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APPENDIX - I

Refinement to Reservoir and River
Temperature and Ice Studies
For Simulation Period
October 1976 to May 1977

Text Changes and
New Exhibits
I and O

For

Alaska Power Authority Comments on the Federal Energy Regulatory
Commission Draft Environmental Impact Statement of May 1984,
Volume 8, Appendix VI, River Ice Simulations, Susitna River,
Watana Dam to Confluence of Susitna and Chulitna Rivers

SUSITNA HYDROELECTRIC PROJECT
ALASKA POWER AUTHORITY COMMENTS
ON THE
F.E.R.C. DRAFT ENVIRONMENTAL IMPACT STATEMENT

APPENDIX VI
RIVER ICE SIMULATIONS

ERRATA

TEXT

a) Table of Contents:

- 1.2.1 Replace "Average" with "Warm"
- 1.2.2 Replace "Average" with "Very Warm"
- 1.2.3 Replace "Cold" with "Average"
- 4.2 Replace "Average" with "Warm"
- 4.3 Replace "Average" with "Warm"
- 4.4 Replace "Cold" with "Average and Cold"
- 4.5 Replace "Cold" with "Average and Cold"

b) Section 1.2, second paragraph, beginning with second sentence, should read, "The winters of 1976-77 and 1982-83 generally gave the lowest water levels and shortest ice cover. The 1981-82 winter resulted in somewhat more ice and higher water levels than the 1976-77 and 1982-83 winters. The winter of 1971-72 resulted in the greatest ice accumulation and furthest progression of the ice front. In the simulations discussed herein, the winter of 1981-82 represents an average winter, 1971-72 represents a cold winter, 1982-83 represents a warm winter and 1976-77 represents a very warm winter. Simulations have also been made for natural conditions for the winters of 1971-72, 1976-77, 1981-82 and 1982-83."

c) Section 1.2.1, title, replace "Average" with "Warm"

- d) Section 1.2.2, title, replace "Average" with "Very Warm"
- e) Section 1.2.2 first paragraph, eighth line, replace "127" with "124"
- f) Section 1.2.3, title, replace "Cold" with "Average"
- g) Chapter 3.0, eighth paragraph, twelfth line, replace "Cold" with "Colder"
- h) Section 4.2, title, replace "Average" with "Warm"
- i) Section 4.2, first paragraph, second line, replace "127" for "126"
- j) Section 4.2, second paragraph, second line, replace "137" with "126," delete "upstream of the Gold Creek Bridge"
- k) Section 4.2, second paragraph, fourth line, replace "4 to 6" with "2 to 5"
- l) Section 4.2, second paragraph, sixth line, replace "approximately four feet higher than" with "equivalent to that"
- m) Section 4.2, third paragraph, first line, replace "average" with "warm"
- n) Section 4.2, third paragraph, third line, replace "137" with "126"
- o) Section 4.3, title and first line, replace "average" with "warm"
- p) Section 4.3, first paragraph, third line, replace "122" with "123"
- q) Section 4.3, first paragraph, fourth line, replace "two to five" with "one to three"
- r) Section 4.3, third paragraph should read, "Based on a simulation of 1976-77 winter conditions, the ice cover would reach approximately river mile 124. Maximum water levels attained would be 1 to 6 feet lower than with Watana only operation. Maximum water levels would be 0 to 1 foot lower than simulated natural conditions at the Slough 8A berms and 2 feet lower than natural conditions at the Slough 9 berm. The berms of Sloughs 8A and 9 would not be overtopped with the 2002

energy demand and would probably not be overtopped with the 2020 energy demand"

- s) Sections 4.4 and 4.5, titles, replace "Cold" with "Average and Cold"
- t) Section 4.4, third paragraph, first sentence, should read, "For the average and cold winters simulated, the leading edge of the ice progressed to river miles 137 and 142, respectively"
- u) Section 4.5, first paragraph, first line, should read "The winters of 1981-82 and 1971-72, respectively, were used for simulating average and cold winter conditions..."
- v) Section 4.5, first paragraph, fourth and seventh lines, replace "cold" with "average"
- w) Section 4.5, first paragraph, fifth, seventh, eighth and tenth lines, replace "average" with "warm"
- x) Section 4.5, first paragraph, ninth line, replace "126" with "124." Replace "4 miles" with "1 mile"
- y) Section 4.5, second paragraph, first, fourth, seventh and ninth lines, replace "cold" with "average"
- z) Section 4.5, second paragraph, third line, replace "5 to 9" with "3 to 7"
- aa) Section 4.5, second paragraph, fifth line, replace "10" with "13"
- bb) Section 4.5, second paragraph, ninth line, replace "average" with "warm"
- cc) Section 4.5, third paragraph, fourteenth line, replace "an average" with "a warm"
- dd) Section 4.5, third paragraph, sixteenth line, replace "117" with "120"

- ee) Section 4.6, first paragraph, second line, replace " average and cold winter" with "warm and average winter"
- ff) Section 4.6, second paragraph, sub heading one, replace "average" with "warm"
- gg) Section 4.6, second paragraph, sub heading two, replace "cold" with "average"
- hh) Section 4.6, third paragraph, third line, replace "average" with "warm."

TABLES

Replace Tables 1, 3, 4, 5, 10, 12 and 15 with the corresponding new tables attached.

EXHIBITS

Replace Exhibits I and O with the corresponding new exhibits attached.

Additionally, ice bridge formation at river mile 9 may be dependent on tides and the occurrence of extremely cold weather, factors which are not influenced by the project. Ice front progression past the Yentna River may be delayed somewhat with project, but in order to provide conservatism in the study, November 1 was accepted as the starting date for computations of filling the Lower Reach with ice.

Table 1 describes the ice simulations provided in this Appendix.

TABLE 1
RIVER ICE SIMULATIONS

Estimated Energy Demand for	<u>Watana Operation</u>		<u>Watana/Devil Canyon Operations</u>				<u>Watana Filling</u>	
	1996	2001	2002	2020			First Winter	Second Winter
<u>Simulated Period</u>								
Nov. '82-May '83 Avg. Year Warm Winter Temps	+	+	+	+			+	
Nov. '71-May '72 Wet Year Cold Winter Temps.	+	+	+	+				
Nov. '76-May '77 Dry Year Warm Winter Temps.	+		+					
Very Nov. '81-May '82 Wet Year Avg. Winter Temps.	+		+					+

TABLE 3
MAXIMUM ICE-AFFECTED WATER LEVELS FOR WINTER OF 1982-1983

Location	River Mile	Threshold Elev. Δ /	Simulated Natural Conditions	Energy Demand for			
				Watana only		Devil Canyon	
				1996	2001	2002	2020
Whiskers slough head	101.5	367	366	370	370	369	370
Side channel at head of Gash Creek	112.0		456	459	461	457	457
Mouth of Slough 6A	112.34		459	462	463	460	459
Slough 8 head	114.1	476	474	476	478	475	475
Side channel MS II	115.5	482	484	488	489	487	488
Side channel MS II	115.9	487	486	491	492	490	491
River Mile 120	120.0		520	525	521	520	523
Moose slough head	123.5		548	550	550	545	550
Slough 8A head (west)	126.1	573	570	572	568	568	573
Slough 8A head (east)	127.1	582	582	582	582	581	583
Slough 9 head	129.3	604	605	603	603	602	603
Side channel upstream of slough 9	130.6		621	617	617	616	617
Side channel upstream of 4th July Creek	131.8		630	628	628	627	628
Slough 9A head	133.7	651	651	650	650	650	650
Side channel upstream of slough 10	134.3	657	658	656	656	655	656
Side channel down- stream of Slough 11	135.3		672	668	668	667	668
Slough 11 head	136.5	687	684	683	683	682	684
Slough 17 head	139.3		-	715	715	714	715
Slough 20 head	140.5	730	-	729	729	728	729
Slough 21 downstream end	141.8	747	-	746	746	746	747
Slough 21 head	142.2	755	-	753	753	752	753
Slough 22 head	144.8	788	-	786	786	785	787
Maximum upstream Extent of Ice Cover in Winter (river mile)			>137	126	124	123	126

TABLE 4
MAXIMUM ICE-AFFECTED WATER LEVELS FOR WINTER OF 1976-1977

Location	River Mile	Threshold Elev. 1/	Simulated Natural Conditions	Energy Demand for			
				Watana only		Devil Canyon	
				1996	2001 ^{2/}	2002	2020 ^{3/}
Whiskers Slough head	101.5	367	366	370		368	
Side channel at head of Gash Creek	112.0		454	457		456	
Mouth of Slough 6A	112.34		457	460		459	
Slough 8 head	114.1	476	472	475		474	
Side channel MS II	115.5	482	480	486		486	
Side channel MS II	115.9	487	483	489		489	
River Mile 120	120.0		520	525		520	
Moose slough head	123.5		546	552		547	
Slough 8A head (west)	126.1	573	569	574		568	
Slough 8A head (east)	127.1	582	581	583		581	
Slough 9 head	129.3	604	603	603		601	
Side channel upstream of slough 9	130.6		616	617		616	
Side channel upstream of 4th July Creek	131.8		626	628		627	
Slough 9A head	133.7	651	649	650		650	
Side channel upstream of slough 10	134.3	657	655	656		655	
Side channel down- stream of Slough 11	135.3		668	667		667	
Slough 11 head	136.5	687	681	684		682	
Slough 17 head	139.3		-	715		714	
Slough 20 head	140.5	730	-	729		728	
Slough 21 downstream end	141.8	747	-	746		746	
Slough 21 head	142.2	755	-	753		752	
Slough 22 head	144.8	788	-	787		785	
Maximum upstream Extent of Ice Cover in Winter (river mile)			>137	126		124	

TABLE 5
MAXIMUM ICE-AFFECTED WATER LEVELS FOR WINTER OF 1981-1982

Location	River Mile	Threshold Elev. ^{1/}	Simulated Natural Conditions	Energy Demand for			
				Watana only		Devil Canyon	
				1996	2001 ^{2/}	2002	2020 ^{3/}
Whiskers slough head	101.5	367	368	371		369	
Side channel at head of Gash Creek	112.0		455	460		456	
Mouth of Slough 6A	112.34		457	462		458	
Slough 8 head	114.1	476	472	477		475	
Side channel MS II	115.5	482	484	488		485	
Side channel MS II	115.9	487	486	491		488	
River Mile 120	120.0		523	527		520	
Moose slough head	123.5		549	555		548	
Slough 8A head (west)	126.1	573	571	574		568	
Slough 8A head (east)	127.1	582	583	585		581	
Slough 9 head	129.3	604	606	607		601	
Side channel upstream of slough 9	130.6		620	620		616	
Side channel upstream of 4th July Creek	131.8		629	631		627	
Slough 9A head	133.7	651	651	653		650	
Side channel upstream of slough 10	134.3	657	657	659		655	
Side channel down- stream of Slough 11	135.3		670	670		667	
Slough 11 head	136.5	687	683	687		682	
Slough 17 head	139.3		-	715		714	
Slough 20 head	140.5	730	-	729		728	
Slough 21 downstream end	141.8	747	-	746		745	
Slough 21 head	142.2	755	-	753		752	
Slough 22 head	144.8	788	-	787		785	
Maximum upstream Extent of Ice Cover in Winter (river mile)			>137	137		124	

TABLE 10
MAXIMUM ICE-AFFECTED WATER LEVELS FOR 1996 ENERGY DEMANDS-WATANA OPERATING

Location	River Mile	Threshold Elev. 1/	Winter Weather Data Used			
			1971-1972	1976-1977	1981-1982	1982-1983
Whiskers slough head	101.5	367	372	370	371	370
Side channel at head of Gash Creek	112.0		459	457	460	459
Mouth of Slough 6A	112.34		462	460	462	462
Slough 8 head	114.1	476	478	475	477	476
Side channel MS II	115.5	482	490	486	488	488
Side channel MS II	115.9	487	492	489	491	491
River Mile 120	120.0		526	525	527	525
Moose slough head	123.5		556	552	555	550
Slough 8A head (west)	126.1	573	576	574	574	572
Slough 8A head (east)	127.1	582	587	583	585	582
Slough 9 head	129.3	604	609	603	607	603
Side channel upstream of slough 9	130.6		624	617	620	617
Side channel upstream of 4th July Creek	131.8		635	628	631	628
Slough 9A head	133.7	651	657	650	653	650
Side channel upstream of slough 10	134.3	657	663	656	659	656
Side channel downstream of Slough 11	135.3		675	667	670	668
Slough 11 head	136.5	687	688	684	687	683
Slough 17 head	139.3		717	715	715	715
Slough 20 head	140.5	730	732	729	729	729
Slough 21 downstream end	141.8	747	746	746	746	746
Slough 21 head	142.2	755	753	753	753	753
Slough 22 head	144.8	788	787	787	787	786
Maximum upstream Extent of Ice Cover in Winter (river mile)			141	126	137	126

TABLE 12
MAXIMUM ICE-AFFECTED WATER LEVELS FOR 2002 ENERGY DEMANDS
WATANA AND DEVIL CANYON OPERATING

LOCATION	River Mile	Threshold Elev. Δ /	Winter Weather Data Used			
			1971-1972	1976-1977	1981-1982	1982-1983
Whiskers slough head	101.5	367	371	368	369	369
Side channel at head of Gash Creek	112.0		458	456	456	457
Mouth of Slough 6A	112.34		460	459	458	460
Slough 8 head	114.1	476	475	474	475	475
Side channel MS II	115.5	482	487	486	485	487
Side channel MS II	115.9	487	489	489	488	490
River Mile 120	120.0		522	520	520	520
Moose slough head	123.5		553	547	548	545
Slough 8A head (west)	126.1	573	574	568	568	568
Slough 8A head (east)	127.1	582	585	581	581	581
Slough 9 head	129.3	604	606	601	601	602
Side channel upstream of slough 9	130.6		620	616	616	616
Side channel upstream of 4th July Creek	131.8		633	627	627	627
Slough 9A head	133.7	651	652	650	650	650
Side channel upstream of slough 10	134.3	657	659	655	655	655
Side channel down- stream of Slough 11	135.3		670	667	667	667
Slough 11 head	136.5	687	685	682	682	682
Slough 17 head	139.3		714	714	714	714
Slough 20 head	140.5	730	728	728	728	728
Slough 21 downstream end	141.8	747	746	746	745	746
Slough 21 head	142.2	755	752	752	752	752
Slough 22 head	144.8	788	785	785	785	785
Maximum upstream Extent of Ice Cover in Winter (river mile)			137	124	124	123

TABLE 15

RIVER ICE SIMULATIONS INCLUDED IN EXHIBITS

<u>Exhibit</u>	<u>Project Status</u>	<u>Energy</u>	<u>Meteorologic</u>	<u>Description</u>	
		<u>Demand</u>	<u>Hydrologic</u>	<u>Winter</u>	<u>Summer</u>
		<u>Year</u>	<u>Data Year</u>	<u>Temps</u>	<u>Flows</u>
B	Natural Conditions		1971-1972	Cold	Wet
C	Natural Conditions		1976-1977	Very Warm	Dry
D	Natural Conditions		1981-1982	Average	Wet
E	Natural Conditions	--	1982-1983	Warm	Average
F	Watana filling	first winter	1982-1983	Warm	Average
G	Watana filling	second winter	1981-1982	Average	Wet
H	Watana operating	1996	1971-1972	Cold	Wet
I	Watana operating	1996	1976-1977	Very Warm	Dry
J	Watana operating	1996	1981-1982	Average	Wet
K	Watana operating	1996	1982-1983	Warm	Average
L	Watana operating	2001	1971-1972	Cold	Wet
M	Watana operating	2001	1982-1983	Warm	Average
N	Watana & Devil				
	Canyon operating	2002	1971-1972	Cold	Wet
O	Watana & Devil				
	Canyon operating	2002	1976-1977	Very Warm	Dry
P	Watana & Devil				
	Canyon operating	2002	1981-1982	Average	Wet
Q	Watana & Devil				
	Canyon operating	2002	1982-1983	Warm	Average
R	Watana & Devil				
	Canyon operating	2020	1971-1972	Cold	Wet
S	Watana & Devil				
	Canyon operating	2020	1982-1983	Warm	Average