
Appendix S

Recreation Supporting Technical Information

As part of the 2012 KHSA EIS/EIR, potential changes in recreation opportunities were modeled by evaluating flow variations between the No Project (“dams in” scenario using the 2010 BiOp Flows) and the Proposed Project (“dams out” scenario using the KBRA Flows), since river flows influence when certain recreational activities could occur. The 2012 KHSA EIS/EIR modeling estimated the flows in multiple reaches of the Klamath River and the analysis compared those modeled flows with the acceptable range of flows for whitewater boating and fishing by reach to estimate the average number of days when those recreational activities could occur under each scenario. The analysis of potential changes in recreation opportunities from the 2012 KHSA EIS/EIR is reproduced in this appendix in Sections S.1 and S.2.

However, flow requirements in the Klamath River have changed since the modeling for the 2012 KHSA EIS/EIR was performed. Separate and independent of the Proposed Project, the National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service (USFWS) issued a Joint Biological Opinion for the Klamath Irrigation Project in 2013 specifying the current hydrology requirements for the Klamath River (2013 BiOp Flows) and the standard to which the USBR Klamath Irrigation Project operates (NMFS and USFWS 2013). As detailed in Section 3.1.6 *Summary of Available Hydrology Information for the Proposed Project*, the range of 2013 BiOp Flows are overall similar to the range of KBRA Flows. Hydrologic model outputs previously developed using the KBRA Flows for the 2012 KHSA EIS/EIR are sufficiently accurate that they can be used to estimate the *range* of conditions under 2013 BiOp Flows, but the hydrologic model results using the KBRA Flows would not always be applicable when evaluating the duration (i.e., number of days) of specific flow ranges during individual months. Monthly variations between ranges of 2013 BiOp and KBRA Flows cause in variations in the exact number of days within the range of acceptable flows for flow-dependent recreational activities, especially in the reaches between Keno and Iron Gate dams. Section S.3 presents the changes in the 2012 KHSA EIS/EIR flow-dependent recreational opportunities due to differences between the 2013 BiOp and KBRA Flows.

The Proposed Project, the data modeled as part of the 2012 KHSA EIS/EIR, and the recreational opportunities under the current 2013 BiOp Flows are further evaluated in Section 3.20.5 *[Recreation] Potential Impacts, Impacts, and Mitigation*.

S.1 Potential Flow Changes That May Alter Flow-Dependent Recreation

Flow-dependent recreational activities on the Klamath River include whitewater boating and fishing. River flows may change based on the various future management scenarios (i.e., “dams in” versus “dams out”) and could subsequently affect the availability and the quality of the recreation experience. Optimal and acceptable flows for various recreation opportunities along reaches of the Klamath River were developed as a part of technical studies completed during the relicensing process (FERC 2007). Optimal and acceptable flow levels can be compared with existing or proposed levels to assess the effect on various recreation activities. River flows under both No Project and Proposed Project alternatives have been modeled by U.S. Bureau of Reclamation (USBR); results of the models are used to project the effects on recreation activities within the various river reaches.

The following tables summarize flows acceptable for fishing and whitewater boating opportunities in the various reaches of the Klamath River. Table S-1 provides a

summary for each of the major river reaches where whitewater boating and fishing currently take place. Table S-2 summarizes monthly changes in flows for the Hells Corner Reach specifically for two sets of flow conditions (1,000 to 3,500 cfs and 1,300 to 3,500 cfs) that may be deemed acceptable for different types of whitewater boating. Tables S-3 through S-8 include the number of days per month with acceptable flows for each activity under the No Project Alternative and the Proposed Project. This data is also presented graphically in Section 3.20 *Recreation*. In Tables S-3 through S-8, it is assumed that flows less than 1,300 cfs are not acceptable for whitewater boating in order not to understate the potential impact of the Proposed Project on whitewater boating. However, the impact of dam removal on whitewater boating could be smaller if acceptable flows for some types of whitewater boating occur between 1,000 and 1,300 cfs.

Table S-1. Summary of Acceptable Flow Data for Whitewater Boating and Fishing.

River Reach	Activity	Acceptable Flows		Total Avg. Annual No Days with Acceptable Flows		Percent Difference
		Low Value (cfs)	High Value (cfs)	Dams In	Dams Out	
Keno Reach	Whitewater Boating	1,000	4,000	151.29	139.30	-7.93%
	Fishing	200	1,500	246.10	237.53	-3.48%
J.C. Boyle Bypass Reach	Whitewater Boating	1,300	1,800	4.63	41.35	793.56%
	Fishing	200	1,000	106.96	141.86	32.63%
Hells Corner Reach	Whitewater Boating/Kayaking	1,000	3,500	331.61	187.67	- 43%
	Whitewater Boating/Rafting	1,300	3,500	277.98	119.33	-57.07%
	Fishing	200	1,500	234.37	228.07	-2.69%
Copco No. 2 Bypass Reach	Whitewater Boating	600	1,500	10.22	223.09	2083.83%
	Fishing	50	600	13.75	2.84	-79.36%
Iron Gate to Scott River	Whitewater Boating/Fishing	800	4,000	278.04	280.86	1.01%
Scott River to Salmon River	Boating	800	7,000	242.96	246.26	1.36%
	Fishing	800	4,000	174.92	182.23	4.18%
Salmon River to Trinity River	Whitewater Boating/Fishing	800	10,000	207.00	210.67	1.78%
Trinity River to Ocean	Whitewater Boating/Fishing	1,800	18,000	238.86	238.33	-0.22%

Source: USBR 2012b,c; PacifiCorp 2004; FERC 2007; Greimann 2012.

Table S-2. Hells Corner - Whitewater Boating Recreation Days from two Different Criteria for "Acceptable Flows."

Month	1,000–3,500 cfs			1,300–3,500 cfs		
	Dams In	Dams Out Days	% Change Days	Dams In Days	Dams Out Days	% Change Days
January	26.27	16.00	39%	20.88	13.4	36%
February	21.94	11.65	47%	17.80	10.3	42%
March	22.59	18.23	19%	21.78	15.7	28%
April	21.80	18.81	14%	20.27	15.4	24%
May	26.88	22.37	17%	25.90	19.5	25%
June	29.96	25.14	16%	28.78	20.3	29%
July	30.41	15.40	49%	17.27	11.0	36%
August	31.00	13.09	58%	19.45	2.3	88%
September	30.00	19.47	35%	17.04	4.1	76%
October	31.00	10.48	66%	31.00	0	100%
November	30.00	6.79	77%	29.43	1	97%
December	29.76	10.24	66%	28.35	4.3	85%
Total	331.61	187.67	43%	277.95	117.3	58%

Source: Greimann 2012.

S.2 Recreational Flow Analysis

The recreation analysis evaluated and estimated the effect of potential future river flows on different recreation activities along various reaches of the Klamath River. High and low flow values for the recreation activities along the various reaches are provided in the following tables. Flow values that fall within these ranges are considered necessary for the various activities to occur. The Klamath Project Simulation Model (KPSIM) coupled to a daily operations model of the Klamath River below Link Dam for the No Project and the Proposed Project alternatives estimated the duration of recreational flows by reach. For additional information on the KPSIM model please refer to the USBR (2012a) report, "Hydrology, Hydraulics and Sediment Transport Studies for the Secretary's Determination on Klamath River Dam Removal and Basin Restoration, Technical Report No. SRH-2011-02."

The average, the maximum, and minimum number of days by month that the river is expected to be within the high and low value are listed on each row of Tables S-3 through S-8. The results are provided for wet, average, and dry start years under both the No Project and Proposed Project alternatives. The data provided for the Proposed Project are only for the years following dam removal (post-2019).

The Hells Corner Reach is a peaking reach and daily averages do not adequately capture conditions. Therefore, the following conditions must be met in order to be considered within range:

Whitewater Boating: Flows are within the desirable range between 10:00 a.m. and 2:00 p.m.

Fishing: Flows are within the desirable range for at least 4 hours either between 5 a.m. and 11 a.m., or between 3 p.m. and 9 p.m.

Table S-3. Analysis for Proposed Project, All Years, Average Number of Days.

River Reach	Activity	Low Value (cfs)	High Value (cfs)	Average Number of Days within Flow Range												
				Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	WY Total
Keno Reach	Whitewater Boating—Standard	1,000	4,000	15.7	12.0	20.5	19.3	23.2	20.9	12.3	2.9	4.2	0.0	2.0	6.5	139.3
	Play Boating	1,100	1,800	6.4	1.9	4.5	5.4	5.7	5.6	6.4	1.4	2.8	0.0	0.8	3.3	44.1
	Fishing	200	1,500	14.9	13.2	6.9	6.3	10.0	14.0	24.4	31.0	30.0	31.0	28.6	27.1	237.5
J.C. Boyle Bypass Reach	Whitewater Boating—Standard	1,300	1,800	3.8	1.9	4.4	3.7	5.8	5.7	7.2	2.3	4.1	0.0	0.0	2.4	41.3
	Fishing	200	1,000	11.6	11.1	3.0	1.4	4.9	4.8	15.6	17.9	10.5	20.5	22.8	19.1	141.9
Hells Corner Reach	Whitewater Boating	1,200	3,500	13.8	10.3	16.1	16.0	21.5	21.6	13.8	3.7	5.5	0.1	1.0	5.2	130.9
	Fishing	200	1,500	14.2	13.1	6.1	5.6	8.6	12.5	22.1	30.2	30.0	31.0	28.6	26.0	228.1
Copco No. 2 Bypass Reach	Whitewater Boating	600	1,500	13.5	12.4	6.1	5.6	8.6	12.5	22.1	30.2	30.0	31.0	28.6	24.5	223.1
	Fishing	50	600	0.7	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5	2.8
Iron Gate to Scott River	Whitewater Boating	800	4,000	21.1	16.6	12.7	13.8	19.2	24.3	29.6	31.0	30.0	29.7	26.9	25.8	280.9
	Fishing	800	2,500	12.7	9.9	5.1	5.5	6.4	14.3	24.8	31.0	30.0	29.7	24.7	20.7	215.1
Scott River to Salmon River	Boating	800	7,000	14.6	9.5	7.5	8.8	14.2	23.7	30.2	31.0	30.0	31.0	26.3	19.3	246.3
	Fishing	800	4,000	5.5	3.9	2.0	2.6	4.7	12.7	26.7	31.0	30.0	30.9	21.8	10.9	182.2
Salmon River to Trinity River	Whitewater Boating/Fishing	800	10,000	8.7	5.0	3.4	4.7	9.6	20.4	30.5	31.0	30.0	30.9	23.8	13.0	210.7
Trinity River to Ocean	Whitewater Boating/Fishing	1,800	18,000	11.8	6.9	5.6	10.1	16.0	25.0	30.5	30.3	30.0	30.8	25.3	16.2	238.3

Source: USBR 2012b,c; PacifiCorp 2004; FERC 2007; Greimann 2012.

Table S-4. Analysis for Proposed Project, All Years, Maximum Number of Days.

River Reach	Activity	Low Value (cfs)	High Value (cfs)	Maximum Number of Days within Flow Range												WY Total
				Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Keno Reach	Whitewater Boating—Standard	1,000	4,000	31	29	31	30	31	30	31	31	30	0	30	31	271
	Play Boating	1,100	1,800	31	28	31	30	31	30	31	31	30	0	30	31	180
	Fishing	200	1,500	31	29	31	30	31	30	31	31	30	31	30	31	366
J.C. Boyle Bypass Reach	Whitewater Boating—Standard	1,300	1,800	31	28	31	30	31	30	31	31	30	0	1	24	117
	Fishing	200	1,000	31	29	31	30	31	30	31	31	30	31	30	31	365
Hells Corner Reach	Whitewater Boating	1,200	3,500	31	29	31	30	31	30	31	31	30	1	30	31	242
	Fishing	200	1,500	31	29	31	30	31	30	31	31	30	31	30	31	366
Copco No. 2 Bypass Reach	Whitewater Boating	600	1,500	31	29	31	30	31	30	31	31	30	31	30	31	366
	Fishing	50	600	29	29	0	0	0	0	0	0	0	0	0	31	89
Iron Gate to Scott River	Whitewater Boating	800	4,000	31	29	31	30	31	30	31	31	30	31	30	31	366
	Fishing	800	2,500	31	29	31	30	31	30	31	31	30	31	30	31	366
Scott River to Salmon River	Boating	800	7,000	31	29	31	30	31	30	31	31	30	31	30	31	366
	Fishing	800	4,000	31	29	31	30	31	30	31	31	30	31	30	31	366
Salmon River to Trinity River	Whitewater Boating/Fishing	800	10,000	31	29	31	30	31	30	31	31	30	31	30	31	366
Trinity River to Ocean	Whitewater Boating/Fishing	1,800	18,000	31	29	31	30	31	30	31	31	30	31	30	31	366

Source: USBR 2012b,c; PacifiCorp 2004; FERC 2007; Greimann 2012.

Table S-5. Analysis for Proposed Project, All Years, Minimum Number of Days.

River Reach	Activity	Low Value (cfs)	High Value (cfs)	Minimum Number of Days within Flow Range												WY Total
				Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Keno Reach	Whitewater Boating—Standard	1,000	4,000	0	0	0	0	0	0	0	0	0	0	0	0	0
	Play Boating	1,100	1,800	0	0	0	0	0	0	0	0	0	0	0	0	0
	Fishing	200	1,500	0	0	0	0	0	0	0	30	30	31	0	0	92
J.C. Boyle Bypass Reach	Whitewater Boating—Standard	1,300	1,800	0	0	0	0	0	0	0	0	0	0	0	0	0
	Fishing	200	1,000	0	0	0	0	0	0	0	0	0	0	0	0	0
Hells Corner Reach	Whitewater Boating	1,200	3,500	0	0	0	0	0	0	0	0	0	0	0	0	0
	Fishing	200	1,500	0	0	0	0	0	0	0	0	30	31	0	0	91
Copco No. 2 Bypass Reach	Whitewater Boating	600	1,500	0	0	0	0	0	0	0	0	30	31	0	0	91
	Fishing	50	600	0	0	0	0	0	0	0	0	0	0	0	0	0
Iron Gate to Scott River	Whitewater Boating	800	4,000	0	0	0	0	0	0	1	30	30	3	2	0	152
	Fishing	800	2,500	0	0	0	0	0	0	0	30	30	3	0	0	99
Scott River to Salmon River	Boating	800	7,000	0	0	0	0	0	0	4	31	30	31	0	0	137
	Fishing	800	4,000	0	0	0	0	0	0	0	30	30	28	0	0	104
Salmon River to Trinity River	Whitewater Boating/Fishing	800	10,000	0	0	0	0	0	0	16	30	30	29	0	0	124
Trinity River to Ocean	Whitewater Boating/Fishing	1,800	18,000	0	0	0	0	0	0	17	1	30	24	0	0	136

Source: USBR 2012b,c; PacifiCorp 2004; FERC 2007; Greimann 2012.

Table S-6. Analysis for No Project, All Years, Average Number of Days.

River Reach	Activity	Low Value (cfs)	High Value (cfs)	Average Number of Days within Flow Range												
				Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	WY Total
Keno Reach	Whitewater Boating—Standard	1,000	4,000	16.1	13.7	19.6	18.0	24.5	22.9	1.8	0.0	0.0	7.9	11.8	14.9	151.3
	Play Boating	1,100	1,800	2.7	0.0	3.6	3.6	7.3	11.2	0.0	0.0	0.0	0.6	5.3	2.5	36.8
	Fishing	200	1,500	16.4	12.2	7.9	13.5	11.6	21.0	30.9	31.0	30.0	31.0	22.9	17.7	246.1
J.C. Boyle Bypass Reach	Whitewater Boating—Standard	1,300	1,800	0.1	1.3	1.7	0.8	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.4	4.6
	Fishing	200	1,000	12.5	6.7	10.5	12.1	12.8	9.5	1.2	0.0	6.5	18.9	7.6	8.6	107.0
Hells Corner Reach	Whitewater Boating	1,200	3,500	23.4	18.7	22.6	21.6	26.3	29.9	24.4	26.7	27.1	31.0	30.0	29.2	310.9
	Fishing	200	1,500	15.0	12.2	7.3	13.4	9.7	15.2	30.8	31.0	30.0	31.0	21.2	17.5	234.4
Copco No. 2 Bypass Reach	Whitewater Boating	600	1,500	0.9	2.5	3.2	2.0	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.7	10.2
	Fishing	50	600	2.1	2.5	2.8	2.7	3.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	13.7
Iron Gate to Scott River	Whitewater Boating	800	4,000	20.3	13.8	12.2	15.0	17.3	24.4	30.9	31.0	30.0	31.0	29.1	23.0	278.0
	Fishing	800	2,500	10.8	7.0	5.4	7.4	6.4	17.5	30.1	31.0	30.0	30.5	23.5	14.3	214.0
Scott River to Salmon River	Boating	800	7,000	13.7	8.3	7.1	10.2	13.2	24.0	30.9	31.0	30.0	30.8	26.0	17.8	243.0
	Fishing	800	4,000	4.1	2.5	1.2	2.2	3.9	13.0	29.4	31.0	30.0	30.3	19.6	7.6	174.9
Salmon River to Trinity River	Whitewater Boating/Fishing	800	10,000	8.7	4.1	2.8	4.5	9.0	21.0	30.7	31.0	30.0	30.5	23.2	11.6	207.0
Trinity River to Ocean	Whitewater Boating/Fishing	1,800	18,000	11.7	6.2	6.1	10.1	16.2	25.5	30.7	30.4	30.0	30.7	25.3	15.9	238.9

Source: USBR 2012b,c; PacifiCorp 2004; FERC 2007; Greimann 2012.

Table S-7. Analysis for No Project, All Years, Maximum Number of Days.

River Reach	Activity	Low Value (cfs)	High Value (cfs)	Maximum Number of Days within Flow Range												WY Total
				Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Keno Reach	Whitewater Boating—Standard	1,000	4,000	31	29	31	30	31	30	31	0	0	31	30	31	245
	Play Boating	1,100	1,800	31	0	31	30	31	30	0	0	0	31	30	31	142
	Fishing	200	1,500	31	29	31	30	31	30	31	31	30	31	30	31	366
J.C. Boyle Bypass Reach	Whitewater Boating—Standard	1,300	1,800	2	20	29	8	11	0	0	0	0	0	0	19	48
	Fishing	200	1,000	31	29	31	30	31	30	31	0	30	31	30	31	245
Hells Corner Reach	Whitewater Boating	1,200	3,500	31	29	31	30	31	30	31	31	30	31	30	31	366
	Fishing	200	1,500	31	29	31	30	31	30	31	31	30	31	30	31	366
Copco No. 2 Bypass Reach	Whitewater Boating	600	1,500	31	28	31	20	18	1	0	0	0	0	0	20	83
	Fishing	50	600	29	25	31	29	30	1	0	0	0	0	0	1	59
Iron Gate to Scott River	Whitewater Boating	800	4,000	31	29	31	30	31	30	31	31	30	31	30	31	366
	Fishing	800	2,500	31	29	31	30	31	30	31	31	30	31	30	31	366
Scott River to Salmon River	Boating	800	7,000	31	29	31	30	31	30	31	31	30	31	30	31	366
	Fishing	800	4,000	31	29	31	30	31	30	31	31	30	31	30	31	366
Salmon River to Trinity River	Whitewater Boating/Fishing	800	10,000	31	29	31	30	31	30	31	31	30	31	30	31	366
Trinity River to Ocean	Whitewater Boating/Fishing	1,800	18,000	31	29	31	30	31	30	31	31	30	31	30	31	366

Source: USBR 2012b,c; PacifiCorp 2004; FERC 2007; Greimann 2012.

Table S-8. Analysis for No Project, All Years, Minimum Number of Days.

River Reach	Activity	Low Value (cfs)	High Value (cfs)	Minimum Number of Days within Flow Range												
				Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	WY Total
Keno Reach	Whitewater Boating—Standard	1,000	4,000	0	0	0	0	0	0	0	0	0	0	0	0	0
	Play Boating	1,100	1,800	0	0	0	0	0	0	0	0	0	0	0	0	0
	Fishing	200	1,500	0	0	0	0	0	0	0	30	31	30	31	0	0
J.C. Boyle Bypass Reach	Whitewater Boating—Standard	1,300	1,800	0	0	0	0	0	0	0	0	0	0	0	0	0
	Fishing	200	1,000	0	0	0	0	0	0	0	0	0	0	0	0	0
Hells Corner Reach	Whitewater Boating	1,200	3,500	0	0	0	0	0	29	0	0	0	31	30	0	183
	Fishing	200	1,500	0	0	0	0	0	0	30	31	30	30	0	0	122
Copco No. 2 Bypass Reach	Whitewater Boating	600	1,500	0	0	0	0	0	0	0	0	0	0	0	0	0
	Fishing	50	600	0	0	0	0	0	0	0	0	0	0	0	0	0
Iron Gate to Scott River	Whitewater Boating	800	4,000	0	0	0	0	0	0	29	31	30	31	20	0	144
	Fishing	800	2,500	0	0	0	0	0	0	15	31	30	3	0	0	121
Scott River to Salmon River	Boating	800	7,000	0	0	0	0	0	0	28	31	30	19	0	0	133
	Fishing	800	4,000	0	0	0	0	0	0	12	31	30	1	0	0	101
Salmon River to Trinity River	Whitewater Boating/Fishing	800	10,000	0	0	0	0	0	0	22	30	30	9	0	0	128
Trinity River to Ocean	Whitewater Boating/Fishing	1,800	18,000	0	0	0	0	0	0	22	1	30	18	0	0	138

Source: USBR 2012b,c; PacifiCorp 2004; FERC 2007; Greimann 2012.

S.3 Changes in 2012 KHSA EIS/EIR Model Results Due to Variations Between KBRA Flows and 2013 BiOp Flows

As previously introduced, the 2013 BiOp Flows are the current hydrology requirement to which the USBR Klamath Irrigation Project operates. The 2013 BiOp Flows are sufficiently different from the previously modeled KBRA Flows that the projected duration (i.e., number of days) for which flows would be within the range of acceptable flows for whitewater boating and fishing would vary between the 2013 BiOp and KBRA Flows. While the 2013 BiOp Flows have a similar annual range as the KBRA Flows, the monthly range varies between the 2013 BiOp and the KBRA Flows. The most prominent difference is that 2013 BiOp Flows generally result in higher flows in the fall months (October through December) and lower flows in the summer months (June through August) when compared to KBRA Flows. Changes in the monthly range of flows could result in more or less flow-dependent recreational opportunities (i.e., whitewater boating and fishing) during certain months and a net change in the total average annual number of days for these recreational activities.

As explained in Section 3.1.6 *Summary of Available Hydrology Information for the Proposed Project*, monthly flow exceedance curve plots are useful for comparing the flow differences by month under 2013 BiOp and KBRA Flows, since they show the entire potential range of flows that would occur during different water year types (i.e., wet, median, and dry year types). Variations between exceedance flow curves for the 2013 BiOp Flows and the KBRA Flows were evaluated to qualitatively determine how monthly variations between the 2013 BiOp and KBRA Flows would alter the estimated number of days within the acceptable flow range for recreational activities under the previous analysis using the KBRA Flows. Monthly flow exceedance curves for the 2013 BiOp and the KBRA Flows exist at Keno Dam (see Figure S-1) and at Iron Gate Dam (see Figure S-2). Accordingly, Klamath River reaches between Keno Dam and Iron Gate Dam are assessed using the exceedance curves at Keno Dam and the reaches downstream of Iron Gate Dam are assessed using the exceedance curves at Iron Gate Dam. This evaluation focuses on exceedance flow curves during July, August, and September, because those are the highest demand months for recreational activities on the Klamath River, but it also considers the exceedance flow curves for the entire year.

Differences between the 2013 BiOp and KBRA Flows, as shown by the monthly flow exceedance curves at Keno Dam (see Figure S-1), are anticipated to produce a net decrease in the number of days that flows are within the acceptable range for whitewater boating between Keno Dam and Iron Gate Dam. Whitewater boating requires a minimum flow of 1,000 cfs to 1,300 cfs in the Keno, J.C. Boyle Bypass, and Hell's Corner reaches (see Table S.1). Much of the variations between the 2013 BiOp and KBRA Flows during winter and spring occur within the acceptable range of flows for whitewater boating and these variations would not alter the number of days whitewater boating could occur during this time period. However, during summer and fall months, variations between the 2013 BiOp and KBRA Flows would alter the number of days available for whitewater boating, since they would change the frequency that flows would be within the acceptable range. In July through September, KBRA Flows would exceed 1,000 cfs during wet water years (represented by flow exceedances of 10% or less) and KBRA Flows would even exceed 1,300 cfs during wet water years in July. Under the KBRA Flows, the projected average number of days of whitewater boating for all water year types between July and September would range from 2.3 days in August in the J.C. Boyle Bypass Reach to 13.8 days in July in the Hell's Corner Reach (Table S-3).

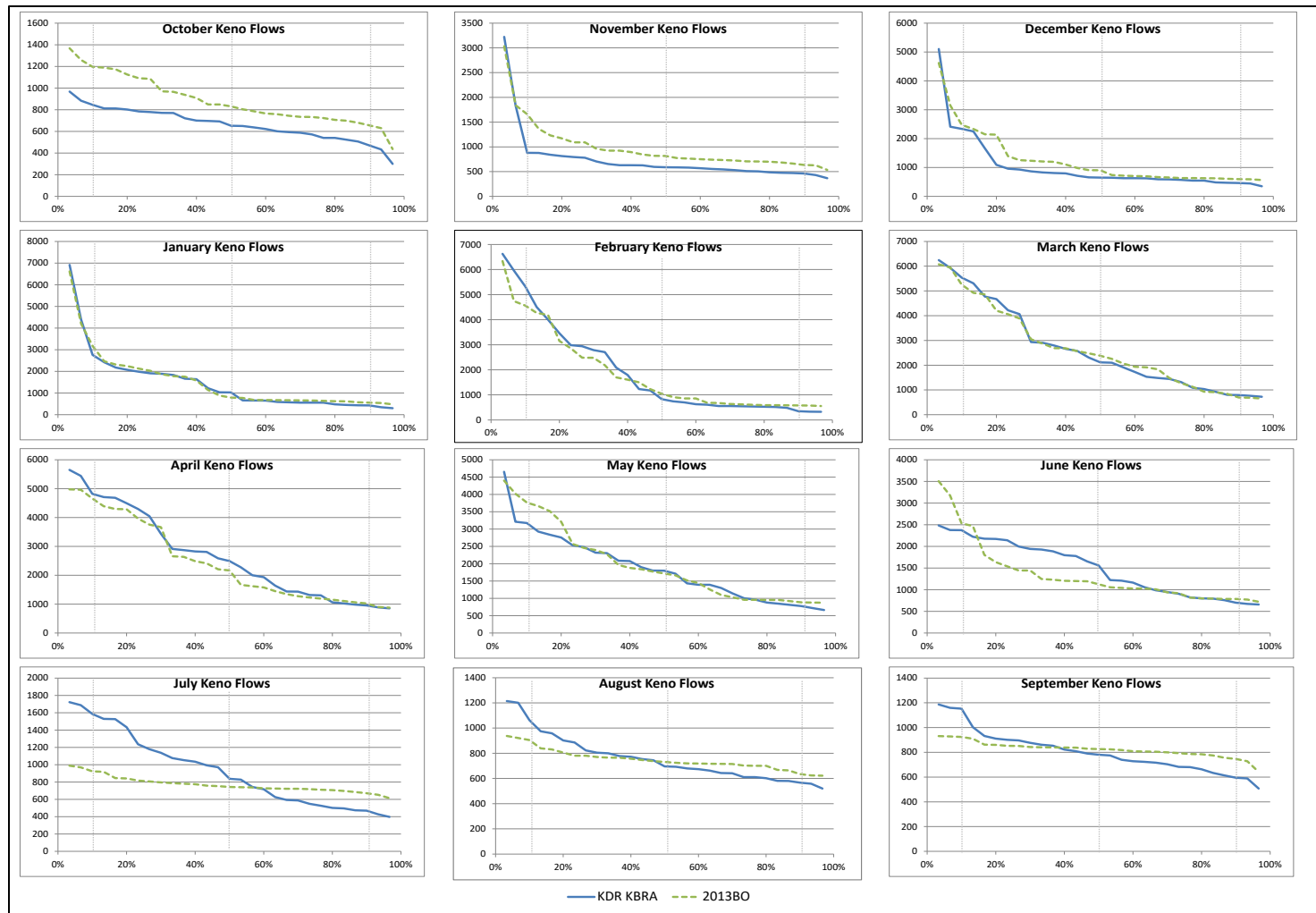


Figure S-1. Monthly Flow Exceedance Curves at Keno Dam for the KBRA Flows (KDR KBRA) and 2013 Joint Biological Opinion Flows (2013 BO). Source: USBR 2016. Note: The scale on the y-axis (flow in cfs) varies significantly between months. Vertical grey dotted lines indicate the 10% (wet year), 50% (median year), and 90% (dry year) flow exceedances.

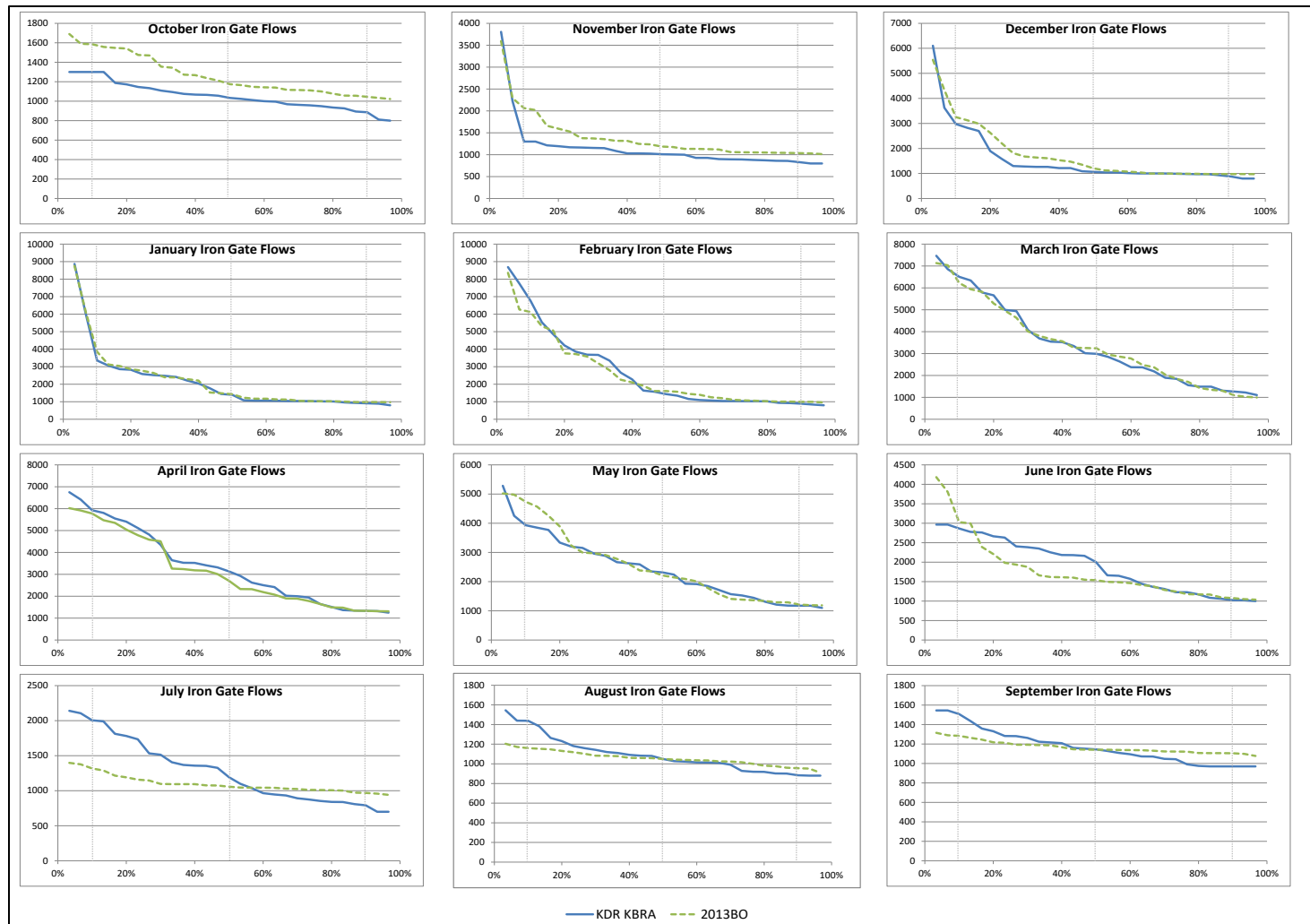


Figure S-2. Monthly Flow Exceedance Curves at Iron Gate Dam for the KBRA Flows (KDR KBRA) and 2013 Joint Biological Opinion Flows (2013 BO). Source: USBR 2016. Note: The scale on the y-axis (flow in cfs) varies significantly between months. Vertical grey dotted lines indicate the 10% (wet year), 50% (median year), and 90% (dry year) flow exceedances.

However, the 2013 BiOp Flows would remain below 1,000 cfs during all water year types between July through September, so the number of days whitewater boating could occur between July and September in the Keno, J.C. Boyle Bypass, and Hell's Corner reaches of the Klamath River would be zero under the 2013 BiOp Flows.

Conversely, in October the projected number of days of whitewater boating would increase under the 2013 BiOp Flows relative to the KBRA Flows. The exceedance curves at Keno Dam in October show that the 2013 BiOp Flows exceed 1,000 cfs in 30 percent of years, with the flows reaching a maximum of approximately 1,400 cfs, but the KBRA Flows are always below 1,000 cfs. Klamath River flows between Keno and Iron Gate dams would be within the range of acceptable flows for whitewater boating under 2013 BiOp Flows in October under some water year types, especially wet water years, but acceptable whitewater boating flows would not occur under KBRA Flows. Thus, the projected average number of days of whitewater boating for all water year types in October between Keno Dam and Iron Gate Dam would be greater under 2013 BiOp Flows than under the KBRA Flows.

Overall, the projected average number of days that would support whitewater boating for all water year types between Keno Dam and Iron Gate Dam would decrease under the 2013 BiOp Flows compared to those modeled in the 2012 KHSA EIS/EIR under the KBRA Flows, since the decreases in July through September are expected to be greater than the increase in October.

The average number of days that fishing could occur between Keno and Iron Gate dams would increase under the 2013 BiOp compared to the KBRA Flows. In addition to detailing the percent of time that flows would be exceeded, the monthly flow exceedance curves also indicate the percent of years when the flows would occur. The percent of years within the acceptable flow range for fishing (i.e., 200 cfs to 1,500 cfs in the Keno, J.C. Boyle Bypass, and Hell's Corner reaches) can be estimated by subtracting the percent exceedance from one hundred percent, if the minimum flow is always greater than the minimum acceptable fishing flow (i.e., 200 cfs). Under the 2013 BiOp and KBRA Flows, the percent of years within the acceptable fishing flow range is similar and the average number of days available for fishing would also remain similar for all months except June and July. In those two months, the 2013 BiOp Flows would be within the acceptable fishing flow range more frequently (approximately 70 percent of years in June; 100 percent of years in July) than the KBRA Flows (approximately 50 percent of years in June; approximately 80 percent of years in July). As a result, there would be a net increase in the projected average number of days with acceptable fishing flows under the 2013 BiOp Flows compared to under the KBRA Flows between Keno Dam and Iron Gate Dam.

A comparison of the monthly exceedance curves for the 2013 BiOp and KBRA Flows at Iron Gate Dam (see Figure S-2) indicates that the number of days flows are within the acceptable range for flow-dependent recreational activities would be generally similar under 2013 BiOp and KBRA Flows downstream of Iron Gate Dam. Most of the variations between the 2013 BiOp and KBRA Flows at Iron Gate Dam occur within the acceptable range of flows for whitewater boating, boating, or fishing and those variations would not alter the number of days flow-dependent recreational activities could occur. Differences between the 2013 BiOp and KBRA Flows outside of the acceptable range of flows downstream of Iron Gate Dam occur infrequently and primarily for either dry (represented by a 90 percent exceedance) or wet (represented by a 10 percent

exceedance) water year types. In May, KBRA Flows would exceed 4,000 cfs in approximately 10 percent of years, but 2013 BiOp Flows would exceed 4,000 cfs in approximately 20 percent of years. This variation between the KBRA and 2013 BiOp Flows would decrease the average number of days within the acceptable flow range for whitewater boating and fishing in the Klamath River from Iron Gate to its confluence with the Salmon River under the 2013 BiOp Flows. In July, KBRA Flows would not exceed 800 cfs in approximately 30 percent of years, but 2013 BiOp Flows would always exceed 800 cfs. The result would be an increase the average number of days within the acceptable flow range for whitewater boating and fishing in the Klamath River downstream of Iron Gate Dam under the 2013 BiOp Flows. The overall net change in the average number of days within the acceptable flow range for recreational activities between the 2013 BiOp and KBRA Flows would be minimal downstream of Iron Gate Dam, but the exact number of days under 2013 BiOp Flows would vary slightly from those modeled in the 2012 KHSA EIS/EIR analysis under the KBRA Flows. This suggests that the average number of days for flow-dependent recreational activities estimated in the 2012 KHSA EIS/EIR analysis downstream of Iron Gate Dam is generally representative of trends and conditions under the 2013 BiOp Flows.

S.4 References

Greimann, B. 2012. Bureau of Reclamation. Email communication with Renee Snyder, Bureau of Land Management, on May 15, 2012.

FERC (Federal Energy Regulatory Commission). 2007. Final Environmental Impact Statement for Hydropower License, Klamath Hydroelectric Project, FERC Project No. 2082-027, FERC/EIS-0201F. Washington, DC, Federal Energy Regulatory Commission, Office of Energy Projects, Division of Hydropower Licensing.

NMFS and USFWS (National Marine Fisheries Service and U.S. Fish and Wildlife Service). 2013. Biological opinions on the effects of proposed Klamath Project operations from May 31, 2013, through March 31, 2023, on five federally listed threatened and endangered species. Prepared by NMFS, Southwest Region, Northern California Office; and USFWS, Pacific Southwest Region, Klamath Falls Fish and Wildlife Office.

PacifiCorp. 2004. Exhibit E7.0 Recreation Resources. February.

USBR (U.S. Bureau of USBR). 2012a. Hydrology, Hydraulics and Sediment Transport Studies for the Secretary's Determination on Klamath River Dam Removal and Basin Restoration, Technical Report No. SRH-2011-02. Prepared for Mid-Pacific Region, Bureau of USBR, Technical Service Center, Denver, CO.

USBR. 2012b. Model runs of the Klamath Project Simulation Model (KPSIM) for Recreational Flows with 'Dams Out' (with KBRA scenario). Updated May 16, 2012.

USBR. 2012c. Model runs of the Klamath Project Simulation Model (KPSIM) for Recreational Flows with 'Dams In' (No Action). Updated May 16, 2012.