

**RESPONSE TO FEBRUARY 16, 2018 REQUEST FOR ADDITIONAL
INFORMATION, RESOURCE AGENCY LATE FILING, AND
OTHER RELATED INFORMATION**

ATTACHMENT M

**ESTIMATION OF APPROXIMATE AREA NEEDED
TO MEET USFWS' OBJECTIVES RELATED TO
ACRE-DAYS OF FLOODPLAIN INUNDATION**

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Attachment M: Estimation of Approximate Area Needed to Meet USFWS' Objectives Related to Acre-Days of Floodplain Inundation

In the January 29, 2018, response to FERC's Ready for Environmental Analysis (REA) notice for the Don Pedro Project, the USFWS listed goals for the amount of floodplain inundation to be achieved along the lower Tuolumne River for different water year types.¹ The specific goals were summarized as:

- 100,000 acre-days in "above normal" water years
- 65,000 acre-days in "below normal" water years
- 35,000 acre-days in "dry" water years

After applying its recommended instream flows, the USFWS estimated that an additional 47,464 acre-days of inundation were needed when compared to unimpaired flow conditions. Using the Tuolumne River Operations Model (W&AR-02) and the Floodplain Hydraulic Study (W&AR-21), an iterative analysis was conducted to modify the relationship between flow and floodplain area for each of the Floodplain Hydraulic Study's three subreaches to test the changes in floodplain geometry needed to meet various additional levels of floodplain inundation. This iterative analysis found a balance between floodplain modifications, additional inundated area, and acre-days of inundation. This analysis, as summarized on the following tables and associated plots, resulted in an approximate estimate of 370 acres of floodplain modification/floodplain lowering.

¹ Separate reviews of the technical merit of the purported relationship between "acre-days" of floodplain inundation and outmigrant survival are included in Attachments T and U of this filing.

Total acre-days, summarized below, were calculated utilizing the area discharge relationships provided in Figures 5.2-2, 5.2-3, and 5.2-4 of the Don Pedro Project AFLA. Discharges utilized in the calculations are the simulated total Don Pedro discharges from the operations model simulation of the flow scenario.

WY – Water Year

WYT – Water Year Type

USFWS Simulation

Year	USFWS Operations Simulation Total Acre-Days for Feb 1 - Jun 15	Number of Days in Feb-Jun15 Period of WY in WYType Above Normal (WYT-2)	Number of Days in Feb-Jun15 Period of WY in WYType Below Normal (WYT-3)	Number of Days in Feb-Jun15 Period of WY in WYType Dry (WYT-4)	USFWS Operations Simulation Total Acre-Days for WYTs 2-4 and Feb 1 - Jun 15	Assigned WYType (if there are less than 100 days in WYT 2, 3, or 4 then there is no acre-days goal assigned)	Acre-Days Goal Based on Assigned WYT	Goal Met (TRUE or -)
1971	35,992	0	135	0	35,992	3	65,000	-
1972	5,253	0	68	38	5,253	3	65,000	-
1973	51,539	61	66	8	51,539	3	65,000	-
1974	44,983	96	39	0	44,983	2	100,000	-
1975	47,755	46	61	28	47,755	3	65,000	-
1976	838	8	0	0	-	-	-	-
1977	838	0	0	0	-	-	-	-
1978	68,825	59	0	0	-	-	-	-
1979	53,654	0	127	0	53,654	3	65,000	-
1980	62,229	29	8	0	-	-	-	-
1981	12,201	0	0	96	-	-	-	-
1982	146,492	59	0	8	-	-	-	-
1983	180,602	0	0	0	-	-	-	-
1984	65,920	128	0	0	62,913	2	100,000	-
1985	18,259	8	58	69	18,259	4	36,000	-
1986	84,333	0	28	8	-	-	-	-
1987	838	0	0	0	-	-	-	-
1988	2,728	0	0	29	-	-	-	-
1989	838	0	0	0	-	-	-	-
1990	838	0	0	0	-	-	-	-
1991	838	0	0	0	-	-	-	-
1992	2,728	0	0	0	-	-	-	-
1993	58,577	127	0	0	58,577	2	100,000	-
1994	2,728	8	0	0	-	-	-	-
1995	81,291	59	0	0	-	-	-	-
1996	92,440	99	29	0	89,268	2	100,000	-
1997	100,471	8	0	0	-	-	-	-
1998	88,425	0	28	0	-	-	-	-
1999	82,453	69	58	0	78,724	2	100,000	-
2000	56,517	39	97	0	56,517	3	65,000	-
2001	13,686	0	8	127	13,686	4	36,000	-
2002	29,850	0	127	8	29,850	3	65,000	-
2003	41,221	0	74	61	41,221	3	65,000	-
2004	26,609	0	98	38	26,609	3	65,000	-
2005	75,964	59	0	8	-	-	-	-
2006	115,487	89	0	0	-	-	-	-
2007	4,018	0	0	31	-	-	-	-
2008	8,120	0	60	68	8,120	4	36,000	-
2009	42,508	0	99	36	42,508	3	65,000	-
2010	27,913	0	135	0	27,913	3	65,000	-
2011	87,521	59	8	0	-	-	-	-
2012	838	0	0	0	-	-	-	-
Median	41,865				42,508		65,000	

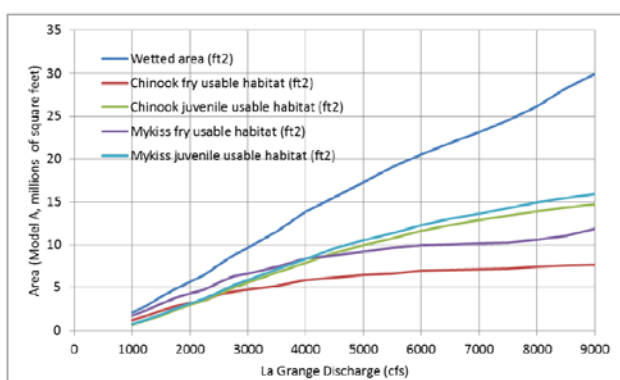


Figure 5.2-2. Model A results showing total wetted and usable habitat areas for juvenile salmonid life stages in the lower Tuolumne River (RM 51.7-40).

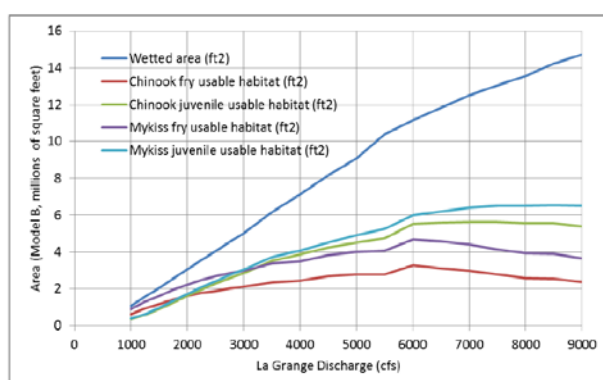


Figure 5.2-3. Model B results showing total wetted and usable habitat areas for juvenile salmonid life stages in the lower Tuolumne River (RM 40-21.5).

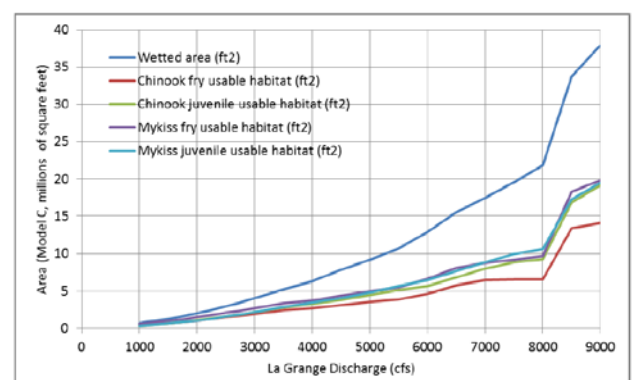


Figure 5.2-4. Model C results showing total wetted and usable habitat areas for juvenile salmonid life stages in the lower Tuolumne River (RM 21.5-0.9).

USFWS Simulation

Plus 370 acres evenly distributed between the three areas starting at 2,000 cfs to achieve the same **MEDIAN inundated acres over the same years.**

Year	USFWS Operations Simulation Total Acre-Days for Feb 1 - Jun 15	Number of Days in Feb-Jun15 Period of WY in WYType Above Normal (WYT-2)	Number of Days in Feb-Jun15 Period of WY in WYType Below Normal (WYT-3)	Number of Days in Feb-Jun15 Period of WY in WYType Dry (WYT-4)	USFWS Operations Simulation Total Acre-Days for WYTs 2-4 and Feb 1 - Jun 15	Assigned WYType (if there are less than 100 days in WYT 2, 3, or 4 then there is no acre-days goal assigned)	Acre-Days Goal Based on Assigned WYT	Goal Met (TRUE or -)
1971	62,182	0	135	0	62,182	3	65,000	-
1972	9,061	0	68	38	9,061	3	65,000	-
1973	73,898	61	66	8	73,898	3	65,000	TRUE
1974	68,640	96	39	0	68,640	2	100,000	-
1975	69,262	46	61	28	69,262	3	65,000	TRUE
1976	1,438	8	0	0	-	-	-	-
1977	1,438	0	0	0	-	-	-	-
1978	97,664	59	0	0	-	-	-	-
1979	80,814	0	127	0	80,814	3	65,000	TRUE
1980	89,484	29	8	0	-	-	-	-
1981	20,419	0	0	96	-	-	-	-
1982	176,508	59	0	8	-	-	-	-
1983	214,285	0	0	0	-	-	-	-
1984	98,545	128	0	0	93,537	2	100,000	-
1985	30,096	8	58	69	30,096	4	36,000	-
1986	114,601	0	28	8	-	-	-	-
1987	1,438	0	0	0	-	-	-	-
1988	4,503	0	0	29	-	-	-	-
1989	1,438	0	0	0	-	-	-	-
1990	1,438	0	0	0	-	-	-	-
1991	1,438	0	0	0	-	-	-	-
1992	4,503	0	0	0	-	-	-	-
1993	85,617	127	0	0	85,617	2	100,000	-
1994	4,503	8	0	0	-	-	-	-
1995	108,339	59	0	0	-	-	-	-
1996	124,572	99	29	0	119,545	2	100,000	TRUE
1997	132,434	8	0	0	-	-	-	-
1998	119,716	0	28	0	-	-	-	-
1999	115,545	69	58	0	109,816	2	100,000	TRUE
2000	87,215	39	97	0	87,215	3	65,000	TRUE
2001	23,005	0	8	127	23,005	4	36,000	-
2002	47,883	0	127	8	47,883	3	65,000	-
2003	57,185	0	74	61	57,185	3	65,000	-
2004	43,689	0	98	38	43,689	3	65,000	-
2005	104,672	59	0	8	-	-	-	-
2006	142,996	89	0	0	-	-	-	-
2007	6,740	0	0	31	-	-	-	-
2008	13,356	0	60	68	13,356	4	36,000	-
2009	64,861	0	99	36	64,861	3	65,000	-
2010	44,919	0	135	0	44,919	3	65,000	-
2011	115,147	59	8	0	-	-	-	-
2012	1,438	0	0	0	-	-	-	-
Median	63,522				64,861		65,000	

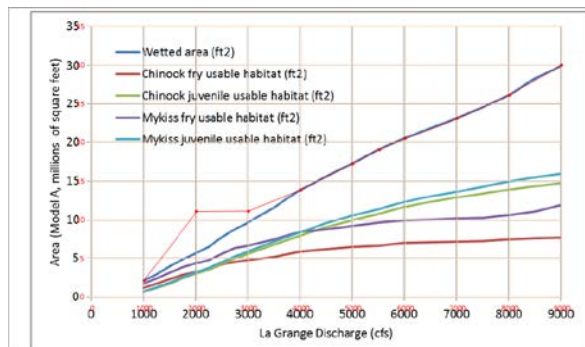


Figure 5.2-2. Model A results showing total wetted and usable habitat areas for juvenile salmonid life stages in the lower Tuolumne River (RM 51.7-40).

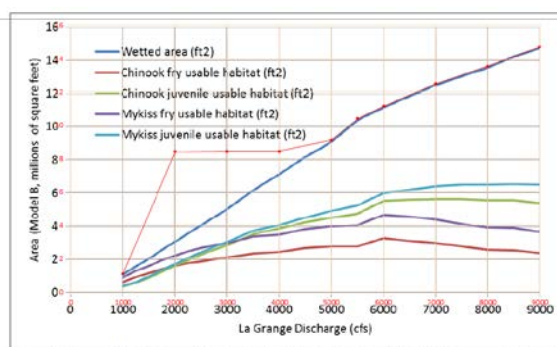


Figure 5.2-3. Model B results showing total wetted and usable habitat areas for juvenile salmonid life stages in the lower Tuolumne River (RM 40-21.5).

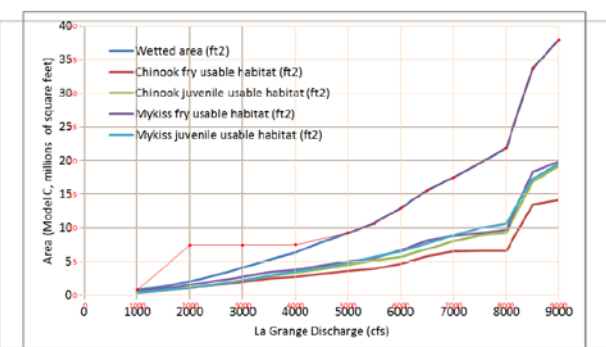
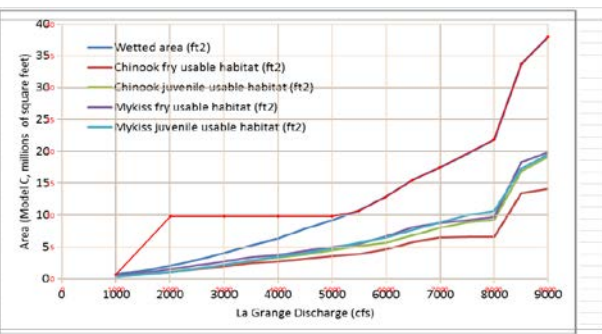
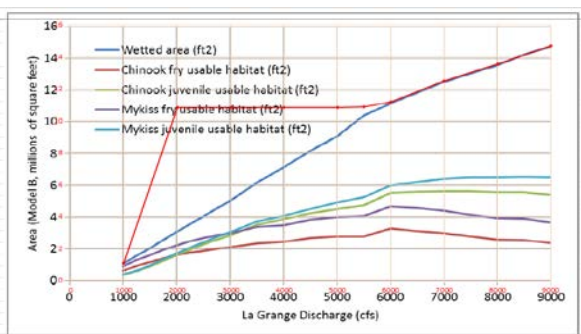
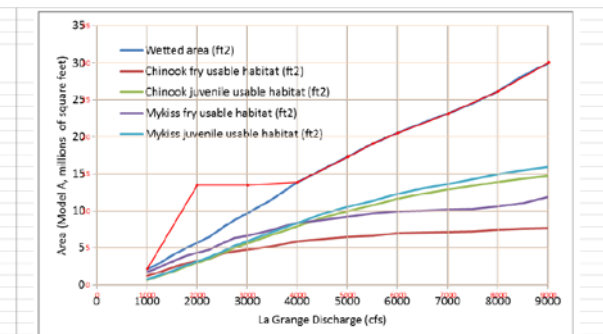


Figure 5.2-4. Model C results showing total wetted and usable habitat areas for juvenile salmonid life stages in the lower Tuolumne River (RM 21.5-0.9).

USFWS Simulation

Plus 535 acres evenly distributed between the three areas starting at 2,000 cfs to achieve the same **AVERAGE inundated acres over the same years.**

Year	USFWS Operations Simulation Total Acre-Days for Feb 1 - Jun 15	Number of Days in Feb-Jun15 Period of WY in WYType Above Normal (WYT-2)	Number of Days in Feb-Jun15 Period of WY in WYType Below Normal (WYT-3)	Number of Days in Feb-Jun15 Period of WY in WYType Dry (WYT-4)	USFWS Operations Simulation Total Acre-Days for WYTs 2-4 and Feb 1 - Jun 15	Assigned WYType (if there are less than 100 days in WYT 2, 3, or 4 then there is no acre-days goal assigned)	Acre-Days Goal Based on Assigned WYT	Goal Met (TRUE or -)
1971	84,836	0	135	0	84,836	3	65,000	TRUE
1972	13,404	0	68	38	13,404	3	65,000	-
1973	79,064	61	66	8	79,064	3	65,000	TRUE
1974	77,740	96	39	0	77,740	2	100,000	-
1975	74,982	46	61	28	74,982	3	65,000	TRUE
1976	2,122	8	0	0	-	-	-	-
1977	2,122	0	0	0	-	-	-	-
1978	99,521	59	0	0	-	-	-	-
1979	91,879	0	127	0	91,879	3	65,000	TRUE
1980	93,518	29	8	0	-	-	-	-
1981	27,195	0	0	96	-	-	-	-
1982	150,866	59	0	8	-	-	-	-
1983	187,852	0	0	0	-	-	-	-
1984	105,874	128	0	0	99,598	2	100,000	-
1985	38,447	8	58	69	38,447	4	36,000	TRUE
1986	109,907	0	28	8	-	-	-	-
1987	2,122	0	0	0	-	-	-	-
1988	5,750	0	0	29	-	-	-	-
1989	2,122	0	0	0	-	-	-	-
1990	2,122	0	0	0	-	-	-	-
1991	2,122	0	0	0	-	-	-	-
1992	5,750	0	0	0	-	-	-	-
1993	90,304	127	0	0	90,304	2	100,000	-
1994	5,750	8	0	0	-	-	-	-
1995	103,703	59	0	0	-	-	-	-
1996	115,979	99	29	0	109,840	2	100,000	TRUE
1997	126,248	8	0	0	-	-	-	-
1998	113,468	0	28	0	-	-	-	-
1999	115,092	69	58	0	108,797	2	100,000	TRUE
2000	98,570	39	97	0	98,570	3	65,000	TRUE
2001	31,067	0	8	127	31,067	4	36,000	-
2002	59,443	0	127	8	59,443	3	65,000	-
2003	60,886	0	74	61	60,886	3	65,000	-
2004	55,569	0	98	38	55,569	3	65,000	-
2005	110,457	59	0	8	-	-	-	-
2006	133,919	89	0	0	-	-	-	-
2007	9,843	0	0	31	-	-	-	-
2008	19,298	0	60	68	19,298	4	36,000	-
2009	73,666	0	99	36	73,666	3	65,000	TRUE
2010	56,574	0	135	0	56,574	3	65,000	-
2011	105,057	59	8	0	-	-	-	-
2012	2,122	0	0	0	-	-	-	-
Average	65,389				69,682		69,632	



DPP-1r Simulation – SJI 602020 WYTs

Plus 370 acres evenly distributed between the three areas starting at 2,000 cfs.

Year	DPP-1r Operations Simulation Total Acre-Days for Feb 1 - Jun 15	Number of Days in Feb-Jun15 Period of WY in WYType Above Normal (WYT-2)	Number of Days in Feb-Jun15 Period of WY in WYType Below Normal (WYT-3)	Number of Days in Feb-Jun15 Period of WY in WYType Dry (WYT-4)	DPP-1r Operations Simulation Total Acre-Days for WYTs 2-4 and Feb 1 - Jun 15	Assigned WYType (WYT on May 1)	Acre-Days Goal Based on Assigned WYT	Goal Met (TRUE or -)
1971	52,816	0	135	0	52,816	3	65,000	-
1972	7,627	0	68	38	3,818	3	65,000	-
1973	38,895	61	66	8	38,895	3	65,000	-
1974	74,141	96	39	0	74,141	2	100,000	-
1975	70,946	46	61	28	70,946	3	65,000	TRUE
1976	3,451	8	0	0	-	-	-	-
1977	158	0	0	0	-	-	-	-
1978	22,959	59	0	0	-	-	-	-
1979	71,079	0	127	0	69,031	3	65,000	TRUE
1980	120,094	29	8	0	-	-	-	-
1981	12,237	0	0	96	-	-	-	-
1982	160,721	59	0	8	-	-	-	-
1983	192,894	0	0	0	-	-	-	-
1984	70,088	128	0	0	65,134	2	100,000	-
1985	22,520	8	58	69	22,520	4	36,000	-
1986	119,362	0	28	8	-	-	-	-
1987	3,451	0	0	0	-	-	-	-
1988	158	0	0	29	-	-	-	-
1989	158	0	0	0	-	-	-	-
1990	158	0	0	0	-	-	-	-
1991	158	0	0	0	-	-	-	-
1992	158	0	0	0	-	-	-	-
1993	22,674	127	0	0	22,674	2	100,000	-
1994	3,451	8	0	0	-	-	-	-
1995	108,691	59	0	0	-	-	-	-
1996	99,948	99	29	0	94,823	2	100,000	-
1997	95,563	8	0	0	-	-	-	-
1998	129,067	0	28	0	-	-	-	-
1999	77,759	69	58	0	72,802	2	100,000	-
2000	81,624	39	97	0	81,624	3	65,000	TRUE
2001	10,036	0	8	127	10,036	4	36,000	-
2002	4,093	0	127	8	4,093	3	65,000	-
2003	14,499	0	74	61	14,499	3	65,000	-
2004	20,290	0	98	38	20,290	3	65,000	-
2005	92,848	59	0	8	-	-	-	-
2006	145,829	89	0	0	-	-	-	-
2007	3,451	0	0	31	-	-	-	-
2008	158	0	60	68	158	4	36,000	-
2009	14,499	0	99	36	14,499	3	65,000	-
2010	22,674	0	135	0	22,674	3	65,000	-
2011	117,053	59	8	0	-	-	-	-
2012	9,647	0	0	0	-	-	-	-
Median	50,430				39,762		69,632	

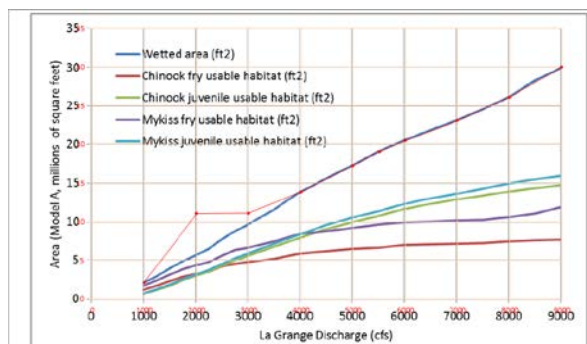


Figure 5.2-2. Model A results showing total wetted and usable habitat areas for juvenile salmonid life stages in the lower Tuolumne River (RM 51.7-40).

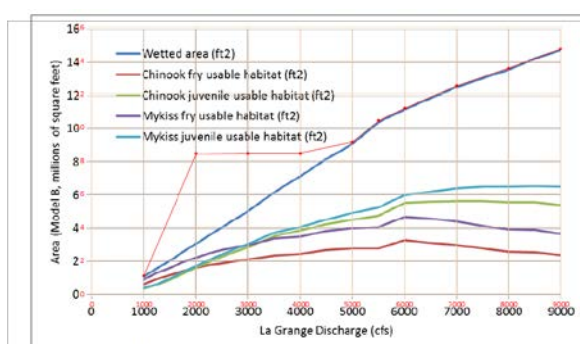


Figure 5.2-3. Model B results showing total wetted and usable habitat areas for juvenile salmonid life stages in the lower Tuolumne River (RM 49-21.5).

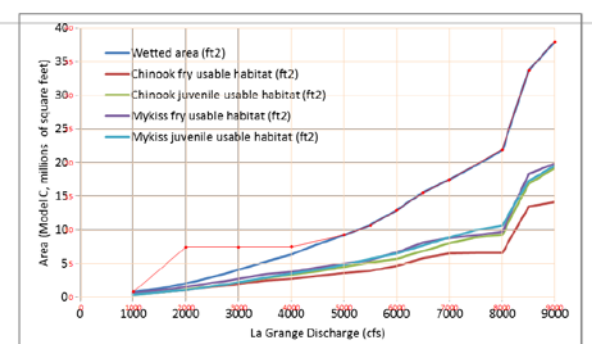


Figure 5.2-4. Model C results showing total wetted and usable habitat areas for juvenile salmonid life stages in the lower Tuolumne River (RM 21.5-0.9).