline the studies for these slough investigations."

RESPONSE:

A similar comment was made by the DOI U.S. Fish and Wildlife Service on the draft License Application in a letter dated January 14, 1983 contained in Exhibit E, Chapter 11 of the License Application. The cited comment is on the fourth page of USFWS specific comments, referenced as 2.3(a)(i) - Sloughs: Paragraph 1.

The March 1983 Acres American Draft Slough Hydrogeology Report discusses the discharge and temperature relationships among the Mainstem Susitna and the sloughs. Additional studies of the discharge and temperature relationships among the mainstem Susitna and the sloughs are ongoing.

It is anticipated that results of the ongoing studies will be available for use by the FERC by April 1984. Additional discussion of the relationships between mainstem and slough hydrologic conditions has been given in the Responses to Comments B.18 and B.19.

RESPONSE TO COMMENT I.22 (cont.):

The Power Authority anticipates that the DEIS will analyze the adequacy of previous studies.

REFERENCES

Alaska Power Authority, Susitna Hydroelectric Project FERC License Application Project No. 7114-000 (1983) Volume 10B, U.S. Fish and Wildlife Service Letter on the Draft License Application (January 14, 1983), previously submitted to the FERC on July 11, 1983.

Acres American, Inc., Draft, Susitna Hydroelectric Project Slough Hydrogeology Report (March 1983), previously submitted to the FERC on July 11, 1983.

COMMENT I.23:

"Page E-2-44: 2.6.2-Fishery Resources: The recently conducted salmon incubation study 2-3/ indicated that chum salmon outmigrate after a particular number of degree-days are exceeded, coincidental with the receeding limb of the spring hydrograph. Further investigation is necessary to fully understand the need for peaking spring flows in relation to chum salmon outmigration."

"2-3/ Wangaard, D.B. and C.V. Burger. 1983. Effects of Various Temperature Regimes on the Incubation of Susitna River Chum and Sockeye Salmon. FWS. Prepared for the APA."

RESPONSE:

Although Wangaard and Burger (1983) did establish the relationship between temperature and incubation rates, they did not indicate that chum salmon outmigration was coincidental with the receding limb of the spring hydrograph. The hydrograph for the Susitna River varies considerably from year to year during the open water season.

Therefore, the establishment of any correlation between outmigration and the receding limits of the hydrograph would be difficult to achieve.

This is demonstrated in Table I.23.A below which presents the average weekly discharges at the Gold Creek USGS gaging

RESPONSE TO COMMENT I.23 (cont.):

station for the period April 1 through June 30, when peak outmigration of juvenile chum salmon occurs, for the years 1981 and 1982.

Extensive studies to determine the relationship between environmental conditions and chum salmon (and other salmonid species) outmigration from the Susitna have been conducted by the Alaska Department of Fish and Game (ADF&G, 1983). Studies in 1982 suggested that peak outmigration of chums may have occurred prior to June 18. The ADF&G outmigrant trap was intalled at the Talkeetna Station on this date and the results were that "the number of outmigrants peaked about the time of installation and rapidly decreased after this time" (ADF&G 1983, page 71). Although insufficient data were available to provide definitive statements on outmigration, the strongest factor relating to outmigration was time of season. The relationship with discharge was modest and the relationship with temperature was poor.

During 1983, two outmigrant traps were operated by ADF&G at the Talkeetna Sampling Station to obtain additional information on outmigration. Also, coded wire tagging was done on several sloughs upstream of the outmigrant traps. The analysis of the data from these studies is currently being performed and will be available in spring 1984. These studies will contribute to the understanding of the need for peaking spring flows in relation to chum salmon outmigration.

RESPONSE TO COMMENT I.23 (cont.):

Table I.23.A

Average Weekly Discharge of the Susitna River

As Measured at the Gold Creek USGS Gaging Station

Week	Average Weekly Discharge 1981 (cfs)	1982 (cfs)
April 1-7	1700	1500
8-14	1771	1500
15-21	1886	1657
22-28	2443	2200
April 29-May 5	5623	3386
May 6-12	20400	5100
13-19	20486	15000
20-26	13500	20143
May 27-June 2	21943	22714
June 3-9	18629	26143
10-16	16914	21857
17-23	18200	28857
24-30	21257	28000

RESPONSE TO COMMENT I.23 (cont.):

REFERENCES

ADF&G, Susitna Hydro Aquatic Studies, Phase II Basic Data Reports for 1982, 5 Volumes (1983), previously submitted to the FERC on October 31, 1983.

Synopsis of the 1982 Aquatic Studies and Analysis of Fish and Habitat Relationship (1983).

Wangaard, D.B. and C.V. Burger, Effects of Various Temperature Regimes on the Egg and Alevin Incubation of Susitna River Chum and Sockeye Salmon, U.S. Fish and Wildlife Service (1983), previously submitted to the FERC on November 29, 1983.

COMMENT I.24:

"Page E-2-58: 3.4.1-Range of Flows: Paragraph 2: The assumption that Case D flows would result in '... essentially no impact to the downstream fishery during the anadromous fish spawning period,' fails to recognize impacts other than flows (e.g. temperature, turbidity, water quality, etc.). In addition, the recent examination of access to nine sloughs 2-4/ indicated that the Case D maximum flow of 19,000 cubic feet per second (cfs) could create acute access problems in several sloughs. Five of the nine sloughs achieve unrestricted access at flows greater than 20,000 cfs. Evidence from the ADF&G studies indicate that the naturally-occuring 1982 summer flows resulted in a significant reduction of available habitat for chum salmon in sloughs. 2-5/ Case D flows could result in similar significant reductions in available habitat."

"2-4/ See Footnote 2-2. [Footnote 2-2/ ADF&G 1983. Synopsis of the 1982 Aquatic Studies and Analysis of Fish and Habitat Relationships. Prepared for the APA.]

"2-5/ See Footnote 2-2, supra."

RESPONSE:

During the spawning period, anticipated changes in temperature, turbidity and other water quality paramaters are not expected to significantly affect the fishery.

RESPONSE TO COMMENT I.24 (cont.):

Mainstem turbidity is expected to be in the range of 50 to 300 NTUs under with-project conditions during the summer months. At these ranges, little difference in the apparent transparency over natural conditions is expected. If anything, turbidity will be reduced. This is true for all operating scenarios described with the FERC License Application. See also the Responses to Comments C.49, Figure 1 and I.32.

Temperature regimes under with-project conditions during August are not expected to be outside the range of temperatures observed under natural conditions. Under the Watana-only scenario, temperature of the mainstem is expected to be approximately equivalent to existing conditions (AEIDC 1984). Under the two-dam scenario, water temperature in the mainstem is expected to be 1-2°C lower during the month of August (AEIDC 1984). Under both scenarios, water temperature of the mainstem is expected to be 2-3°C warmer in September than under natural conditions (AEIDC 1984).

Other water quality parameters are not expected to be significantly changed under with-project conditions regardless of the operating regime defined.

For a detailed discussion of access conditions related to mainstem discharge, please refer to the Response to Comment I.94. Based upon the information presented in FERC License Application Figure E.2.39, a discharge of 19,000 cfs is equalled or exceeded approximately 70 percent of the time. However, in September, this discharge is equalled or exceeded only approximately 15 percent of the time. In 1982, average discharge for August was 15,000 cfs during which adult salmon did gain access to the sloughs for spawning.

REFERENCES

Arctic Environmental Information and Data Center (AEIDC), Susitna Hydroelectric Project Aquatic Impact Assessment: Effects of Project-Related Changes in Temperature, Turbidity, and Stream Discharge on Upper Susitna Salmon Resources During June Through September (January 1984), previously submitted to the FERC on January 20, 1984.

COMMENT I.25:

"Page E-2-59: 3.6.1-Susitna River Fishery Impacts: As indicated in Section 3.5-Energy Production and Net Benefits, the 12,000 cfs maximum August flow was established through a power production versus net economic benefits analysis. The flow level was established prior to an evaluation of access to sloughs in the Susitna River upstream of the Talkeetna River and is not biologically based. The 1982 ADF&G studies 2-6/ and Trihey's (1982) 2-7/ work on slough access indicate flows of 12,000 cfs would restrict access to six of the nine sloughs studied."

"2-6/ See Footnote 2-2. [Footnote 2-2/ ADF&G 1983. Synopsis of the 1982 Aquatic Studies and Analysis of Fish and Habitat Relationships. Prepared for the APA.]

"2-7/ Trihey, E.W. 1982. Preliminary Assessment of Access by Spawning Salmon to Side Slough Habitat above Talkeetna. Prepared for the APA."

RESPONSE:

Quantitative analysis of mainstem discharge necessary to provide access to the slough spawning area was considered in the selection of the 12,000 cfs minimum flows for the August through mid-September period. The selection of the 12,000 cfs minimum was based in part upon results presented by E. W. Trihey (1982) in which it is stated:

> "Upstream passage into Slough 9 by adult chum salmon would not appear to be restricted when mainstem discharge were 18,000 cfs or higher. Access becomes increasingly more difficult as mainstem discharge decrease (sic). At stream flows of 12,000 cfs and less an acute access problem exists."

This consideration is discussed in FERC License Application Exhibit E, Chapter 3 on pages E-3-96 and E-3-97. Please

RESPONSE TO COMMENT I.25 (cont.):

refer to the Response to Comment I.94 for further discussion related to this question.

REFERENCES

Trihey, E. W., Preliminary Assessment of Access by Spawning Salmon to Side Slough Habitat Above Talkeetna, Draft Report (1982), previously submitted to the FERC on July 11, 1983.

COMMENT I.26:

"Page E-2-60: 3.6.2-Tributary Fishery Impacts: According to ADF&G, 2-8/ the Gash Creek mouth (River mile (RM) 111.6) could become perched given the applicant's proposed post-project flows. Spawning coho salmon were observed in this creek during 1981 and 1982."

"2-8/ See Footnote 2-2. [Footnote 2-2/ ADF&G 1983. Synopsis of the 1982 Aquatic Studies and Analysis of Fish and Habitat Relationships. Prepared for the APA.]"

RESPONSE:

According to our analysis, Gash Creek is expected to degrade (R&M Consultants, 1982, pages 4-12). However, due to inaccessibility, this assessment consisted of an aerial reconnaisance which revealed fairly fine-grained sediments.

The ADF&G Synopsis Report cited by the Department of the Interior makes no reference to post-project flows. The report states that, "Gash Creek, a small tributary near river mile 111.6, has had significant numbers of spawning coho during 1981 and 1982. This creek flows through a culvert under the Alaska Railroad. Dewatering of the side channel during very low flow periods could potentially block access" (i.e., access into the side channel).

Apparently, there is no reference to perching of the mouth of Gash Creek. Hence, statements in the ADF&G Synopsis report are not inconsistent with the results of the R&M report. However, because of the significant numbers of spawning coho and the level of analysis to determine that Gash Creek will degrade, the perching potential of Gash Creek will be reexamined.

COMMENT I.27:

"Potential fishery impacts related to post-project flows above the mouth of the Talkeetna River are not limited to access to side sloughs (for chum salmon) or tributaries (for chinook, coho, and pink salmon). The analysis of impacts to salmon should be by life phase, i.e. adult passage, spawning, incubation, rearing, and outmigration. The habitats used moderately or heavily by salmon for at least one life phase are tributaries, tributary mouths, upland sloughs, side sloughs, side channels, and the mainstem. 2-8/ As a species proceeds from one life phase to another it frequently proceeds to a habitat type better suited for the next life phase. Access would need to be assured at times other than that which allows adult chums to pass into side sloughs. Post-project changes in water quality and quantity could severely degrade these habitats. Based upon the 1982 flows, ADF&G studies 2-9/ indicate that significant reductions in available spawning habitat in the side sloughs could occur post-project. Post-project flows could also significantly change the existing relationship between the mainstem and the other habitats previously mentioned. Post-project changes in other water quality parameters would affect the fisheries. For example, burbot show a high positive correlation with turbidity levels, while juvenile coho salmon are negatively correlated. 2-10/"

"2-8/ See Footnote 2-2. [Footnote 2-2/ ADF&G 1983. Synopsis of the 1982 Aquatic Studies and Analysis of Fish and Habitat Relationships. Prepared for the APA.]

"2-9/ See Footnote 2-2, supra.

"2-10/ See Footnote 2-2, supra."

RESPONSE:

Studies of impacts to salmon above the mouth of the Talkeetna have not been limited to access to side sloughs or tributaries. Studies have been undertaken in the mainstem river, side sloughs, side channels and upland sloughs to determine existing habitat conditions and use by adults, incubating eggs and juveniles. Please refer to the Responses to Comments I.18, B.9, B.10, B.37, B.57, C.66 and F.2.

Neither access to the tributaries nor the tributaries themselves will be significantly impacted by the Project. See the Response to Comment B.11 regarding tributary mouth perching above Talkeetna. This habitat type (tributaries) is where the majority of the upstream (above Talkeetna), migrating, Susitna salmon spawn. Approximately 100 percent of the chinook, pink and coho spawning, 85 percent of the chum spawning and 20 percent of the sockeye spawning occurs in the tributaries (ADF&G 1983a). Because there will be no effect on the tributaries the major emphasis has been placed on the other habitat types which will be affected.

Studies have indicated that access to side sloughs could potentially be impacted by projected flow regimes. Mitigation measures have been proposed to avoid or minimize this potential impact. Other studies, particularly by ADF&G, refine the relationship between flows and habitat. These studies are specifically designed to examine the relationships between river flows and individual life stages. For example, ADF&G has specific groups in the SuHydro Study Team that examine anadromous adults and resident and juvenile anadromous species. Within the latter group, specific studies have been made on incubation rearing, and outmigration (ADF&G 1983b). In addition, ADF&G has specific studies on adult passage and spawning (ADF&G 1983b). Also, the U.S. Fish and Wildlife Service (Wangaard and Burger, 1983) has specifically investigated the effects of various water temperature regimes on the egg and alevin incubation of Susitna River chum and sockeye salmon.

Although with-project flows may change water quantity and, perhaps, quality (e.g., temperature) it is not necessarily true that these changes will result in significant habitat degradation. For example, natural overtopping of the berms at the head end sloughs can destroy favorable habitat by disrupting substrate and causing deposition of silt. Under with-project conditions, the frequency of overtopping is expected to decrease, particularly if protective berms are added. In this example, the deposition of silt and scouring of substrate is expected to decrease with the consequent habitat improvement over existing conditions.

As a species moves between habitats, it should be recognized that it does not always freely migrate to an optimum habitat. Instead it may be forced to one that will allow the slight advantage of survival versus mortality. For example, a juvenile in a tributary may either have the choice of outmigrating during freezeup or staying and not surviving. The alternative habitat may be the mainstem

RESPONSE TO COMMENT I.27 (cont.):

river but the conditions in this habitat are not necessarily (or even usually) optimum.

This habitat may be better suited for the next life phase, particularly if it is a choice between survival and mortality. However, this does not preclude that this alternative habitat might be significantly improved due to the Project.

The 1982 studies in the sloughs by ADF&G (1983) considerably expanded the information base on side sloughs. Also, incremental analyses (IFG analysis) of instream flow versus fish habitat for selected side sloughs were initiated in the 1982 field season to determine how spawning activity by salmon in this habitat-type would respond to various flows. These studies were completed during the 1983 field season (analyses are expected to be complete in spring 1984). Therefore, the 1982 indications by ADF&G are being refined. Refinement of the relationships between mainstem flow and the other habitat-types is also being completed (primarily in spring to summer 1984). Therefore, prior to completion of these studies the statement by the USFWS that "[b]ased upon the 1982 flows, ADF&G studies 2-9 indicate that significant reductions in available spawning habitat in the side sloughs could occur post-project" is premature. Also, this statement does not account for the mitigation plans proposed by the Power Authority that are designed to provide for the existing productivity of spawning habitat. See the Response to Comment B.9 for detail concerning these mitigation plans.

The Power Authority anticipates that the DEIS will summarize and incorporate prior work on fisheries impacts.

REFERENCES

Alaska Department of Fish and Game, Draft 1983 Phase II Adult Anadromous Fish Investigation Report (1983a).

ADF&G, Susitna Hydro Aquatic Studies, Phase II Basic Data Reports for 1982, 5 Volumes (1983), previously submitted to the FERC on October 31, 1983.

Synopsis of the 1982 Aquatic Studies and Analysis of Fish and Habitat Relationship (1983).

RESPONSE TO COMMENT I.27 (cont.):

Wangaard, D. B. and C. V. Burger, Effects of Various Water Temperature Regimes on the Egg and Alevin Incubation of Susitna River Chum and Sockeye Salmon, U.S. Fish and Wildlife Service (1983), previously submitted to the FERC on November 29, 1983.

COMMENT I.28:

"It should also be recognized that post-project changes in water quality and quantity would (given Case C) result in identifiable changes in the Susitna River down to the estuary. 2-11/ The Arctic Environmental Information and Data Center (AEIDC) 2-12/ concluded Case C would result in an increase in flows of 127.2% at Susitna Station (downstream of the Yentna River) during March. During July, flows below the Chulitna River would be decreased by 25%, and at Susitna Station by 12%. Identifiable changes in river temperature 2-13/ and other water quality parameters (e.g. turbidity) would also be predicted below the Chulitna River. These project-related changes would be attenuated downstream; however, our knowledge of the fishery resources and habitats downstream of the mouth of the Talkeetna River is considered to be an order of magnitude below that in the Devil Canyon to Talkeetna River reach. 2-14/ At present, escapement data are not available for the Talkeetna and Chulitna Rivers, thus, the number of salmon dependent upon the Susitna River below the mouth of the Talkeetna River, other than for migration, is not known. It is likely many more fish are dependent upon the lower reaches of the Susitna River than on the reach above the mouth of the Talkeetna River. In addition, the Susitna River downstream from the mouth of the Chulitna River is broad, and relatively shallow; a configuration which would lead one to expect greater impacts from smaller changes in flow. Dismissal of impacts downstream of the mouth of the Talkeetna River would be premature at this time, and should be fully discussed. 2-15/"

"2-11/ AEIDC. 1983. Examination of Discharge and Temperature Changes due to the Proposed Susitna Hydroelectric Project. Prepared for the APA.

"2-12/ See Footnote 2-11, *supra*.

"2-13/ See Footnote 2-11, *supra*.

COMMENT I.28 (cont.):

"2-14/ See Footnote 2-2. [Footnote 2-2/ ADF&G 1983. Synopsis of the 1982 Aquatic Studies and Analysis of Fish and Habitat Relationships. Prepared for the APA.]

"2-15/ See Footnote 2-11, supra."

RESPONSE:

Please reference the Response to Comment B.8 and the Responses to Comments C.39 through C.41 which discuss the Lower River. Also, please refer to the Responses to Comments B.16, B.23, B.33, B.38 regarding water temperatures downstream of the confluence and Responses to Comments B.14 and C.38 on sediment and bedload transport in and downstream of the confluence area. Please refer to the Response to Comment F.13 on impacts in the Lower River.

COMMENT I.29:

"Page E-2-61: (d) Riparian Vegetation and Wildlife Habitat: The post-project instream flow regime has tremendous potential to impact the timing and extent of floods, freeze-up, and spring ice jams, as well as the riparian groundwater relationships. We do not understand how it can be stated that the regime, '...is unrelated to any of these factors.' It is stated that, '...it may be desirable to maintain riparian vegetation by simulating spring floods for a short period of time. However, the spring runoff storage is a key element of the project. Large releases for even a few days would have severe economic impact on the project. Hence, no minimum flood discharges were considered.' In response to our concern that the receeding limb of high spring flows may be important to stimulate smolt outmigration, it is stated in Chapter 11, Response W-3-026, 'When the significance of flow-related stimuli to smolt outmigration is defined, the flow regime can be adjusted.' The apparent conflict in the statements in the application should be reconciled and the environmental implications of this flow decision examined."

RESPONSE:

The statement from the FERC License Application quoted by the U.S. Fish and Wildlife Service (USFWS) that the flow regime "is unrelated to any of these factors" has been incompletely quoted. The full sentence states that "Minimum flow selection for the cases considered is unrelated to any of these factors." Please refer to the Response to Comment

RESPONSE TO COMMENT I.29 (cont.):

I.562 for a more thorough discussion of this citation which also appears in Exhibit E, Volume 3 of the License Application (page E-10-110).

The USFWS also includes riparian groundwater relationships as one of the factors. The License Application did not state that groundwater relationships were not related to minimum flow nor were these relationships excluded from consideration of project minimum flow selection. The License Application studied the relationship between groundwater and changes in mainstem flow. The goal of these studies has been to determine if such a relationship exists. There does not appear to be an apparent conflict between statements in the Application. The flow regime proposed in the License Application has examined both economic and environmental requirements. Results from both the ongoing studies and the negotiation process may refine this regime.

COMMENT I.30:

"Page E-2-62: (e) Water Quality: The pre-versus post-project temperature changes should be described throughout the year."

RESPONSE:

Please refer to the Response to Comment B.6. In summary, simulations for post-project reservoir and stream temperatures are considering entire water years.

COMMENT I.31:

"At the present time reservoir release temperatures are available for only one year (1981). With only one year's data it is impossible to estimate the range of effects. In addition, the data indicate that 1981 temperatures were atypical when compared to computer-predicted temperatures for water years 1968 to 1982. Of the fifteen years examined by AEIDC 2-16/, 1981 was the only year in which temperatures declined from June to July."

"2-16/ See Footnote 2-11. [Footnote 2-11/ AEIDC. 1983. Examination of Discharge and Temperature Changes due to the Proposed Susitna Hydroelectric Project. Prepared for the APA.]"

RESPONSE TO COMMENT I.31:

Please refer to the Response to Comment B.6. In summary, simulations are being carried out for three water years representing years of low, average and high flows and for three water years representing cold, average and warm winter conditions.

COMMENT I.32:

"Other pre- versus post-project water quality changes should also be described (e.g. turbidity, sediment, metals, nutrients, etc.)."

RESPONSE:

Project-related water quality changes are anticipated to include changes in concentration and temporal distribution of suspended sediments. Since nutrients and metals are chemically associated with suspended sediments in relatively large concentrations (when compared to their dissolved fraction), we are currently focusing some of our attention on studies to determine the ecological effects of altering the Susitna River suspended sediment regime.

The effects of the Project will be a reduction in the amplitude of the temporal cycles of both suspended sediments and turbidity. The seasonal distribution of suspended sediments and the concentration of suspended sediments are important in determining the ability of salmon to spawn in the mainstem or other fish to otherwise utilize mainstem habitats. These factors are also important for juvenile rearing through provision of cover thus reducing predator pressure on the juvenile fish. The Project is expected to delay the natural clearing of the riverine discharges in fall, winter and spring with respect to suspended sediment. Both reservoirs and the downstream riverine flows are predicted to have continuous suspended sediment concentrations between 50 and 300 mg L^{-1} under project operation conditions. Sustained moderate to high concentrations of suspended sediments (and also turbidity) could possibly produce biological effects during October-April (when compared to the natural or existing situation) in all riverine areas directly influenced by mainstem discharges.

Since the net effect of the Project will be storage of at least 70 percent of the natural sediment discharge,

RESPONSE TO COMMENT I.32 (cont.):

downstream transport of particulate metals and nutrients will be reduced. Reduction of downstream transport of biologically active and/or dissolved metals and nutrients is also expected to occur.

Studies are continuing to assess the ecological effect of project-related changes in the water quality with respect to turbidity, suspended sediment, metals and nutrients.

COMMENT I.33:

"Page E-2-64: Maximum Drawdown Selection: This section should discuss that in the event both reservoirs are drawndown to their minimum elevation, downstream flows would be provided such that outflow would equal inflow."

RESPONSE:

During a low flow event both the Watana and Devil Canyon reservoirs would be drawn down to their minimum levels and the outflow from the Project would be not less than the natural inflow to the Project until inflow increased sufficiently to permit storing water. The first sentence of the paragraph on FERC License Application page E-2-64 (also on FERC License Application page E-10-113) could be revised to read as follows:

> "The downstream flow requirement at Gold Creek will be met at all times unless both the Watana and Devil Canyon reservoirs are drawn to their minimum level and the combination of project outflow, which is not less than natural inflow under these conditions, and intervening natural flow between the project and Gold Creek are less than the flow requirement."

COMMENT I.34:

"Page E-2-69: (iii) Suspended Sediment/Turbidity/Vertical Illumination: Paragraph 9: The basis for the conclusion, 'Downstream from Talkeetna, turbidity and suspended sediment levels should remain essentially the same as baseline conditions,' should be provided for the winter clear water period. We recommend further investigation of post-project turbidity and suspended sediment levels due to impoundments

COMMENT I.34 (cont.):

in discontinuous permafrost regions. Several references are footnoted for your convenience. 2-17/"

"2-17/ Bodaly, R.A., D.M. Rosenberg, M.N. Gaboury, R.E. Hecky, R.W. Newburg, and K. Patalas. 1983. Ecological Effects of Hydroelectric Development in Northern Manitoba, Canada: The Churchill - Nelson River Diversion. IN Sheehan, P.J., Miller, D.R., Butler, G.C., and Bourdeau, Ph. (Eds). Effects of Pollutants at the Ecosystem Level. John Wiley & Sons. New York.

"Hecky, R.E. and H.A. Ayles. 1974. Summary of Fisheries-Limnology Investigations on Southern Indian Lake. Lake Winnipeg, Churchill and Nelson Rivers Study Board Report. Winnipeg, Manitoba.

"Newbury, R.W., K.G. Beaty, and G.K. McCullough. 1977. Initial Shoreline Erosion in a Permafrost Affected Reservoir, Southern Indian Lake, Canada. Dept. Environ., Fish and Marine Serv. Winnipeg, Manitoba."

RESPONSE:

The commentor refers to a section of FERC License Application Exhibit E dealing with "Watana Development" (FERC License Application page E-2-65, Section 4.1.1). The discussion involving the quoted statement deals specifically with the section discussing water quality changes during construction (Section 4.1.1 c.iii). Discussions prior to the quoted statement explain that the impoundment expected during construction will only extend a few kilometers (probably less than 10km) upstream of the cofferdam used for diversion of the river into the diversion tunnels. We anticipate little detectable increase of suspended sediments due to river impoundment during construction and none associated with the type of bank/shoreline erosion of permanently frozen glacio-lacustrine fine sediments discussed in the three documents referenced by the commentor. Natural levels of suspended sediments and turbidity are very low in the Susitna River during the winter season, therefore any increase in wintertime suspended sediments will be detectable. However, stockpiling of draglined material, together with proper scheduling of construction activities and implementation of environmental safeguards should minimize downstream impacts from suspended sediments.

RESPONSE TO COMMENT I.34 (cont.):

Substantial settling and/or dilution of construction-related suspended sediment will occur in the 50-plus mile reach between the Watana Dam site and Talkeetna.

COMMENT I.35:

"Page E-2-78: (i) Minimum Downstream Target Flows: Project operations flows, where they differ from naturally occuring flows, should be provided during reservoir filling. It may be useful to gradually increase winter flows during the filling period so that changes in the river and fisheries due to increased winter flows can be monitored."

RESPONSE:

It would be impractical to fill the reservoir and to release discharges similar to normal project operations since both inactive and active storage must be filled prior to operation, and the Power Authority plans to minimize the filling period while still maintaining acceptable instream flows.

The Alaska Power Authority has proposed the filling schedule in the FERC License Application as a compromise between filling the reservoir as rapidly as possible and maintaining flows. Monitoring of project effects will occur when the Project becomes operational. Although progressive steps in implementing project flows might be desirable in terms of analysis, they still would not be the same conditions as actual operation. In addition, there will be plenty of time to monitor project effects when the Project comes on line. There will be an extended period of time for monitoring project operations that will support the refinement of mitigation programs. See also, Responses to Comments B.26 and F.19.

COMMENT I.36:

"Page E-2-84: (d) River Morphology: Sediment would be expected to aggrade (over a long period of time) at the Chulitna-Susitna confluence until a new equilibrium is reached. We are unaware of any data or study being initiated to attempt to quantify the distance at which downstream aggradation could occur or what changes are possible in bed elevation. Changes at the confluence could affect fish movement or boat navigation, exacerbate winter river ice conditions, and have unfortunate consequences for

COMMENT I.36 (cont.):

the village of Talkeetna. We recommend more thorough evaluation of sediment transport, bedload movement, and aggradation at the Chulitna-Susitna confluence."

RESPONSE:

Please refer to the Responses to Comments B.14 and C.38 for discussions of the results of sedimentation studies. A draft report on the suspended sediment and bedload transport characteristics of the Susitna River near the Chulitna River confluence is available. The report will be finalized by March 1984.

REFERENCES

Harza-Ebasco, Susitna Hydroelectric Project Reservoir and River Sedimentation, Draft Report (1983).

COMMENT I.37:

"<u>Page E-2-87: Watana to Talkeetna; Paragraph 5</u>: It is our understanding that reservoir temperature outflows are currently available for water year 1981 only. Water year 1981 was atypical when compared to water years 1968 to 1982, and was the only year in which computer-predicted temperatures declined from June to July. 2-18/ We recommend that the temperature studies reflect at least two data."

"2-18/ See Footnote 2-11. [Footnote 2-11/ AEIDC. 1983. Examination of Discharge and Temperature Changes due to the Proposed Susitna Hydroelectric Project. Prepared for the APA.]"

RESPONSE:

Please refer to the Responses to Comments B.6 and I.31.

COMMENT I.38:

"<u>Page E-2-88: Talkeetna to Cook Inlet</u>: Modeling by AEIDC 2-19/ based upon water year 1981 for Watana alone, and Watana and Devil Canyon together, indicates identifiable

COMMENT I.38 (cont.):

post-project temperature impacts below the confluence of the Chulitna River. We suspect this might also occur during filling of Watana. We recommend this potential impact be re-examined."

"2-19/ See Footnote 2-11. [Footnote 2-11/ AEIDC. 1983. Examination of Discharge and Temperature Changes due to the Proposed Susitna Hydroelectric Project. Prepared for the APA.]"

RESPONSE:

An additional report by AEIDC (1984), referenced below, which was supplied to the FERC on October 31, 1983, further examines the potential impacts of the temperature changes. Please refer to the Responses to Comments B.16 and B.38 for more detailed discussion of temperatures downstream of the Susitna-Chulitna confluence. The program of studies on instream and reservoir temperatures is explained in the Response to Comment B.6.

REFERENCES

Arctic Environmental Information and Data Center (AEIDC), Susitna Hydroelectric Project Aquatic Impact Assessment: Effects of Project-Related Changes in Temperature, Turbidity, and Stream Discharge on Upper Susitna Salmon Resources During June Through September (January 1984), previously submitted to the FERC on January 20, 1984.

COMMENT I.39:

"Page E-2-88: Reservoir: We recommend that modeling be undertaken for reservoir ice formation and breakup during filling, as well as operation. The time of breakup has significant implications to potential crossings by animals (e.g. caribou). We expect this modeling may not be possible until several years of temperature data have been collected for the reservoir model."

RESPONSE TO COMMENT I.39:

Please refer to the Response to Comment B.32 regarding modeling of ice cover formation and melting on the reservoir. Also, please refer to the Response to Comment B.6 regarding the selection of water years and cases to be examined. The ice routine developed by Hamblin and Patterson has been applied on several Canadian lakes. We do not believe that several years of data on Eklutna Lake would be necessary to model ice cover formation and melting. A report on calibration of the model is being prepared by Harza-Ebasco and is expected to be available to the FERC in March 1984.

COMMENT I.40:

"Page E-2-90: Talkeetna to Cook Inlet: The expected delay in ice cover formation downstream from the Talkeetna River should be discussed. This will have potential impacts to beaver caches, movement by animals such as moose, and recreational access."

RESPONSE:

The FERC License Application (page E-2-89) discusses the potential delay in ice processes including frazil ice generation in the Watana to Talkeetna reach during filling of the Watana Reservoir. A similar delay may be expected in the formation of an ice cover on the river downstream of Talkeetna (page E-2-90). It has been suggested (R&M, 1983) that much of the ice which forms the ice cover on the lower river downstream of Talkeetna is generated in the Susitna River upstream of Watana. This is due to the generally colder air temperatures in the reach as compared to farther downstream. When filling of Watana Reservoir begins, ice generated upstream of Watana will accumulate in the reservoir and will not contribute to ice cover formation in the lower river. In addition, the temperature of water released from the reservoir will be elevated above pre-project levels during the winter. This will also affect the production of frazil ice in the Susitna River and will contribute to later formation of an ice cover in the lower river.

The ice simulation studies described in the Response to Comment B.6 utilize a mathematical model of ice processes for the Susitna River between the Susitna-Chulitna confluence and the dam sites (middle reach). Detailed ice

RESPONSE TO COMMENT I.40 (cont.):

simulations downstream of the confluence would not be reliable because of the complexity of the channel in the lower river. However, based on the studies for the middle reach, we expect to be able to estimate the changes in the ice cover development in the lower reach. For instance, based on existing winter ice conditions at Sunshine and Susitna Station, and expected changes in winter flow with the dam(s) in place, changes in the water/ice cross-section configuration can be estimated. With the reduced ice contribution from the middle reach, the reduced progression rate for the leading edge in the lower river may be estimated.

To the extent that ice cover of the lower river is delayed, moose movements may be restricted since moose are apparently reluctant to cross open water in extremely cold weather (see FERC License Application pages E-3-408, E-3-466 and E-3-467). Likewise, recreational and other use of the river as a travelway will be inhibited. It is anticipated that a delay in ice cover formation would have no adverse effect on the creation or utilization of beaver caches and could be beneficial.

REFERENCES

R&M Consultants, Susitna Hydroelectric Project, Susitna River Ice Studies.

Ice Observations 1982-1983, page 32 (in preparation).

COMMENT I.41:

"Page E-2-96: (vii) Total Dissolved Solids, Conductivity, Significant Ions, Alkalinity, and Metals: Long-term increases in mercury levels in fish are quite possible. This potential problem is inadequately researched in the application. We refer you to several references. 2-20/ Based upon available data, Bodaly and Hecky (1982) 2-21/ concluded that in cool-temperate North America high mercury levels in fish probably result from reservoir formation in a large proportion of cases. Bodaly, Hecky, and Fudge (1984) 2-22/ found fish mercury levels responded quickly to impoundment, increasing noticeably within two to three years. The elevated mercury levels appear to be long-term. Generally, they found mercury levels had not declined after

COMMENT I.41 (cont.):

five to eight years of impoundment. Data from Bodaly and Hecky (1982) 2-23/ suggest mercury concentrations in predatory fish is related to the amount of terrestial material flooded and not increased nutrients levels, increased suspended clay sediments, or changes in water exchange times. Bodaly, Hecky, and Fudge (1984) 2-24/ concluded, "The widespread nature of the high fish mercury level - new reservoir association makes it imperative that elevated fish mercury levels be considered in all impact assessments of proposed reservoirs."

"The references cited 2-25/ discuss bioaccumulation of mercury in impoundment fisheries, not fisheries downstream from the reservoirs. The immediate implications would be for those fisheries in the reservoirs (e.g. arctic grayling) or for any evaluation of the fishery potential of the reservoirs. Prior to an investigation of the available literature (the reference section of Bodaly, Hecky, and Fudge (1984) 2-26/ is extensive) one should not dismiss the potential for bioaccumulation of mercury in downstream fisheries, particular given the high natural mercury levels in the Susitna River (see Table 2-17). We recommend that a predictive water quality model be incorporated into the overall AEIDC modeling effort and baseline mercury levels continue to be monitored in the future impoundment areas and downstream. Mercury levels in soils and fish should also be monitored."

"2-20/ Bodaly, R.A. and R.E. Hecky. 1979. Post-Impoundment Increases in Fish Mercury Levels in the Southern Indian Lake Reservoir, Manitoba, Can. Fish. Mar. Serv. Manuscript Rep. 1531: iv + 15 pp.

"Bodaly, R.A. and R.E. Hecky. 1982. The Potential for Mercury Accumulation in Fish Muscle as a Result of the Proposed Peace River Site C Reservoir Can. Dept. Fish and Oceans. Winnipeg, Manitoba.

"Bodaly, R.A. and R.E. Hecky, and R.J.P. Fudge. 1984. Increases in Fish Mercury Levels in Lakes Flooded by the Churchill River Diversion, Northern Manitoba, Can. J.Fish. Aquat Sci. Suppl. (in Press).

"2-21/ See Footnote 2-20, supra.

"2-22/ See Footnote 2-20, supra.

COMMENT I.41 (cont.):

"2-23/ See Footnote 2-20, supra.

"2-24/ See Footnote 2-20, supra.

"2-25/ See Footnote 2-20, supra.

"2-26/ See Footnote 2-20, supra."

RESPONSE:

Current literature as cited by the reviewer in this Comment and Comment I.342 concerning the accumulation of mercury in fish tissues of new impoundments indicates that:

1. Higher mercury levels in fish tissue are more likely to occur in predatory (piscivorous) fish than in fish feeding lower on the food chain;

2. High fish tissue mercury concentrations could occur in new impoundments anywhere in North America;

3. High fish tissue mercury concentrations can be expected in a very high proportion of new reservoirs in cool-temperate areas of North America;

4. Fish tissue mercury concentrations are probably not closely related to new impoundment flushing rates, suspended sediment levels, nutrient levels or limniological parameters commonly related to the reservoir's long-term trophic status;

5. Fish tissue mercury concentrations in new reservoirs will probably be more closely related to the amount of shallow areas containing large amounts of organic material which will be newly flooded.

Based on the preceding information, the Power Authority does not anticipate a significant problem with high concentrations of mercury in tissues of fish in the two reservoirs of the Susitna Hydroelectric Project. Our conclusion is primarily based on the fact that the reservoirs will not flood relatively large terrestrial areas covered by great quantities of organic detritus and vegetation. In addition, we expect extensive blanketing of flooded organic detritus and vegetation by precipitating inorganic sediment particles, and low production of labile organic materials by autochthonous primary productivity. Mercury appears to be bioaccumulated to relatively high concentrations by piscivorous fish, therefore resident

RESPONSE TO COMMENT I.41 (cont.):

predatory fish (rainbow trout, Dolly Varden, burbot) may be the most likely candidate fish in the Susitna River downstream of the project to achieve significantly high mercury tissue concentrations. We do not presently anticipate high concentrations of biologically available (bacterially methylated or biomass accumulated) mercury being discharged from the project reservoirs. At present, we do not anticipate increased primary or secondary productivity of labile organics to take place downstream from the project reservoirs because of high, year-round suspended sediment concentrations in the mainstem. Consequently, we do not presently anticipate downstream mercury bioaccumulation problems in the Susitna River fishery.

The Alaska Power Authority will continue to consider the subject of fish mercury contamination. Review of the growing scientific literature on this subject will be done and appropriate action taken.

COMMENT I.42:

"Page E-2-98: (ii) Sloughs: Please refer to our comments on page E-2-40. The relationship between mainstem surface flow, groundwater dynamics, upwelling in salmon spawning zones of side sloughs, and local runoff to these sloughs needs to be characterized."

RESPONSE:

Please refer to the Response to Comment I.22. Also, please refer to the Responses to Comments B.18 and B.19 for a discussion of the relationship between groundwater, mainstem, upwelling and elevation.

REFERENCES

USGS, Quadrangle Map of Talkeetna Mountains C-6 and D-6.

COMMENT I.43:

"Page E-2-101: 4.1.3 - Watana Operation: The application should discuss the potential impacts on water quality and quantity parameters associated with the testing of the turbines at Watana."

RESPONSE TO COMMENT I.43:

Testing of the turbines is scheduled to commence during filling when the reservoir water elevation is above the minimum drawdown elevation (page E-2-82, Volume 5A of the FERC License Application). Flow through the cone valves will be adjusted as necessary to maintain a constant flow downstream from Watana during testing of the turbines. The flows discharged from Watana during the testing of the units will be essentially the same as those during filling. The only difference will be that the flow through the turbines will displace some of the flow that would have passed through the fixed cones. Therefore, there will be no change in water quantity during testing and only minimal change in water quality.

COMMENT I.44:

"<u>Page E-2-112: (b) River Morphology</u>: Please refer to our comments on page E-2-84."

RESPONSE:

Please refer to the Response to Comment I.36.

COMMENT I.45:

"<u>Page E-2-114: Watana Reservoir: Paragraph 4</u>: It is indicated that Watana, '...will be operated to take advantage of the temperature stratification within the reservoir.' Basic assumptions underlying this statement should be discussed in detail."

RESPONSE:

Watana will be operated to take advantage of the temperature stratification within the reservoir to minimize the pre-project to with-project water temperature difference downstream. The basic assumption is that Watana will be operated to maintain with-project temperatures as close to natural (pre-project) temperatures as possible. In early summer, it is acknowledged that temperatures throughout the reservoir will likely be less than natural temperatures. Since it will be desirable to maintain warm water temperatures for the fisheries during this time, the intake gates will be operated to pass the warmest water possible. During this period the warmest water will be at the surface

RESPONSE TO COMMENT I.45 (cont.):

of the reservoir. Therefore, water will be drawn through the intake which is nearest the surface. Since the reservoir will be filling during this period of the year, the intake gates will be operated successively to draw water from near the surface. That is, water will initially be drawn through a lower intake gate because the reservoir will be drawn down. As the reservoir fills, the next higher gate will become submerged. Once this gate is sufficiently submerged to pass the power house flow, the gate below will be closed. This procedure will continue until the annual filling cycle is complete.

Using this procedure of drawing water near the surface in mid- and late summer, the surface temperature of the reservoir should be near the natural river temperatures. Therefore, it should be possible to approximately match natural temperatures during this period. It is assumed that natural temperatures are preferable during mid- and late summer.

In fall, the natural water temperature decreases to near 0°C and remains near this temperature through winter until break-up in the spring. During this period, it has been assumed that with-project outlet temperatures approximating the natural temperature of near 0°C are preferable.

Therefore, water will be withdrawn to provide the coldest possible water downstream. This water will be drawn from near the surface, as this will be the source of the coldest water during the winter. However, alternative outlet temperature scenarios suggested by ice and fishery studies will be analyzed as appropriate during the ongoing process of impact assessment refinement and mitigation planning. See the Response to Comment B.38 for a discussion of the most recent analyses of predicted with-project downstream temperatures.

COMMENT I.46:

"Page E-2-117: Eklutna Lake Modeling: The Eklutna Lake data collection program was important to the efforts to verify the applicability of the DYRESM computer model. The ability of DYRESM to correct the consistent one to two degree C underestimation should be demonstrated. We recommend meteorological data be provided for the period of record to show how the 1982 data compare to this record. The data collection program should be extended over a second year to

COMMENT I.46 (cont.):

lend confidence to the model's ability to mimic actual temperature releases."

RESPONSE:

Please refer to the Response to Comment B.6 for a discussion of the reservoir temperature modeling. This Response references a response to FERC's Schedule B Request for Supplemental Information No. 2.28 which includes a schedule for calibration and production runs for the DYRESM model study. A calibration report based on Eklutna Lake data from June 1, 1982 to May 30, 1983 is expected to be available in March 1984. The model calibration can be verified with data from June 1983 to May 1984 when these become available.

COMMENT I.47:

"Page E-2-118: Watana Reservoir Modeling: Paragraph 1: It is indicated that meteorological data from June through December 1981 (seven months) were inputted to DYRESM. Page E-2-121 indicates that June through September (four months) data were used as DYRESM input. The November 15, 1982 draft license application indicates that data from June through October, 1981 (5 months) were used in DYRESM simulation modeling. These apparent discrepancies should be explained.

"Please refer to our comments on page E-2-87 on reservoir temperature modeling. We continue to recommend two full years of data collection for input to DYRESM (see Comment W-2-048, Chapter 11)."

RESPONSE:

There does not appear to be a discrepancy between pages E-2-118 and E-2-121 of the FERC License Application regarding the period of meteorological data input to DYRESM. As indicated on page E-2-118, meterological data from the period June 1981 through December 1981 were utilized in the DYRESM model. Referring to the HEATSIM simulation, the last sentence of the first paragraph on page E-2-121 reads: "Meteorological data for 1981 was used for June through December." DYRESM was run for the same period using the same hydrological and meteorological data described as for HEATSIM. License Application page E-2-121 indicates that the Watana discharges used in the HEATSIM simulation were taken from two sources:

RESPONSE TO COMMENT I.47 (cont.):

1. For the period June 1981 through September 1981, discharges simulated by the project operation model study (described in Section 3.2) were used; and

2. For the period October 1981 through December 1981 "long term average weekly simulated discharge" was used.

The apparent discrepancy between the Draft License Application (page E-2-57) and the final License Application (pages E-2-118, E-2-121) resulted from additional studies which included the months of November and December which were made for the final License Application.

Please refer to the Response to Comment I.37 regarding reservoir temperature simulation.

COMMENT I.48:

"Page E-2-119: Watana Reservoir Modeling: Paragraph 7: It is important to have an understanding of the potential range of post-project occurrences. Examples would be the range of dates when reservoir ice formation would occur, ice thickness, and ice breakup. At the present time, since DYRESM has not been run for October to June (or January to June?) the time of reservoir ice breakup cannot be confidently predicted."

RESPONSE:

Please refer to the Response to Comment I.39 on modeling of reservoir ice formation and melting. Also please refer to the Response to Comment I.47 on the period for which DYRESM was run for the FERC License Application.

COMMENT I.49:

"Page E-2-121: Mainstem: Paragraph 1: Please refer to our comments on the reservoir modeling efforts, immediately above. In addition, tributary temperature and flow data and the influence of turbidity and suspended sediment should be determined and incorporated into the model."

RESPONSE:

Temperature data are available for Denali Station since August 29, 1974 and for Cantwell Station since May 29, 1980. There are no water temperature data available before 1983 in

RESPONSE TO COMMENT I.49 (cont.):

the tributaries between Cantwell Station and Devil Canyon Damsite.

A water temperature data collection program was carried out by ADF&G to collect water temperature in the mainstem and tributaries during the summer of 1983. Thermographs were placed in the mainstem and some tributaries above the Devil Canyon Damsite. These data, when available, may be used to estimate tributary temperatures influent to the reservoir.

Stream flow data are available for Gold Creek Station since August 1949 and at Cantwell Station from May 1961 to September 1972 and from June 1980 to the present.

There are no stream flow data available in the tributaries between Cantwell Station and Gold Creek. Tributary flow data may be estimated from the Gold Creek and Cantwell Stations using the drainage area ratio.

These data may be applied to simulate the thermal behavior and ice formation of the proposed reservoirs.

The principle influence of suspended sediments on the simulation of the thermal structure and outflow temperature of lakes and reservoirs is through the contribution of the suspended sediment load to the density of the water. For example, at 20°C a suspended sediment concentration of 100 mg/l of material of density 2,650 Kg/m^3 would cause approximately 0.8°C change in temperature. Whereas at 4°C, because of the nonlinear relation of temperature to density, the same concentration would cause a 5°C temperature change.

The errors caused in the thermal predictions occur mainly in the inflow dynamics, and to a lesser extent in the calculation of the vertical diffusion of heat. As an example, an inflow temperture of 9°C and suspended sediment concentration of 100 mg/l would have a density equal to pure water at 4°C, and thus should be inserted at the bottom (underflow), whereas the model would insert the inflow at a higher level (interflow) at which the temperature is 9°C (neglecting the entrainment effect). Another possible source of error occurs in the simulation of the vertical mixing due to downward settling of suspended sediments. Such settling occurs from a level where the temperature profile is stabilized to a level lower in the profile where the temperature is close to 4°C, and thus the suspended sediments contribute substantially to the density. At this point, the profile may become unstable and form an internal mixed layer. In summary, the neglect of suspended sediments would result in a thermal profile which is too warm at the surface and too cold at the bottom. If the intake structure is located well below the surface, the simulated outflow temperatures would be too low. The Watana multi-level intake is located in the upper 150 feet of the 600-foot deep reservoir and is generally in or above the thermo-cline.

The magnitudes of these errors are to be determined by the residence time of the lower layer where the insertion errors and internal mixing take place, the inflow temperatures, and the suspended sediment concentrations. Because of the complex relation among these variables, it is extremely difficult to estimate the value of possible errors, theoretically. However, from the experience of the Eklutna Lake study, the lower layer (hypolimnion) minimum residence time at maximum inflow was about 120 days and at an average measured inflow temperature of approximately 4°C (July), and estimated suspended sediment concentration of the order of magnitude of 900 mg/l. These values may be compared to the minimum summer residence time of the proposed Watana reservoir of 120 days (July) and inflow temperature of 10°C and average suspended sediment load of 1,000 mg/l.

Because of the similar nature of the residence times, the inflow temperatures and suspended sediment concentration in the two reservoirs, it is concluded the errors in simulating outflow temperatures by the neglect of the suspended sediments in the model would be about the same as those found in the Eklutna Lake simulations. Thus, underestimation of outflow temperature of about 1°C would result during the early summer period. This error would be smaller at other times of the year.

The above analysis indicates that the neglect of the effect of the suspended sediment load will not affect the accuracy of the temperature simulation of the proposed reservoir, significantly. Therefore, the suspended sediment load and hence, the turbidity are not incorporated in the reservoir temperature simulation model.

The influence of turbidity and suspended sediment on the riverine morphology and biological ecology are currently being assessed on a primarily qualitative basis since quantitative effects are not predictable at present. The effects of the project will be a reduction in the amplitude of the temporal cycles of both suspended sediments and turbidity. The project should also delay the annual fall-winter clearing of riverine discharges by sedimentation and flushing actions resulting in sustained high

RESPONSE TO COMMENT I.49 (cont.):

concentrations of suspended sediments (predicted to range between 50-300 mg/l) and turbidity (predicted to range between 10-50 NTU) in both reservoirs and the downstream river flows.

Since the dams will significantly retard peak flows and suspended sediment and bedload discharges of the river, scouring activity downstream should result in a predominantly amoured and more confined river channel in the Devil Canyon to Talkeetna reach. (Please refer to the Responses to Comments B.14 and C.45.) Sustained moderate to high concentrations of suspended sediments and turbidity are expected to produce relatively positive biological effects during May-September, but negative biological effects during October-April, when compared to the natural situation.

Suspended sediments have well recognized negative impacts on aquatic biota of cold water streams. The effects are primarly mechanically mediated and include:

1. Clogging and abrasion of gills and other respiratory surfaces of aquatic organisms;

2. Adhering to the chorion of incubating eggs;

3. Providing conditions conducive to the entry and persistence of disease-related organisms;

4. Inducing behavioral modifications;

5. Entombing of different life stages;

6. Affecting useable habitat by scouring and filling pools and riffles, and by changing bedload composition of particulates;

7. Abrading and smothering of phytobenthos and other immobile life stages;

8. Affecting intragravel permeability;

9. Affecting the fishing for and catchability of sport fishes by causing turbidity; and

RESPONSE TO COMMENT I.49 (cont.):

10. Reducing the quantity of light useable to phytobenthos by causing turbidity.

REFERENCES

R&M Consultants, Susitna Hydroelectric Project, - Glacial Lake Studies (December 1982), previously submitted to the FERC on July 11, 1983.

Peratrovich, Nottingham and Drage, Inc., Susitna Reservoir Sedimentation and Water Clarity Study (November 1982), previously submitted to the FERC on July 11, 1983.

Harza-Ebasco Susitna Joint Venture, Eklutna Lake Temperature and Ice Study (with 6-month simulation for Watana Reservoir), Draft Report (January 1984).

COMMENT I.50:

"Page E-2-122: Sloughs: During the winter, ice formation in conjunction with much higher flows (compared to natural winter flows) could result in significant downstream staging and overtopping of the side sloughs. Overtopping would dramatically lower slough temperatures and adversely impact fish incubation and rearing. 2-27/ This potential impact should be thoroughly discussed."

"2-27/ See Footnote 2-2. [Footnote 2-2/ ADF&G 1983. Synopsis of the 1982 Aquatic Studies and Analysis of Fish and Habitat Relationships. Prepared for the APA.]"

RESPONSE:

See Response to Comment I.131 for discussions of the use of protective berms to prevent slough overtopping.

Overtopping of sloughs is a natural phenomena that frequently occurs on the Susitna River. In addition to overtopping that occurs during spring and summer, overtopping occurs during winter as was observed on Slough 8A during the winter season of 1982. As part of the Mitigation Plan, the Power Authority has included the construction of protective berms at the upstream ends of the productive sloughs so as to decrease the frequency of or completely avoid overtopping. This mitigation measure will stabilize the slough habitat and help to minimize potential impacts on incubation and rearing that naturally occur.

Please refer to the Response to Comment B.6 concerning plans of study for reservoir and stream temperature and ice studies. The ice process simulations described in the Response to Comment B.6 include estimation of water surface staging with the Project in operation. This information allows for determination of sloughs which may be overtopped during the winter due to project implementation. Ice process simulations carried out for the License Application and described therein for Watana in operation (FERC License Application pages E-2-123 to E-2-127, Figures E.2.184, E.2.185), Devil Canyon in operation (FERC License Application pages E-2-169 to E-2-170) and Watana filling (FERC License Application pages E-2-88 to E-2-90) allow an estimation of the expected staging for 1981 hydrological and meteorological conditions with the Project(s) in place.

COMMENT I.51:

"Page E-2-123: Talkeetna to Cook Inlet: AEIDC recently examined river temperature profiles for one and two dams for June through September. 2-28/ Their computer models SNTEMP predicted identifiable temperature changes below the Chulitna River, ranging up to an approximately one degree C difference in June for the one dam senario [sic]. Post-project operations with two dams showed greater changes downstream from the Chulitna River.

"When DYRESM has been input with data throughout the year, for a two-year period, the potential post-project temperature effects for the reach below the Chulitna River will need to be re-examined.

"The application should explain why the discussion on river temperatures uses HEATSIM, and AEIDC uses a different model, SNTEMP."

"2-28/ See Footnote 2-11. [Footnote 2-11/ AEIDC. 1983. Examination of Discharge and Temperature Changes due to the Proposed Susitna Hydroelectric Project. Prepared for the APA.]"

RESPONSE:

Please refer to the Responses to Comments B.16, B.23 and B.38 for discussions of the temperatures downstream of the Susitna-Chulitna confluence. Please refer to the Response to Comment B.6 for a discussion of the temperature models. Please refer to the Responses to Comments B.8 and C.39 through C.41 on Lower River.

Additionally, please refer to the Response to Comment B.6 for a comparison of HEATSIM and SNTEMP. The HEATSIM model is proprietary to Acres American, Inc. (Acres) and was utilized by Acres in their studies for the License Application. SNTEMP is available to AEIDC and includes consideration of topographic shading and tributary temperatures, refinements which HEATSIM does not include. For these reasons, SNTEMP was selected for further studies on the Susitna Hydroelectric Project.

COMMENT I.52:

"Page E-2-124: Watana Reservoir: It is indicated that DYRESM was run using 1981 data collected throughout the year. It is our understanding this was not the case. Please clarify this apparent discrepancy. Please refer to our comments on pages E-2-119 and E-2-121."

RESPONSE:

The source of the apparent discrepancy cited in the Comment is not clear. The first paragraph of Exhibit E Chapter 2 Section 4.1.3(c)(ii) on FERC License Application pages E-2-123 and E-2-124 refers the reader to section 4.1.3(c)(i) in which it is explained (FERC License Application pages E-2-118 and E-2-121) that meteorological data from Watana Camp for the period June 1981 through December 1981 were used in DYRESM simulations for the Watana Reservoir. The second and third sentences of the first paragraph of Section 4.1.3(c)(ii) specifically state that the period after December 31, 1981 was not modeled using DYRESM.

Also, please refer to the Responses to Comments I.47 and I.49.

COMMENT I.53:

"Page E-2-124: Watana to Talkeetna: Please refer to our comments on pages E-2-119, E-2-121, E-2-123. When DYRESM is input with data collected throughout the year, and over a 2-year period, it would be appropriate to re-examine river ice dynamics.

"The timing, ice thickness, and river staging due to the ice has large, obvious, implications in regard to severity of breakup, extent of freeze-up, ice jamming and the extent of open water (downstream from dam). Large amounts of ice deposited at tributary or slough mouths during spring could effect smolt outmigration and/or adult immigration."

RESPONSE:

Please refer to the Responses to Comments I.39, I.48, I.49 and I.51. In particular, please refer to the Response to Comment B.6 on reservoir and stream temperature and ice studies.

RESPONSE TO COMMENT I.53 (cont.):

Downstream of Devil Canyon, the existing natural freeze-up, ice jamming and breakup are frequently severe events. Under these natural conditions, smolt outmigration and/or adult inmigration takes place.

As indicated in the FERC License Application (page E-2-126), under with-project conditions the ice cover will tend to melt in place due to warmer discharge from the reservoir and the regulation of spring floods which normally cause breakup ice runs.

The severity of spring ice cover breakup jamming is expected to be reduced when the Project is operating. Thus, it is likely that there would be a reduction in the amount of ice deposited at tributary or slough mouths during spring breakup runs. Therefore, any negative effects on smolt outmigration and/or adult inmigration would be expected to be significantly less severe than under natural conditions.

Please refer to the Responses to Comments I.132 and B.44 regarding protective berms for the productive sloughs and the role of ice-related water surface staging in slough overtopping.

COMMENT I.54:

"Page E-2-127: Talkeetna to Cook Inlet: We recommend that the predicted post-project changes in ice processes be quantified and analyzed in this reach. At present, evidence points to identifiable post-project changes to flows, temperatures, ice conditions, water quality (e.g. turbidity and suspended sediment), and frequency of flooding. These would occur in a broad and shallow river system for which we have rather limited knowledge of the aquatic resources. The morphology of the reach downstream from the mouth of Talkeetna River would lead one to expect greater impacts to result from smaller changes."

RESPONSE:

The current state of the art is not advanced to the point that mathematical computer models are available to simulate braided channels (as in the Lower River) having different water levels and ice thicknesses. Please refer to the Responses to Comments B.16, B.23 and B.38 regarding project-related changes to temperatures and turbidities downstream of the Chulitna-Susitna confluence. Please refer to the Responses to Comments B.14 and C.38 regarding

RESPONSE TO COMMENT I.54 (cont.):

aggradation and degradation downstream of the Chulitna-Susitna confluence. Please refer to the Response to Comment F.13 regarding the expected impacts in the Lower River. Please refer to the Responses to Comments B.33 and I.40 regarding the expected changes in ice conditions in the lower river.

It is not practical, at the present time, to simulate ice conditions with-project in the Susitna River downstream of the Chulitna-Susitna confluence, in the same manner as for the reach upstream of the confluence.

COMMENT I.55:

"Page E-2-132: (vi) Total Dissolved Gas Concentration: The current natural level of dissolved gas in Devil Canyon exceeds the State water quality criteria of 110%. Further increases in gas downstream from the dam(s) could adversely effect juvenile and adult fisheries, in addition to resident fisheries. It is indicted the, '...fixed-cone valves will be used to discharge all releases with a recurrence interval of less than 1:50 years.' We assume events greater than 1:50 years would, therefore, necessitate spilling. It should be clarified if this would occur, when it would occur, and how often (based uopn the 32 years of record) we could expect spilling. Modeling of the formation of dissolved gas and downstream dissipation may be appropriate. We suspect supersaturated gas formed by spilling at the Watana dam may not sufficiently dissipate in the Devil Canyon reservoir. This could create releases of high dissolved gas through the Devil Canyon turbines and valves. This scenario should be fully analyzed."

RESPONSE:

The FERC License Application (pages A-1-9 and A-7-8) indicates that the purpose of the fixed cone valve outlet works at Watana and Devil Canyon is to discharge floods with recurrence intervals of less than 50 years after they have been routed through the reservoirs. Floods having recurrence intervals of greater than 50 years occurring when the reservoir is full would require spillway operation. Discussions of the frequency of spillway operation based on the 32 years of reservoir operation modeling are given in the License Application (pages E-2-111, E-2-132, E-2-163, E-2-171 and Tables E.2.50 and E.2.58). As indicated in Table E.2.50, the spillway would not be operated during any of the 32 years simulated for Watana, only operation based

RESPONSE TO COMMENT I.55 (cont.):

on year 1995 and year 2000 load forecasts. Table E.2.58 indicates that, based on year 2002 simulation, the Devil Canyon spillway would operate once in the 32 years of record (1967). We do not believe it is necessary to model formation and dissipation of dissolved gas for floods having a recurrence interval of greater than 50 years. Please refer to the Response to Comment I.60 for further discussion of this subject.

COMMENT I.56:

"Page E-2-135: (viii) Total Dissolved Solids, Conductivity, Significant Ions, Alkalinity, and Metals: Please refer to our comments on pages E-2-34 and E-2-96."

RESPONSE:

Please refer to Responses to Comments I.21 and I.41.

COMMENT I.57:

"Page E-2-146: (f) Instream Flow Uses: During 1982, ADF&G documented chinook salmon spawning above the Devil Canyon dam site at the confluence of and within two small clear water tributaries. 2-29/"

"2-29/ See Footnote 2-2. [Footnote 2-2/ ADF&G 1983. Synopsis of the 1982 Aquatic Studies and Analysis of Fish and Habitat Relationships. Prepared for the APA.]"

RESPONSE:

The FERC License Application states on the referenced page (page E-2-146) that "... the Devil Canyon and Devil Creek rapids act as a natural barrier to most upstream fish movement." The word "most" must be clearly understood. Although the Alaska Department of Fish and Game did document chinook salmon spawning above the Devil Canyon site, the numbers observed must be placed into perspective. The total number of spawners observed in 1982 above Devil Canyon was 11 fish, compared to an estimated escapement of about 10,913 chinook past Curry Station. Based on these findings, the statement that "most" fish do not migrate upstream of Devil Canyon is correct. In fact, the statement should indicate

RESPONSE TO COMMENT I.57 (cont.):

that virtually all (99.9%) adult salmon spawn below Devil Canyon.

REFERENCES

ADF&G, Susitna Hydro Aquatic Studies, Phase II Basic Data Reports for 1982, 5 Volumes (1983), previously submitted to the FERC on October 31, 1983.

Volume 2, Adult Anadromous Fish Studies (1983).

COMMENT I.58:

"Page E-2-152: (v) Total Dissolved Gas Concentration: Please refer to our comments on page E-2-132."

RESPONSE:

Please refer to the Response to Comment I.55.

COMMENT I.59:

"Page E-2-154: 4.2.3 - Watana/Devil Canyon Operation: The anticipated testing of the Devil Canyon turbines should be discussed. Potential impacts on water quality and quantity, and mitigation for adverse impacts should be described."

RESPONSE:

Please refer to the Response to Comment B.12 for a discussion of testing and commissioning of the Devil Canyon units, and the potential downstream impacts.

COMMENT I.60:

"Page E-2-158 to 162: (iii) Floods: The discussions concerning floods up to the probable maximum flood (PMF) should examine the potential creation of supersaturated dissolved gas and, through modeling, examine the fate of the gas downstream. Please refer to our comments on page E-2-132."

RESPONSE TO COMMENT I.60:

The FERC License Application (page E-2-161) indicates that floods having recurrence intervals of less than or equal to 50 years would be released through the powerhouse and outlet works cone valves, thus providing for minimal gas supersaturation of the water released from Devil Canyon Dam. The justification for using the 1:50 year flood is given in the License Application (page B-2-19) as follows:

> "On the basis of an evaluation of the related impacts and discussions with interested federal and state agencies, spillway facilities were designed to limit discharges of water from either Watana or Devil Canyon that may become supersaturated with nitrogen to a recurrence period of not less than 1:50 years."

As is discussed in the Response to Comment B.34, the anticipated performance of the cone valves with respect to preventing downstream nitrogen supersaturation was verified through prototype tests at Lake Comanche and are documented in a Lake Comanche Dissolved Nitrogen Study by Ecological Analysts, Inc. Additionally, Acres American, Inc. has indicated that the jet issuing from the cone valves would plunge less than one foot into the tailwater and that the expected supersaturation would thus be less than 3 percent.

To pass floods with recurrence intervals greater than 50 years, the spillway will be operated. Depending on the dilution of spillway flow by flow through the cone valves and powerhouse, gas supersaturation levels may increase downstream of Devil Canyon Dam. This tendency would be minimized by a specially designed dispersal-type flip bucket for the spillway. Physical model studies will be utilized in the design of the spillway and flip bucket. However, it was judged unnecessary to model the gas saturation levels occurring so infrequently.

Please also refer to the Response to Comment I.55.

REFERENCES

Ecological Analysts, Inc., Lake Comanche Dissolved Nitrogen Study (1982).

RESPONSE TO COMMENT I.60 (cont.):

Acres American, Inc., Nitrogen Supersaturation Studies Memorandum (September 13, 1982).

COMMENT I.61:

"Page E-2-164: (b) River Morphology: It is stated, '...the occurrences of high flows capable of initiating gravel bed movement in the Susitna River above Talkeetna will be increased.' To our knowledge the bedload and suspended sediment studies to date have only examined general morphological changes in post-versus pre-project conditions. These studies should be extrapolated quantitatively to existing, as well as potential fish habitats with regard to spawning and rearing substrates. An analysis of the potential reduction of spawning gravel with an examination of long-term effects of removing spawnable substrate sources above the dam sites should be initiated. The flows needed to maintain slough, side channel, tributary mouths, and mainstem spawning gravel should also be examined."

RESPONSE:

The statement that "the occurrences of high flows capable of initiating gravel bed movement in the Susitna River above Talkeetna will be increased" refers to the first few years after Devil Canyon becomes operational and is relative to the flows occurring during Watana operation. The flood flows occurring during the first few years of Devil Canyon will remain much lower than the natural flood flows.

The higher flood flows (relative to Watana operation) will occur only during the late summer period after Watana reservoir is filled. As energy demand increases, the flood magnitude for a given recurrence interval will be reduced. This is illustrated in FERC License Application Figure E.2.199. After the first few years of Devil Canyon operation, the occurrences of high flows will be similar to those occurring during Watana operation. As stated in the FERC License Application, the impacts described for Watana operation will remain relevant.

RESPONSE TO COMMENT I.61 (cont.):

A draft report on the reservoir and river sedimentation has been completed. The final report is scheduled for release in March 1984. To the extent possible, these studies have quantitatively examined with-project morphological changes. These changes are expected to result in a degradation of approximately zero to 0.3 foot in the Devil Canyon to Talkeetna reach. Refer to the Response to Comment C.45. This is due to the armored condition of the mainstem in this reach.

COMMENT I.62:

"Page E-2-164: Watana and Devil Canyon Reservoirs: Paragraph 1: It is stated, 'Since the available simulation data ended at the end of FY 1981 (September 30, 1981), mean weekly flows from the Case C, 2010 demand simulation were used for the October to December period.' If it is possible to simulate temperatures from flows in this manner we recommend that flows and temperatures be simulated using the inflow/outflow data for the 32 years of record. It should be noted that the year modeled (water year 1981) was an unusual year from several aspects. First, it was the only year of the 15 simulated by AEIDC, through SNTEMP, displaying a decrease in temperature from June to July. 2-30/ Also, on page E-2-167 it is cited as the worst case of the 32 years of record in terms of frequency of release and discharge through Devil Canyon. This confirms our view that we need at least two years of input to DYRESM to allow some understanding of post-project temperature impacts."

"2-30/ See Footnote 2-11. [2-11/ AEIDC. 1983. Examination of Discharge and Temperature Changes due to the Proposed Susitna Hydroelectric Project. Prepared for the APA.]"

RESPONSE:

Please refer to the Response to Comment B.6 in which reservoir temperature simulation is outlined. The reservoir temperature simulations are being carried out for three years representing minimum, average and high releases (water years 1974, 1982 and 1981, respectively). Additional simulations are being made for cold, average and warm

RESPONSE TO COMMENT I.62 (cont.):

winters for the ice process simulation studies. Simulating the extreme hydrological events rather than meteorological events is justified since under with-project conditions, the hydrothermal characteristics of the river near the project area will be modified to a certain extent. With the moderating effect of the new reservoirs, the downstream river temperature near the project area will not respond as rapidly to the climatic changes. The inflow and outflow of the reservoirs will play important roles in the modification of the river temperatures. It is therefore considered more appropriate that temperatures under with-project conditions be examined based on the range of the inflow variations instead of temperature variations. It is not practical to simulate reservoir temperatures for the entire 32 years of streamflow record because of insufficient meteorological and water temperature data. Simulation of mean and extreme events coupled with sound judgments will provide a reasonable assessment of potential downstream impacts.

The Power Authority anticipates that the DEIS will summarize and incorporate previous temperature modeling studies.

COMMENT I.63:

"Page E-2-167: Watana and Devil Canyon Reservoir: Paragraph 12: We gain the impression that releases of 12,000 to 15,000 cfs would be provided at Devil Canyon when temperatures of 8°C occur. This would mean flows downstream of Gold Creek of perhaps 13,000 to 17,000 cfs during July and August; comparable to Case C-1, or Case C-2 flows. We had previously understood this was not considered acceptable by the applicant. The applicant should clarify this apparent discrepancy.

"Figures E-2-215 and E-2-216 display the predicted ability of the Devil Canyon intake facilities to match outflow temperatures to inflow temperatures. It would be helpful to also display pre-project temperatures on these figures."

RESPONSE:

The FERC License Application does not indicate that releases of from 12,000 cfs to 15,000 cfs are unacceptable; only that the target minimum flows given by Case C were judged to be economically and environmentally acceptable. The License Application states on page E-2-62:

RESPONSE TO COMMENT I.63 (cont.):

"3.7 - Operational Flow Scenario Selection

"Based on the economic analysis discussed above, it was judged that, while cases A, A1 and A2 flows produced essentially the same net benefit, the loss in net benefits for Case C is of acceptable magnitude. The loss associated with Case C1 is on the borderline between acceptable and unacceptable. However, as fishery and instream flow impacts (and hence mitigation costs associated with the various flow scenarios) are refined (see Table E.3.39 in Chapter 3), the potential decrease in mitigation costs associated with higher flows will not offset the loss in net benefits. Thus, selecting a higher flow case such as C1 cannot be justified by savings in mitigation costs. The loss in net benefits associated with Cases C2 and D are considered unacceptable and the mitigation cost reduction associated with these higher flows will not bring them into the acceptable range."

Case C provides target minimum flows that must be released from the most downstream reservoir as an impact mitigation measure. This minimum release may be exceeded when the load demand on the Project requires a greater discharge or if the reservoirs are full and incoming flow must be passed to prevent excessive dam surcharging and overtopping. The paragraph cited in this Comment describes the means which will be used to release flows to minimize temperature-related impacts when the reservoirs are full. FERC License Application Table E.2.58 indicates that releases of this nature would occur in 21 and 13 of the 32 years simulated for the 2002 and 2010 project operation simulations, respectively.

The selection of the target minimum flow is further discussed in the License Application (page E-2-59) as follows:

"As flow is transferred from the winter to the August-September time period for fishery and instream flow mitigation purposes, the amount of usable energy decreases. This decrease is not significant until the flow provided at Gold Creek during August reaches the 12,000 to 14,000 cfs range. For a flow of 19,000 cfs at Gold Creek, a flow scenario that represents minimum downstream fishery impact, approximately 46 percent of the potential project net benefits have been foregone."

RESPONSE TO COMMENT I.63 (cont.):

ADF&G did measure water temperatures on the Susitna River above the mouth of Portage Creek (RM 148-8), for the period of July 17, 1981 to October 3, 1981. These data are reported in the Phase 1 Final Draft Report Volume 2, Part 1 Aquatic Habitat & Instream Flow Project, pages EC-88 through EC-91.

REFERENCES

ADF&G, Susitna Hydro Aquatic Studies, Subtask 7.10 - Phase I Final Draft Report, Aquatic Habitat and Instream Flow Project, Volume 2, Part 1, pages EC-88 through EC-91 (1981).

COMMENT I.64:

"Page E-2-167: Mainstem: The downstream temperature predictions in this section do not agree with the recent work by AEIDC. 2-31/ We assume since AEIDC is responsible for this analysis, the model they are using is current and the model in the application, HEATSIM, has been discontinued. If this is the situation, we recommend that those sections evaluating pre- versus post-project downstream temperature shifts be revised to reflect the current AEIDC work using SNTEMP. Additionally, replacement of HEATSIM with SNTEMP should also mean a total replacement of the ICESIM input data."

"2-31/ See Footnote 2-11. [2-11/ AEIDC. 1983. Examination of Discharge and Temperature Changes due to the Proposed Susitna Hydroelectric Project. Prepared for the APA.]"

RESPONSE:

Please refer to the Response to Comment B.6 for a discussion of the HEATSIM, ICESIM, SNTEMP and other models. Please refer to the Response to Comment B.31 for a discussion of the use of SNTEMP results with the ice process simulation model. Note that AEIDC predicted temperatures on a monthly average basis using SNTEMP and the temperature predictions in the License Application were based on daily iterations.

COMMENT I.65:

"Page E-2-169: Sloughs: Please refer to our comments on page E-2-40. We believe the relationship between the side sloughs and the mainstem needs to be better defined. This position is supported in the ADF&G Synopsis Report, 2-32/ 'Mainstem influence upon the side slough habitats...is not presently well defined. Such influences are most likely related to indirect impacts such as influences on rates of upwelling water sources and winter overflow of the slough heads caused by ice processes.'"

"2-32/ See Footnote 2-2. [2-2/ ADF&G 1983. Synopsis of the 1982 Aquatic Studies and Analysis of Fish and Habitat Relationships. Prepared for the APA."

RESPONSE:

See Response to Comment I.22.

COMMENT I.66:

"Page E-2-169: Talkeetna to Cook Inlet: The expected downstream temperature changes should be discussed as well as the downstream limits of these changes, by month."

RESPONSE:

Please refer to the Responses to Comments B.16, B.23 and B.38 which discuss potential stream temperature changes in the reach between the Chulitna-Susitna confluence and Cook Inlet.

COMMENT I.67:

"Page E-2-171: (v) Total Dissolved Gas Concentration: According to the ADF&G Synopsis Report, 2-33/ 'The relatively low rates of dissipation of the naturally entrained dissolved gas in the reach of river below the [Devil Canyon] rapids suggests that higher levels of supersaturation that may be created by water spillage at either of the proposed dams would not dissipate sufficiently to reduce the hazard to either adult or juvenile chinook

COMMENT I.67 (cont.):

salmon as well as other species of salmon.' Please refer to our comments on page E-2-132."

"2-33/ See Footnote 2-2. [2-2/ ADF&G 1983. Synopsis of the 1982 Aquatic Studies and Analysis of Fish and Habitat Relationships. Prepared for the APA.]"

RESPONSE:

Please refer to the Responses to Comments I.55 and I.60.

COMMENT I.68:

"Page E-2-172: (vii) Total Dissolved Solids, Conductivity, Alkalinity, Significant Ions and Metals: Please refer to our comments on pages E-2-34 and E-2-96."

RESPONSE:

Please refer to the Responses to Comments I.21 and I.41.

COMMENT I.69:

"Page E-2-186: 6.3 Mitigation-Watana Impoundment: Paragraph 4: The potential for, and anticipated extent of, aggradation of the Chulitna-Susitna confluence must be better defined, along with many other parameters we have identified, prior to discussions of mitigation needs at this site."

RESPONSE:

Please refer to the Responses to Comments B.14 and C.38 concerning potential aggradation at the Susitna-Chulitna confluence area.

A reasonable discussion of mitigation measures and an estimate of the magnitude of those measures should not be precluded where existing studies are not as precise or exact as could be achieved through additional years of data collection and study. The use of judgment along with conservative estimates of impacts may be all that is required to determine whether a potential impact exists and whether a practical measure can be taken to mitigate for that impact if, in fact, it occurs. Using this reasoning, one can make conservative estimates of the costs of

RESPONSE TO COMMENT I.69 (cont.):

mitigation measures and determine the effects on project feasibility from environmental, engineering and economic viewpoints. A more thorough discússion of this point is contained in the Response to Comment C.31.

COMMENT I.70:

"Chapter 3 generally fails to quantify the existing resources, quantify the potential impacts, and provide specific mitigation measures to deal with identified, quantified, adverse impacts."

RESPONSE:

Exhibit E of the FERC License Application contained all data on fish, wildlife and botanic resources that was available in the project area at the time of preparation of the License Application (see Responses to Comments C.63, C.64, C.78, C.80 and C.89). Extensive quantitative data is provided throughout the Exhibit. For example, the Botanical Resources Section includes estimates of the number of acres within various vegetation types based on vegetation mapping, and estimates of the amount of each type that will be lost to each project action. Baseline wildlife descriptions present detailed quantitative data obtained during project-related studies, as well as from relevant studies outside the project area. The impact assessments also provide considerable quantification. Exhibit E includes over 200 tables and figures presenting detailed quantitative data on botanical and wildlife resources. Quantitative results from more recent field work have been and will continue to be provided as they are received from the Alaska Department of Fish and Game, University of Alaska, and other contractors.

Refinement of proposed mitigation measures is continuing. Additional documentation of the feasibility and probable effectiveness of proposed wildlife and botanical mitigation measures will be provided in a Mitigation Plan Update Report in May 1984. This plan will include data presented in an Impact Assessment Update and Refinement Report to be prepared in April 1984.

Additional quantification and refinement of information on fisheries resources has continued since submission of the License Application. This information is available in reports by the ADF&G (annual reports for the 1983 field season), the Arctic Environmental Information and Data

RESPONSE TO COMMENT I.70 (cont.):

Center (AEIDC) and other contractors. The ADF&G is in the process of analyzing data and completing reports on the 1983 field season. These will be available in the spring of 1984. Information from these reports will be used by the AEIDC in continuation of the documentation of impacts due primarily to flow changes expected with the Project. The results of these analyses are expected to be completed in the summer of 1984.

The Power Authority anticipates that the DEIS will incorporate available studies and will analyze significant areas of uncertainty.

COMMENT I.71:

"Through consultation, the FWS can advise the applicant as to the breadth of our responsibilities. In the area of botanical resources, recent budget cutbacks have precluded in depth analysis of existing data."

RESPONSE:

The Alaska Power Authority and its consultants are in frequent contact with the USFWS and other federal and state agencies. The Power Authority anticipates that the DEIS will reasonably analyze existing data and will incorporate data analyses prepared by the Power Authority and others.

COMMENT I.72:

"Proposed mitigation measures should have proven success in Alaska, or in a similar environment. If proposals are not proven, they should be demonstrated effective in the project area. For example, hatchery propagation of grayling needs to be demonstrated as an effective mitigation option since previous grayling hatchery programs have not been particularly successful in Alaska. Likewise, the proposed slough modifications are unproven and should be demonstrated effective in the Susitna River system. Proposed vegetation manipulations have not been tested. The viability of providing alternative raptor nest sites in presently unoccupied areas has not been proven. The legality of such measures to mitigate for bald eagle nests is untested."

RESPONSE TO COMMENT I.72:

The mitigation measures or proposed plans presented by the Power Authority in the FERC License Application are expected to have a high degree of success. The statement that the proposed slough modifications are unproven is not correct. Numerous such modifications have been made throughout the Pacific Northwest, Canada and Alaska and have been successful. The reader is referred to the Response to Comment B.9 for further details. References for many of these successful modifications and techniques were provided in the License Application (Chapter 3, Section 2.4).

Demonstration of slough modifications on the Susitna River is not currently planned. The reasons for this are:

1. Slough modification is an existing technique (as mentioned) that has had proven success. Therefore, it is anticipated that similar success will occur on the Susitna.

2. The costs involved in performing a demonstration project are significant.

3. The slough modifications proposed in the License Application are designed to alleviate potential impacts on existing productive sloughs that occur as a result of with-project conditions. Those conditions are not presently available. Therefore, the Power Authority has and will continue to develop information to predict with-project conditions. The Power Authority firmly believes that the plan (including alternatives) presented will insure that the existing resources can be protected or that alternative measures can be implemented to insure a viable resource.

The Power Authority anticipates that the DEIS will discuss the adequacy of proposed mitigation plans.

COMMENT I.73:

"Fishery Resources of the Susitna River Drainage:

"The current problems with the water quality computer modeling efforts invalidates much of the fisheries discussions. For example, if we lack a valid river

COMMENT I.73 (cont.):

temperature model and/or ice process model, we cannot confidently discuss potential impacts nor discuss viable mitigation for these concerns."

RESPONSE:

Please refer to the Response to Comment B.6 for a discussion of the models in use and their validity.

COMMENT I.74:

"Fishery Resources of the Susitna River Drainage:

"We continue to lack specificity on the mitigation proposals. Mechanical manipulation of sloughs is being proposed. This section should describe specifically being proposed and which sloughs, side channels, and mainstem reaches are proposed for alteration. There is no indication as to the overall effectiveness of such measures."

RESPONSE:

The mitigation plan presented in the FERC License Application does provide sufficient specificity to elicit more than just general comments from the resource agencies. The Power Authority has clearly presented a plan that employs proven measures and is designed to be highly effective in maintaining the existing resources or ensuring that alternative measures can be implemented to insure a viable resource. Ongoing studies are designed to refine existing information in order that final detailed designs for mitigative measures can be developed. The final selection and design of mitigation measures will be derived in consultation with the resource agencies.

See the Responses to Comments B.9 and I.72 for additional discussion.

COMMENT I.75:

"Fishery Resources of the Susitna River Drainage:

"The significance of the reach below the Chulitna River confluence should be determined. At present, the number of fish using this lower reach, other than for migration, is unknown. We do not believe the fishery impacts will cease at the Chulitna River (please refer to our comments on page E-3-100). Studies should be undertaken to examine the resources of this lower reach and to examine potential impacts and determine mitigation needs."

RESPONSE:

It is incorrect to state that little is known about the fishery resources downstream of Talkeetna. Considerable data are available in the ADF&G basic data reports for the 1981 and 1982 field seasons and in the ADF&G 1983 synopsis report. All of these documents have been transmitted to the FERC for use in developing the Draft Environmental Impact Statement. Some of this information has been summarized in the Responses to Comments B.8, I.98 and I.99. Fish habitat, resident fish and anadromous fish studies have also provided information on fish resources in the lower river. Refer to ADF&G's 1978 Preliminary Environmental Assessment of Hydroelectric Development on the Susitna River. The ADF&G FY 1984 Plan of Study also provides information on the planned aquatic studies program.

REFERENCES

ADF&G, Preliminary Environmental Assessment of Hydroelectric Development on the Susitna River (1978).

ADF&G, Summary of Preliminary Plans for FY 1984 Aquatic Studies Program Activities by Habitat Type and River Mile.

COMMENT I.76:

"Botanical Resources

"This section has been considerably improved over the November 15, 1982 draft license application. We appreciate the incorporation of our comments on the draft, most notably with regard to baseline sections."

RESPONSE TO COMMENT I.76:

Comment noted.

COMMENT I.77:

"Botanical Resources

"Although the impacts section now identifies the full range of vegetation impact issues, there is no estimate of the size of areas which may be potentially affected by changes in vegetation cover. Refinement of the vegetation map to better relate it to wildlife habitat is necessary before the impacts analysis can be completed. Information is then needed on the tradeoffs relative to fish, wildlife, and botanical impacts, as well as cost and design considerations in the siting of project support facilities, roads, and transmission lines."

RESPONSE:

Quantification of areas in which vegetation cover will be lost or significantly altered is found throughout the FERC License Application Botanical Resources text and tables. Areas to be affected by changes in vegetation cover as a result of facility construction and operation are quantified in Exhibit E, on FERC License Application pages E-3-276 through E-3-278. Other areas will be subject to changes of vegetation cover as a result of dynamic processes occurring along roads, the impoundment areas, and the downstream floodplain. Further attention is being given to the quantification of the latter areas during impact assessment refinement.

COMMENT I.78:

"Botanical Resources

"Three other concerns with the impacts section are:

(1) Incorrect assessment of wetlands (see comments on Section 3.2.3, 3.3);
(2) Incompatibility of vegetation typing within the different transmission corridor segments (see comments on Section 3.2.2(e), and 3.3); and
(3) Calculation errors in summing areas of each vegetation type affected by the transmission corridor (see comments on Table E.3.86)."

RESPONSE TO COMMENT I.78:

This Comment references concerns which are more specifically stated elsewhere in the material provided by the Department of Interior. For specific discussion of these aspects, refer to the appropriate responses as follows:

1. Wetlands--see the Response to Comment I.330;

2. Vegetation typing--see the Response to Comment I.327; and

3. Tables E.3.86--see the Response to Comment I.419.

COMMENT I.79:

"<u>Botanical Resources</u>

"The Mitigation Plan is considerably improved over the draft license application; however, it is still incomplete and too general. Implementation, construction, and operation schedules are not clear for many recommended mitigation measures (e.g. land acquisition and management). Incorporation of recommended mitigation measures into project plans is uncertain (e.g. construction techniques, limitations on spoil areas, etc.). Neither replacement lands nor habitat manipulations have been identified as to suitable size, location or type. Moreover, replacement lands and habitat manipulations cannot be realistically identified until:

(1) Moose carrying capacity as well as associated browse, and vegetation mapping studies are completed;
(2) Appropriate wetlands interpretations are made;
(3) Possible mitigation lands are identified, their potential mitigation benefits calculated, and their availability determined."

RESPONSE:

The Power Authority continues to update and refine its mitigation planning based upon more complete data and continuing analysis. The mitigation plans presented in the FERC License Application will undergo considerable refinement before being finalized.

RESPONSE TO COMMENT I.79 (cont.):

The Power Authority also anticipates that the DEIS will identify reasonable mitigaton options with appropriate specificity.

COMMENT I.80:

"Botanical Resources

"Numerous general references are made to browse habitat improvement techniques, land acquisition for habitat management, and increasing browse by clearing or prescribed burning of forests. However, specific information on the potential benefits, time-frames, and suitable vegetation cover types for controlled burning, clearing, and crushing are not provided. The applicant had indicated that such information would be included in Section 3.4.2 in response to our original comments (Chapter 11, W-3-183)."

RESPONSE:

Because there is a considerable amount of published and unpublished information on habitat enhancement methods applicable to the Susitna River Basin that has not been reviewed and synthesized, it was decided that review should be conducted. This review of habitat enhancement methods has been initiated and a report is scheduled to be available in April 1984. A study has also been conducted over the past several months to identify candidate lands for moose habitat enhancement based on criteria developed with and data collected by the Alaska Department of Fish & Game. The Alaska Power Authority has also been working closely with the Alaska Department of Natural Resources' Division of Land and Water Management and jointly have identified approximately 500,000 acres of candidate land. This candidate Mitigation Lands Report will be available in February 1984. These two documents will be used to refine mitigation planning, the status of which will be presented in a Mitigation Plan Refinement Report scheduled to be available in late May 1984.

COMMENT I.81:

"Botanical Resources

"We believe that mitigation agreements should be worked out with applicable landowners and incorporated into project licensing. Otherwise, there is no guarantee that necessary

COMMENT I.81 (cont.):

management polices (e.g. restrictions on use of project access roads and off-road or all terrain vehicles, habitat manipulations, control of other uses, etc.) will be adopted. Our main concern with the Mitigation Plan stem from its development within a short time period which allowed no agency consultation before the formal license review. There is need for joint efforts by the resource agencies and principle study investigators, in conjunction with the applicant's consultants, to: (1) clarify issues; (2) analyze mitigation options; (3) agree on remaining data gaps and how to fill them; and (4) modify this proposal into a mutually acceptable, effective Mitigation Plan. Such a procedure and useful dialogues among the different resource study groups were initiated during the August 1982 Adaptive Environmental Assessment (AEA) workshop and February 28 - March 2, 1983 follow-up modeling session. Much of the progress made then relative to identifying data gaps has since been lost due to delays and budget cuts."

RESPONSE:

Please refer to the Responses to Comments I.301B and I.494. In addition, please refer to the Response to Comments A.10, B.42, F.1, F.6 and F.28.

FERC License Application Chapter 11, Volumes 10A and 10B document the extensive consultation and coordination which dates back to before 1980 between the Power Authority and other agencies. Even earlier consultation is documented in the Final Environmental Impact Statement prepared by the U.S. Army Corps of Engineers for their Susitna Hydroelectric Project (1977). Consultation since the distribution of the Draft FERC License Application is summarized below.

Federal, state and local agency personnel including J. Hall, L. Corin, G. Stackhouse and A. Rappoport from the USFWS participated in a series of workshops from November 29, 1982 through December 2, 1982. The Draft Exhibit E to the License Application, mailed to agencies on November 15, 1982 was reviewed in detail by its authors at this workshop. This provided an early opportunity for agency review of mitigation plans. Informal comments received during the workshop and the formal agency review comments (see Chapter 11, Volume 10B of the License Application) were used in refining the Mitigation Plan presented in the Application submitted to the FERC on February 28, 1983.

On March 3, 1983, preview copies of the 8000 page FERC License Application were distributed to interested agencies.

RESPONSE TO COMMENT I.81 (cont.):

The USFWS initially received two, and then a third copy was provided to facilitate review by their Western Alaska Ecological Services office. Formal acceptance of the License Application was delayed until July 12, 1983 and agencies formally received additional review copies in early August.

Workshops reviewing FY 84 Plan studies were held in July 1983 in the following areas: Aquatic Biology, July 18; Socioeconomic, July 19; Terrestrial, July 20; and Archaeology, July 22, 1983. Federal, state and local agencies were invited to attend and received copies of the plans of study.

In September 1983, agencies were invited to see the project area and review field programs with the investigators. NMFS, DNR, DEC and FWS (Mr. G. Stackhouse) participated in these trips on October 5 and 6, 1983.

Concurrent with meetings, workshops and field trips, the Power Authority has continually distributed to resource agencies technical reports on various topics. For example, during the 1983 calendar year, the following reports were provided to various agencies:

ADF&G	Game Reports for 1982-83
ADF&G	Data Reports, Habitat Synthesis Report, Winter Program Report
AEIDC	Temperature and Stage Reports

With respect to the need for cooperative efforts between the resource agencies and principle study investigators to develop a mutually acceptable, effective Mitigation Plan, please refer to Response to Comment F.1 and to the description of the Susitna Settlement Process.

REFERENCES

U.S. Army Corps of Engineers, Office of the Chief Engineer, Final Environmental Impact Statement, Hydroelectric Power Development, Upper Susitna River Basin, South-central Railbelt Area, Alaska (January 1977).

COMMENT I.82:

"<u>Botanical Resources</u>

"We remain concerned that the cumulative impacts of both reservoir sites, borrow and spoil sites, access roads, transmission corridors and potential indirect vegetation losses are not addressed in accordance with our comments on the draft (Chapter 11, W-3-114 and W-3-149)."

RESPONSE:

The effects of cumulative project-induced impacts on wildlife are considered in the Impact Summary and Mitigation Plan Sections of FERC License Application, Exhibit E, Chapter 3 (Sections 4.3.5 and 4.4 respectively). Section 4.3.5 addresses the cumulative impacts of the entire project on populations, species and communities. Cumulative impacts on wildlife are also considered in the mitigation options presented in Section 4.4. Throughout the remainder of the text, specifically identified project effects are discussed individually in order to facilitate accurate assessment of each impact mechanism for each species or group. Without prior consideration and quantification of individual impact mechanisms where feasible, subsequent assessment of cumulative impacts of the entire project cannot be accomplished. The ongoing refinement of impact assessment and mitigation planning is advancing our predictive capability with respect to cumulative effects. Results of this refinement process will be presented in the Impact Assessment Update and Refinement Report to be completed in April 1984.

COMMENT I.83:

"<u>Wildlife Resources</u>

"A concern that we have with the discussion of impacts is the repeated inference that wildlife will generally move to adjacent areas as project area habitats are altered or destroyed. Little is known of adjacent habitat values and whether those habitats are already fully utilized or even suitable for the species of interest are minimal. A further problem is that no source is provided for many of the conclusions presented here."

RESPONSE TO COMMENT I.83:

The Power Authority disagrees that Section 4.3 of Exhibit E contains "the repeated inference that wildlife will generally move to adjacent areas as project area habitats are altered or destroyed." Our re-reading of the wildlife impact discussion indicates no such simplistic inference; such a conclusion on the part of the reader was certainly not intended by the authors.

In the discussions of impacts to moose presented in FERC License Application Chapter 3, Sections 4.3.1(a) and 4.3.2(a), 31 impact mechanisms are specifically identified. FERC License Application page E-3-397, paragraph 2, states that

> "The direct impacts that will most severely affect moose populations in the middle Susitna basin are, in order of decreasing severity: permanent loss of habitat, blockage of seasonal migration routes, disturbance by machines and humans, hazards associated with the drawdown zone and alteration of habitat. Moose in the lower basin will be affected mostly by alteration of habitat."

FERC License Application page E-3-398, paragraph 3, states

> "There is no question that moose will be affected by this loss of habitat: browse availability will be reduced; winter range, calving areas and breeding areas will be lost; movements may be altered as a result of behavioral or physical barriers; animals will be more vulnerable to predation and hunting (as a result of the loss of cover); and repeated human and mechanical disturbances may preclude use of some areas by moose."

These introductory statements and subsequent, more detailed supporting discussions clearly demonstrate that habitat destruction and alteration, along with blockage of movement, are considered to be the most severe impact mechanisms that will affect moose in the middle and lower Susitna Basins.

There is no indication in the moose impact discussions that individual animals will merely relocate from areas of habitat loss to surrounding lands, where they will continue to survive as before. The impact discussions place great emphasis on the importance of elevation differences and terrain complexity in limiting the occurrence of suitable habitat within and around the project area. The importance of winter habitat as a population-limiting factor, and the dependence of winter habitat availability on elevation, slope and snow depth, are explained to be especially important in this regard. The impoundment areas in particular are shown to provide a major source of winter habitat which will be unavailable following clearing and flooding. For example, FERC License Application page E-3-400, paragraph 2, states

> "Because low elevation riparian shrub, deciduous forest, coniferous forest and muskeg habitats will not be available in areas adjacent to the impoundment, the removal of these habitats by initial clearing activities and later flooding will deprive moose of a large area of high quality winter range. Assuming that bottomland browse resources throughout the middle Susitna basin are fully utilized by moose in severe winters, clearing and flooding of the impoundment will force moose to depend on and likely over-utilize the remaining winter range. Moose which never use the impoundment area will also be affected by over-utilization of these adjacent areas. Increased mortality would be expected caused by starvation and increased predation, whereas natality may decrease because of the poor physical condition of the moose."

The reviewer states "Little is known of adjacent habitat values and (data on) whether those habitats are already fully utilized or even suitable for the species of interest are minimal." Again, this implies an expectation on the part of the authors that individual animals will simply relocate to surrounding areas about which little is known from the standpoint of habitat suitability of utilization. Exhibit E states no such expectation and provides substantive information on habitat requirements and area limitations for the wildlife species discussed. For example, the impact assessment for moose is based on state-of-the-art modeling for carrying capacity and population dynamics, as explained in FERC License Application Section 4.3.1(a)(iii), pages E-3-412 through E-3-414, and in the Response to Comment F.42. A pilot browse study was conducted during the summer of 1983 to test alternative methods for quantification of current annual growth by height, density, dry weight, stem diameter and other parameters. A report on this study will be available in February 1984.

Although the above examples discuss moose, we are not aware of other places in Exhibit E where it is indicated that

RESPONSE TO COMMENT I.83 (cont.):

other wildlife species will simply redistribute themselves without detriment during and after project construction. Nor are we aware of places where Exhibit E fails to discuss current, area-specific information on habitat utilization. For example, distribution and movement patterns, habitat use and population characteristics of caribou in and around the project area are discussed in FERC License Application Section 4.2.1(b), pages E-3-318 through E-3-325. FERC License Application Section 4.3.3(b), pages E-3-479 through E-3-482, discusses probable caribou impacts of the access route from the Denali Highway. This discussion opens by stating "The access road between the Denali Highway and the two damsites is likely to have a substantial effect on caribou movements." The ensuing discussion cites numerous studies on individual and population-level responses of caribou to human structures and activities. The discussion concludes that,

> "The Susitna-Nenana subherd is resident in the access road area and, although the rate of exchange of individuals with the main herd is unknown, the presence of the Watana impoundment in conjunction with heavy hunting pressure will probably result in a substantial decrease in this subherd."

In the case of the black bear, Exhibit E clearly states that,

> "After filling, it is unlikely that a viable resident black bear population will exist upstream from Watana Creek. Transient bears may use areas adjacent to the impoundment, and a few black bears may reside there year-round. However, the lack of denning areas and adequate forest stands near the remaining food supplies will severely limit the resident population" (FERC License Application Section 4.3.1(e)(ii), pages E-3-428 and E-3-429).

In the Impact Summary (FERC License Application Section 4.3.5(a), pages E-3-502 and E-3-503), this conclusion is reiterated:

> "Black bears will be severely affected by the project, primarily as a result of inundation of denning and feeding habitat upstream from Tsusena Creek. The Watana reservoir will inundate approximately 69 percent of the denning habitat occurring in that area (black bears are restricted to the band of forest along the river), whereas about 6 percent of the denning habitat

> in the Devil Canyon reservoir vicinity will be lost. Additional denning areas will be impacted by road and transmission line construction. The resident population of about 30-50 bears between the Tyone River and Tsusena Creek will probably be eliminated."

The summary concludes:

> "Cumulative impacts of mortality from hunting, increased encounters with brown bears, and bear/human conflicts, in concert with loss of denning and feeding habitats due to facilities and disturbance, will greatly reduce the black bear population in the middle basin."

Again, there is no indication that bears will relocate to adjacent areas; the fact that they are largely confined to a narrow band of limiting habitat which will be lost as a result of impoundment is clearly stated. It is known, and stated, that habitat in neighboring areas is unsuitable.

Although the above examples apply to large mammals with relatively low population densities, similar treatment is given to other species with greater population densities. Unlike most mammals, birds are highly mobile and may disperse great distances should disturbances or habitat loss affect traditional use areas. For individual birds directly affected by impoundment filling, dispersal to other suitable habitats is highly probable. Incorporation of these directly affected birds into surrounding bird populations is likely for most species. In far northern regions, the winter season represents the time of greatest stress on resident birds. At this time, food is much more limited than in summer and many resident woodpeckers and passerines (e.g., chickadees, woodpeckers) maintain enlarged feeding territories to compensate for this paucity of food (Conner 1981). For these 10-12 species, individuals directly displaced by habitat losses would likely establish new breeding territories in summer; but if winter populations are presently saturated, some absolute decreases in area populations proportional to the amount of habitat loss could occur within several years. For the remaining migratory birds (35 species) or those that wander erratically in winter (10 species), displacement to other suitable breeding habitats will probably be the greatest level of impact incurred. The Susitna Hydroelectric Project lies mostly within the boreal forest zone, probably the most extensive, relatively uniform avian habitat in North America. Many migrant passerines breeding in this zone winter in the

RESPONSE TO COMMENT I.83 (cont.):

tropical regions of Central America and northern South America (A.O.U. 1983). Here they compete with large populations of resident birds in a habitat much more limited in size than the boreal forest zone. Population regulation through competition for food and space, if important as a limiting factor to these passerine populations, probably occurs at this season. Therefore it appears unlikely that populations of these species are saturated on the expansive breeding grounds, where absolute losses of habitat would be less important than on the more crowded wintering grounds. Therefore, "changes in the distribution and relative abundance of species in the area" will occur, with probably little impact to some species (migrants), but some local population declines for other species (residents).

REFERENCES

Conner, R. N., Seasonal Changes in Woodpecker Foraging Patterns, Auk 98(3): 562-570 (1983).

American Ornithologists' Union (A.O.U.), Check-list of North American Birds (6th Ed.) (1983).

COMMENT I.84:

"Wildlife Resources

The majority of recommended compensation measures are generally insignificant and unsubstantiated. For example: increases in ungulates through browse improvement would compensate for losses to their predators (bears and wolves); carrion from increased road mortality and impoundment hazards would compensate for wolverine habitat losses; salmon benefitting through slough modifications would compensate for decreases in other bear foods; flow regulation resulting in downstream habitat improvement compensates for upstream losses of moose and beaver habitats; and general habitat improvements for larger species would compensate for small birds and small mammal losses."

RESPONSE:

The examples provided by the reviewer are not representative of the full range of mitigation measures presented in the 23 mitigation plans for wildlife (FERC License Application

RESPONSE TO COMMENT I.84 (cont.):

Exhibit E, Chapter 3, Section 4.4.2(b), pages E-3-525 through E-3-540). Indeed, the examples cited are not really compensation measures at all. Rather, they are probable compensating factors likely to occur without deliberate, species-specific intervention. Because they may affect the total picture of cumulative impacts on certain species, these factors should be taken into account and are noted for that reason.

COMMENT I.85:

"Page E-3-24: - Incubation and Emergence: Based upon their apparent inability to distinguish upper Susitna River sockeye salmon stocks from Talkeetna or Chulitna River drainage stocks, Bernard et al. (1983 3F-1/ concluded that fry do not rear above Curry Station (River Mile (RM) 120.5). The outmigration data from 1982 appears to support this hypothesis. However, outmigration may have been substantially complete when the outmigration trap was installed (June 18). Growth exhibited by juveniles collected in the trap throughout the summer and the observations of outmigrants during the spring of 1983 at slough #11 indicated important sockeye salmon rearing habitat may be found in the upper Susitna River.3F-2/ Further investigation appears warranted in regard to sockeye salmon rearing."

"3F-1/ Bernard, D.R., et al. 1983. Comparison of Scale Patterns from Sockeye Salmon Sampled from Different Rivers within the Susitna River Watershed in 1982. ADF&G. Div of Com. Fish."

"3F-2/ ADF&G. 1983. Synopsis of the 1982 Aquatic Studies and Analysis of Fish and Habitat Relationships. Prepared for the APA."

RESPONSE:

The document (ADF&G, 1983 Synopsis Report) referenced by the commentor does not include data collected in 1983. Additional studies by the Alaska Department of Fish and Game were initiated in 1983 to investigate this issue. The

RESPONSE TO COMMENT I.85 (cont.):

report on initial results should be available in late spring 1984. See Response to Comment I.95 for additional details.

REFERENCES

ADF&G, Susitna Hydro Aquatic Studies, Phase II Basic Data Reports for 1982, 5 Volumes (1983), previously submitted to the FERC on October 31, 1983.

Synopsis of the 1982 Aquatic Studies and Analysis of Fish and Habitat Relationship (1983).

COMMENT I.86:

"Page E-3-32: Juvenile Behavior: Juvenile chum salmon are generally thought to outmigrate quite soon after emerging. Data collected by ADF&G in 1982 3F-3/ indicate chum salmon juveniles spend up to three months in the Susitna River. This rearing period may be important since the Susitna River estuary is very turbid and may not provide adequate rearing habitat. The density patterns observed by ADF&G suggests juvenile chums prefer lower velocity areas and are associated with backwater areas near the mouths of sloughs and clear water tributaries.3F-4/ The report should be expanded to include a discussion of chum salmon rearing. The implications of the ADF&G finding should be discussed in the analysis of post-project impacts."

"3F-3/ See Footnote 3F-2. [Footnote 3F-2/ ADF&G. 1983. Synopsis of the 1982 Aquatic Studies and Analysis of Fish and Habitat Relationships. Prepared for the APA.

"3F-4/ See Footnote 3F-2, supra."

RESPONSE:

The results of Alaska Department of Fish and Game studies have shown that chum may spend as much as three months in freshwater, prior to outmigrating. The Synopsis Report (ADF&G 1983) referenced by the U.S. Fish and Wildlife Service is only a portion of the information currently available on rearing habitats in the Susitna River. Extensive information is also available in:

RESPONSE TO COMMENT I.86 (cont.):

Alaska Department of Fish and Game, Susitna Hydro Aquatic Studies Phase II Basic Data Report, Volume 3, (1983) Resident and Juvenile Anadromous Fish Studies on the Susitna River below Devil Canyon, 1982, Parts I and II plus appendices.

Alaska Department of Fish and Game, Subtask 7.10, Phase I Final Draft Report Juvenile Anadromous Fish Study on the Lower Susitna River (1982), ADF&G/SuHydro, 1981.

Alaska Department of Fish and Game, Preliminary Environmental Assessment of Hydroelectric Development on the Susitna River (1978), prepared for the U.S. Fish and Wildlife Service.

REFERENCES

ADF&G, Susitna Hydro Aquatic Studies, Phase II Basic Data Reports for 1982, 5 Volumes (1983), previously submitted to the FERC on October 31, 1983.

Synopsis of the 1982 Aquatic Studies and Analysis of Fish and Habitat Relationship (1983).

COMMENT I.87:

"Page E-3-41 (v) Burbot: The ADF&G Synopsis Report 3F-5/ states that burbot habitat shows a strong correlation with turbidity. These findings should be discussed in light of the post-project implications on turbidity."

"3F-5/ See Footnote 3F-2. [Footnote 3F-2/ ADF&G. 1983. Synopsis of the 1982 Aquatic Studies and Analysis of Fish and Habitat Relationships. Prepared for the APA.]"

RESPONSE:

Many fish species which are adapted to turbid waters are probably also adapted to low light intensities. The burbot is found to be active in conditions of low light intensities, but not necessarily high turbidity conditions, in many waters of North America (Scott and Crossman 1973). The burbot is active in low light conditions and even shows

RESPONSE TO COMMENT I.87 (cont.):

an inversion of circadian rhythm patterns - becoming active by day - during the long diurnal periods of winter darkness near the Arctic Circle (Schwassermann 1980). Therefore, it is unclear if the correlation reported in the ADF&G 1983 Synopsis Report is directly related to turbidity per se, or to the decreased light associated with turbid conditions. Based on the above-cited references, the latter would seem to be the case.

Since turbidities in the mainstem Susitna will be decreased during the summer months, it may be expected that, at least above Talkeetna, light penetration may be somewhat improved. Below Talkeetna, the influence of the Chulitna and Talkeetna Rivers may significantly reduce increased light penetration. In ice-covered reaches of the river, winter increases in turbidity may not significantly decrease light compared to the decreases from ice and snow cover.

The effects of changed light intensities on the ecology of Susitna River burbot are presently unknown.

REFERENCES

Scott, W. B. and E. J. Crossman, Freshwater Fishes of Canada, Bulletin 184, Fisheries Research Board of Canada, Ottawa (1983).

Schwassermann, H. O., Biological Rhythms: Their Adaptive Significance, in Environmental Physiology of Fishes, M. A. Ali, ed. (1980).

COMMENT I.88:

"Page E-3-42: (vi) Round Whitefish: The ADF&G data indicate that significant numbers of round whitefish remain in the mainstem of the Susitna River. They are associated with the mouths of tributaries and turbidity mixing zones of clear water sloughs.3F-6/"

"3F-6/See Footnote 3F-2. [Footnote 3F-2/ ADF&G. 1983. Synopsis of the 1982 Aquatic Studies and Analysis of Fish and Habitat Relationships. Prepared for the APA.]"

RESPONSE TO COMMENT I.88:

The FERC License Application states that "The presence of whitefish near the mouths of tributary streams in the March to May period after none had been caught in the same locations between November-February, indicates a general pattern of movement into the various tributaries in the spring (ADF&G 1981e)."

Further studies by ADF&G (1983) show that, in addition to the tributaries, round whitefish are associated with the mouths of tributaries. They also state that "...round whitefish...were all more likely to be found in the mainstem in spring and fall than summer. These species (including round whitefish) apparently use tributaries and sloughs in the summer, the mainstem in the spring and fall during migrations, and the mainstem in winter as over-wintering habitat."

Accordingly, the License Application stated that, <u>in general</u>, the association of round whitefish with tributary mouths is associated with their movement into the various tributaries.

<u>REFERENCES</u>

ADF&G, Susitna Hydro Aquatic Studies, Phase II Basic Data Reports for 1982, 5 Volumes (1983), previously submitted to the FERC on October 31, 1983.

Synopsis of the 1982 Aquatic Studies and Analysis of Fish and Habitat Relationship, pages G-20 and G-21 (1983).

Alaska Department of Fish and Game, Susitna Hydro Aquatic Studies Phase I Final Draft Report, Resident Fish Investigation on the Lower Susitna River, (1981e).

COMMENT I.89:

"<u>Page E-3-62: (i) Mainstem and Side Channels</u>: We suspect the Susitna-Chulitna confluence area is important to the anadromous fisheries for rearing and milling. We suspect chinook, coho, sockeye, and chum rearing and/or overwintering may occur here. The importance of the confluence area to the fisheries of the Chulitna and the

COMMENT I.89 (cont.):

Talkeetna Rivers are not known since fishery runs into these two river systems were not included in the ADF&G studies. Post-project winter flows would be approximately four times greater than pre-project flows; winter turbidity would be noticeably higher (affecting feeding and predator-prey relationships); aggradation is probable; and temperature and ice processes would probably be dramatically changed from pre-project conditions. We recommend that the value of this area be evaluated and the post-project impacts assessed."

RESPONSE:

Based on the data presently available, some locations within the confluence area have been shown to be utilized by juvenile salmon for overwintering and rearing. Most notably are Rabideaux Slough, Sunshine Slough and Birch Creek Slough. It is important to recognize that in the confluence area, the river is a highly unstable braided river reach. Year to year differences in available habitat are great. See Responses to Comments I.99 and B.8.

We assume that the suspicion expressed by the commentor is based mainly on circumstantial evidence. Adult salmon which enter the confluence area spawn primarily in the Chulitna and Talkeetna river basins. Outmigrating juveniles from the Chulitna and Talkeetna and upper Susitna drainage certainly must pass through this reach and may on occasion result in high concentrations of juveniles in the area. Some juvenile rearing habitats have been evaluated in the reach as cited above.

It should be noted that under with-project conditions during the winter, the increased discharge from the Susitna River could quite conceivably enhance overwintering habitat in the confluence area. The increased discharge from the Susitna River will create larger breakwater zones in the mouths of the Talkeetna and Chulitna Rivers which under natural conditions are either nonexistant or are limited in extent. Winter turbidity effects on juvenile overwintering habitats and predatory-prey relationships are not anticipated to be significant. Increased turbidity may provide additional cover for juvenile salmon thereby enhancing survivorship. Anticipated temperature changes and ice process changes could result in an enhancement of the overwintering habitats.

Aggradation of bedload and suspended sediments in the confluence area will occur primarily during the summer, openwater period.

COMMENT I.90:

"Page E-3-62: Salmon: The importance of the reach between the Yentna River and the Susitna River above the Chulitna and Talkeetna Rivers to anadromous fisheries is presently unknown. The Yentna River Station allows ADF&G to separate out the Yentna River run from the Susitna River run upstream from this point. Lack of stations on the Chulitna and Talkeetna Rivers prevents determining the importance of these two river systems to the overall Susitna River run. We recommend that stations be established on the Chulitna and Talkeetna Rivers."

RESPONSE:

The Power Authority does not agree with the recommendation to establish monitoring stations on the Talkeetna and Chulitna Rivers. The importance of these two rivers for salmon spawning is not questioned. Approximately 90 percent of the salmon escapement past the Sunshine Station enter either the Chulitna or Talkeetna Rivers. However, since the project will not affect either of these rivers, it is sufficient to obtain a composite estimate of the salmon escapement to the rivers.

COMMENT I.91:

"Page E-3-80: (ii) Construction and Operation of Watana Camp, Village and Airstrip: Paragraph 1: Justification for separating the construction camp, construction village and permanent townsite should be provided. Combining these developments would help to minimize adverse impacts, particularly to botanical and wildlife resources but also to aquatic resources. We suggest that serious consideration be given to combining these facilities."

RESPONSE:

The Watana Construction Camp will be a self-sufficient installation for housing project construction personnel who are on single status. The Construction Village will likewise be a self-sufficient installation for housing construction-related personnel and their dependents. The overriding criteria for separating these two installations is the mitigation of sociological and psychological factors. Adherence to this criterion becomes more important when the construction site is located remote from urban areas and in zones of hostile climatic conditions.

RESPONSE TO COMMENT I.91 (cont.):

The Construction Village and Permanent Village are contiguous. The latter will provide housing for personnel involved in the operation of the Project and their dependents. The Permanent Village will conceptually be the same as other rural hamlets in Alaska. The Construction Village will have a useful life consistent with the construction period, whereas the Permanent Village will exist as long as the Project is in operation. The development of the Construction Camp and Village will be one of the first construction activities. The Permanent Village will not be constructed until the project is nearing completion and the need is established for operating personnel orientation and training. At this time, housing for both construction personnel and their dependents, as well as operating personnel and their dependents, will be necessary. It is conceivable that some facilities of a permanent nature may be constructed in the Construction Village for later utilization in the Permanent Village. This possibility will be studied in detail during the design phase of the project development.

COMMENT I.92:

"Page E-3-80: (ii) Construction and Operation of Watana Camp, Village and Airstrips: Last Paragraph: We understand that current plans call for expanding the 2500-foot temporary airstrip to 6000 feet in length rather than constructing two airstrips. 3F-7/ We concur with this proposal."

"3F-7/See Footnote 3F-2. [Footnote 3F-2/ ADF&G. 1983. Synopsis of the 1982 Aquatic Studies and Analysis of Fish and Habitat Relationships. Prepared for the APA.]"

RESPONSE:

Reference is made to the Draft Report, Watana Airstrip Feasibility Study - Phase 1 Report to the Alaska Power Authority dated September 1983.

In this report, the feasibility and cost/benefits were analyzed for the construction of a temporary airstrip at the existing Watana Camp during the later part of 1983.

The temporary strip proposed and emphasized in the report is 2,500 feet in length with the possibility of extension to

RESPONSE TO COMMENT I.92 (cont.):

4,000 and 6,000 feet at a later date if conditions warrant. No commitments for expansion were made in the report.

On July 5, 1983, an application for permit was filed with the Department of the Army, Alaska District Corps of Engineers for placement of fill in wetlands to construct the 2,500-foot long temporary airstrip. On November 9, 1983, an Army permit, File No. 071-0YD-4-830374 was issued, and can be found in the Reference Volume of this response document.

Although the proposed 2,500-foot long airstrip is expandable to 6,000 feet, no plans have been made to do so. Therefore, the last paragraph of Section (ii) on FERC License Application page E-3-80 is correct as is under present conditions.

REFERENCES

Alaska Power Authority, Susitna Hydroelectric Project Watana Airstrip Feasibility Study Phase 1, Task 39, Draft Report, pages 8, 19-20, Figure 1, Appendix E (September 1983).

U.S. Army Corps of Engineers, Alaska District Corps of Engineers, Letter to Alaska Power Authority transmitting permit November 9, 1983).

U.S. Army Corps of Engineers, Permit Enabling Alaska Power Authority to Discharge Dredged or Fill Material, Application No. 071-OYD-4-830374 (November 9, 1983).

COMMENT I.93:

"Page E-3-84 to 86: Mainstem Habitats: We believe that the knowledge of potential post-project water quality impacts is inadequate. Please refer to our comments on Chapter 2, pages E-2-19, E-2-34, E-2-69, and E-2-96. Post-project reservoir fisheries should be re-examined after the reservoirs' water quality parameters are assessed."

RESPONSE:

Please refer to the Responses to Comments I.21, I.34 and I.41.

COMMENT I.94:

"Page E-3-96: Slough Habitats: Paragraph 4: According to the ADF&G Synopsis Report 3F-8/, unrestricted access to slough #9 does not occur until the mainstem discharges at Gold Creek exceeds 20,000 cubic feet per second (cfs). Acute access problems occur at flows less than 18,000 cfs. The applicant should revise the discussion to reflect the more current ADF&G assessment.

"Nine sloughs were examined by ADF&G 3F-9/; Whiskers Creek Slough, and sloughs #6A, #8A, #9, #11, #16B, #20, #21, and #22. Five of the sloughs (#9, #16B, #20, #21, #22) show acute access problems below 18,000 cfs, and unrestricted access is not achieved until flows exceed 20,000 cfs to 26,400 cfs."

"3F-8/See Footnote 3F-2. [3F-2/ ADF&G. 1983. Synopsis of the 1982 Aquatic Studies and Analysis of Fish and Habitat Relationships. Prepared for the APA.]

"3F-9/See Footnote 3F-2, *supra*."

RESPONSE:

Based on the conclusions reached by ADF&G in their Synopsis Report, it is evident that the sloughs identified in this Comment are candidates for modifying the mouths to provide more suitable access conditions. The results presented below in Table I.94.A in terms of the provision of mainstem discharges to provide suitable access conditions must be coupled with the relative importance of these sloughs to the existing spawning populations. Table I.94.B provides a summary of the estimated escapement of adult salmon to the five sloughs (#9, #16B, #20, #21 and #22) observed in 1981, 1982 and 1983 and the proportion of slough spawning salmon utilizing each slough as well as the proportion of the estimated escapement of adult salmon to the upper river (past the Curry Station) which utilize each slough for spawning. Based on this analysis, it is evident that the numbers of salmon implicated by the conclusions reached by ADF&G are relatively small.

RESPONSE TO COMMENT I.94 (cont.):

Table I.94.A
Discharge Versus Access Relationships for Upper Susitna Side Sloughs and Relative Utilization by Three Salmon Species (License Application Appendix A8)

	ACCESS		PEAK ESCAPEMENT COUNTS				
Slough	Acute[1]	Unrestricted	Sockeye 1981	Sockeye 1982	Pink[2] 1982	Chum 1981	Chum 1982
Whiskers Creek	8,000 cfs	10,000 cfs	0	0	138	0	0
6A	-	8,000 cfs	0	0	35	11	2
8A	7,860 cfs	12,500 cfs	177	68	28	620	336
9	18,000 cfs	20,000 cfs	6	10	12	260	300
11	-	6,700 cfs	214	893	131	411	459
16B	18,000 cfs	26,400 cfs	0	0	0	0	0
20	20,000 cfs	21,500 cfs	2	0	64	14	30
21	20,000 cfs	23,000 cfs	38	53	64	274	736
22	20,000 cfs	22,500 cfs	0	0	0	0	0

1 The use of the term "acute" implies a threshold mainstem discharge below which adult salmon attempting to gain access may be subjected to extensive physical stress, increased predation or prevention of access to the spawning habitat. If mainstem discharge is maintained at or below this level on a continuous basis, future use of the spawning area may be constrained.

2 1982 data only as even year runs dominate in the Susitna.

\- Data unavailable.

RESPONSE TO COMMENT I.94 (cont.):

Table I.94.B

Estimates of Escapement and Relative Importance of Selected Sloughs[1]

		Chum			Sockeye			Pink		
Slough	Year	Escapement Estimate	Proportion of Slough Spawning Salmon (Percent)	Proportion of Escapement Past Curry[2] (Percent)	Escapement Estimate	Proportion of Slough Spawning Salmon (Percent)	Proportion of Escapement Past Curry[2] (Percent)	Escapement Estimate	Proportion of Slough Spawning Salmon (Percent)	Proportion of Escapement Past Curry[2] (Percent)
9	1981	368	8.2	2.8	18	0.8	0.6	0	0	0
	1982	603	11.9	2.1	13	0.9	1.0	18	6.1	<0.1
	1983	430	14.6	2.0	0	0	0	0	0	0
16B[3]	1981	5	0.5	0.1	0	0	0	0	0	0
	1982	0	0	0	0	0	0	0	0	0
	1983	0	0	0	0	0	0	0	0	0
20	1981	24	0.5	0.2	0	0	0	0	0	0
	1982	28	0.5	0.1	0	0	0	75	25.2	0.1
	1983	103	3.5	0.5	0	0	0	0	0	0
21	1981	657	14.6	5.0	63	2.9	2.3	0	0	0
	1982	1,737	34.4	5.9	87	5.9	6.7	9	3.0	<0.1
	1983	481	16.3	2.3	294	27.8	15.5	0	0	0
22	1981	0	0	0	0	0	0	0	0	0
	1982	0	0	0	0	0	0	0	0	0
	1983	105	3.5	0.5	0	0	0	0	0	0

RESPONSE TO COMMENT I.94 (cont.):

Table I.94.B (cont.)

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1 Extracted from ADF&G 1983 Phase II Adult Anadromous Investigations Draft Report, December 1983. Prepared for the Alaska Power Authority, Anchorage, Alaska.

2 Estimated escapement past Curry are: for Chum 13,100 in 1981, 29,400 in 1982 and 21,100 in 1983; for Sockeye 2,800 in 1981, 1,300 in 1982 and 1,900 in 1983; for Pink 1,000 in 1981, 58,000 in 1982 and 5,500 in 1983.

3 Sloughs 16 and 16B are closely associated with each other. The ADF&G Anadromous Adult Reports do not segregate these two sloughs.

COMMENT I.95:

"Page E-3-97: Slough Habitats: Paragraph 5: Please refer to our comments on page E-3-24. The conclusion that the Susitna River sockeye salmon upstream of the Talkeetna River are strays from the Chulitna and Talkeetna Rivers stocks is presently unsubstantiated."

RESPONSE:

In comparing scale patterns from different sockeye salmon stocks in the Susitna River, Bernard et al. (1983, page 22) concluded that:

> "Most probably adult sockeye salmon passing Curry Station are strays from the Chulitna and Talkeetna Rivers and are not a separate stock. Most of thes (sic) fish spawn in sloughs above Curry Station, and their fry either move down to the Lower Susitna River to overwinter and/or die."

REFERENCES

ADF&G, Susitna Hydro Aquatic Studies, Phase II Basic Data Reports for 1982, 5 Volumes (1983), previously submitted to the FERC on October 31, 1983.

Bernard, D. R., G. Oliver, W. Goshert and B. Cross, Comparison of Scale Patterns From Sockeye Salmon Sampled From Different Stocks in the Susitna River in 1982, Appendix 2-H to: Susitna Hydro Aquatic Studies Phase II Final Report, Volume 2, Adult Anadromous Fish Studies, 1982 (1983).

COMMENT I.96:

"Page E-3-97 to 98: Slough Habitats: Paragraph 6: The relationship between mainstem flows and slough upwelling should be further examined (see paragraph 3 of this section and our comments on Chapter 2, page E-2-98)."

RESPONSE:

Please refer to the Responses to Comments B.18 and B.19 for additional information on the relationship between mainstem flows and slough upwelling. Also refer to the specific

RESPONSE TO COMMENT I.96 (cont.):

Responses to Comments C.32, I.22 and I.42.

COMMENT I.97:

"Page E-3-98: Slough Habitats: Paragraph 7: Please refer to our comments on Chapter 2, page E-2-44, and the recently completed salmon incubation study. 3F-10/ It is unfortunate that the incubation study was not continued through smolt stages. Pre- versus post-project temperature changes could result in significant differences in outmigration timing and/or survival. We recommend that the study be re-initiated to determine timing and survival through smolting."

"3F-10/ Wangaard, D.B. and C.V. Burger. 1983. Effects of Various Temperature Regimes on the Incubation of Susitna River Chum and Sockeye Salmon. U.S. FWS. Prepared for the APA."

RESPONSE:

The study by Wangaard and Burger (1983) of the U.S. Fish and Wildlife Service (USFWS) contributed significantly to the understanding of the relationships between various temperature regimes and the incubation of Susitna River chum and sockeye salmon. The recommendation by the USFWS that the study be re-initiated to determine timing and survival through smolting has been evaluated by the Power Authority. At this time, however, the Power Authority does not believe that this study is necessary. The reasons for this are:

1. The USFWS has proposed that survival through smolting (particularly for chum salmon) be tested via salt water challenge tests. These laboratory tests are very useful in certain situations. A typical application of this test is to determine the "readiness" of hatchery-reared salmon to adapt to sea water in order that they may be released at an optimum time.

2. A second application of this test is to determine the viability of smolts following exposure to various stresses (e.g., seawater challenge tests can be used to test smolt viability following exposure to toxic chemicals). Such tests are valuable to understanding the mechanisms and results of stresses, or in this case, various rearing temperatures.

RESPONSE TO COMMENT I.97 (cont.):

However, these are laboratory tests in a controlled environment that eliminates much of the natural variation that occurs in the actual field situation. As such, extreme caution must be used in extrapolating the results of such tests to the field situation. For example, a laboratory test for smolt viability would probably involve the following: collection of eggs in the field from a limited number of sites; incubation in a laboratory situation; rearing on artificial diet; and then testing of selected fish over time by exposing them directly to salt water. From this, the relationships among temperature, temperature units, timing of outmigration and smolt viability would be examined. Success of rearing the fish from egg to yolk absorption size under laboratory conditions could range as high as 90% or better. In the natural environment, this value would be below 50% and probably closer to 10%. Also, in the natural environment, there is a wide range of variation within the juvenile fish population because they originate from numerous sites (various sloughs, side channels and tributaries spread out over a large area), are reared under a wide variety of conditions (e.g., temperature, flow, substrate, etc.), have a wide range of distances to outmigrate to sea water, and show a considerable variation in the time they spend in fresh water (e.g., ADF&G (1983) has found a major portion of the juvenile chums outmigrate from the Talkeetna to Devil Canyon reach by mid-June, but some may remain in this reach and rear for up to 3 months). Upon reaching sea water, the juveniles are not directly exposed to sea water but may instead move between areas of varying salinity, if necessary. This is particularly true for juveniles that outmigrate through Cook Inlet where large areas of varying salinity are available. For these reasons, it would not be scientifically valid to directly extrapolate the laboratory results to the field situation.

3. The Power Authority has funded extensive studies to determine timing, incubation rates and rearing periods for chum salmon (and other species) in the field situation. These studies, primarily by the Alaska Department of Fish and Game, have been ongoing for several years (see Response to Comment I.23). The results from these studies, those of Wangaard and Burger (1983) and the extensive literature on this subject are adequate to understanding the potential

RESPONSE TO COMMENT I.97 (cont.):

impacts from temperature on incubating and rearing chum and other salmon.

REFERENCES

ADF&G, Susitna Hydro Aquatic Studies, Phase II Basic Data Reports for 1982, 5 Volumes (1983), previously submitted to the FERC on October 31, 1983.

Synopsis of the 1982 Aquatic Studies and Analysis of Fish and Habitat Relationship (1983).

Wangaard, D. B. and C. V. Burger, Effects of Various Temperature Regimes on the Incubation of Susitna River Chum and Sockeye Salmon, U.S. Fish and Wildlife Service (1983), previously submitted to the FERC on November 29, 1983.

COMMENT I.98:

"Page E-3-100: (iii) Cook Inlet to Talkeetna: It is stated that the Chulitna River contribution is 39% and the Talkeetna River contribution is 18%. We assume the upper Susitna River contribution is the remaining 43%. Lacking hydrological, modeling and biological data to the contrary, it could be assumed that greater impacts would occur upstream of the mouths of Talkeetna and Chulitna Rivers than to downstream.

"However, given that our understanding of the fishery use in the lower reach is a magnitude below that for the upper Susitna River, and the river is broad and relatively shallow, we would not dismiss significant project-related impacts in this reach. Although we do not know the level of fishery use in this reach, we suspect this reach contains important spawning and rearing habitat.

"In a report prepared for the APA, the Arctic Environmental Information and Data Center (AEIDC) 3F-11/ concluded, 'The effort to delineate river reaches where post-project flows differ significantly from natural flows has been unsuccessful. The purpose of this effort was to limit the area where flow-related impacts (other than water quality issues) need to be considered. Being unable to establish these limits, it appears necessary to include the entire length of river when considering aquatic habitat effects.'

COMMENT I.98 (cont.):

"It appears that an aquatic studies program is necessary to examine post-project impacts downstream of the Chulitna River. We request the applicant provide the FWS with a copy of the downstream studies program proposed to be undertaken in 1984 by APA."

"3F-11/ AEIDC. 1983. Examination of Discharge and Temperature Changes due to the Proposed Susitna Hydroelectric Project. Prepared for the APA."

RESPONSE:

The relative contribution of water from the Upper Susitna, Chulitna and Talkeetna Rivers is correct for the Sunshine USGS gaging station. These three rivers combined contribute approximately one-half of the total discharge of the Susitna River at the Sunshine Station USGS gaging station near the mouth of the river.

Considerable information pertaining to the Lower River has been presented in the ADF&G data reports collected in the 1981 and 1982 field seasons. Much of this information is included in Exhibit E of the License Application. Further information pertaining to the Lower River is presented in the ADF&G 1982 Phase II Synopsis Report.

Additional studies are currently being conducted to describe the response of water surface areas of various habitat types to various mainstem discharges. These studies are being used to further refine the analysis presented in the License Application and to develop a plan of study to further refine the impact analysis of the Lower River. Once plans for the additional studies are outlined, the plan will be discussed with the appropriate resource agencies.

COMMENT I.99:

"Page E-3-101: Mainstem Habitats: Paragraph 1: We believe that the information on fish use downstream of the Chulitna River is due to the very limited data gathering efforts expended in this reach rather than limited fish use. Please refer to our comments on page E-3-100, immediately above, and on Chapter 2, page E-2-60."

RESPONSE TO COMMENT I.99:

The Power Authority does not agree that there has been a limited gathering effort expended on the reach of the Susitna River downstream of the Chulitna River confluence.

Considerable effort has been expended to describe the spawning characteristics of eulachon and habitats through the reach have been sampled for adult and juvenile salmon as well as other anadromous and resident fish species. Escapement index counts have been made in most of the tributaries to the Susitna downstream of Talkeetna as well as in the Talkeetna River and Chulitna River drainages (ADF&G 1981, 1983a, 1983b). Quantitative habitat relationships for juvenile salmon have been developed for four side slough habitats downstream of Talkeetna (ADF&G 1983c). Hydraulic and ice processes studies have been conducted and are continuing at the present time. As discussed in the Response to Comment B.8, considerable information has been collected regarding fishery habitats downstream of Talkeetna. ADF&G has collected information on escapement of adult salmon, resident species, utilization of habitats, juvenile salmon rearing habitats and eulachon spawning habitats (ADF&G 1981, 1983a, 1983b, 1983c, 1983d). An index to the data collected in 1982 (ADF&G 1983a, 1983b) is also available (ADF&G, 1983e). Results of investigations of the fishery habitats downstream of Talkeetna prior to the present study are presented by Riis and Friese (1978).

The Power Authority anticipates that the DEIS will summarize and incorporate all such available data.

REFERENCES

ADF&G, Susitna Hydro Aquatic Studies, Subtask 7.10 - Phase I Final Draft Report, Aquatic Habitat and Instream Flow Project (1981).

ADF&G, Susitna Hydro Aquatic Studies Draft Phase II Data Report - Winter Aquatic Studies, October 1982-May 1983 (1983), previously submitted to the FERC on October 31, 1983.

RESPONSE TO COMMENT I.99 (cont.):

ADF&G, Susitna Hydro Aquatic Studies, Phase II Basic Data Reports for 1982, 5 Volumes (1983), previously submitted to the FERC on October 31, 1983.

Synopsis of the 1982 Aquatic Studies and Analysis of Fish and Habitat Relationship (1983).

Volume 2, Adult Anadromous Fish Studies (1983).

ADF&G, Susitna Hydro Aquatic Studies, Phase II Basic Data Reports, Index of Data and Analyses (1983).

Riis, J. C. and N. V. Friese, Fisheries and Habitat Investigations of the Susitna River - A Preliminary Study of Potential Impacts of the Devil Canyon and Watana Hydroelectric Projects (1978).

COMMENT I.100:

"Page E-3-101: Mainstem Habitats: Paragraph 2: Regarding water temperature changes, we have commented throughout Chapter 2. Please refer to our comments on pages E-2-60, E-2-62, E-2-87, E-2-88, E-2-119, E-2-123, E-2-124. To summarize, due to insufficient data and the recent changes in computer temperature models we believe that the predictions in the application are inadequately supported. Identifiable temperature changes are predicted by AEIDC below the Chulitna River confluence. 3F-12/"

"3F-12/ See Footnote 3F-11. [Footnote 3F-11/ AEIDC. 1983. Examination of Discharge and Temperature Changes due to the Proposed Susitna Hydroelectric Project. Prepared for the APA.]"

RESPONSE:

Please refer to the Responses to Comments I.28, I.30, I.37, I.38, I.39, I.48, I.51 and I.56.

Please refer to the Responses to Comments B.16, B.23 and B.38 for discussions of the temperatures downstream of the Susitna-Chulitna confluence. Please refer to the Response to Comment B.6 for a discussion of the current temperature studies. Please refer to the Responses to Comments B.8 and C.39 through C.41 on Lower River Studies and Lower River.

COMMENT I.101:

"Further analysis should be made of potential aggredation at the Chulitna River confluence (see our comments on Chapter 2, page E-2-84), and of sediment transport and bedload movement (see our comments on Chapter 2, page E-2-164)."

RESPONSE:

Please refer to the Responses to Comments I.36, I.61, B.14 and C.38 for discussions of the results of current sedimentation studies. A draft report on the suspended sediment and bedload transport characteristics of the

RESPONSE TO COMMENT I.101 (cont.):

Susitna River near the Chulitna River confluence is available. This report will be finalized by March 1984.

REFERENCES

Harza-Ebasco, Susitna Hydroelectric Project Reservoir and River Sedimentation, Draft Report (1983).

COMMENT I.102:

"Page E-3-101: Mainstem Habitats: Paragraph 3: Reduction in the occurrence of the 1-in-2 year flood event so that it becomes a 1-in-5 or 1-in-10 year event could result in dramatic changes in habitats of particular importance, such as sloughs. Information from the ADF&G Aquatics Studies Program from the last two flow years may provide valuable insight. For instance, observations of successional processes and beaver activities should provide indications of post-project impacts due to decreased flows and flood events."

RESPONSE:

The reference page refers to mainstem habitats in the lower river (Talkeetna to Cook Inlet). The small reduction in the number and magnitude of peak flows is not expected to result in dramatic changes. For example, high turbid flows in the lower Susitna River may still inhibit fish passage at times as well as limit benthic production. It is expected, however, that reduction will result in some potential changes. The Alaska Department of Fish and Game Aquatic Studies Program has primarily concentrated on the river reach between Talkeetna and Devil Canyon. Some of this information may provide insight to impacts on the lower river. For example, if the frequency of an overtopping of particular slough was decreased, the slough habitat would tend to become more stable and its value as habitat may actually increase. Groundwater would then be the primary contributor to the slough's discharge, although local runoff could at certain times, be quite significant. To better refine the impact predictions for the lower river, the Power Authority is currently studying, in a step-wise manner, the changes that are expected to occur. These studies first involved a statistical analysis of the significance of flow changes as a result of the Project. A final report on these analyses will be available in the very near future. (The

RESPONSE TO COMMENT I.102 (cont.):

Department of Interior apparently has a draft of this document.) The second step in this study has two tasks. One task was to review the existing information in the literature and from field studies to determine what information is available. The second task was to perform field studies to determine how the lower river changes physically over a range of natural existing flows. This second task has included aerial photography and ground reconnaissance. A report on these studies will be tentatively available in the spring of 1984. Comments from the various resource agencies will be elicited in response to this report.

The successional processes and beaver activities are of interest and will continue to be considered in the refinement of impact predictions.

COMMENT I.103:

"Page E-3-106: (i) Reservoir Habitats: Please refer to our comments on Chapter 2, pages E-2-69, and E-2-96. We believe the issues of reservoir turbidity and suspended sediment in discontinuous permafrost need further investigation."

RESPONSE:

Refer to the Responses to Comments I.34 and I.41.

COMMENT I.104:

"Page 114: Winter/Ice Season: Paragraph 7: According to the ADF&G Synopsis Report 3F-13/, chum salmon may rear in the Susitna River for up to three months rather than just the one month indicated in this section. The significance of this information is that it may indicate the Susitna River estuary, being very turbid, does not provide good rearing habitat. The dependance of chum salmon on the Susitna River environments, thus, may be much greater than first thought.

"The incubation study conducted by the FWS showed the timing of chum and sockeye salmon development to yolk absorption in 4° C water compared to the slough #8A temperature regime to be nearly identical. We recommend the studies be continued,

COMMENT I.104 (cont.):

comparing chum smolt development with anticipated post-project to pre-project temperature conditions."

"3F-13/ See Footnote 3F-2. [3F-2/ ADF&G. 1983. Synopsis of the 1982 Aquatic Studies and Analysis of Fish and Habitat Relationships. Prepared for the APA.]"

RESPONSE:

The Alaska Department of Fish and Game did find that some juvenile chums may spend as much as three months in fresh water prior to outmigrating.

The significance of this information does not necessarily indicate that the Susitna River estuary, being very turbid, does not provide good rearing habitat. This is only one hypothesis of many that could explain freshwater rearing. Turbid conditions are also found for prolonged periods in the mainstem Susitna and side channels. They are also found at times in sloughs when they are overtopped. Rearing chums are found in all of these habitats.

The recommendation that the U.S. Fish and Wildlife Service continue studies on chum salmon development under various temperatures is discussed in the Response to the Comment I.97.

COMMENT I.105:

"Page 114: Winter/Ice Season: Paragraph 8: It is stated that gas supersaturation would not be a problem because of the use of cone valves in the spilling design. According to Chapter 2, the cone valves would be frequently used, particularly in the early years of project operation. One of the conclusions of Acres American in their design of cone valves 3F-14/ is that: 'In view of the nature of analyses and lack of precedence for the proposed valves arrangement, it is recommended that a physical model study be carried out to confirm the performance of the valves.'"

"3F-14/ Krishnan, G. September 13, 1982. Gas Concentration and Temperature of Spill Discharge Below Watana and Devil Canyon Dams. Acres American. Prepared for the APA."

RESPONSE TO COMMENT I.105:

The Power Authority's consultants are of the opinion that small-scale physical model tests of the cone valves would not provide accurate information regarding dissolved gas concentrations downstream of the cone valves. Air entrainment and energy dissipation in the jet issuing from the valve are dependent on the turbulence in the jet as measured by the Reynolds number (Falvey 1980). In small-scale models the turbulent intensity is not similar to prototype conditions and surface tension also affects performance (de S. Pinto 1982). Therefore, it is not likely that dissolved gas saturation would be accurately simulated in a small-scale model.

A more accurate estimate of the dissolved gas concentration downstream of the cone valves would be possible by testing existing, similar full-scale installations. Such a test was run by Ecological Analysts, Inc. for Milo Bell and is referenced in the memorandum from Krishnan to Hayden cited in the Comment. As indicated in the FERC License Application, the dissolved gas concentration downstream of the valves was within acceptable limits. Additionally, please refer to the Response to Comment B.34.

REFERENCES

Falvey, Henry J., Air-Water Flow in Hydraulic Structures, Free Falling Water Jets, U.S. Department of the Interior, Water and Power Resources Service (now Bureau of Reclamation), Denver, CO (December 1983).

de S. Pinto, N. L., S. H. Neidert and J. J. Ota, Water Power and Dam Construction, Aeration at High Velocity and Flows (February - March 1982).

COMMENT I.106:

"Page E-3-124: (iii) Operation Impacts: Last Paragraph: Please refer to our comments on pages E-3-100 and E-3-101."

RESPONSE:

Please refer to Responses to Comments I.98, I.99 and B.8.

COMMENT I.107:

"Page E-3-131: Mainstem Habitats: Paragraph 3: The discussion on the ice front with both dams operating is inconsistent with the discussion on ice formation in Chapter 2, page E-2-169. Neither explanation appears to reflect current modeling of post-project conditions. Please refer to our comments on the reservoir, river, and ice modeling efforts in Chapter 2 (page E-2-124)."

RESPONSE:

Please refer to the Response to Comment B.40 for a correction of the discrepancy. See also Response to Comment B.6.

COMMENT I.108:

"Page E-3-136: In-Stream Activity: Use of heavy equipment could also result in destruction of stream banks."

RESPONSE:

The construction "heavy equipment" referred to as entering water bodies are the road crossings of water bodies that are under construction. Where this necessarily must occur, construction specifications will require the contractor to repair the area damaged by his equipment to a pre-established criteria.

COMMENT I.109:

"Page E-3-136: Erosion: Access to upstream habitat could also be limited."

RESPONSE:

Increased runoff and turbidity alone would not be expected to limit upstream migration. Access to upstream habitat is not expected to be limited unless the erosion results in a physical blockage to upstream migration (e.g., a slide occurs). The Power Authority anticipates that the DEIS will reasonably discuss project-related physical blockage.

COMMENT I.110:

"Page E-3-136: Fill Placement: The severity of fill placement impacts would also be related to timing. Streams used by grayling in summer may be dry in winter.

"Sheetflow discharge, when concentrated through culverts, may tear the vegetative mat and result in thermokarst in permafrost areas."

RESPONSE:

Comment noted.

At some ice-rich sites in Alaska, particularly along the Dalton Highway, an inadequate number of culverts resulted in concentrated sheet flow and serious downslope thermal erosion. This problem will be minimized through identification of potential problem areas and installation of a sufficient number of culverts so that no single culvert drains a large area. Minimum specifications will be determined during detailed design and these will be incorporated into the Erosion Control Plan along with procedures for monitoring the effectiveness of culverts.

COMMENT I.111:

"Page E-3-136: Changes in Water Quality: Road maintenance activities, such as blading and clearing of berms, could lead to erosion. Runoff from these areas would adversely impact water quality and could fill in culverts and drainage ditches."

RESPONSE:

The Power Authority has described mitigation measures for erosion control (see pages E-3-154 and E-3-155 of the FERC License Application). These measures are designed to avoid or minimize the potential impacts described and will be part of the routine maintenance of the access road. The erosion control plan will further address these matters.

COMMENT I.112:

"Page E-3-139: Changes in Water Quality: Fuel should be banned within 100 feet of a flowing water course.

"To facilitate cleanup, the project oil spill plan should contain project area maps with all water drainages, direction of flows, and sites and access points identified where cleanup actions could be initiated."

RESPONSE:

Fuel facility siting for the project will incorporate good engineering practices and address Federal and State recommendations for the 100-foot setback from a flowing water course, along with the topography of an area, drainage patterns, etc. The SPCC Plan will be reviewed by ADEC, EPA and other appropriate agencies to ensure that facility planning is in accord with agency requirements for the protection of State water quality. The fuel ban proposed by the commentor is not necessary for effective spill prevention control and countermeasure efforts.

The SPCC Plan will address responses to potential spill scenarios, i.e., flowing water, wetlands, lakes, drainage patterns, etc. Project topographic maps will be used to formulate general approaches by project personnel in the event of a spill. Spill responses will be incorporated in the Project plan as well as implemented through personnel training at intervals frequent enough to assure adequate understanding of the SPCC Plan. The Plan will identify critical areas for spill response, but cannot identify all areas where cleanup actions could be initiated. Providing a map for major storage areas is feasible and could be available with the SPCC Plan.

COMMENT I.113:

"Page E-3-142: Alteration of Waterbodies: Paragraphs 1 and 8: It is stated, 'Permanent roads may be built to provide all-season access.' The discussion in these sections should be limited to the proposed project development. This would consist of access to the transmission line corridor via trails from existing access routes at intermittent points along the corridor. A more detailed description of the transmission line access proposal is found on page A-4-6.

COMMENT I.113 (cont.):

"If the towers are to be set in concrete, excavations will be required and provisions for pumping of silty water needed."

RESPONSE:

The preferred mode of access to the transmission line is that described on FERC License Application page A-4-6. However, there is a possibility that some form of permanent road to the ROW may have to be constructed. The refinement of transmission access will continue as the Project continues through the detailed design phase.

Any pumping or discharging of waters, silty or otherwise, will be conducted in accordance with state and/or federal permits related to these activities.

COMMENT I.114:

"Page E-3-144: Alterations of Waterbodies: Paragraph 6: Use of ramps rather than bank cuts would help to minimize impacts to the aquatic habitats."

RESPONSE:

In general, stream crossings of construction equipment are effected where the terrain or banks of the water bodies are adequate for equipment movement. Construction specifications will require the contractor to file an equipment movement plan in order to obtain the necessary permits from state, federal and, for some areas, native agencies.

COMMENT I.115:

"Page E-3-144 to 145: Alterations of Waterbodies: Last Paragraph: We recommend that dredging, if required, be timed so that it does not occur during periods of salmon spawning."

RESPONSE:

This Comment refers to the laying of cable under the Knik Arm of Cook Inlet.

RESPONSE TO COMMENT I.115 (cont.):

The operation of excavating trenches, laying of submarine cable and backfilling has advanced in sophistication in recent years. Equipment is now available to do the above in one continuous operation; thereby the disturbance to the channel bed is restricted to a small area at any point in time. This disturbance of placing bed material into suspension is localized to the area of excavating and backfilling at the time of the operation. This area at any point in time is a very small percent of the channel width and consequently the material placed in suspension, although concentrated at the area in question, would have a minute, insignificant effect on the body of water as a whole.

The removal and replacement of materials for trench excavation is not expected to have any significant impact because of the existing high turbidity and the extensive mixing that occurs due to the extreme tidal fluctuation. Any effects should be short-term and, therefore, would probably not be detectable.

In conclusion, although the construction contractor could possibly schedule this work to avoid the migrations of August and the first part of September, the water quality would show no overall measurable improvement by this action and the area of disturbance would at all times be very limited.

COMMENT I.116:

"Page E-3-145: Changes in Water Quality: What is considered long-term should be defined. For example, a 24 hour increase in sediment and turbidity could result in an identifiable delay in grayling spawning."

RESPONSE:

Construction activities associated with transmission line stream crossings are expected to result in increased suspended sediment concentration. The duration of the periods of increased suspended sediment concentrations is expected to be on the order of a few hours, or fractions of a day, and should not significantly interfere with grayling spawning activities.

COMMENT I.117:

"Page E-3-148: 2.4.1 Selection of Project Evaluation Species: We recommend rainbow trout, Dolly Varden, and burbot be included as evaluation species by the applicant, since these species meet the criteria established in this section. For additional justification please refer to our January 24, 1983 letter."

RESPONSE:

The criteria that the Power Authority used to select species for evaluation were:

1. High human use value;

2. Dominance in the ecosystem; and

3. Sensitivity to project impacts.

Species with high regional visibility and commercial, sport, subsistence or aesthetic value were given priority (see page E-3-148 of the FERC License Application). Since the evaluation species play a dominant role in the ecosystem, they may serve as indicator species. By maintaining critical habitats for evaluation species, many of the potential impacts on less sensitive species or species with a lower evaluation priority will be mitigated.

Although rainbow trout, Dolly Varden and burbot are recognized as important species, they do not meet all of the criteria with a ranking as high as the species selected for evaluation. The U.S. Fish and Wildlife Service (USFWS) similarly ranks these species in a lower resource category than the evaluation species (see License Application, Chapter 11, letter from USFWS to the Power Authority dated January 24, 1983). Furthermore, the exclusion of these three species as evaluation species has not precluded intensive studies on them, as warranted. These species, and other fish species (such as round white fish, longnose suckers, etc.) have been studied extensively in conjunction with studies on the evaluation species. They have also been studied specifically. Examples of such specific studies include extensive radio-tagging of rainbow trout to determine migratory movements and studies to determine spawning behavior of burbot (ADF&G 1983). Studies on Dolly Varden have been limited, primarily because the numbers found have been extremely low in spite of intensive sampling efforts over the last two field seasons. They are caught by

RESPONSE TO COMMENT I.117 (cont.):

sport fishermen, primarily at clear water tributary mouths downstream of Talkeetna and in the Talkeetna River. These areas are outside the area where the most pronounced project-related impacts are anticipated and thus are outside of the most intensive study area for the Project.

REFERENCES

ADF&G, Susitna Hydro Aquatic Studies, Phase II Basic Data Reports for 1982, 5 Volumes (1983), previously submitted to the FERC on October 31, 1983.

Volume 3, Resident and Juvenile Anadromous Fish Studies on the Susitna River Below Devil Canyon (1983).

Alaska Power Authority, Susitna Hydroelectric Project FERC License Application Project No. 7114-000 (1983) Volume 10A. U.S. Fish and Wildlife Service Letter (January 24, 1983), previously submitted to the FERC on July 11, 1983.

COMMENT I.118:

"Page E-3-149: 2.4.2 Selection of Project Evaluation Species: Paragraph 6: Please refer to our comments on pages E-3-24 and E-3-100 to 102."

RESPONSE:

Please refer to Responses to Comments I.85, I.99 and I.117.

COMMENT I.119:

"Page E-3-150: 2.4.3 Mitigation of Construction Impacts Upon Fish and Aquatic Habitats: We have not received the design criteria manuals. 3F-15/ Both manuals should be provided to resource agencies for a minimum of 30 days for review and approval. The manuals should then be incorporated into the license as binding articles.

"We support the establishment of a monitoring program funded by the project, and a board of representatives from appropriate State, Federal, and having the authority to recommend project modifications to assure that mitigation is effective. The procedure by which this would occur should be incorporated into the license as an article.

COMMENT I.119 (cont.):

"Costs would be incurred for the mitigation identified. We recommend specifications pertaining to environmental protection contain provision for payment at rates similar to that payable for regularly scheduled production work. When the licensee's contract goes out to bid, those competing for the contract should be aware of monies specified for environmental protection tasks."

"3F-15/ Personal communication on September 30, 1983 with Thomas J. Arminski, APA Deputy Project Manager, Susitna Hydroelectric Project."

RESPONSE:

A. The Power Authority anticipates that the Design Criteria Manual can be reviewed and commented upon by agencies.

The Power Authority also intends to have a Construction Practices Manual prepared prior to any construction activity. This manual would be the joint product of the Design Consultant and a yet-to-be-selected Construction Manager. Current planning envisions engaging a Construction Manager in FY 86 (at least a year prior to construction activities). It is anticipated that resource agencies will have the opportunity to review and comment on the Construction Practices Manual, and that construction specifications would include by reference both the design criteria and the Construction Practices Manual.

B. The Power Authority reported to the FERC the USFWS recommendation for full financial funding of monitoring programs (FERC License Application page E-3-548). As stated elsewhere (see Response to Comment I.147), the Power Authority anticipates the organization and operation of an interagency monitoring team but feels the appropriate role for the team is that of adviser. As for all other projects of which the Power Authority is aware, the Power Authority plans to directly contract for required monitoring and mitigation activities, including these costs, in construction or operation budgets as appropriate. The Power Authority may not delegate its statutory and regulatory responsibilities to other agencies or groups of agencies. The Power Authority has not proposed to fund state and federal agencies to perform their normal

RESPONSE TO COMMENT I.119 (cont.):

regulatory functions. The resource agencies will be able to review and comment on the DEIS and the FEIS and will probably participate in the development of license stipulations. We do not anticipate, however, that once the Project gets underway resource agencies may casually "recommend project modifications to assure that mitigation is effective." The license and/or memoranda-of-understanding may prescribe appropriate mechanisms for modifying mitigation or monitoring programs.

C. The Design Criteria Manual, the Construction Practices Manual and, as required, contract specifications will define performance standards and facilities specifications for the protection of environmental resources that bidders must incorporate into their bids. The Power Authority, its agents and the regulatory agencies will appropriately monitor to assure compliance and, if necessary, to effect corrective measures.

COMMENT I.120:

"Page E-3-152: (ii) Mitigation: Beaver control measures related to fish passage should be controlled by ADF&G."

RESPONSE:

The Power Authority will coordinate with the various state and federal agencies concerning beaver control measures related to fish passage. We will conform to all state and Federal laws concerning beaver control; specifically we are cooperating with the Alaska Department of Fish and Game under Title 16 of the Alaska State Statutes.

The issue of beaver control illustrates the potential for interactions which need to be addressed by resource managers. Should sloughs be managed for beaver habitat or for fishery purposes? The Power Authority's intent, as outlined in the Application, has been to manage for the fishery resource in the more productive sloughs and to allow the natural course of events to continue in the less productive sloughs. This approach may be modified as the mitigation details are refined and agencies determine their management goals.

COMMENT I.121:

"Page E-3-152: Presence or Absence of Fish/Fish Habitats: Provisions should be included in the mitigation plan for modifications if fish are discovered upstream at a later date."

RESPONSE:

The referenced statement in the FERC License Application states:

> "Streams having documented fish or fish habitat at or upstream from the road crossing will be designed to pass fish. Only those streams without fish or fish habitat at, or upstream from, the road crossing will be designed solely on the basis of hydrologic and hydraulic criteria."

This statement does encompass the provision for modifications if fish are discovered upstream at a later date, primarily under the provision that if fish habitat exists at or upstream from the crossing, the crossing will be designed to pass fish. Fish passage will be maintained. In the unlikely event that a stream is designated as not having viable fish habitat (a designation process will be performed in consultation with the resource agencies), but later it is found to have fish present that require passage, modifications will be made to the crossing to allow for this passage.

Modification of bridges is not expected because it is unlikely that bridges would prevent or impede fish passage.

COMMENT I.122:

"Page E-3-153: Flow Regime: All culverts should be armored at both ends with rip-rap at the time of installation, or flared-end culverts should be used."

RESPONSE:

Treatment of the hydraulic approaches to culverts is dependent upon the velocity of the flow in the natural channel and the composition of bed material at the culvert entrance and outlets. The velocities should be such that bed material is not scoured at the approaches. Scouring of the bed material impacts water quality and could provoke

RESPONSE TO COMMENT I.122 (cont.):

culvert failure with the passage of time. The Comment to which this Response is directed is correct and is considered good design practice.

COMMENT I.123:

"Page E-3-153: Methods of Installation: Intermittent water courses should be surveyed in summer and staked for culvert installations."

RESPONSE:

Where needed, culvert installations will be designed to accommodate flows of both intermittent and continuous flowing streams.

COMMENT I.124:

"Page E-3-154: (ii) Mitigation: Paragraph 1: Revegetation measures should be undertaken immediately after surface disturbance, or as soon as use ceases."

RESPONSE:

The Power Authority anticipates that the DEIS will discuss the appropriate timing of revegetation mitigation measures and the FERC License will include conditions regarding revegetation. The Power Authority agrees that revegetation measures designed to avoid or minimize erosion should be undertaken promptly after the activities creating the surface disturbance have ceased. Specifically, the Power Authority anticipates that a final Revegetation/Rehabilitation Plan for the Project will be prepared by the Power authority during the detailed design phase of Project development. The nature and timing of revegetation measures will be established in this plan. See also Response to Comment I.425. Proposed revegetation/rehabilitation measures are also discussed on pages E-3-275 through E-3-281 of the License Application.

COMMENT I.125:

"Page E-3-155: (ii) Mitigation: Paragraph 4: The settling ponds should be maintained by cleaning them out when one-half of their original capacity is lost."

RESPONSE:

Settling ponds are designed to provide sufficient retention time to allow settling of suspended material, so that prescribed ADEC water quality requirements are complied with. Retention time is a function of the inflow into the settling pond, therefore, stipulating a maintenance criteria on the basis of usable volume is not reasonable. The cleaning cycle should be based on water quality standard for the effluent. Consequently, the construction contractor will be required to monitor the effluent periodically and submit certified records to the Alaska Power Authority.

COMMENT I.126:

"Page E-3-155: (ii) Mitigation: Paragraph 1: The references mentioned should be incorporated into the erosion control manual."

RESPONSE:

The Power Authority anticipates starting to prepare the Erosion Control Plan as early as this summer, reflecting the mitigation recommendations of the DEIS. A final Erosion Control Plan for the Project will be prepared by the Power Authority during the detailed design phase of Project development. The plan will present detailed guidelines for erosion control measures, including consideration of the measures discussed in the cited references.

COMMENT I.127:

"Page E-3-156: (ii) Mitigation: Paragraph 3: Stockpiling in the floodplain may be preferable to moving the material outside of the floodplain. This would depend upon the timing and location of the intended activity."

RESPONSE TO COMMENT I.127:

The Power Authority concurs that the use of stockpiled material depends entirely on "the timing and location of the intended activity." Although the final decision in this regard will be made during the detailed design, stockpiling of the majority of river channel excavated materials would likely be adjacent to or in immediate proximity to the borrow area.

COMMENT I.128:

"Page E-3-156: (ii) Mitigation: Paragraph 1: The Spill Prevention Contaiment and Countermeasure Plan (SPCC) should be provided to the resource agencies for a minimum 30-day review period and, following approval, be incorporated into the license application. The SPCC should be a part of the licensee's construction contract for the project."

RESPONSE:

SPCC Planning regulations are under the jurisdiction of the EPA, 40 C.F.R. § 112 and ADEC, 18 A.A.C. § 75. Therefore, the SPCC Plan should not be incorporated into the License. To incorporate the SPCC Plan into the License would duplicate EPA/ADEC responsibilities, would make FERC responsible for a matter which it is not prepared to administer and would needlessly, and perhaps dangerously, restrict EPA/ADEC/APA abilities to respond quickly to spill events.

The SPCC Plan should be developed in coordination with the construction contractor based on guidelines to be provided by the Power Authority. See also the Response to Comment I.425.

COMMENT I.129:

"Page E-3-161: (ii) Measures to Avoid Impacts: Paragraph 2: The project may affect all three of the factors mentioned, rather than just mainstem stage. We suspect channel geometry is related, in the side sloughs, to frequency and severity of breaching of the slough's upstream berm. This process is directly related to mainstem stage, and in the winter, location of the ice front. If the river does not freeze, as is predicted for the river downstream from the

COMMENT I.129 (cont.):

dams for an unknown distance, then this major influence on slough geometry and succession would be eliminated.

"The relationship between mainstem stage and slough flows has been an assumed, yet unproven, assumption. Please refer to our comments on page E-3-98 and on Chapter 2, page E-2-98."

RESPONSE:

Please refer to the Response to Comment B.43 for a discussion of the potential for impacts on channel geometry and slough flow. Please refer to the Responses to Comments B.18, B.19 and I.22 on the relation between mainstem stage and slough flow. Additionally, please refer to the specific Response to Comment I.97.

COMMENT I.130:

"Page E-3-162: (ii) Measures to Minimize Impacts: In the FWS letter on the Susitna hydroelectric project pre-application 3F-16/, the ongoing AEIDC modeling efforts were summarized. The FWS continues to support the AEIDC modeling efforts. The AEIDC study should provide the basis for determining project instream flow impacts and a reasonable assessment of mitigation alternatives."

"3F-16/ See FWS letter dated January 14, 1983 to Eric P. Yould, APA. Included in Chapter 11."

RESPONSE:

The Power Authority agrees that the AEIDC effort is an important part of the ongoing analysis.

COMMENT I.131:

"Page E-3-162: Winter Flow Regime (October-April): Paragraph 2: It is unclear as to what project stage is being discussed. The discussion appears to be restricted to pre-Devil Canyon conditions, based upon the assumption that the ice front would be upstream of Sherman RM 130. With Devil Canyon operating, it was assumed that the ice front would form between Talkeetna (RM 99) and Sherman (RM 130) (see page E-3-134) or downstream of Talkeetna (see Chapter 2, page E-2-169). Discussion should be provided as

COMMENT I.131 (cont.):

to: how the sloughs needing a protective berm were selected; how it was established which sloughs would be overtopped more frequently than once every five years; and how these sloughs would be managed after Devil Canyon is operating.

"The benefits of establishing maximum winter flows should be discussed. If staging due to ice formation in the upper Susitna River occurs only prior to the initiation of operations at Devil Canyon, the overtopping of sloughs could be controlled by maintaining flows below a maximum level. Disturbance of the ten sloughs due to the construction of protective berms may, therefore, be avoided. Flows to cleanse the sloughs could also then be provided, if needed. Again, it is premature to establish an instream flow regime since the AEIDC study is not complete.

"Winter flows, downstream of the Chulitna River, are expected to be up to 373% higher under post-project than pre-project conditions. 3F-17/ The ice front would probably form downstream from Talkeetna (Chapter 2, page E-2-169) and be delayed for an indeterminent period of time (Chapter 2, page E-2-170). Downstream from the Chulitna River confluence, the Susitna River is broad and relatively shallow. We consider this reach more susceptible to impacts due to this channel geometry. Impacts and mitigation needs in this lower reach should be included in this section."

"3F-17/ See Footnote 3F-11. [Footnote 3F-11/AEIDC. 1983. Examination of Discharge and Temperature Changes due to the Proposed Susitna Hydroelectric Project. Prepared for the APA.]"

RESPONSE:

Please refer to the Response to Comment B.40 for a correction of the discrepancy between pages E-3-134 and E-2-169 of the License Application. Please refer to the Response to Comment B.44 for a discussion of the selection of the sloughs requiring berms for protection. Please note also that the report referenced in the Comment has been updated (AEIDC, January 1984).

The need for establishing maximum winter flows will be examined. This examination will necessarily include consideration of both the environmental and economic ramifications.

RESPONSE TO COMMENT I.131 (cont.):

The intent of the protective berms is to exclude high flows that overtop the upstream berms and to stabilize conditions (flow, velocity, etc.) in the slough. The construction of the berms is not expected to cause disturbances that will negatively impact fish. The reasons for this are:

1. The construction would occur during periods when little or no activity by salmon occurs in the slough;

2. The construction would be during low water periods which would allow erosion control procedures to be more readily applied; and

3. The berms are in the upstream end of the slough where slough flows are small or non-existant (slough discharge under non-overtopping conditions generally increases in the downstream direction as additional groundwater and tributary flow is contributed to the slough flow).

Therefore, construction would occur primarily on dry land, well upstream of the major spawning activity areas.

The period between completion of Watana Dam and completion of Devil Canyon Dam will be on the order of 10 years. The Power Authority does not feel that the productive sloughs should be left vulnerable to overtopping for this extended period of time. Also, even during operation of both dams, there is a possibility that during extreme events (e.g., high flows from tributaries) overtopping could occur if no berm was present. The intent of the berms is to decrease the likelihood of such overtopping. As a consequence, these are expected to positively benefit the productivity of the sloughs.

Although overtopping of the sloughs may assist in removing fine silt from the sloughs, observations have also shown that deposition of silts can occur as a result of overtopping (e.g., on Slough 21). In the second instance, a protective berm to exclude this silt could help to maintain spawning habitat.

Data and analyses needed to determine potential impact has been collected and mitigation procedures proposed to avoid or minimize these impacts. The intent of the AEIDC studies is to further refine the existing data by coupling it with other studies (ice processes, reservoir modeling, etc.).

RESPONSE TO COMMENT I.131 (cont.):

The Power Authority agrees that it is premature to establish a final flow regime at this time. However, the instream flow regime proposed in the FERC License Application forms the basis for a final flow regime for the Project, as refined by the ongoing field studies and analyses described in other responses and references herein.

Please refer to the Response to Comment B.6 for a description of the ice process simulations and to the Responses to Comments B.33 and I.40 regarding the delay in ice formation downstream from the Talkeetna River confluence. Please refer to the Response to Comment F.13 regarding potential impacts in the lower river and to the Responses to Comments B.8 and C.39 on the lower river.

The Power Authority anticipates that the DEIS will analyze a reasonable range of flow regimes and their impacts.

REFERENCES

Arctic Environmental Information and Data Center (AEIDC), Susitna Hydroelectric Project Aquatic Impact Assessment: Effects of Project-Related Changes in Temperature, Turbidity, and Stream Discharge on Upper Susitna Salmon Resources During June Through September (January 1984), previously submitted to the FERC on January 20, 1984.

COMMENT I.132:

"Page E-3-163: Winter Flow Regime (October - April): Paragraph 3: The process which led to the selection of the ten sloughs should be fully described. The location of slough B should be indicated. It is not shown on Figures E.3.12 to E.3.17.

"With the construction of the protective berms, the ice cover formed on the sloughs would not be flushed out in the spring. Ice could remain in these protected sloughs well into June. The impact of this phenomenon upon the fishery should be included in this section along with a discussion of mitigative measures for any potential impacts. Adverse impacts may be related to changes in timing of outmigration, early inmigration, and quality of rearing habitat."

RESPONSE TO COMMENT I.132:

Please refer to the Response to Comment I.50 on ice cover induced staging and slough overtopping, I.53 on break-up ice jamming effects on ice deposition at slough or tributary mouths and I.131 on winter flow regime including consideration of ice-induced staging, protective berms, maximum winter flows and impacts downstream of the Chulitna-Susitna confluence. Also, please refer to the Response to Comment B.44 on selection of sloughs for protective berms.

Attached is a map showing the location of Slough B. It is adjacent to Slough 8A and between river miles 126 and 127.

The ten sloughs were selected on the basis that (1) they are currently productive sloughs that support adult spawning; and (2) initial studies have indicated that at the flows and the predicted location of the ice front in the FERC License Application, these sloughs will require an increase in the height of the berms at the upstream end of these sloughs for protection.

Any given slough would need a predicted overtopping frequency of more than once every five years to be protected.

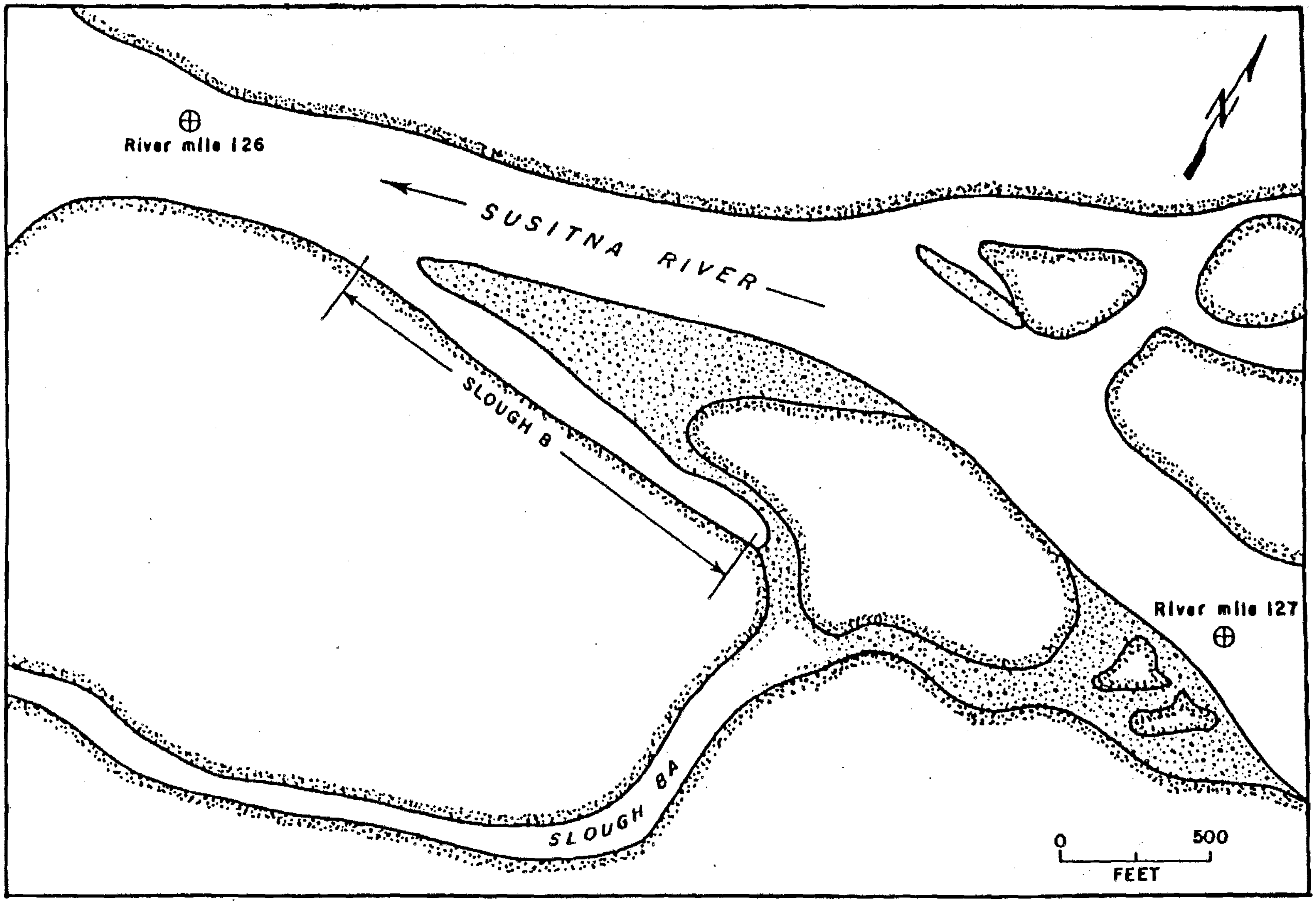
As the flow release schedules are refined through additional study and the negotiation process, the need for upstream berms will be reexamined.

The purpose of the protective berms is to prevent overtopping of the upstream end of the slough. This prevents mainstem water from entering the slough. Therefore, the discharge from the slough originates primarly from groundwater during the ice-covered season. (With a protective berm in place, additional flow to the slough can originate from local sources such as runoff.) Because this groundwater is warmer than 0°C, the ice that may form is not of the magnitude that is found in the mainstem (up to several feet thick). Water would still be expected to flow out of the slough and fish would be expected to outmigrate.

Under existing natural conditions, sloughs are frequently not overtopped during spring. A prime example is Slough 11 which has not been overtopped in several years, yet it is one of the most productive sloughs in the upper river. As a result of observations of the processes occurring in the natural system, it is not anticipated that mitigative

RESPONSE TO COMMENT I.132 (cont.):

measures will be necessary. As with the entire slough modification program part, however, the potential for this impact will be included as part of the monitoring program.



Appendix Figure 2-G-3. Slough B located at RM 126.3 approximately, Adult Anadromous Investigations, Su Hydro Studies, 1982.

COMMENT I.133:

"Page E-3-165: Summer Flows: The term 'rectifying measures' should be clarified, as should the manner in which the listed sloughs were selected. According to the ADF&G Synopsis Report 3F-18/, slough #11 (RM 135) has unrestricted access at flows greater than 6,700 cfs while slough #9 has an acute access problem with flows of less than 18,000 cfs. We are unable to locate slough B and, apparently, sloughs #8, #8A, #8B, #8C, Moose, A', #9A, #9B, and #17 have not been examined by ADF&G to determine whether an access problem exists. 3F-19/ We assume that different measures are proposed for the different sloughs. Since Table E.3.39 lists a specific number of sloughs which would receive a particular rectification, we assume specific mitigation plans for each slough are being proposed. We would like to review any such plans along with an explanation of the selection process and reasons as to why flow manipulations could not be utilized to avoid and/or minimize the adverse impacts. Also, it is unclear as to whether short-term augmenting flows are being proposed or not."

"3F-18/ See Footnote 3F-2. [Footnote 3F-2/ ADF&G. 1983. Synopsis of the 1982 Aquatic Studies and Analysis of Fish and Habitat Relationships. Prepared for the APA.]

"3F-19/ See Footnote 3F-2, supra."

RESPONSE:

The term "rectifying measures" refers to the various habitat modification options which may be implemented to mitigate adverse effects of project operation on habitats utilized by various life stages of the fish.

In the FERC License Application, thirteen sloughs were identified which provide spawning habitat for the majority of the slough spawning salmon between Devil Canyon and Talkeetna. In these thirteen sloughs, one or more habitat modification options could be implemented as necessary. If no modification is needed, none would be implemented. The thirteen sloughs identified as possible sites for implementation of mitigation options were selected on the basis of the observed number of salmon presently utilizing the sloughs. It was determined that if fifty or more salmon were observed in a slough during the 1981 and/or 1982 study periods (FERC License Application Table E.3.12), the slough

RESPONSE TO COMMENT I.133 (cont.):

would be included as a potential site for habitat modification.

As assumed by the commentor, different mitigation options could be implemented at each of the sloughs. For example, since unrestricted access conditions occur at Slough 11 when mainstem discharge is 6,700 cfs or greater, no restructuring of the mouth of Slough 11 is necessary. However, the potential limitation to access indicated for Slough 9 at flows of 18,000 cfs or less (see the Response to Comment I.94) indicates that restructuring of the mouth of Slough 9 does have merit.

The specification of the number of sloughs to receive specific restructuring methods as tabulated in FERC License Application Table E.3.39 was based on the estimated numbers of sites for which such modification might be warranted.

COMMENT I.134:

"Page E-3-165: Access Mitigation: Eight sloughs are indicated as needing restructured mouths. These sloughs should be identified.

"In the third paragraph it is indicated that lowering the slough mouths by 1.5 feet would provide unrestricted access. Please refer to our comments on page E-3-163. It is not specified which sloughs would undergo the proposed modifications. We would expect lowering of all the sloughs by the same amount would result in different post-modification access conditions. We would like to review the analysis which lead to the conclusion that the decrease in elevation by the sepcified 1.5 feet would allow unrestricted access to specified sloughs."

RESPONSE:

The number of sloughs which may need restructuring is eight. These will be selected from the thirteen sloughs identified in the FERC License Application on page E-3-165 or from other sloughs in the reach between Devil Canyon and Talkeetna.

The specification of 1.5 feet of depth for restructuring is based on an estimate of how much might need to be removed from a given slough. An idealized restructuring is presented in the License Application on Figure E.3.28. Depending upon the specific characteristics of a slough

RESPONSE TO COMMENT I.134 (cont.):

selected for restructuring, the average depth of excavation may be less than 1.5 feet. FERC License Application Figure E.3.28 represents what will be done at a typical slough.

COMMENT I.135:

"Page E-3-166: Access Mitigation: Last Paragraph: Sloughs which would be restructured should be identified and the specific proposals described. We are not cognizent of what is being proposed in this section, or where it is being proposed."

RESPONSE:

See the Responses to Comments B.9, I.133 and I.134.

COMMENT I.136:

"Page E-3-166: Spawning Habitat Mitigation: Please refer to our comments on page E-3-98.

"The referenced ongoing aquatic studies should be described."

RESPONSE:

The referenced ongoing studies are the same as those described to the various resource agencies (including the U.S. Fish and Wildlife Service) during the July 18, 1983 workshop conducted by the Power Authority in Anchorage. An update on the status of these studies is provided in the Response to Comment C.32.

COMMENT I.137:

"Page E-3-167: Scarifying Side-Channels: This section should identify the four side channels proposed to be scarified. We are interested in the analysis of the specific side channels, including timing, volume, and duration of the proposed high-flow release, the maintenance schedule proposed (if needed), the species (by life stage) that are expected to benefit due to the proposed modification for each side channel, and the number of each species the specific side channels would be expected to produce."

RESPONSE TO COMMENT I.137:

See the Responses to Comments B.9 and I.133. Hydraulic information describing the physical character of the side channels is currently being analyzed. Refinement of the assessment of the effects of the Susitna Project on side channel habitat and fish species will be completed during the spring of 1984.

Use of side channels under natural conditions is limited primarily to rearing juvenile salmon. It is anticipated that under with-project conditions, additional spawning and incubation habitats will become available. This will be an enhancement of the side channel habitat type.

COMMENT I.138:

"Page E-3-168: Slough Gravel Cleaning: The utility of a high-flow release to cleanse sloughs should be discussed.

"The location of the mainstem spawning sites should be provided and gravel sources identified. An analysis as to which species are expected to benefit, and the anticipated production should be provided."

RESPONSE:

Although periodic high flows may enable cleansing the sloughs of accumulated sediments, several considerations may preclude the desirability of utilizing this method. For those sloughs at which the upstream berms have been increased to protect them from overtopping during the winter, it may not be possible to provide sufficient water to overtop the berms. Also, if high flow is used to cleanse the sloughs of accumulated sediments, the flows must be high enough to substantially overtop the upstream berms. At discharges which barely overtop the upstream berms, velocities in the sloughs are not sufficient to scour the sediments and in fact may cause accumulation of sediments in the slough.

The Power Authority anticipates that the DEIS will reasonably identify spawning sites and gravel sources.

COMMENT I.139:

"Page E-3-170 to 171: (iii) Measures to Minimize Impacts: Once the reservoir temperature model is reflects two years of data, an examination of post-project temperature impacts should be made. It is our understanding that the river temperature model used in this application, HEATSIM, has been replaced with SNTEMP (see our comments on Chapter 2, pages E-2-123, E-2-167).

"In the last paragraph it is unclear whether the temperature discussions are for Watana alone, or for both dams. Temperature impacts are expected to change during the filling and operation of Watana, the construction of Devil Canyon, operation of the two dams under low and high power needs, and operation during dry and wet years. The potential benefits of a low level intake port in the Watana dam should be discussed as a mitigation measure for adverse temperature impacts during filling."

RESPONSE:

Please refer to the Responses to Comments I.51 and I.64 (DOI Comments on FERC License Application pages E-2-123 and E-2-167). Please refer to the Response to Comment B.6 regarding reservoir and instream temperature modeling and for a discussion of HEATSIM and SNTEMP.

The temperature discussions in the last sentence of the first paragraph of FERC License Application page E-3-171 (Measures to Avoid Impacts) refer to Watana operation (see FERC License Application Figures E.2.180 and E.2.182).

Temperature impacts are expected to change during the filling and operation of Watana and during the operation of the two dams. The construction of Devil Canyon should have minimal impact. During the second stage of filling Devil Canyon, temperature impacts can also be expected.

Flow throughout the year is affected by low and high power demand and project operation during wet and dry years. Since the resultant project flows affect temperature, the effects of wet and dry years and power demand on temperature are currently being investigated.

The potential benefit of a "mid" level intake port in the Watana Dam is being examined as a mitigation measure for adverse temperature impacts during filling. Alternative

RESPONSE TO COMMENT I.139 (cont.):

mitigation measures are also being considered. Please refer to the Response to Comment I.8.

COMMENT I.140:

"Page E-3-173: Grayling Propagation Technology: Last Paragraph: We recommend that the viability of a grayling propagation program be established prior to license issuance since it is a major element of the proposed mitigation program."

RESPONSE:

The Power Authority concurs that the viability of a grayling propagation program be established. This has been proposed by the Power Authority in the FERC License Application. The Power Authority does not agree that such a program must be established prior to license issuance. Nor does it feel that issuance of a license should be contingent on the results of such a program.

COMMENT I.141:

"Page E-3-173: Hatchery Propagation of Grayling or Other Resident Species: Paragraphs 2 and 3: The lakes and/or streams to be stocked should be determined through consultation and approval of the appropriate resource agencies, and land owners or managers."

RESPONSE:

The Power Authority concurs with this statement as indicated by statements on page E-3-173 of the License Application. The Power Authority intends to execute agreements with the appropriate adjacent landowners and resource agencies to effectuate appropriate stocking of the lakes.

COMMENT I.142:

"Page E-3-174: Introduction of Rainbow Trout into Devil Canyon Reservoir: The potential of the Devil Canyon reservoir as fishery habitat should be re-examined in light of our comments on Chapter 2, pages E-2-69, and E-2-96."

RESPONSE TO COMMENT I.142:

The Power Authority does not presently anticipate a mercury bioaccumulation problem associated with the Susitna Hydroelectric Project reservoirs.

Please refer to the related Response to Comment I.41.

COMMENT I.143:

"Page E-3-174: (ii) Measures to Avoid Impacts: The impacts of greater than 1-in-50 year floods should be fully evaluated, and mitigation proposed. Given the expected life of the project, the potential for a flood event greater than this project design is high.

"The referenced test of the Lake Comanche cone valves was evaluated for the applicant by Acres American. 3F-20/ Please refer to our comments on page E-3-114.

"Given the lack of a strong endorsement by the applicant's consultant, the anticipated frequent use of the valves, and the potential magnitude of supersaturation as a fisheries problem, we recommend that the physical model study be undertaken."

"3F-20/ See Footnote 3F-14 [Footnote 3F-14/ Krishnan, G. September 13, 1982. Gas Concentration and Temperature of Spill Discharge Below Watana and Devil Canyon Dams. Acres American. Prepared for the APA.]"

RESPONSE:

Please refer to the Responses to Comments I.60 and I.55 with regard to the need for evaluation of formation and dissipation of dissolved gas for floods having a recurrence interval of greater than 50 years.

Please refer to the Response to Comment I.105 with regard to a physical model study of the cone valves.

COMMENT I.144:

"Page E-3-176: (i) Mitigation of Access and Impoundment Impacts: Paragraph 2: Final decisions on the distribution of grayling should be made through consultation with, and approval of the appropriate resource agencies and land owners and/or managers."

RESPONSE:

See Response to Comment I.141.

COMMENT I.145:

"Page E-3-177: (ii) Mitigation for Downstream Impacts: The modeling effort by AEIDC is in an embryonic stage and could not have been the basis of either the impacts analysis or mitigation proposals in this section. The forthcoming AEIDC report should demonstrate that their system of models is functional. One of the initial findings of AEIDC's work is that, contrary to the assumption of the mitigation plan, project impacts do extend downstream of the Chulitna River. 3F-21/ We recommend that the impact assessment include effects downstream of the Chulitna River, and appropriate mitigation for any adverse impacts identified."

"3F-21/ See Footnote 3F-11 [Footnote 3F-11/ AEIDC. 1983. Examination of Discharge and Temperature Changes due to the Proposed Susitna Hydroelectric Project. Prepared for the APA.]"

RESPONSE:

The analysis being performed by AEIDC using a system of linked models has resulted in an evaluation of access conditions to adult salmon spawning areas and juvenile salmon rearing habitats. This analysis is presented in the AEIDC report entitled "Susitna Hydroelectric Project Aquatic Impact Assessment: Effects of Project-Related Changes in Temperature, Turbidity, and Stream Discharge on Upper Susitna Salmon Resources During June Through September"

RESPONSE TO COMMENT I.145 (cont.):

(AEIDC, 1983). A final version of this report has been submitted to the FERC.

REFERENCES

Arctic Environmental Information and Data Center (AEIDC), Susitna Hydroelectric Project Aquatic Impact Assessment: Effects of Project-Related Changes in Temperature, Turbidity and Stream Discharge on Upper Susitna Salmon Resources During June Through September (January 1984), previously submitted to the FERC on January 20, 1984.

COMMENT I.146:

"Page E-3-179: 2.5.2 Construction Phase: The mitigation planning related to pre-construction and construction phases, should occur prior to license issuance."

RESPONSE:

The Power Authority anticipates that the DEIS will reasonably describe necessary mitigation for pre-construction and construction phases, including the extensive mitigation planning which has occurred prior to license issuance and any additional mitigation planning which should occur after license issuance.

The FERC would not authorize any actions which might permanently alter the project site prior to issuing a license. The Power Authority might proceed on state or private lands under state permitting authority, however, to construct non-power project aspects of the development, such as roads or fisheries.

COMMENT I.147:

"Page E-3-180: 2.6 Monitoring Studies: We agree that an interagency mitigation monitoring team must be established to ensure the proper and successful execution of the mitigation plan and to determine its effectiveness. The composition, funding, mandate, and authorities should be specified as a license article. We look forward to the anticipated discussions which will lead to establishing this team."

RESPONSE TO COMMENT I.147:

The Power Authority anticipates that the organization and operation of an appropriate monitoring team will be determined when it becomes clear what mitigation monitoring role the various agencies require to discharge their responsibilities.

Please also refer to Response to Comment I.119B.

COMMENT I.148:

"Page E-3-188: 2.8.1 U.S. Fish and Wildlife Service: Recommendation at Bottom of Page: To ensure its effectiveness as a mitigation measure, a slough modification demonstration should be undertaken in the Susitna River. The demonstration slough should display, prior to modification, the anticipated post-project conditions for sloughs for which mitigation is proposed. For example, the slough selected for demonstration should be characterized by inadequate access, silt accumulation, insufficient groundwater flow, and limited spawning habitat. Preferably, the demonstration slough should be a slough which does not currently support spawning and/or rearing salmon."

RESPONSE:

See Responses to Comments B.9, I.133 and I.134.

The Power Authority appreciates the suggestions made and will consider them for inclusion in the ongoing mitigation planning process.

COMMENT I.149:

"Page E-3-189: 2.8.2 Alaska Department of Fish and Game: Second Recommendation: The response states a report analyzing instream flows and temperatures required to maintain existing populations would be available after June 30, 1983. We request that the applicant provide the FWS with a copy of the report."

RESPONSE TO COMMENT I.149:

The referenced report, the AEIDC "Susitna Hydroelectric Project Aquatic Impact Assessment: Effects of Project-Related Changes in Temperature, Turbidity, and Stream Discharge on Upper Susitna Salmon Resources During June through September," was furnished to the FERC in preliminary form on November 1, 1983 and in final form on January 20, 1984. The Power Authority will make this report available to the Department of the Interior.

COMMENT I.150:

"Pages E-3-295 and E-3-296: 4.1.3 - Species Contributing to Recreation, Subsistence and Commerce: The section should be expanded to reflect that not only birds, but many wildlife species in the project area contribute to non-consumptive forms of recreation. Incidential viewing of wildlife in conjunction with other activities is an unquantifiable but well documented value. These non-consumptive values, the subsistence and commerce values and the ecological values mentioned in the Introduction, Section 4.1, were all considered in selecting evaluation species within the FWS Mitigation Policy (46 F.R. No. 15, January 23, 1981) and Resource Category determinations for this project (FWS letter to Eric P. Yould, January 24, 1983)."

RESPONSE:

The last sentence of the first paragraph of Section 4.1.3 (FERC License Application page E-3-295) should be modified to read: "In theory, many wildlife species contribute to non-consumptive forms of recreation such as bird-watching, but the area is too remote to attract many people who come solely to view wildlife." A description of existing and projected recreational uses of project area wildlife is presented in Exhibit E, Chapter 7. Consumptive wildlife values are discussed in Exhibit E, Chapter 5.

COMMENT I.151:

"Page E-3-304: - Cover Requirements: Paragraph 7: Proposed remapping of vegetation to better reflect moose habitat components should be described here. Please also refer to our previous comments, Section 3.2.2(a)."

RESPONSE:

The description of the program for remapping of vegetation in the Susitna Project area is contained in FERC License Application, Exhibit E, page E-3-201. Refinements to the scope of the mapping efforts are currently being made in consultation with personnel from the Alaska Department of Fish and Game and the U.S. Fish and Wildlife Service.

COMMENT I.152:

"Page E-3-305: Habitat Use in the Middle Susitna Basin: Paragraph 1: The evaluation of moose use of different vegetation types by month would be improved by considering the comparative availability of these types and subareas important to moose throughout the middle Susitna basin. Vegetation mapping, including understory characteristics did not occur in 1983 as had been indicated by the applicant in response to our comments on the draft license application (Chapter 11, W-3-204). Once vegetation is retyped we recommend that this and other baseline data be reevaluated. The availability, of different vegetation types and understory values of those types should be considered within the constraints described on page E-3-304."

RESPONSE:

A Pilot Browse study and a Phenology study were accomplished. Both of these studies provide a valuable base for scoping the vegetation mapping. See the Response to Comment I.151.

COMMENT I.153:

"Page 307: - Food Habits: Paragraph 3: While we support attempts to quantify moose winter carrying capacity as a first step in simulation modeling tjos sectopm sjpi ;d a;sp ;ost [sic] references and reflect concurrence of principal moose investigators. The assumptions included in Appendix E.3.H should be validated. Please refer to our comments on Section 4.3.1(a)(iii) and on the Mitigation Plan."

RESPONSE:

The Power Authority has difficulty in fully understanding the first part of this Comment due to the typographical errors. The second part refers to FERC License Application Appendix E3H. An updated version of the FY 1984 Terrestrial Program Plan of Study for impact assessment and mitigation plan refinement is presently being finalized and will be transmitted to the FERC within a few weeks.

COMMENT I.154:

"Page E-3-310: . Lower Susitna Basin; Paragraph 2: The applicant should confirm that all biotelemetry data indicated here as being available in June 1983 is contained in the ADF&G report provided to the FWS in September 1983. 3W-1/ We have similarly assumed that other information to be supplied in June 1983 is also in the September report (e.g., responses to our comments on the draft, Chapter 11, W-3-209)."

"3W-1/ Modafferi, Ronald D. April 1983. Susitna Hydroelectric Project, Phase II Progress Report, Big Game Studies. Volume II. Moose-Downstream. Submitted to the APA by the ADF&G.

"Ballard, Warren B., Jackson S. Whitman, Nancy G. Tankersley, Lawrence D. Aumiller, and Pauline Hessing. April 1983. Susitna Hydroelectric Project, Phase II Progress Report, Big Game Studies. Volume III. Moose Upstream. Submitted to the APA by the ADF&G."

RESPONSE:

The biotelemetry data reference on page E-3-310 of the FERC License Application was a general reference to the data contained in the annual reports produced by the Alaska Department of Fish and Game (ADF&G) in 1983 for big game studies. The reports identified in the Comment footnote by Modafferi (1983) and Ballard, et al. (1983) contain the subject data. These reports were transmitted to the FERC by letter dated May 31, 1983. The next series of ADF&G annual reports, which will contain an additional year of biotelemetry data, are scheduled to be available in May 1984.

REFERENCES

ADF&G, Susitna Hydroelectric Project, Phase II Progress Report - Big Game Studies (1983), previously submitted to the FERC on May 31, 1983.

Modafferi, R. D., Volume II, Moose - Downstream (1983).

COMMENT I.155:

"Page E-3-315: . Mortality Factors: We reiterate our draft application recommendation that this discussion include hunting as a mortality factor. Although the applicant's response indicated that the subject was covered in Chapter 3, Section 5, we find no such section (Chapter 11, W-3-216). Please also see our comments on Chapter 5, Section 3.7.2. Treatment of hunting should be better coordinated between Chapters 3 and 5, given the effect that both recreational and subsistence hunting can have on wildlife population size, structure, and distribution."

RESPONSE:

The following paragraph should be viewed as an addition to FERC License Application Section 4.2.1(a)(iii)--Mortality Factors (FERC License Application page E-3-317).

While brown bears and wolves are important predators of moose and account for a significant percentage of natural mortality, hunting mortality is also an important factor affecting moose populations. Hunting, at least in recent decades, has been highly regulated within the Susitna Basin. In most years, take is restricted to bulls. A given rate of hunting mortality probably has less effect on the population size of moose than the same natural mortality rate due to the bulls-only restriction. Since moose are polygynous, taking of bulls usually does not directly affect subsequent reproduction. Poaching mortality is less predictable and may account for additional mortality of breeding animals.

COMMENT I.156:

"Page E-3-325: (c) Dall Sheep: Paragraph 1: The preliminary nature of information presented here should be stated in view of ADF&G's proposal for intensive ground observations and sheep studies which were conducted from March through July, 1983."

RESPONSE TO COMMENT I.156:

The subject studies are described in detail on page E-3-524 of the FERC License Application under Continued Monitoring and Study Needs. Preliminary results from these studies are discussed in the Response to Comment A.11. Final results of these studies are scheduled to be available by May 1984. Please refer to the Response to Comment I.189 for a description of project area sheep studies conducted from 1980 through 1983.

COMMENT I.157:

"Page E-3-327: (ii) Mineral Lick Use: Paragraph 1: The Jay Creek mineral lick area should be better described and defined by elevation range and special area."

RESPONSE:

See the Response to Comment A.11.

COMMENT I.158:

"Page E-3-328: (ii) Mineral Lick Use: Paragraph 5: During ADF&G's intensive 1983 summer studies, moose were not observed using the lick itself (Nancy Tankersley, personal communication). ADF&G now considers previous observations of moose use to be incidental."

RESPONSE:

This is the Power Authority's current understanding as well.

COMMENT I.159:

"Page E-3-328: (d) Brown Bear: Paragraph 1: Current study delays and funding cutbacks are preventing collection of

COMMENT I.159 (cont.):

valuable information and may make later comparisons of year-to-year variations difficult. 3W-2/"

"3W-2/ APA. September 8, 1983. Appendices 2 and 3 to Agenda Item IV, Action Item No. 1, FY 1983 Program Changes and Their Impact on the FY 1984 Program and Current Proposed FY 1984 Budget Allocations, Susitna Hydroelectric Project. Prepared for the APA Board of Directors."

RESPONSE:

The Power Authority continues to fund big game studies. "Valuable information" probably referred to vegetation maps, wetlands maps and big game censuses. All of these activities are funded through FY84, and are funded in the FY85 budget approved by the Board of Directors. Since little location and census activity is performed during summer and early fall, little information was lost before these activities were fully funded by Board of Directors action on supplementary budget requests in November 1983. Pilot Browse, Phenology and ADF&G Game Reports will be available in 1984.

COMMENT I.160:

"Page E-3-331: Seasonal Movements: Paragraph 4: Given the large home range sizes of brown bear documented on page E-3-323 (last paragraph through page E-3-334, paragraph 1), we do not believe that bear use of the Susitna River area has been overestimated as indicated here.

"Page E-3-335: Home Ranges: Paragraph 5: Our proceeding comments apply here."

RESPONSE:

The assessment of whether the estimates of bear use of the Susitna River area represent underestimates or overestimates is entirely dependent on the study area referred to. If one refers to the study area for which the population of radio-collared brown bears is representative, then the estimates are probably underestimates due to the fact that some bears' use of the area is missed because of monitoring frequency. However, if one refers to the Middle Susitna Basin (refer to FERC License Application Figure E.3.3. for its boundaries), as was done in the cited paragraphs of the

RESPONSE TO COMMENT I.160 (cont.):

License Application, then the estimates are probably overestimates because the sample of radio-collared animals does not represent a random sample of bears within the Middle Basin. In particular, the sample includes little representation from the Oshetna and Tyone River watersheds which are part of the Middle Basin but are distant from the Susitna River.

COMMENT I.161:

"Page E-3-337: (c) Black Bear: Paragraph 1: Funding cutbacks and study delays are precluding necessary study progress and will make later data analyses needlessly difficult and incomplete."

RESPONSE:

Please refer to the Response to Comment I.159.

COMMENT I.162:

"Page E-3-341: Food Habits: Paragraph 2: The applicants should describe ongoing studies which address the importance of ungulate prey to black bear (page 236; paragraph 1 of the draft application)."

RESPONSE:

The ongoing big game studies are described in the ADF&G Fiscal Year 1984 Plan of Study referenced in the Response to Comment C.78. Pages 12 and 13 of that study describe the studies of black and brown bears in the project area.

COMMENT I.163:

"Page E-3-342: Home Range: Paragraph 2: It should be clarified how overlaps in home ranges with the impoundment area can be greater than 100%."

RESPONSE:

In the 1981 black bear and brown bear studies of Miller and McAllister (1982), bear use of areas in the proximity of the Susitna River was examined by comparing three concentric zones: the Watana and Devil Canyon impoundments, a one-mile zone surrounding each impoundment and a five-mile zone

RESPONSE TO COMMENT I.163 (cont.):

surrounding each impoundment. These zones are shown in the attached figure excerpted from Miller and McAllister (1982). Examination of the attached figure shows that a portion of the two five-mile zones overlap in the area between the Devil Canyon and Watana impoundments. Values over 100% overlap were obtained when a large portion of a bear home range occurred within this area. For further information please refer to Miller and McAllister (1982).

REFERENCES

ADF&G, Susitna Hydroelectric Project, Phase I Final Report-Big Game Studies (1982), previously submitted to the FERC on May 31, 1983.

Miller, S. D. and D. C. McAllister, Volume VI, Black Bear and Brown Bear (1982).

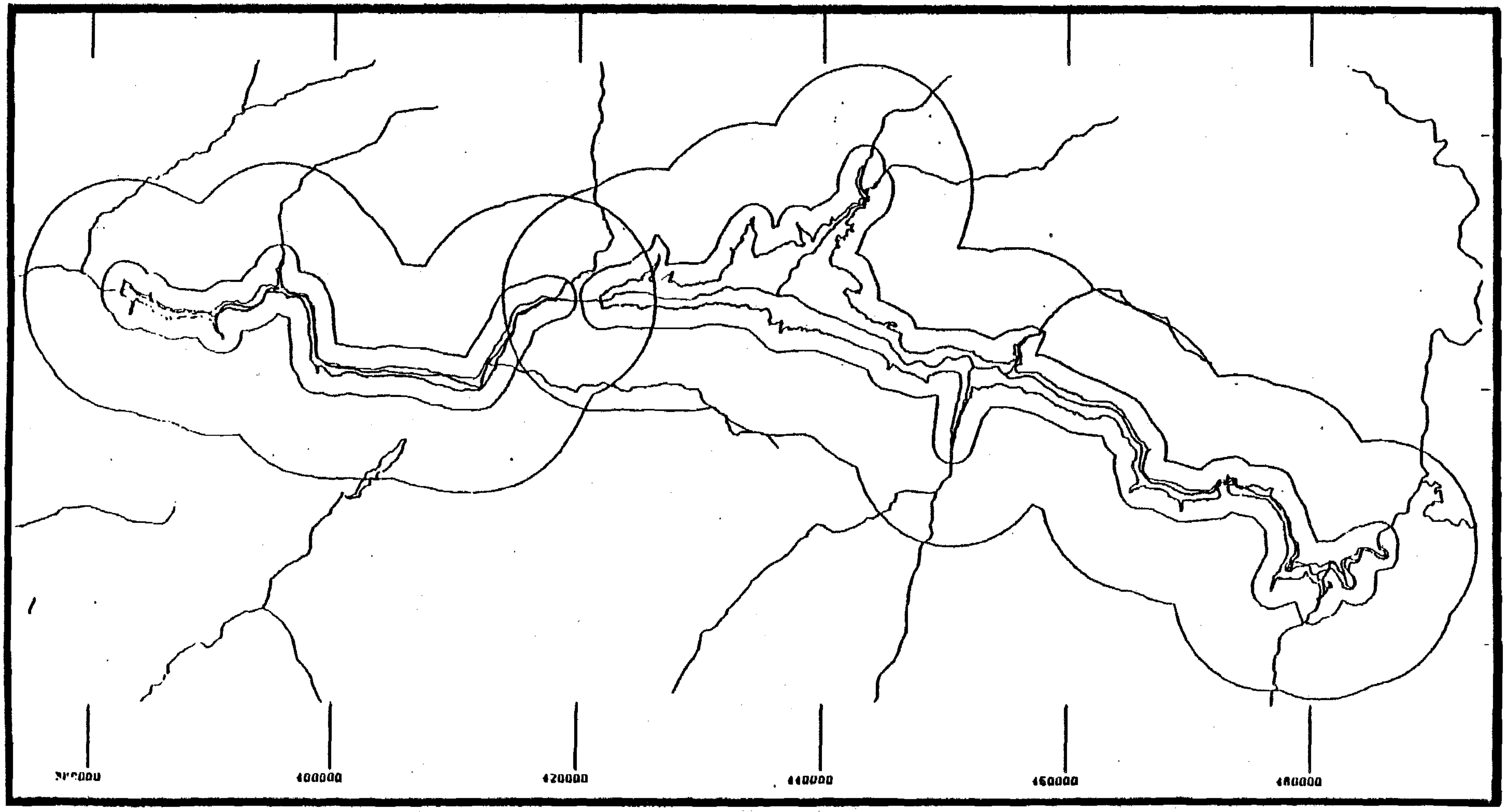


Figure 3. Illustration of proximity polygons that are one mile and five miles from the shoreline of proposed Watana and Devils Canyon Impoundments. From Miller and McAllister (1982).

COMMENT I.164:

"Page E-3-342: Population Size: Funding cutbacks prevented the 1983 spring recensusing of black bear."

RESPONSE:

The 1983 Spring recensusing of black bear was attempted but curtailed because too few bears were being observed compared with the number known to be present based on radio tracking.

COMMENT I.165:

"Page E-3-344: (f) Wolf: Funding cutbacks have curtailed monitoring. Since May 1983 only 2 relocation flights have been made for radio-collared wolves."

RESPONSE:

Please refer to the Response to Comment I.159.

COMMENT I.166:

"Page E-3-347: - Food Habits: Paragraph 6: Given the habitat losses, disturbances, and other project impacts discussed in Section 4.3, it would seem doubtful that the caribou population will increase, thus benefitting wolves and relieving some moose predator mortality as suggested here."

RESPONSE:

This Comment refers to the "Baseline Description" section of the FERC License Application which is intended to provide a "without-project" description. Effects of the Project on caribou are described in Section 4.3. This section indicates that quantification of cumulative Project effects on caribou is impossible (FERC License Application page E-3-501). Therefore, although the Nelchina herd is apparently increasing in size at present, the direction and rate of change with the Project is not possible to predict. Given the considerable historical variation in herd size and the uncertainty regarding the significance of Project impacts, it is certainly possible that the herd may continue to increase under the "with-project" scenario. Refer to the Jakimchuk study already sent to the FERC, for the view that

RESPONSE TO COMMENT I.166 (cont.):

population size may be effectively independent of project impacts.

REFERENCES

Jakimchuk, R. D., Disturbance to Barrenground Caribou; A Review of the Effects and Implications of Human Developments and Activities (July 1980), previously submitted to the FERC on May 31, 1983.

COMMENT I.167:

"Page E-3-349: (g) Wolverine: As with other big game species, funding cutbacks are interfering with needed data collection. No funds have been available since spring of 1983 to track the six wolverine radio-collared for the project."

RESPONSE:

Please refer to the Response to Comment I.159.

COMMENT I.168:

"Page E-3-354: (a) Beaver: There have been no further beaver studies or model development since March 1983. Additional data have not been provided as indicated in response to our comments on the draft license application (Chapter 11, W-3-237). We are particularly disappointed that the opportunity has been lost to verify and expand upon 1982 cache counts and to better evaluate beaver habitats and populations which could be affected by the proposed project."

RESPONSE:

An aerial beaver cache survey along the Susitna River was conducted during the fall of 1983. The survey included a complete count between Talkeetna and Portage Creek and a general survey downstream of Talkeetna. Beaver overwintering studies are scheduled to be conducted this spring and further model development is also planned based on field survey data and other inputs.

COMMENT I.169:

"Page E-3-356: (ii) Population Characteristics: At present there is no reliable estimate of the beaver population below Talkeetna (Phil Gipson, personal communication). Such an estimate would serve as a baseline for evaluating upstream habitat losses and downstream habitat improvement. Fall cache counts, marking of those caches, and later spring surveys to determine overwinter survival are necessary to assess impacts. Surveys could help identify the movement patterns of young animals and downstream habitats which may be improved due to project construction. Coordination between furbearer biologists and hydrologists to assess icing conditions was not accomplished in spring, 1983 as agreed to at the February 28 - March 2, 1983 follow-up AEA workship.3W-3/"

"3W-3/ Everitt, Robert R., Nicholas C. Sonntag, Gregory T. Auble, James E. Roelle, and William Gazey. October 22, 1982. Susitna Hydroelectric Project Terrestrial Environmental Workshop and Preliminary Simulation Model. LGL Alaska, Anchorage and Fairbanks.

"Everitt, Robert R., Nicholas C. Sonntag, Gregory T. Auble, James E. Roelle, and William Gazey. April 27, 1983. Susitna Hydroelectric Project, Draft Report, Terrestrial Environmental Mitigation Planning Simulation Model. ESSA Ltd., USFWS and LGL Alaska for Harza/EBASCO, Anchorage."

RESPONSE:

Please refer to the Responses to Comments I.168 and I.269.

COMMENT I.170:

"Page E-3-357: (ii) Population Characteristics: Paragraph 3: The need for trapper surveys was agreed to at the February 28 - March 2, 1983 follow-up AEA workshop. 3W-4/ Since no such work has been undertaken, we recommend that a trapping survey be made of residents along the railroad, in

COMMENT I.170 (cont.):

Talkeetna, in Cantwell, along the Denali Highway, and in the Watana area."

"3W-4/ See Footnote 3W-3. [Footnote 3W-3/ Everitt, Robert R., Nicholas C. Sonntag, Gregory T. Auble, James E. Roelle, and William Gazey. October 22, 1982. Susitna Hydroelectric Project Terrestrial Environmental Workshop and Preliminary Simulation Model. LGL Alaska, Anchorage and Fairbanks.

"Everitt, Robert R., Nicholas C. Sonntag, Gregory T. Auble, James E. Roelle, and William Gazey. April 27, 1983. Susitna Hydroelectric Project, Draft Report, Terrestrial Environmental Mitigation Planning Simulation Model. ESSA Ltd., USFWS and LGL Alaska for Harza/EBASCO, Anchorage.]"

RESPONSE:

Recently completed household and business surveys of Talkeetna, Trapper Creek and Cantwell residents will help supplement the information on trapping presented in the FERC License Application. The household survey included questions on the number of persons in each household who trap, where and how often they trap, what species they trap, and the importance of trapping for recreation, food, income and cultural pursuits. The business survey included questions on the percent of gross annual revenues attributable to trapping activities, what areas are important to those activities and what species are trapped as part of their business. The results of the surveys are being tabulated, and a general report will be available in March 1984.

COMMENT I.171:

"Page E-3-357: (b) Muskrat: Sufficient water depth below ice is a habitat requisite for muskrat as well as beaver. Measurement of lake depths in the middle Susitna River basin would allow assessment of which lakes are critical overwintering areas. Shallower lakes where pushups may be visible but muskrats do not successfully overwinter could also be then identified (Phil Gipson, personal communication)."

RESPONSE TO COMMENT I.171:

The reviewer has not substantiated the need for the requested additional information concerning lake depths in the middle Susitna Basin. FERC License Application page E-3-436 notes that:

> "Of the 103 lakes surveyed for muskrat sign in spring 1980, 17 occurred within borrow sites D or E or the impoundment zone (Table E.3.154); only 5 of these lakes have muskrat pushups (Gipson et al. 1982). A total of 13 pushups were observed on these 5 lakes but the number of muskrats this represents is unknown (pushups are temporary structures, and one muskrat can create many of these during a winter). A likely estimate of the number of muskrats to be lost as a result of this habitat loss is 5 to 10 animals. Improved downstream habitat will compensate for this loss."

Downstream habitat improvement for muskrat will occur as a result of stabilization of water levels and greater winter water depths in sloughs and side channels between Devil Canyon and Talkeetna. Of the 103 lakes surveyed for muskrat sign during spring 1980, only 16, or approximately 15%, actually contained muskrat pushups (Gipson 1982). Of these 16 lakes, only 5 will be directly affected by project construction and operation. It is unlikely that these 5 lakes provide "critical overwintering areas" for the muskrat population of the middle Susitna Basin, and it is improbable that their removal will produce population-level effects on muskrat. Thus, establishing a field program for the measurement of lake depths in the middle Susitna River Basin appears to be unnecessary and inappropriate.

REFERENCES

ADF&G, Susitna Hydroelectric Project, Subtask 7.11 - Phase I Report, Environmental Studies, Furbearer Studies (1982).

Gipson, P. S., S. W. Buskirk and T. W. Hobgood (April 1982).

COMMENT I.172:

"Page E-3-358: (c) River Otter: Paragraph 2: We suggest that furbearer and aquatic researchers determine whether areas where otter tract concentrations were observed in November 1980 correspond with grayling movements to overwintering areas."

RESPONSE:

Studies by the Alaska Department of Fish and Game (1983) have shown that grayling exhibit a fall outmigration from tributaries to the mainstem. No grayling overwintering data were collected in November 1980 to determine if otter track concentrations correlate with grayling movements to overwintering areas and the limited data collected since then are not sufficient to perform this analysis. No plans are being made to define overwintering areas to the extent necessary to perform this correlation, primarily because of the extreme difficulties in sampling fish during the winter period and the limited data that are produced. Even if grayling concentrations were found near otter track concentrations, it would require an otter food habits study to confirm that the otter were feeding on grayling and not other fish which may overwinter in the same locations as grayling. Finally, because otter tracks were observed at 46 percent of the 37 checkpoints visited along the Susitna River and were fairly uniformly distributed among checkpoints between the Indian and Oshetna Rivers (Gipson, et al. 1982), the effort required to determine whether or not track concentrations correlate with grayling concentrations does not appear to be justified.

REFERENCES

Alaska Department of Fish and Game, Susitna Hydro Aquatic Studies Draft Phase II Data Report - Winter Aquatic Studies, October 1982-May 1983 (1983), previously submitted to the FERC on October 31, 1983.

ADF&G, Susitna Hydroelectric Project, Subtask 7.11 - Phase I Report, Environmental Studies, Furbearer Studies (1982).

Gipson, P. S., S. W. Buskirk and T. W. Hobgood (April 1982).

COMMENT I.173:

"Page E-3-365: (h) Coyote: An addition to the information provided here is an observation of a coyote feeding on remains of a moose on ice in the Susitna River, about 7 miles downstream from the mouth of Portage Creek during March, 1983 (Phil Gipson, personal communication)."

RESPONSE:

This information is consistent with the coyote distribution information provided in the cited section (License Application page E-3-365).

COMMENT I.174:

"Page E-3-369 (a) Raptors and Raven: Paragraph 1: Definitions for raptor 'nesting locations' and 'nest sites' were found in Section 4.3.1(n)(i), page E-3-443, paragraph 1; not in Appendix 3.I as indicated here.

"The draft report stated '. . . precise elevations of nests and cliff-tops relative to maximum impoundment fill levels are integral to a sound mitigation plan . . .' (Chapter 11, W-3-251). That information is essential to several of the recommended mitigation plans (e.g. Section 4.4.2(a)(9), and (b)(10), (20), and [21]). The applicant should confirm that these data were obtained, and by whom, and how the data will be incorporated into the Mitigation Plans."

RESPONSE:

More precise elevational and horizontal measurements of nesting locations and potential mitigation sites will be made during early summer of 1984 by an experienced raptor biologist. This information will be used to develop a more detailed raptor mitigation plan containing specific implementation procedures for mitigation impacts at each nesting location and for enhancing nesting habitat at selected sites.

The most precise nest location information currently available has been provided in Exhibit E, Chapter 3, Tables E.3.127, E.3.127b, E.3.160, E.3.161 and E.3.162. As stated in the footnote to Table E.3.161,

> "Differences occur between elevations given here and those reported by Kessel et al. (1982a)....All

RESPONSE TO COMMENT I.174 (cont.):

> elevations have been reviewed and some revisions were made; however, in some cases, estimates given here may contain errors of as much as 30.5 m (100 ft.). All elevations must be considered approximate (unless otherwise noted) until the majority are rechecked with the precision altimeter."

Elevations of the raptor nesting locations and nest sites described in Tables E.3.160 and E.3.161 are estimates made from topographic maps with 100-ft. contour intervals.

COMMENT I.175:

"Page E-3-385: (v) Middle Basin Bird Communities: We appreciate inclusion of Table E.3.139 and the expanded discussion on avian habitat types and densities. Once the proposed vegetation and wetland maps are completed, these data should be reexamined for further understanding of middle basin bird communities and project impacts."

RESPONSE:

Results of vegetation mapping (see Response to Comment I.151) can be used to refine impact assessments and mitigation plans.

COMMENT I.176:

"Page E-3-396: 4.3 Impacts: Paragraph 1: While we agree that acceleration of secondary development in the Susitna River basin is an indirect rather than direct project impact, the potential for such development should be fully assessed within the intent of NEPA (42 U.S.C. 4321 et seq.)."

RESPONSE:

Please see the Response to Comment F.71. To reiterate, the potential for secondary development in the Susitna River Basin is dependent upon action and circumstances that are beyond the ability of the Power Authority to predict or determine. The Power Authority is continuing to work on land use planning and management policies with the Bureau of Land Management, Alaska Department of Natural Resources, Matanuska-Susitna Borough and the native corporations. Collectively and individually, these entities will have the greater controllable influence on the ultimate development of the Susitna River Basin.

The FERC License Application and supporting material have addressed the potential for secondary development to the extent possible, and have identified the uncertainty of such development.

The Power Authority anticipates that the DEIS will appropriately address reasonably foreseeable indirect impacts, if any.

COMMENT I.177:

"Page E-3-396: 4.3 Impacts Paragraph 2: Please refer to our comments on Table E.3.144 regarding inconsistencies with data presented elsewhere and to additional comments on the species - specific impact tables."

RESPONSE:

This Comment cross-references other Comments and does not raise an issue or question by itself. For specific discussions of these other aspects, refer to the appropriate Responses as follows:

1. Table E.3.144--see Response to Comment I.305; and

2. Species-Specific Tables E.3.146 and E.3.168--see Responses to Comments I.306 to I.312.

COMMENT I.178:

"Pages E-3-396 to E-3-397: Moose: The qualitative statements which characterize this section confirm the need to aggressively pursue development of the moose carrying capacity model and completion of necessary background studies. Please refer to our previous concerns with the validity of these numbers (Section 4.2.1(a)[ii])."

RESPONSE:

Please refer to the Responses to Comments C.86 and I.153.

COMMENT I.179:

"Page E-3-396: (a) Moose: Paragraph 1: Details on specific locations and the magnitude of benefits from the Watana project should be provided here."

RESPONSE:

The cited paragraph is the introductory paragraph of the moose impact section, and, therefore, the Power Authority does not agree that details and specifics of benefits should be provided there. Discussion of the potential benefits of the Watana project to moose are provided in FERC License Application pages E-3-407 and E-3-466 relative to downstream habitat.

COMMENT I.180:

"Page E-3-405: - Permanent Loss of Habitat: Paragraph 1: In addition to describing how increased moose densities could cause a decline in habitat quality adjacent to project impact areas, consideration should be given to existing utilization of those areas by moose and whether displaced moose could ultimately survive."

RESPONSE:

Please refer to Mitigation Plan No. 8, FERC License Application page E-3-530 for an explanation of contingency plans for directly displaced moose should surrounding browse availability be determined to be too low for increased numbers of moose.

COMMENT I.181:

"Page E-3-406: - Upper Susitna Basin: Please refer to our previous comments on altered habitats, including needed quantification of these areas (Section 3.3.1(a)(ii) and (iii), (b)(ii),(iii), and [iv]). We are concerned that due to decreased funding, plant phenology data obtained in 1983 may not be analyzed. These data and analyses are essential to assess implications of the reservoir impoundment and potential values of proposed habitat improvements. See our comments on Section 3.3.1(b)(iv)."

RESPONSE:

The plant phenology data obtained in 1983 are currently being analyzed, and a final report containing the data and a discussion of results is scheduled to be completed in early May 1984. These data will be utilized in the continuing review and analyses of impacts and mitigation measures.

For more information specific to the referenced sections in this Comment, please refer to the Responses to Comments I.338 to I.340 and I.345 to I.352.

COMMENT I.182:

"Page E-3-409: - Blockage of Movements: To better understand potential movement blockages, we recommend that concentration areas and timing of moose crossings of the

COMMENT I.182 (cont.):

Susitna River be analyzed relative to slopes in the drawdown zone."

RESPONSE:

The commentor has not indicated what the impact would be that this analysis would address.

COMMENT I.183:

"Page E-3-410: - Blockage of Movements: Paragraph 2: As we commented on Chapter 2, page E-2-90, the expected delay in ice cover formation downstream from Talkeetna should be re-evaluated and the results provided to allow better quantification of the potential for interference with moose movements."

RESPONSE:

Please refer to the Responses to Comments I.40 and B.6.

COMMENT I.184:

"Page E-3-410: Blockage of Movements: Paragraph 5: The applicant should provide the schedule and scope for the additional information."

RESPONSE:

The additional information discussed in this paragraph refers to the ongoing upstream moose studies being conducted by the Alaska Department of Fish and Game. The most recent ADF&G annual report (Ballard, et al. 1983) was published following publication of the FERC License Application and transmitted to the FERC by letter dated May 31, 1983. The

RESPONSE TO COMMENT I.184 (cont.):

next ADF&G annual report will be available in April-May 1984 and will be transmitted to the FERC at that time.

REFERENCES

ADF&G, Susitna Hydroelectric Project, Phase II Progress Report - Big Game Studies (1983), previously submitted to the FERC on May 31, 1983.

Ballard, W. B., J. S. Whitman, N. G. Tankersley, L. D. Aumiller and P. Hessing, Volume III, Moose - Upstream (1983).

COMMENT I.185:

"Page E-3-411 - Mortality: Paragraph 1: The need to provide baseline data on hunting demand and harvest was previously identified, as was the need to coordinate consideration of hunting between Chapter 3 and Chapter 5 (Section 4.2.1(a)[iii]). Whether hunting will remove displaced animals and thus prevent overbrowsing of remaining habitats will depend on the magnitude of that displacement and regulation of hunting by the Alaska Board of Game."

RESPONSE:

Please refer to the Response to Comment I.155. Dispersal of moose directly displaced by impoundment filling would likely lead to increased utilization of browse in the immediate vicinity of the impoundment. Decisions as to whether these moose would best be utilized by the hunting public, or should be allowed to integrate into surrounding moose populations, thereby potentially increasing those populations above their carrying capacity, is the responsibility of the Alaska Board of Game. Recommendations provided in future mitigation plans, currently being refined, will be closely coordinated with personnel from the Alaska Department of Fish and Game.

COMMENT I.186:

"Page E-3-412: (iii) Quantification of Project Effects: We support efforts to model moose carrying capacity and subsequently simulate the cumulative effects of habitat

COMMENT I.186 (cont.):

loss, habitat alteration, and various mortality factors. This model will also allow a quantitative evaluation of the habitat values of alternative replacement lands. It should also be used to evaluate habitat values of alternative habitat improvement methods, e.g., burning, clearing, crushing, etc. Budget cutbacks and study delays are, however, interfering with the timely completion of this habitat quantification. Contrary to information presented here and responses to our previous recommendations concerning vegetation values (Chapter 11, W-3-203 and W-3-204), the necessary vegetation mapping may not be available until State fiscal year 1985."

RESPONSE:

Please refer to the Response to Comment I.153. Also, please note that although certain planned programs were not conducted in 1983 due to budgetary limitations, final simulation modeling results are still expected to be available by early 1986 as stated in the FERC License Application (page E-3-414).

COMMENT I.187:

"Page E-3-414: (iii) Quantification of Project Effects: Paragraph 6: The scope and timing of preliminary model analyses to be available in 1983 should be described."

RESPONSE:

Please refer to the Response to Comment C.86.

COMMENT I.188:

"Pages E-3-416B: (ii) Filling and Operation: Paragraph 7: Please refer to our previous comment on page E-3-409 that slopes within the drawdown zone be analyzed relative to wildlife crossings (Section 4.3.1(a)[ii]). We again recommend modeling of reservoir ice formation and break-up during filling as well as operation (see our comments on Chapter 2, page E-2-88). The time of break-up has significant implications with regard to potential crossings by animals such as caribou."

RESPONSE TO COMMENT I.188:

This Comment refers to previous specific Comments. Please see the Responses to Comments I.182 and I.39 for Responses to the first and second parts of this Comment, respectively.

COMMENT I.189:

"Page E-3-417: (c) Dall Sheep: Sheep studies, particularly in the Jay Creek mineral lick area, were not undertaken until March through July, 1983. Information presented here should be qualified as preliminary."

RESPONSE:

We disagree that sheep studies were not undertaken until 1983. Ballard, et al. (1982) presents the results of aerial sheep surveys of the project area conducted during summer 1980, winter 1981, spring 1981 and summer 1981 as well as ground observations of the Jay Creek lick area conducted in spring 1981. The spring-early summer 1981 aerial surveys included 33 aerial surveys of the Jay Creek lick area. In addition, Tankersley (1983) presents the results of aerial sheep surveys of the project area conducted in winter 1982 and summer 1982, plus numerous incidental aerial observations. Ground observations of the Jay Creek lick area conducted during spring 1982 and aerial composition counts in the Watana Hills sheep trend count area for 10 years between 1950 and 1982 are also reported. Please also see the Response to Comment I.189.

REFERENCES

ADF&G, Susitna Hydroelectric Project, Phase I Final Report - Big Game Studies (1982), previously submitted to the FERC on May 31, 1983.

Ballard, W. B., J. H. Westlund, C. L. Gardner and R. Tobey, Volume VIII, Dall Sheep (1982).

ADF&G, Susitna Hydroelectric Project, Phase II Progress Report - Big Game Studies (1983), previously submitted to the FERC on May 31, 1983.

Tankersley, N. G., Volume VIII, Dall Sheep (1983).

COMMENT I.190:

"Page E-3-418: (i) Construction: Paragraph 2: Disturbance of sheep at the Jay Creek mineral lick may be more immediate than lick inundation. However, disturbance from recreationists could extend through the project life. The cumulative impacts should be evaluated."

RESPONSE:

During project construction, major ground activities will be prohibited within one-half mile of the Jay Creek mineral lick between April 15 and June 15. During and following construction, the reservoir adjacent to the lick will be closed to boat and float plane use within one-half mile of the lick (see FERC License Application page E-3-532). It is expected that these restrictions will reduce the potential for disturbance impacts by recreationists to a low level, probably less than the current potential for disturbance by field study personnel. As project planning and Mitigation Plan refinement continues, these restrictions will be refined as necessary in cooperation with resource management agencies.

COMMENT I.191:

"Pages E-3-419 to E-3-420: (i) Construction: Paragraphs 2 through 4: The Jay Creek mineral lick area is apparently more extensive than it was originally thought to be. Additional downstream lick areas discovered during ADF&G's recent work in the area would also be fully or partially inundated (Nancy Tankersly, personal communication). While erosive water action could cause exposure of additional mineral soil, it will more likely cause loss of the steep rocky cliffs resulting in added stress and exposure to predators when sheep use the area.

"Given the apparent elevation range of the Jay Creek lick area, it is uncertain that the lick was originally created or is maintained by the water action along the creek.

"The discussion should consider impacts from proposed reservoir clearing activities and provide information on how access for those activities is to be provided. Timber clearing and associated access are further sources of disturbance and could impact sheep use of the Jay Creek lick area."

RESPONSE TO COMMENT I.191:

Please refer to the Response to Comment A.11 for further discussion on the complex of lick sites known as the Jay Creek mineral lick, including the East Fork lick located approximately 10 miles north of the reservoir. The Jay Creek lick complex consists of many lick areas generally above the Watana Reservoir elevation (usually 2,200-2,500 feet in elevation). The most popular area is a large rocky bluff ranging from 2,000 to 2,550 feet in elevation. At present, it does not appear likely that erosive action of reservoir waters will cause loss of steep, rocky cliff habitat. However, this possibility will be investigated during future impact assessment refinement efforts.

Please note that the text of the FERC License Application does not say that the Jay Creek lick area was created or is maintained by the water action along the creek as suggested by the Comment.

Please refer to the Response to Comment I.190 regarding access restrictions during project construction and operation.

COMMENT I.192:

"Page E-3-421: (i) Construction: Potential disturbance and loss of habitat from borrow area activites should be discussed. 3W-5/"

"3W-5/ Miller Sterling D. and Dennis C. McAllister. 1982. Susitna Hydroelectric Project. Phase I Final Report. Big Game Studies. Volume VI, Black Bear and Brown Bear, page 60. Submitted to the APA by the ADF&G."

RESPONSE:

Excavation of borrow areas required for construction of the Watana dam and adjoining facilities (e.g., cofferdams, spillways and service roads connecting the camp, village and powerhouse-dam complex) will remove habitat of brown and black bears, influencing seasonal movements and preventing foraging in locations now used by these species in spring and late summer. During project construction, borrow area

RESPONSE TO COMMENT I.192 (cont.):

excavation activities will disturb individual bears directly.

Borrow area E (see Exhibit E, Chapter 6, Figure E.6.13) is in a brown bear spring foraging area (Miller and McAllister 1982). Approximately half of this site (by area) occupies a first-level terrace on the north side of the active floodplain of the Susitna River. This terrestrial habitat area will pond during excavation and will be permanently lost as a source of forage vegetation (see Exhibit E, Chapter 3, Figure E.3.25). As noted by Miller and McAllister (1982), "over the long run the habitat in this area would likely be vacated by brown bears regardless of the borrow area because of its proximity to the Watana dam site and flooding by the Devil Canyon dam."

Excavation of three other borrow areas will displace brown bears with home ranges overlapping these sites (Miller and McAllister 1982). Borrow area D and quarry site B are located adjacent to the mouth of Deadman Creek immediately west of the creek; the third site, borrow area H, is approximately 0.25 miles south of Fog Creek (see Exhibit E, Chapter 6, Figure E.6.13).

Borrow area D will have the greatest impact on black bears (Miller and McAllister 1982). This site, in the tablelands area west of Deadman Creek, is used by black bears foraging for berries in late summer. Miller and McAllister (1982) state:

> "[I]n the late summer these tableland areas are used both by local resident black bears as well as by bears moving to these areas from downstream locations. The plant ecology study (subtask 7.12) prepared by the Agricultural Experiment Station, University of Alaska indicates the size of Area D as 228 hectares of which 48% is low mixed shrub and 32% is birch shrub (op. cit., Table 4, page 23). Bog blueberry (Vaccinium uliginosum), crowberry (Empetrum nigram) (sic) and Mt. cranberry (V. vitis-idaea) were especially common in these shrub types according to this study. Borrow area D encompasses 0.02% of the low mixed shrub type found in the entire upper Basin and 0.22% of the birch shrub type (op. cit.). From the perspective of a black bear, however, these low percentages are misleading as the proximity of these types to escape cover (especially forests) governs their use by black bears. Borrow area D encompasses a much higher percentage of

RESPONSE TO COMMENT I.192 (cont.):

these types which are also found in close proximity to escape cover."

Miller and McAllister (1982) state that borrow areas B and H and the north part of E are in forested areas where black bears are resident, and that excavation of area H would produce the greatest impact of these three sites on black bears.

Several borrow and quarry sites were not considered as primary sites for this project because of lengthy haul distance to the damsite, adverse environmental impacts, insufficient quantities and poor quality material. These include B, C, F and H, as stated in page E.6.17 of the License Application.

Potential impacts to brown bears resulting from borrow area activities, including human disturbance and loss of habitat, will be addressed in the impact assessment and mitigation update report. This report will incorporate data from the 1983 and 1984 ADF&G reports.

REFERENCES

Acres American, Inc., Susitna Hydroelectric Project, Subtask 7.12--Phase I Final Report, Environmental Studies, Plant Ecology Studies (1982).

Miller, S.D. and D.C. McAllister, Alaska Power Authority, Susitna Hydroelectric Project, Phase I Final Report, Big Game Studies, Volume VI, Black Bear and Brown Bear (1982).

COMMENT I.193:

"Page E-3-426: (ii) Filling and Operation: Paragraph 3: While brown bears could physically cross the reservoir, they would likely be inhibited by adjacent human activities. 3W-6/"

"3W-6/ See Footnote 3W-5. [3W-5/ Miller Sterling D. and Dennis D. McAllister. 1982. Susitna Hydroelectric Project. Phase I Final Report. Big Game Studies. Volume VI, Black Bear and Brown Bear, page 60. Submitted to the APA by the ADF&G.]"

RESPONSE TO COMMENT I.193:

It does not seem likely that adjacent human activities would inhibit bear crossings along most of the reservoir length since the only location along the 54-mile long reservoir where human activities would consistently take place is within a few miles of the dam. During the reservoir clearing program, human activity will extend the length of the reservoir.

COMMENT I.194:

"Page E-3-427: (i) Construction: Paragraph 3: According to Figure E.3.37, borrow area E is more extensive than it was originally thought to be and represents a significant source of disturbance to the high density black bear denning in the area (Sterling Miller, personal communication)."

RESPONSE:

The size of borrow area E has not been changed; it is no more extensive than was originally thought to be. Figure E.3.37 does not accurately portray the borrow area because it exaggerates its size. Figure E.6.13 in the License Application and Figure 8.18 in the December 1982 Geotechnical Supplement more accurately define the maximum boundaries of borrow area E. The impact of borrow area E and other borrow areas on black bear denning habitat is addressed on page E-3-427 of the License Application.

REFERENCES

Acres American, Inc., Susitna Hydroelectric Project, 1982 Supplement to the 1980-81 Geotechnical Report, Volume 1 (December 1982).

COMMENT I.195:

"Page E-3-428: (i) Construction: Paragraph 4: The ADF&G Phase II Annual Report (April 1983) shows the Watana impoundment area to be more important to black bear denning

COMMENT I.195 (cont.):

than previously realized. Thirteen of 24 black bear dens found within the project area will be flooded. 3W-7/"

"3W-7/ Miller Sterling D. April 1983. Susitna Hydroelectric Project, Phase II Progress Report, Big Game Studies. Volume VI. Black Bear and Brown Bear. Submitted to the APA by the ADF&G."

RESPONSE:

The referenced report was provided to the FERC by letter dated May 31, 1983. It should be noted that, while the FERC License Application indicates that 69% of the black bear denning habitat in the Watana impoundment vicinity will be lost, the new data suggests that only 54% will be lost.

COMMENT I.196:

"Page E-3-431 to E-3-432: (f) Wolf: Last Paragraph: We agree that wolves may temporary increase as a result of increased availability of prey due to displacement adjacent to the reservoir area. Those initial benefits may later mean more significant impacts to wolves as hunters and predators eliminate prey."

RESPONSE:

The FERC License Application recognizes (pages E-3-431, E-3-432 and E-3-503) that there may be a fluctuation (temporary increase, then decrease) in wolf numbers following reservoir clearing.

COMMENT I.197:

"Page E-3-435: (ii) Filling and Operations: Paragraph 3: Line 1: A more accurate statement would be that no beavers are known to overwinter in the river reach between Watana and Devil Canyon (Phil Gipson, personal communication)."

RESPONSE:

The Power Authority agrees that this wording is more accurate.

COMMENT I.198:

"Page E-3-435 to E-3-436: (ii) Filling and Operation: Paragraph 4: The value of sites occupied by beaver in the winter depends on water stability. Thus, flow fluctuations for even a few days could affect downstream beaver. Beaver could be frozen out of their lodges and/or food caches if water levels suddenly drop. Alternatively, their lodges and food caches could be destroyed should sudden flow releases cause ice movements or flooding out of beaver sites. The potential for daily flow fluctuations in winter should be described.

"As we commented on Chapter 2, page E-2-90, the expected delay in ice cover formation downstream from Talkeetna should be described here and the implications discussed in regard to beaver habitat improvement proposals. We recommend using hydrologic data in conjunction with revised vegetation maps and with information on vegetation succession to quantify downstream areas likely to be affected under different flow regimes. Please refer to our previous comments on the uncertainties in existing reservoir temperature and icing models which make these conclusions on downstream vegetation succession and icing processes questionable (Section 3.3.1(b)[iii]).

"An explanation should be provided of when, how, and by whom, '...available hydrologic data will be used to determine the most likely locations for enhancement [habitat improvement] in downstream sections, as indicated in the applicant's response to our previous comments on this subject (Chapter 11, W-3-324).

"We question whether beaver habitat can be improved. Other than to create stable but higher winter flows and deeper water in some sloughs and side-channels for beaver use, there may be other physical manipulations which could improve beaver habitat. These would be to: (1) dig out sloughs to increase their depth; (2) put in berms at upstream channel openings to slow down flows; or (3) put a dam at downstream channel mouths to deepen the water in the channel. These are all drastic measures whose values have not been proven in Alaska, and which potentially conflict with management and mitigation plans for other species."

RESPONSE TO COMMENT I.198:

The last paragraph of this Comment provides the key to the entire discussion. The Comment indicates that probably the best way to improve beaver habitat is "to create stable but higher winter flows and deeper water in some sloughs and side-channels for beaver use." This is exactly what the Project will provide. Under natural (without-project) conditions, average monthly winter flows at Gold Creek and Sunshine are (FERC License Application Tables E.2.8 and E.2.9):

	Gold Creek	Sunshine
November	2,577 cfs	6,028 cfs
December	1,807 cfs	4,267 cfs
January	1,474 cfs	3,565 cfs
February	1,249 cfs	2,999 cfs
March	1,124 cfs	2,681 cfs
April	1,362 cfs	3,226 cfs

Under with-project conditions, comparable average monthly flows will be approximately (from FERC License Applicaton Tables E.2.54 and E.2.56):

November	9,600 cfs	13,100 cfs
December	11,300 cfs	13,700 cfs
January	10,600 cfs	12,700 cfs
February	10,200 cfs	11,900 cfs
March	9,300 cfs	10,800 cfs
April	8,100 cfs	10,000 cfs

The increased water depth which would result from these project-induced increased winter flows would vary depending on the physical cross-section characteristics of the given site, but, at Gold Creek and Sunshine, the increases would be approximately 4.5 and 1.6 feet, respectively.

Under base-loading, daily fluctuations will be held to a minimum and limits will be negotiated with the resource management agencies concerning both maximum daily variations and hourly rate of change of discharge. Thus, with or without ice cover, it is anticipated that habitat conditions for beaver downstream from Gold Creek will be improved by the Project. The delay in ice cover formation in this reach of the river (see Response to Comment I.40) will further improve habitat conditions for beaver. Please see also the Responses to Comments I.346, I.542 and I.552.

RESPONSE TO COMMENT I.198 (cont.):

Proposed habitat improvement measures for beaver (see Mitigation Plan No. 19, page E-3-537) will also enhance beaver (and other aquatic and semi-aquatic furbearers) downstream. Further evaluation of project impacts and refinement of mitigation measures for furbearers is being conducted as part of ongoing impact assessment and Mitigation Plan refinement efforts. Please refer to the Responses to Comments I.29, I.40, I.168, and I.310 for further related discussion.

COMMENT I.199:

"Page E-3-436: (j) Muskrat: Paragraph 1: The effectiveness of proposed downstream improvements to muskrat habitat should be demonstrated."

RESPONSE:

Muskrats are predicted to benefit from project alterations in downstream areas in two ways: (1) The presence of greater amounts of open water in winter in downstream river sections after completion of the dams will allow muskrats to overwinter (a critical period) in sections of the river which were unavailable to them before (due to shallow water and extensive ice cover), and (2) the enhancement of downstream sloughs for beaver will secondarily benefit muskrats. The creation of deep ponds by beaver damming activities will also create overwintering habitat for muskrats. This commensal relationship between beavers and muskrats is well documented (Errington 1961, Larin 1961, Curatolo, et al. 1981) and is expected to occur in the Susitna Basin.

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