ALASKA POWER AUTHORITY

SUSITNA HYDROELECTRIC PROJECT

Federal Energy Regulatory Commission

Project No. 7114

Technical Memorandum

Framework for Preparation of Comparisons Documents

Prepared for:
HARZA-EBASCO SUSITNA JOINT VENTURE

Entrix, Inc.

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FRAMEWORK FOR PREPARATION OF COMPARISONS DOCUMENTS

1.0 INTRODUCTION

This technical memorandum presents a framework for conducting the analyses leading to an environmental and economic comparisons report and the supporting Case E-VI impact and mitigation report series. The framework is depicted schematically in Figure 1. The purpose of the analyses is to develop a set of reports to support the selection of a set of environmental constraints through negotiations between the Alaska Power Authority and the resource agencies. These negotiations are part of the overall settlement process for the Susitna River Hydroelectric Project.

The Power Authority's goal is to operate the project to maximize power and energy benefits within environmental and operational constraints. Environmental contraints include maximum and minimum instream flows (termed flow requirements) and maximum rates of flow change. Operational constraints include environmental constraints, a minimum reservoir level, a maximum reservoir level which if exceeded results in a prespecified operating procedure, maximum and minimum turbine output, and system electrical energy demand.

The objective of the comparisons process, as part of the overall settlement process, is to compare the aquatic habitat availability for selected species/life stages resulting from a range of environmental constraints to the effects of the constraints on the economics of the project. The environmental benefits and economic costs of providing mitigation through maintenance of specified downstream flow requirements can be evaluated. This evaluation provides the basis for negotiations between the Power Authority and the resource agencies.

The Power Authority proposes to use a set of environmental flow constraints called Case E-VI (Table 1 and Figure 2). These streamflows are referenced to the USGS streamgage at Gold Creek. All geographical areas that may be impacted by the construction and operation of the project will be evaluated in the Case

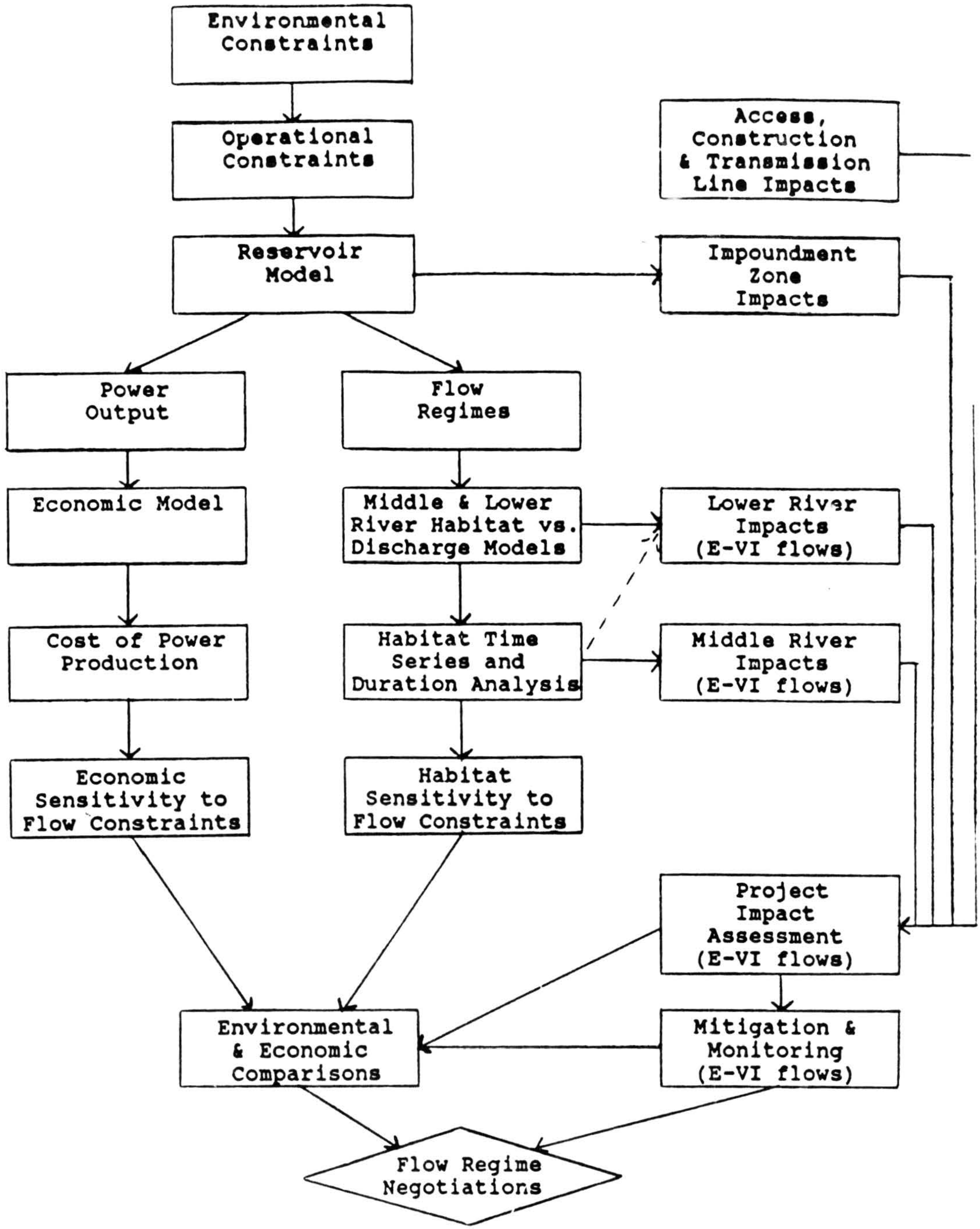

Figure 1. Schematic diagram depicting the framework for conducting the analyses for the comparisons process.

Table 1

SUSITNA HYDROELECTRIC PROJECT
FLOW CONSTRAINTS FOR ENVIRONMENTAL
FLOW REQUIREMENT CASE EVI.

Water Week	Beginning day month	Gold Creek Flow (cfs) Minimum	Maximum	Water Week	Beginning day month	Gold Creek Flow (cfs) Minimum	Maximum
14	31 Dec.	2,000	16,000	40	1 July	9,000*	35,000
15	7 Jan.	2,000	16,000	41	8 July	9,000*	35,000
16	14 Jan.	2,000	16,000	42	15 July	9,000*	35,000
17	21 Jan.	2,000	16,000	43	22 July	9,000*	35,000
18	28 Jan.	2,000	16,000	44	29 July	9,000*	35,000
19	4 Feb.	2,000	16,000	45	5 Aug.	9,000*	35,000
20	11 Feb.	2,000	16,000	46	12 Aug.	9,000*	35,000
21	18 Feb.	2,000	16,000	47	19 Aug.	9,000*	35,000
22	25 Feb.	2,000	16,000	48	26 Aug.	9,000*	35,000
23	4 Mar.	2,000	16,000	49	2 Sep.	8,000	35,000
24	11 Mar.	2,000	16,000	50	9 Sep.	7,000	35,000
25	18 Mar.	2,000	16,000	51	16 Sep.	6,000	35,000
26	25 Mar.	2,000	16,000	52	23 Sep.	6,000	35,000
27	1 Apr.	2,000	16,000	1	1 Oct.	6,000	18,000
28	8 Apr.	2,000	16,000	2	8 Oct.	6,000	17,000
29	15 Apr.	2,000	16,000	3	15 Oct.	5,000	16,000
30	22 Apr.	2,000	16,000	4	22 Oct.	4,000	16,000
31	29 Apr.	2,000	16,000	5	29 Oct.	3,000	16,000
32	6 May	4,000	16,000	6	5 Nov.	3,000	16,000
33	13 May	6,000	16,000	7	12 Nov.	3,000	16,000
34	20 May	6,000	16,000	8	19 Nov.	3,000	16,000
35	27 May	6,000	16,000	9	26 Nov.	3,000	16,000
36	3 June	9,000*	35,000	10	3 Dec.	2,000	16,000
37	10 June	9,000*	35,000	11	10 Dec.	2,000	16,000
38	17 June	9,000*	35,000	12	17 Dec.	2,000	16,000
39	24 June	9,000*	35,000	13	24 Dec.	2,000	16,000

* Minimum summer flows are 9,000 cfs except in dry years when the minimum will be 8,000 cfs. A dry year is defined by the one-in-ten year low flow.

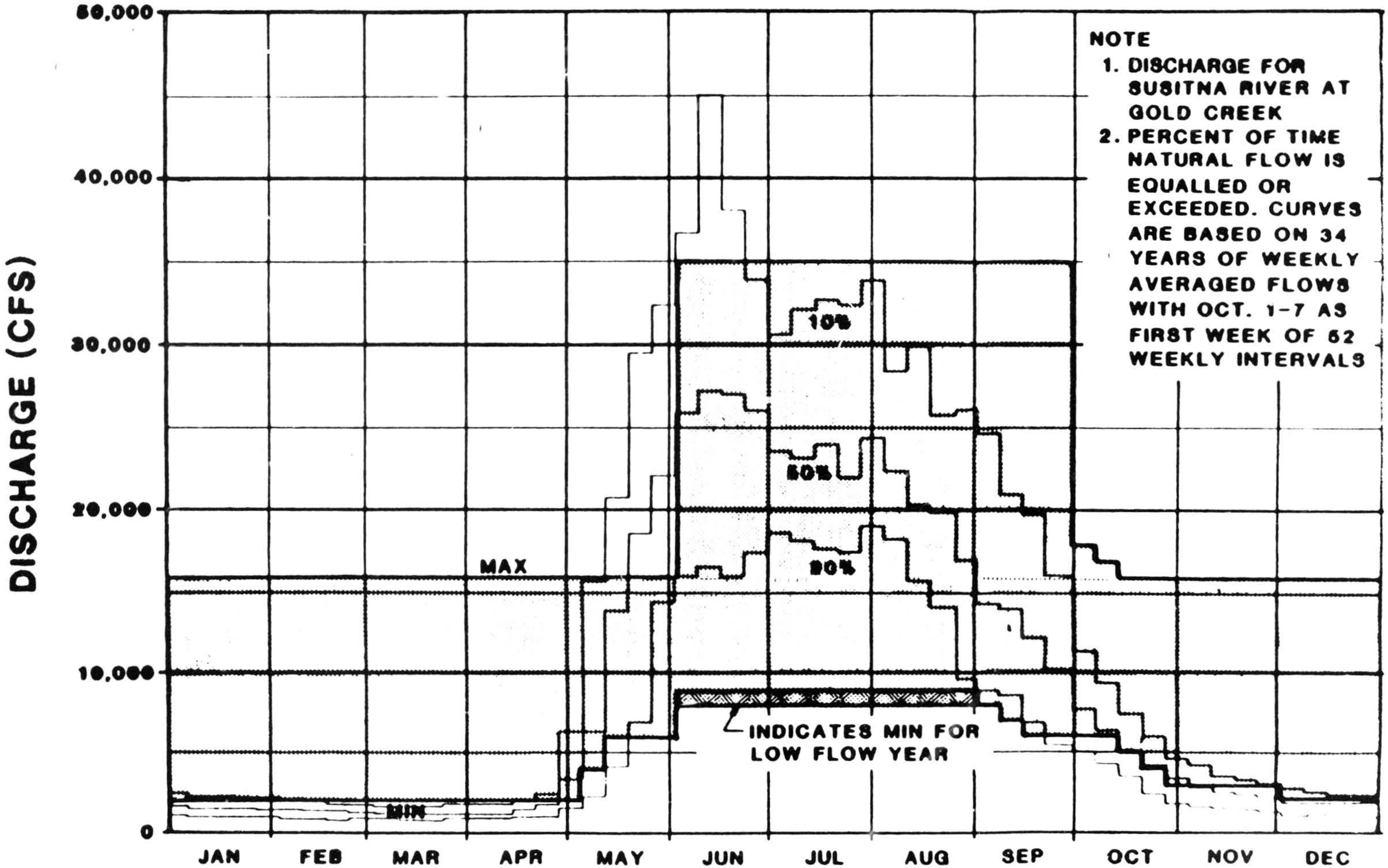

Figure 2. Case E-VI environmental flow constraints and range of natural flows.

E-VI impact and mitigation report series. The location most affected by changes in environmental constraints is the Susitna River between Devil Canyon and Talkeetna (middle Susitna River). A sensitivity analysis will be conducted for this river segment by modifying the Case E-VI environmental constraints and comparing the habitat gained or lost to the increase or decrease in the project cost. This analysis will be presented in the comparisons report, which will form the basis for beginning flow negotiations between the Power Authority and the resource agencies.

This technical memorandum is divided into five sections. Section 2.0 discusses the approach for conducting the analyses in the Talkeetna to Devil Canyon segment of the Susitna River for Case E-VI and other flow constraints. Section 3.0 presents the Case E-VI impacts and mitigation analyses in other geographic areas affected by the project. Section 4.0 identifies the reports that will be available to support the comparisons process. The final section presents the schedule for information flow among those preparing support documents for the comparisons process.

2.0 MIDDLE SUSITNA RIVER ANALYSIS

Selection of Environmental Constraints

The environmental constraints are specified as maximum and minimum flows rather than a specific flow. The selection of flow constraints for the evaluation of habitat-cost sensitivity involves two basic steps. The first step is to select a set of environmental constraints which represents the range of flows between the natural and power flows. The second step is the selection of annual sets of seasonal values based on specific habitat management objectives (e.g. optimizing chinook rearing habitat). These values will be developed by the aquatic studies group working on comparisons documents, which includes Entrix, Harza-Ebasco (HE), Trihey and Associates (T&A), and Arctic Environmental Information and Data Center (AEIDC).

The Power Authority's preferred flow constraints (Case E-VI) and the modified flow constraints proposed for the initial habitat-cost sensitivity analyses are presented in Table 2. In all cases but one, the minimum flow constraint for the modified case was different from the minimum flow constraint for Case E-VI during only one season, leaving unchanged the remaining minimum and maximum constraints. In the one exception (WH 8), the winter maximum constraints were changed, leaving unchanged the remaining maximum and minimum constraints. The selection of these constraints was based on the assumption that an economic and environmentally sound project will have constraints similar to those of Case E-VI. The annual set of weekly flow constraints can be separated into four major divisions: winter flows, spring transitional flows, summer flows, and fall transitional flows.

In winter (November-April) maximum flow constraints are more important than minimum, since normal project operation would produce discharges greater than the minimum flow constraints. The selected winter maximum is intended to establish a boundary near the upper range of operational flows that would result in flow stability and protect overwintering habitat. Side sloughs are especially important in this context because chinook juveniles utilize this habitat for overwintering. The Case E-VI maximum flow of 16,000 cfs would prevent overtopping of all the major sloughs prior to freeze-up, and stabilize habitat availability during ice-cover periods. Modified winter maximum flow constraints of 12,000, 8,000 and 4,000 cfs will also be evaluated with and without ice cover.

The winter minimum flow was established to prevent dewatering incubation habitat while avoiding disturbance to the thermal character of overwintering habitat. The 2,000 cfs Case E-VI minimum represents the high mean natural winter flow. A modified minimum winter flow constraint of 5,000 cfs will be evaluated with and without an ice cover to assess benefits to incubating salmon embryos and overwintering fish.

Flow constraints during the spring transition period (mid to late May) are intended to maintain flow stability by preventing rapid decreases in discharge due to decreasing power demand in May and require gradual increases in flow to summer levels. The minimum flow constraints are most important during this period. Beginning in May, Case E-VI minimum flow constraints step up from 2,000 to 4,000 cfs for one week then to 6,000 cfs for 3 weeks, and finally

Table 2. Case E-VI and modified flow constraints expressed as Gold Creek flows (cfs) for preliminary analyses in the comparisons process.

Water Week	Beginning Day	Month	Minimum Constraints E-VI	SL 5*	SL 7*	SL 9*	Maximum Constraints
14	31	Dec.	2,000	2,000	2,000	2,000	16,000
15	7	Jan.	2,000	2,000	2,000	2,000	16,000
16	14	Jan.	2,000	2,000	2,000	2,000	16,000
17	21	Jan.	2,000	2,000	2,000	2,000	16,000
18	28	Jan.	2,000	2,000	2,000	2,000	16,000
19	4	Feb.	2,000	2,000	2,000	2,000	16,000
20	11	Feb.	2,000	2,000	2,000	2,000	16,000
21	18	Feb.	2,000	2,000	2,000	2,000	16,000
22	25	Feb.	2,000	2,000	2,000	2,000	16,000
23	4	Mar.	2,000	2,000	2,000	2,000	16,000
24	11	Mar.	2,000	2,000	2,000	2,000	16,000
25	18	Mar.	2,000	2,000	2,000	2,000	16,000
26	25	Mar.	2,000	2,000	2,000	2,000	16,000
27	1	Apr.	2,000	2,000	2,000	2,000	16,000
28	8	Apr.	2,000	2,000	2,000	2,000	16,000
29	15	Apr.	2,000	2,000	2,000	2,000	16,000
30	22	Apr.	2,000	2,000	2,000	2,000	16,000
31	29	Apr.	2,000	2,000	2,000	2,000	16,000
32	6	May	4,000	4,000	4,000	4,000	16,000
33	13	May	6,000	<u>5,000</u>	6,000	6,000	16,000
34	20	May	6,000	<u>5,000</u>	6,000	6,000	16,000
35	27	May	6,000	<u>5,000</u>	6,000	6,000	16,000
36	3	June	9,000**	<u>5,000</u>	<u>7,000</u>	<u>9,000</u>	35,000
37	10	June	9,000**	<u>5,000</u>	<u>7,000</u>	<u>9,000</u>	35,000
38	17	June	9,000**	<u>5,000</u>	<u>7,000</u>	<u>9,000</u>	35,000
39	24	June	9,000**	<u>5,000</u>	<u>7,000</u>	<u>9,000</u>	35,000
40	1	July	9,000**	<u>5,000</u>	<u>7,000</u>	<u>9,000</u>	35,000
41	8	July	9,000**	<u>5,000</u>	<u>7,000</u>	<u>9,000</u>	35,000
42	15	July	9,000**	<u>5,000</u>	<u>7,000</u>	<u>9,000</u>	35,000
43	22	July	9,000**	<u>5,000</u>	<u>7,000</u>	<u>9,000</u>	35,000
44	29	July	9,000**	<u>5,000</u>	<u>7,000</u>	<u>9,000</u>	35,000
45	5	Aug.	9,000**	<u>5,000</u>	<u>7,000</u>	<u>9,000</u>	35,000
46	12	Aug.	9,000**	<u>5,000</u>	<u>7,000</u>	<u>9,000</u>	35,000
47	19	Aug.	9,000**	<u>5,000</u>	<u>7,000</u>	<u>9,000</u>	35,000
48	26	Aug.	9,000**	<u>5,000</u>	<u>7,000</u>	<u>9,000</u>	35,000
49	2	Sep.	8,000	<u>5,000</u>	<u>7,000</u>	<u>9,000</u>	35,000
50	9	Sep.	7,000	<u>5,000</u>	7,000	<u>9,000</u>	35,000
51	16	Sep.	6,000	<u>5,000</u>	6,000	6,000	35,000
52	23	Sep.	6,000	<u>5,000</u>	6,000	6,000	35,000
1	1	Oct.	6,000	<u>5,000</u>	6,000	6,000	18,000
2	8	Oct.	6,000	<u>5,000</u>	6,000	6,000	17,000
3	15	Oct.	5,000	5,000	5,000	5,000	16,000
4	22	Oct.	4,000	4,000	4,000	4,000	16,000
5	29	Oct.	3,000	3,000	3,000	3,000	16,000
6	5	Nov.	3,000	3,000	3,000	3,000	16,000
7	12	Nov.	3,000	3,000	3,000	3,000	16,000
8	19	Nov.	3,000	3,000	3,000	3,000	16,000
9	26	Nov.	3,000	3,000	3,000	3,000	16,000
10	3	Dec.	2,000	2,000	2,000	2,000	16,000
11	10	Dec.	2,000	2,000	2,000	2,000	16,000
12	17	Dec.	2,000	2,000	2,000	2,000	16,000
13	24	Dec.	2,000	2,000	2,000	2,000	16,000

Table 2 cont.

Water Week	Beginning Day	Month	Minimum Constraints E-VI	SL 12*	SL 15*	SL 23*	Maximum Constraints
14	31	Dec.	2,000	2,000	2,000	2,000	16,000
15	7	Jan.	2,000	2,000	2,000	2,000	16,000
16	14	Jan.	2,000	2,000	2,000	2,000	16,000
17	21	Jan.	2,000	2,000	2,000	2,000	16,000
18	28	Jan.	2,000	2,000	2,000	2,000	16,000
19	4	Feb.	2,000	2,000	2,000	2,000	16,000
20	11	Feb.	2,000	2,000	2,000	2,000	16,000
21	18	Feb.	2,000	2,000	2,000	2,000	16,000
22	25	Feb.	2,000	2,000	2,000	2,000	16,000
23	4	Mar.	2,000	2,000	2,000	2,000	16,000
24	11	Mar.	2,000	2,000	2,000	2,000	16,000
25	18	Mar.	2,000	2,000	2,000	2,000	16,000
26	25	Mar.	2,000	2,000	2,000	2,000	16,000
27	1	Apr.	2,000	2,000	2,000	2,000	16,000
28	8	Apr.	2,000	2,000	2,000	2,000	16,000
29	15	Apr.	2,000	2,000	2,000	2,000	16,000
30	22	Apr.	2,000	2,000	2,000	2,000	16,000
31	29	Apr.	2,000	2,000	2,000	2,000	16,000
32	6	May	4,000	4,000	4,000	4,000	16,000
33	13	May	6,000	6,000	6,000	6,000	16,000
34	20	May	6,000	6,000	6,000	6,000	16,000
35	27	May	6,000	6,000	6,000	6,000	16,000
36	3	June	9,000**	12,000	15,000	23,000	35,000
37	10	June	9,000**	12,000	15,000	23,000	35,000
38	17	June	9,000**	12,000	15,000	23,000	35,000
39	24	June	9,000**	12,000	15,000	23,000	35,000
40	1	July	9,000**	12,000	15,000	23,000	35,000
41	8	July	9,000**	12,000	15,000	23,000	35,000
42	15	July	9,000**	12,000	15,000	23,000	35,000
43	22	July	9,000**	12,000	15,000	23,000	35,000
44	29	July	9,000**	12,000	15,000	23,000	35,000
45	5	Aug.	9,000**	12,000	15,000	23,000	35,000
46	12	Aug.	9,000**	12,000	15,000	23,000	35,000
47	19	Aug.	9,000**	12,000	15,000	20,000	35,000
48	26	Aug.	9,000**	12,000	15,000	17,000	35,000
49	2	Sep.	8,000	12,000	15,000	15,000	35,000
50	9	Sep.	7,000	12,000	14,000	14,000	35,000
51	16	Sep.	6,000	6,000	6,000	6,000	35,000
52	23	Sep.	6,000	6,000	6,000	6,000	35,000
1	1	Oct.	6,000	6,000	6,000	6,000	18,000
2	8	Oct.	6,000	6,000	6,000	6,000	17,000
3	15	Oct.	5,000	5,000	5,000	5,000	16,000
4	22	Oct.	4,000	4,000	4,000	4,000	16,000
5	29	Oct.	3,000	3,000	3,000	3,000	16,000
6	5	Nov.	3,000	3,000	3,000	3,000	16,000
7	12	Nov.	3,000	3,000	3,000	3,000	16,000
8	19	Nov.	3,000	3,000	3,000	3,000	16,000
9	26	Nov.	3,000	3,000	3,000	3,000	16,000
10	3	Dec.	2,000	2,000	2,000	2,000	16,000
11	10	Dec.	2,000	2,000	2,000	2,000	16,000
12	17	Dec.	2,000	2,000	2,000	2,000	16,000
13	24	Dec.	2,000	2,000	2,000	2,000	16,000

Table 2 cont.

Water Week	Beginning Day	Beginning Month	Minimum Constraints E-VI	Minimum Constraints SL 9/15*	Minimum Constraints SL 9/23*	Maximum Constraints
14	31	Dec.	2,000	2,000	2,000	16,000
15	7	Jan.	2,000	2,000	2,000	16,000
16	14	Jan.	2,000	2,000	2,000	16,000
17	21	Jan.	2,000	2,000	2,000	16,000
18	28	Jan.	2,000	2,000	2,000	16,000
19	4	Feb.	2,000	2,000	2,000	16,000
20	11	Feb.	2,000	2,000	2,000	16,000
21	18	Feb.	2,000	2,000	2,000	16,000
22	25	Feb.	2,000	2,000	2,000	16,000
23	4	Mar.	2,000	2,000	2,000	16,000
24	11	Mar.	2,000	2,000	2,000	16,000
25	18	Mar.	2,000	2,000	2,000	16,000
26	25	Mar.	2,000	2,000	2,000	16,000
27	1	Apr.	2,000	2,000	2,000	16,000
28	8	Apr.	2,000	2,000	2,000	16,000
29	15	Apr.	2,000	2,000	2,000	16,000
30	22	Apr.	2,000	2,000	2,000	16,000
31	29	Apr.	2,000	2,000	2,000	16,000
32	6	May	4,000	4,000	4,000	16,000
33	13	May	6,000	6,000	6,000	16,000
34	20	May	6,000	6,000	6,000	16,000
35	27	May	6,000	6,000	6,000	16,000
36	3	June	9,000**	9,000	9,000	35,000
37	10	June	9,000**	9,000	9,000	35,000
38	17	June	9,000**	9,000	9,000	35,000
39	24	June	9,000**	9,000	9,000	35,000
40	1	July	9,000**	9,000	9,000	35,000
41	8	July	9,000**	9,000	9,000	35,000
42	15	July	9,000**	9,000	9,000	35,000
43	22	July	9,000**	9,000	9,000	35,000
44	29	July	9,000**	9,000	9,000	35,000
45	5	Aug.	9,000**	15,000	23,000	35,000
46	12	Aug.	9,000**	15,000	20,000	35,000
47	19	Aug.	9,000**	15,000	20,000	35,000
48	26	Aug.	9,000**	15,000	17,000	35,000
49	2	Sep.	8,000	15,000	15,000	35,000
50	9	Sep.	7,000	14,000	14,000	35,000
51	16	Sep.	6,000	6,000	6,000	35,000
52	23	Sep.	6,000	6,000	6,000	35,000
1	1	Oct.	6,000	6,000	6,000	18,000
2	8	Oct.	6,000	6,000	6,000	17,000
3	15	Oct.	5,000	5,000	5,000	16,000
4	22	Oct.	4,000	4,000	4,000	16,000
5	29	Oct.	3,000	3,000	3,000	16,000
6	5	Nov.	3,000	3,000	3,000	16,000
7	12	Nov.	3,000	3,000	3,000	16,000
8	19	Nov.	3,000	3,000	3,000	16,000
9	26	Nov.	3,000	3,000	3,000	16,000
10	3	Dec.	2,000	2,000	2,000	16,000
11	10	Dec.	2,000	2,000	2,000	16,000
12	17	Dec.	2,000	2,000	2,000	16,000
13	24	Dec.	2,000	2,000	2,000	16,000

Table 2 cont.

Water Week	Beginning Day	Month	Minimum Constraints E-VI	WL 5*	Maximum Constraints WH 8*	E-VI
14	31	Dec.	2,000	5,000	8,000	16,000
15	7	Jan.	2,000	5,000	8,000	16,000
16	14	Jan.	2,000	5,000	8,000	16,000
17	21	Jan.	2,000	5,000	8,000	16,000
18	28	Jan.	2,000	5,000	8,000	16,000
19	4	Feb.	2,000	5,000	8,000	16,000
20	11	Feb.	2,000	5,000	8,000	16,000
21	18	Feb.	2,000	5,000	8,000	16,000
22	25	Feb.	2,000	5,000	8,000	16,000
23	4	Mar.	2,000	5,000	8,000	16,000
24	11	Mar.	2,000	5,000	8,000	16,000
25	18	Mar.	2,000	5,000	8,000	16,000
26	25	Mar.	2,000	5,000	8,000	16,000
27	1	Apr.	2,000	5,000	8,000	16,000
28	8	Apr.	2,000	5,000	8,000	16,000
29	15	Apr.	2,000	5,000	8,000	16,000
30	22	Apr.	2,000	5,000	8,000	16,000
31	29	Apr.	2,000	5,000	8,000	16,000
32	6	May	4,000	5,000	8,000	16,000
33	13	May	6,000	6,000	8,000	16,000
34	20	May	6,000	6,000	8,000	16,000
35	27	May	6,000	6,000	8,000	16,000
36	3	June	9,000**	9,000	35,000	35,000
37	10	June	9,000**	9,000	35,000	35,000
38	17	June	9,000**	9,000	35,000	35,000
39	24	June	9,000**	9,000	35,000	35,000
40	1	July	9,000**	9,000	35,000	35,000
41	8	July	9,000**	9,000	35,000	35,000
42	15	July	9,000**	9,000	35,000	35,000
43	22	July	9,000**	9,000	35,000	35,000
44	29	July	9,000**	9,000	35,000	35,000
45	5	Aug.	9,000**	9,000	35,000	35,000
46	12	Aug.	9,000**	9,000	35,000	35,000
47	19	Aug.	9,000**	9,000	35,000	35,000
48	26	Aug.	9,000**	9,000	35,000	35,000
49	2	Sep.	8,000	8,000	35,000	35,000
50	9	Sep.	7,000	7,000	35,000	35,000
51	16	Sep.	6,000	6,000	35,000	35,000
52	23	Sep.	6,000	6,000	35,000	35,000
1	1	Oct.	6,000	6,000	8,000	18,000
2	8	Oct.	6,000	6,000	8,000	17,000
3	15	Oct.	5,000	5,000	8,000	16,000
4	22	Oct.	4,000	5,000	8,000	16,000
5	29	Oct.	3,000	5,000	8,000	16,000
6	5	Nov.	3,000	5,000	8,000	16,000
7	12	Nov.	3,000	5,000	8,000	16,000
8	19	Nov.	3,000	5,000	8,000	16,000
9	26	Nov.	3,000	5,000	8,000	16,000
10	3	Dec.	2,000	5,000	3,000	16,000
11	10	Dec.	2,000	5,000	8,000	16,000
12	17	Dec.	2,000	5,000	8,000	16,000
13	24	Dec.	2,000	5,000	8,000	16,000

Table 2 cont.

Footnotes

*Designation of modified constraints

SL x denotes Summer Low constraint set at x,000 cfs - only the Case E-VI summer minimum flow constraints are modified, while the Case E-VI maximum constraints remained unchanged

SL x/y denotes Summer Low constraint set at x,000 cfs through the end of July followed by a y,000 cfs constraint beginning in early August - only the Case E-VI summer minimum constraints are modified, while the Case E-VI maximum constraints remained unchanged.

WL x denotes Winter Low constraint set at x,000 cfs - only the Case E-VI winter minimum flow constraints are modified, while the Case E-VI maximum constraints remained unchanged.

WH x denotes Winter High constraint set at x,000 cfs - only the Case E-VI winter maximum flow constraints are modified, while the Case E-VI minimum constraints remained unchanged.

**Minimum summer flows are 9,000 cfs except in dry years when the minimum will be 8,000 cfs. A dry year is defined by the one-in-ten year low flow.