CVFPP

2017 UPDATE

TECHNICAL SERIES

DRAFT Technical Memorandum

Central Valley Flood Protection Plan Investment Strategy – Appendixes

March 2017

STATE OF CALIFORNIA
THE NATURAL RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

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Contents

Appendixes

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Appendix A: Historical Expenditures Support

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Appendix A: Historical Expenditures Support

A.1 State Expenditures

A.1.1 General Fund

Table A-1. DWR General Fund Expenditures by Year, Millions $[1]

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Average
DWR General Fund Total	526.7	157.5	233.7	56.8	33.0	235.2	313.9	190.3	127.6	108.1	106.1	93.7	94.2	97.7	122.9	166.5
DWR General Fund Flood Portion[2]	150.8	56.3	178.1	38.6	16.8	150.3	238.3	120.6	111.7	92.7	92.1	80.9	82.2	82.5	84.1	105.1

Notes:
1. In 2015 dollars.
2. Public Safety and Prevention of Damage

Source: Governor's Budgets, 2001-2016

Table A-2. DFM General Fund Expenditures by Year, Millions $[1]

DFM Flood Implementation Programs	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Average
Flood Emergency Response	6.48	11.90	13.89	13.16	13.34	17.03	15.14	14.62	14.65	16.18	13.64
Flood System Operations and Maintenance	10.98	19.07	22.07	18.92	19.20	15.60	13.69	13.15	14.03	13.58	16.03
Floodplain Risk Management	1.15	5.17	7.15	7.17	4.28	4.70	4.08	4.89	6.09	6.85	5.15
Flood Management Planning	3.42	10.73	11.24	4.09	0.17	0.75	0.62	0.61	1.28	1.18	3.41
Flood Risk Reduction Projects	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
System	0.69	5.01	9.39	0.89	0.00	0.02	4.40	0.00	0.00	0.03	2.04
Urban	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Non-Urban	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Central Valley Total	**22.73**	**51.88**	**63.73**	**44.23**	**36.99**	**38.10**	**37.93**	**33.28**	**36.05**	**37.83**	**40.27**
Statewide	50.93	45.79	9.62	1.62	0.71	0.94	0.17	0.28	0.55	0.52	11.11
Delta	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Statewide Total	**73.66**	**97.67**	**73.35**	**45.85**	**37.70**	**39.03**	**38.10**	**33.55**	**36.60**	**38.35**	**51.39**

Note:
1. In 2015 dollars.

Source: DWR, 2016

A.1.2 General Obligation Bonds

Table A-3. DFM General Obligation Bond Expenditures by Year, Millions $[1]

DFM Flood Implementation Programs	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Average
Flood Emergency Response	0.00	0.26	13.24	7.47	11.09	10.62	9.92	16.38	15.83	11.96	9.68
Flood System Operations and Maintenance	0.00	0.00	1.47	0.18	0.50	0.60	3.30	3.80	5.18	8.83	2.39
Floodplain Risk Management	0.00	0.00	7.17	19.22	24.55	23.88	20.50	18.64	8.60	1.90	12.45
Flood Management Planning	0.00	10.75	41.01	31.73	42.40	39.45	37.56	51.22	49.97	32.08	33.62
Flood Risk Reduction Projects	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
System	0.00	0.59	1.73	2.31	11.69	28.62	19.65	32.30	23.06	19.36	13.93
Urban	0.00	0.55	111.82	157.64	174.10	120.31	51.96	87.80	134.13	77.24	91.56
Non-Urban	49.95	21.00	14.03	9.69	10.09	11.85	10.10	13.12	7.71	11.11	15.87
Central Valley Total	**49.95**	**33.15**	**190.46**	**228.25**	**274.42**	**235.32**	**152.99**	**223.26**	**244.50**	**162.49**	**179.48**
Statewide	50.63	46.00	38.46	45.66	67.24	102.08	102.63	84.59	92.29	45.79	67.54
Delta	0.00	0.00	26.76	27.84	24.69	70.53	56.50	41.04	44.42	38.52	33.03
Statewide Total	**100.58**	**79.15**	**255.68**	**301.76**	**366.36**	**407.93**	**312.13**	**348.90**	**381.21**	**246.80**	**280.05**

Note:
1. In 2015 dollars.

Source: DWR, 2016

A.1.3 Combined General Fund and General Obligation Bonds Expenditures

Table A-4. DFM Combined General Fund and General Obligation Bond Expenditures by Year, Millions $[1]

DFM Flood Implementation Programs	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Average
Flood Emergency Response	6.48	12.16	27.13	20.63	24.43	27.66	25.06	31.00	30.48	28.15	23.32
Flood System Operations and Maintenance	10.98	19.07	23.54	19.10	19.70	16.20	16.99	16.96	19.21	22.42	18.42
Floodplain Risk Management	1.15	5.17	14.31	26.39	28.83	28.58	24.57	23.53	14.69	8.75	17.60
Flood Management Planning	3.42	21.47	52.24	35.82	42.57	40.19	38.18	51.83	51.25	33.26	37.02
Flood Risk Reduction Projects	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
System	0.69	5.60	11.12	3.20	11.69	28.64	24.05	32.30	23.06	19.39	15.97
Urban	0.00	0.55	111.82	157.64	174.10	120.31	51.96	87.80	134.13	77.24	91.56
Non-Urban	49.95	21.00	14.03	9.69	10.09	11.85	10.10	13.12	7.71	11.11	15.87
Central Valley Total	**72.68**	**85.02**	**254.20**	**272.48**	**311.41**	**273.42**	**190.92**	**256.53**	**280.55**	**200.31**	**219.75**
Statewide	101.56	91.80	48.08	47.29	67.95	103.01	102.80	84.87	92.85	46.31	78.65
Delta	0.00	0.00	26.76	27.84	24.69	70.53	56.50	41.04	44.42	38.52	33.03
Statewide Total	**174.24**	**176.82**	**329.03**	**347.61**	**404.05**	**446.96**	**350.22**	**382.45**	**417.81**	**285.15**	**331.43**

Note:
1. In 2015 dollars.

Source: DWR, 2016

A.1.4 Combined State and Local Expenditures AB 156 Reporting

Table A-5. Combined State and Local Expenditures by Year, Millions $[1]

Year	Total Cost	Reporting Urban LMAs	Reporting Non-urban LMAs
2008	$10.99	20	34
2009	$27.39	18	53
2010	$20.04	21	55
2011	$22.54	23	58
2012	$19.96	21	56
2013	$27.57	23	67
Combined Average[2]	**$23.50**	**21**	**54**
Local Average[3]	**$21.50**		

Notes:
1. Nominal dollars due to inconsistent data reporting.
2. Local agencies were required by AB 156 for the first time on September 30, 2008 to submit their expenses. 2008 was not included in the average due it being an incomplete reporting year.
3. State maintenance yards expenditures are approximately $2M per year and are deducted from the combined average to result in a local average reported expenditure.

Source: DWR, 2013

A.2 Federal Expenditures

A.2.1 United States Army Corps of Engineers (USACE)

Table A-6. USACE Annual Budget for Flood Control in the Central Valley, $[1]

Year	Surveys, Feasibility, Preconstruction Engineering & Design	Construction	Operation & Maintenance	Total Expenditure
2003	$3,327,000	$50,348,000	$12,359,000	$66,034,000
2004	$2,250,000	$16,200,000	$15,255,000	$33,705,000
2005	$1,720,000	$25,061,000	$11,471,000	$38,252,000
2006	$361,000	$36,812,000	$11,138,000	$48,311,000
2007	$339,000	$65,073,000	$8,132,038	$73,544,038
2008	$339,000	$66,528,000	$9,105,063	$75,972,063
2009	$807,000	$57,968,000	$6,901,515	$65,676,515
2010	$807,000	$94,455,000	$13,093,000	$108,355,000
2011	$807,000	$102,500,000	$12,904,000	$116,211,000
2012	$1,654,000	$64,548,000	$15,154,000	$81,356,000
2013	$2,303,000	$103,000,000	$15,991,000	$121,294,000
2014	$2,164,000	$76,850,000	$17,196,000	$96,210,000
2015	$1,975,000	$98,800,000	$15,373,000	$116,148,000
2016	$4,000,000	$88,026,000	$16,176,000	$108,202,000

Note:
1. Expenditures not adjusted for inflation.

Source: USACE, 2002 - 2015

Table A-7. USACE Total Budget for Flood Control Projects in the Central Valley, $[1]

Year	Annual Budget Including the Folsom JFP	Folsom JFP Budget	Annual Budget Excluding the Folsom JFP
2003	$66,034,000		$66,034,000
2004	$33,705,000		$33,705,000
2005	$38,252,000		$38,252,000
2006	$48,311,000		$48,311,000
2007	$73,544,038		$73,544,038
2008	$75,972,063		$75,972,063
2009	$65,676,515	$9,000,000	$56,676,515
2010	$108,355,000	$66,700,000	$41,655,000
2011	$116,211,000	$78,000,000	$38,211,000
2012	$81,356,000	$21,000,000	$60,356,000
2013	$121,294,000	$86,700,000	$34,594,000
2014	$96,210,000	$66,400,000	$29,810,000
2015	$116,148,000	$92,600,000	$23,548,000
2016	$108,202,000	$56,024,000	$52,178,000

Note:
1. Expenditures not adjusted for inflation.

Source: USACE, 2002 - 2015

Table A-8. USACE Budget for Individual Flood Control Project, $[1]

Year	Surveys, Feasibility, Preconstruction Engineering & Design	Construction	Sum of Operation & Maintenance	Sum of Total Expenditure
American River Watershed				
2003	$1,375,000	$27,180,000	$0	$28,555,000
2004	$50,000	$8,000,000	$0	$8,050,000
2005	$415,000	$11,175,000	$0	$11,590,000
2006	$0	$28,960,000	$0	$28,960,000
2007	$0	$46,800,000	$0	$46,800,000
2008	$0	$36,500,000	$0	$36,500,000
2009	$0	$13,000,000	$0	$13,000,000
2010	$0	$7,300,000	$0	$7,300,000
2011	$0	$4,700,000	$0	$4,700,000
2012	$0	$26,548,000	$0	$26,548,000
2013	$0	$11,500,000	$0	$11,500,000
2014	$0	$5,650,000	$0	$5,650,000
2015	$675,000	$1,200,000	$0	$1,875,000
2016	$3,500,000	$18,641,000	$0	$22,141,000

Table A-8. USACE Budget for Individual Flood Control Project, $[1]

Year	Surveys, Feasibility, Preconstruction Engineering & Design	Construction	Sum of Operation & Maintenance	Sum of Total Expenditure
American River Watershed (Folsom Dam JFP)				
2009	$0	$9,000,000	$0	$9,000,000
2010	$0	$66,700,000	$0	$66,700,000
2011	$0	$78,000,000	$0	$78,000,000
2012	$0	$21,000,000	$0	$21,000,000
2013	$0	$86,700,000	$0	$86,700,000
2014	$0	$66,400,000	$0	$66,400,000
2015	$0	$92,600,000	$0	$92,600,000
2016	$0	$56,024,000	$0	$56,024,000
Black Butte Lake				
2003	$0	$0	$2,034,000	$2,034,000
2004	$0	$0	$2,269,000	$2,269,000
2005	$0	$0	$1,882,000	$1,882,000
2006	$0	$0	$1,989,000	$1,989,000
2007	$0	$0	$1,452,202	$1,452,202
2008	$0	$0	$1,625,962	$1,625,962
2009	$0	$0	$1,232,458	$1,232,458
2010	$0	$0	$2,234,000	$2,234,000
2011	$0	$0	$2,367,000	$2,367,000
2012	$0	$0	$2,337,000	$2,337,000
2013	$0	$0	$2,259,000	$2,259,000
2014	$0	$0	$2,564,000	$2,564,000
2015	$0	$0	$2,233,000	$2,233,000
2016	$0	$0	$2,777,000	$2,777,000
Buchanan Dam, Eastman Lake				
2003	$0	$0	$1,796,000	$1,796,000
2004	$0	$0	$2,526,000	$2,526,000
2005	$0	$0	$1,958,000	$1,958,000
2006	$0	$0	$1,781,000	$1,781,000
2007	$0	$0	$1,300,337	$1,300,337
2008	$0	$0	$1,455,927	$1,455,927
2009	$0	$0	$1,103,573	$1,103,573
2010	$0	$0	$2,041,000	$2,041,000
2011	$0	$0	$2,119,000	$2,119,000
2012	$0	$0	$2,032,000	$2,032,000
2013	$0	$0	$1,919,000	$1,919,000
2014	$0	$0	$2,052,000	$2,052,000

Table A-8. USACE Budget for Individual Flood Control Project, $[1]

Year	Surveys, Feasibility, Preconstruction Engineering & Design	Construction	Sum of Operation & Maintenance	Sum of Total Expenditure
2015	$0	$0	$1,976,000	$1,976,000
2016	$0	$0	$2,001,000	$2,001,000
Farmington Dam				
2003	$0	$0	$308,000	$308,000
2004	$0	$0	$341,000	$341,000
2005	$0	$0	$526,000	$526,000
2006	$0	$0	$202,000	$202,000
2007	$0	$0	$147,484	$147,484
2008	$0	$0	$165,130	$165,130
2009	$0	$0	$125,167	$125,167
2010	$0	$0	$481,000	$481,000
2011	$0	$0	$0	$0
2012	$0	$0	$470,000	$470,000
2013	$0	$0	$450,000	$450,000
2014	$0	$0	$490,000	$490,000
2015	$0	$0	$558,000	$558,000
2016	$0	$0	$431,000	$431,000
Hidden Dam, Hensley Lake				
2003	$0	$0	$1,751,000	$1,751,000
2004	$0	$0	$2,621,000	$2,621,000
2005	$0	$0	$1,828,000	$1,828,000
2006	$0	$0	$2,090,000	$2,090,000
2007	$0	$0	$1,525,943	$1,525,943
2008	$0	$0	$1,708,528	$1,708,528
2009	$0	$0	$1,295,041	$1,295,041
2010	$0	$0	$2,170,000	$2,170,000
2011	$0	$0	$2,163,000	$2,163,000
2012	$0	$0	$2,272,000	$2,272,000
2013	$0	$0	$2,018,000	$2,018,000
2014	$0	$0	$2,067,000	$2,067,000
2015	$0	$0	$2,059,000	$2,059,000
2016	$0	$0	$2,180,000	$2,180,000
Marysville, Yuba City Levee Reconstruction				
2003	$0	$5,900,000	$0	$5,900,000
2004	$0	$500,000	$0	$500,000
2005	$0	$3,686,000	$0	$3,686,000

Table A-8. USACE Budget for Individual Flood Control Project, $[1]

Year	Surveys, Feasibility, Preconstruction Engineering & Design	Construction	Sum of Operation & Maintenance	Sum of Total Expenditure
Merced County Streams				
2003	$0	$500,000	$313,000	$813,000
2004	$0	$0	$280,000	$280,000
2005	$0	$0	$292,000	$292,000
2006	$0	$0	$251,000	$251,000
2007	$0	$0	$183,259	$183,259
2008	$0	$0	$205,187	$205,187
2009	$0	$0	$155,529	$155,529
2010	$0	$0	$451,000	$451,000
2011	$0	$0	$401,000	$401,000
2012	$0	$0	$399,000	$399,000
2013	$0	$0	$350,000	$350,000
2014	$0	$0	$400,000	$400,000
2015	$0	$0	$394,000	$394,000
2016	$0	$0	$387,000	$387,000
New Hogan Lake				
2003	$0	$0	$2,006,000	$2,006,000
2004	$0	$0	$2,789,000	$2,789,000
2005	$0	$0	$2,044,000	$2,044,000
2006	$0	$0	$1,994,000	$1,994,000
2007	$0	$0	$1,455,852	$1,455,852
2008	$0	$0	$1,630,050	$1,630,050
2009	$0	$0	$1,235,556	$1,235,556
2010	$0	$0	$2,515,000	$2,515,000
2011	$0	$0	$2,476,000	$2,476,000
2012	$0	$0	$2,456,000	$2,456,000
2013	$0	$0	$3,971,000	$3,971,000
2014	$0	$0	$2,593,000	$2,593,000
2015	$0	$0	$2,639,000	$2,639,000
2016	$0	$0	$2,993,000	$2,993,000
New Melones Lake				
2003	$0	$0	$1,651,000	$1,651,000
2004	$0	$0	$1,697,000	$1,697,000
2012	$0	$0	$1,897,000	$1,897,000
2013	$0	$0	$1,806,000	$1,806,000
2014	$0	$0	$1,937,000	$1,937,000
2015	$0	$0	$2,255,000	$2,255,000
2016	$0	$0	$1,998,000	$1,998,000

Table A-8. USACE Budget for Individual Flood Control Project, $[1]

Year	Surveys, Feasibility, Preconstruction Engineering & Design	Construction	Sum of Operation & Maintenance	Sum of Total Expenditure
Pine Flat Lake				
2003	$0	$0	$2,500,000	$2,500,000
2004	$0	$0	$2,732,000	$2,732,000
2005	$0	$0	$2,941,000	$2,941,000
2006	$0	$0	$2,831,000	$2,831,000
2007	$0	$0	$2,066,960	$2,066,960
2008	$0	$0	$2,314,278	$2,314,278
2009	$0	$0	$1,754,192	$1,754,192
2010	$0	$0	$3,201,000	$3,201,000
2011	$0	$0	$3,378,000	$3,378,000
2012	$0	$0	$3,291,000	$3,291,000
2013	$0	$0	$3,218,000	$3,218,000
2014	$0	$0	$3,593,000	$3,593,000
2015	$0	$0	$3,259,000	$3,259,000
2016	$0	$0	$3,409,000	$3,409,000
Sacramento and San Joaquin Basin Study				
2012	$300,000	$0	$0	$300,000
2013	$300,000	$0	$0	$300,000
2014	$466,000	$0	$1,500,000	$1,966,000
Sacramento River Bank Protection				
2003	$0	$6,916,000	$0	$6,916,000
2004	$0	$3,000,000	$0	$3,000,000
2005	$0	$3,400,000	$0	$3,400,000
2006	$0	$0	$0	$0
2007	$0	$10,960,000	$0	$10,960,000
2008	$0	$22,028,000	$0	$22,028,000
2009	$0	$23,968,000	$0	$23,968,000
2010	$0	$17,955,000	$0	$17,955,000
2011	$0	$15,000,000	$0	$15,000,000
2012	$0	$10,000,000	$0	$10,000,000
2013	$0	$3,000,000	$0	$3,000,000
2014	$500,000	$3,000,000	$0	$3,500,000
2015	$500,000	$1,000,000	$0	$1,500,000
2016	$500,000	$6,000,000	$0	$6,500,000
Sac-San Joaquin Delta Islands and Levees				
2003	$100,000	$0	$0	$100,000
2004	$1,100,000	$0	$0	$1,100,000
2009	$468,000	$0	$0	$468,000

Table A-8. USACE Budget for Individual Flood Control Project, $[1]

Year	Surveys, Feasibility, Preconstruction Engineering & Design	Construction	Sum of Operation & Maintenance	Sum of Total Expenditure
2010	$468,000	$0	$0	$468,000
2011	$468,000	$0	$0	$468,000
2012	$1,015,000	$0	$0	$1,015,000
2013	$1,015,000	$0	$0	$1,015,000
2014	$447,000	$0	$0	$447,000
San Joaquin River Basin				
2003	$600,000	$0	$0	$600,000
2004	$800,000	$0	$0	$800,000
2005	$530,000	$0	$0	$530,000
2014	$751,000	$0	$0	$751,000
South Sacramento County Streams				
2003	$0	$3,680,000	$0	$3,680,000
2004	$0	$2,100,000	$0	$2,100,000
2005	$0	$1,000,000	$0	$1,000,000
2006	$0	$2,852,000	$0	$2,852,000
2007	$0	$7,313,000	$0	$7,313,000
2008	$0	$8,000,000	$0	$8,000,000
2009	$0	$12,000,000	$0	$12,000,000
2010	$0	$2,500,000	$0	$2,500,000
2011	$0	$4,800,000	$0	$4,800,000
2012	$0	$5,000,000	$0	$5,000,000
Sutter County				
2003	$677,000	$0	$0	$677,000
2004	$200,000	$0	$0	$200,000
2005	$275,000	$0	$0	$275,000
2006	$361,000	$0	$0	$361,000
2007	$339,000	$0	$0	$339,000
2008	$339,000	$0	$0	$339,000
2009	$339,000	$0	$0	$339,000
2010	$339,000	$0	$0	$339,000
2011	$339,000	$0	$0	$339,000
2012	$339,000	$0	$0	$339,000
2013	$988,000	$0	$0	$988,000
Yuba River Basin				
2003	$250,000	$0	$0	$250,000
2005	$100,000	$0	$0	$100,000
2012	$0	$2,000,000	$0	$2,000,000
2013	$0	$1,800,000	$0	$1,800,000

Table A-8. USACE Budget for Individual Flood Control Project, $[1]

Year	Surveys, Feasibility, Preconstruction Engineering & Design	Construction	Sum of Operation & Maintenance	Sum of Total Expenditure
2014	$0	$1,800,000	$0	$1,800,000
2015	$0	$4,000,000	$0	$4,000,000
2016	$0	$7,361,000	$0	$7,361,000
Other				
2003	$325,000	$6,172,000	$0	$6,497,000
2004	$100,000	$2,600,000	$0	$2,700,000
2005	$400,000	$5,800,000	$0	$6,200,000
2006	$0	$5,000,000	$0	$5,000,000
2015	$800,000	$0	$0	$800,000

Note:
1. Expenditures not adjusted for inflation.

Source: USACE, 2002 - 2015

A.2.2 FEMA

Table A-9. FEMA Hazard Mitigation Assistance Expenditures in the Central Valley, Millions $[1]

FEMA HMA Programs	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Average
GF Expenses by Year											
Flood Mitigation Assistance (FMA)	0.2	0.9	1.2	1.1	0.6	0.7	0.1	1.1	1.1	0.3	0.9
Pre-Disaster Mitigation (PDM)	0.0	0.0	0.4	0.8	0.5	0.0	0.0	16.1	19.2	4.4	3.9
Hazard Mitigation Grants Program (HMGP)	151.5	173.8	120.9	48.9	0.1	0.0	0.0	36.1	15.0	33.9	42.2
Total	**151.7**	**174.7**	**122.6**	**50.8**	**1.1**	**0.7**	**0.1**	**53.3**	**35.2**	**38.6**	**52.7**

Note:
1. In 2015 dollars

Source: California State Auditor, 2007-2016

Table A-10. FEMA Flood Hazard Mapping Expenditures in California, Thousands $[1]

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Average
Funds given to California (DWR) through[2]												
CTP	230	67				352	152	-270	1,065	508	692	350
Map Modification	20	706	70	136	225	72	157	-2				173
Total	**250**	**773**	**70**	**136**	**225**	**424**	**309**	**-272**	**1,065**	**580**	**692**	**387**
FEMA Expenditures[3]												
Map Modification – State Total	32,000					No data						6,500
Map Modification – CVFPP Counties	6,150					No data						1,230
Risk Map – State Total	No data				13,500	16,000	No data					
Risk Map – CVFPP Counties	No data				4,500	No data						

Notes:
1. Nominal dollars due to inconsistent data reporting.
2. *Source: California State Auditor, 2006-2016*
3. *Source: FEMA, 2010*

A.3 Local Expenditures

A.3.1 City Expenditures on Flood Management

Table A-11. Estimated City Expenditures on Flood Management, Central Valley Region, FYs 2003-2014

	2003	2004	2005	2006	2007`	2008	2009	2010	2011	2012	2013	2014
Streets, Highways, Storm Drains ($ million)[1]												
Operating Expenditures	13	14	16	14	16	15	13	13	13	12	12	14
Capital Outlay	14	15	20	17	20	26	17	17	19	18	15	13
Total	**27**	**30**	**36**	**31**	**36**	**41**	**31**	**30**	**32**	**30**	**27**	**28**
Disaster Preparedness ($ million)[1]												
Operating Expenditures	0.13	0.01	0.03	0.12	0.05	0.03	0.03	0.02	0.02	0.00	0.00	0.01
Capital Outlay	0.00	0.03	0.02	0.02	0.02	0.01	0.01	0.00	0.00	0.00	0.00	0.02
Total	**0.13**	**0.04**	**0.05**	**0.13**	**0.07**	**0.05**	**0.04**	**0.02**	**0.02**	**0.00**	**0.00**	**0.03**
Grand Total	**27.31**	**29.90**	**35.95**	**31.40**	**36.14**	**40.74**	**30.62**	**30.22**	**32.04**	**29.99**	**27.22**	**27.71**

Note:
1. In 2015 dollars

Source: SCO (2016a)

A.3.2 County Flood Management Expenditures

Table A-12. County Expenditures on Flood Management, Central Valley Region, FYs 2003-2014

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Flood Control, Soil, Water Conservation ($ million)[1]												
Operation Expenditures	2.0	2.3	2.1	1.3	1.4	2.8	2.7	2.6	2.6	2.7	2.6	0.9
Capital Outlay	0.3	0.4	0.4	0.2	0.2	0.5	0.5	0.5	0.5	0.5	0.5	0.2
Total	**2.3**	**2.7**	**2.5**	**1.5**	**1.6**	**3.3**	**3.2**	**3.1**	**3.0**	**3.2**	**3.0**	**1.1**

Note:
1. In 2015 dollars

Source: SCO (2016b)

A.3.3 Special District Expenditures on Flood Management

Table A-13. Estimated Special District Expenditures on Flood Management, Central Valley Region, FYs 2003-2014

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Flood Control and Water Conservation ($ million)[1]												
Ongoing	33.0	35.0	33.0	34.3	59.1	44.6	43.7	41.6	41.6	38.1	41.1	41.7
Debt Service	7.9	8.7	8.8	49.0	8.9	8.1	13.6	22.8	20.2	20.3	21.8	24.5
Fixed Assets	17.8	18.4	16.7	13.1	22.7	15.1	18.9	32.7	21.2	36.0	25.4	66.8
Other	11.2	16.7	7.3	9.3	3.6	53.0	3.7	106.4	99.0	102.1	69.1	45.5
Total	**69.9**	**78.8**	**65.8**	**105.7**	**94.3**	**120.8**	**79.9**	**203.5**	**182.0**	**196.5**	**157.4**	**178.5**
Drainage and Drainage Maintenance ($ million)[1]												
Ongoing	67.1	57.5	73.5	82.4	35.0	37.5	39.6	37.2	43.5	47.3	43.8	44.6
Debt Service	4.7	4.2	6.6	4.8	0.5	0.8	0.8	0.7	0.7	0.9	5.2	0.9
Fixed Assets	1.2	0.8	3.6	0.3	5.5	16.3	1.1	0.1	6.9	5.0	11.6	8.0
Other	26.9	39.7	35.4	53.6	13.9	17.7	17.1	17.2	10.1	7.7	4.0	3.5
Total	**99.9**	**102.2**	**119.1**	**141.1**	**54.9**	**72.3**	**58.6**	**55.2**	**61.2**	**60.9**	**64.6**	**57.0**
Land Reclamation and Levee Maintenance ($ million)[1]												
Ongoing	26.7	31.7	33.4	39.2	43.7	64.5	137.5	106.2	68.3	81.3	64.8	61.0
Debt Service	3.0	3.5	2.3	2.9	2.2	3.9	4.5	11.3	7.2	8.9	7.4	5.4
Fixed Assets	3.4	1.4	1.1	2.5	98.1	18.2	7.6	5.7	6.6	3.7	4.5	0.9
Other	4.0	2.9	0.2	0.2	0.4	2.0	0.1	0.1	0.1	1.2	9.2	1.9
Total	**37.1**	**39.5**	**37.0**	**44.8**	**144.4**	**88.6**	**149.7**	**123.3**	**82.2**	**95.1**	**85.9**	**69.2**
Grand Total	**206.9**	**220.5**	**221.9**	**291.6**	**293.6**	**281.7**	**288.2**	**382.0**	**325.4**	**352.5**	**307.9**	**304.7**

Note:
1. In 2015 dollars

Source: SCO, 2016c

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Appendix B: Management Action Support

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Appendix B: Management Action Support

Table B-1. Flood Management Actions and Types

Management Action Type	Management Action
Flood Infrastructure 	Flood infrastructure varies significantly based on the type of flooding. Flood infrastructure can include the following:
	 ***Levees and Floodwalls.*** Levees and floodwalls are designed to confine flood flows by containing waters of a stream or lake.
	 ***Levee Setback.*** Setbacks improve channel conveyance, improve the level of safety, and minimize disruptions to vital riparian corridors.
	 ***Channels.*** Channels convey flood waters to reduce the risk of slow-rise, flash, and debris-flow flooding.
	 ***Bypasses.*** Bypasses redirect and convey flood waters to reduce the risk of slow-rise, flash, and debris-flow flooding.
	 ***Retention and Detention Basins.*** Retention and detention basins are used to collect stormwater runoff and slowly release it at a controlled rate so that vulnerable areas are not flooded or eroded.
	 ***Culverts and Pipes.*** Culverts and pipes are closed conduits used to drain stormwater runoff.
	 ***Coastal Armoring Structures, Shoreline Stabilization, and Streambank Stabilization.*** Coastal armoring structures and shoreline stabilization reduce risk to low-lying coastal areas from flooding.
	 ***Debris Mitigation Structures.*** Debris mitigation structures such as Sabo dams, debris fences, and debris basins separate large debris material from debris flows, or they contain debris flows above a protected area when debris and alluvial flooding occur.

Table B-1. Flood Management Actions and Types

Management Action Type	Management Action
	Hydraulic Structures. Hydraulic structures include gates, weirs, and inlet/outlet structures.
Reservoir and Floodplain Storage and Operations 	Reservoir and floodplain storage and operations include the following:
	Reservoir and Floodplain Storage. Reservoir and floodplain storage can regulate flood flows by reducing the magnitude of flood peaks occurring downstream.
	Storage Operations. Storage operations optimize the magnitude and timing of reservoir releases. This can reduce downstream flooding by optimizing the magnitude or timing of reservoir releases or through greater coordination of storage operations.
Operations, Maintenance, Repair, Rehabilitation, and Replacement 	Consistent facility maintenance (and necessary repairs) is fundamental to proper system function. Many flood facilities were constructed in the early to mid-twentieth century and are near or have exceeded their expected service lives. Within the SPFC and other systems, some facilities were built much earlier and incorporated into the systems in an as-built condition. In both cases, the challenge of maintaining these facilities can be increased by what are considered design deficiencies by today's engineering standards and land use needs. Proper O&M of functioning facilities can avoid the need for major repairs, new capital projects associated with deferred maintenance and keep costs low. Inadequate O&M (deferred maintenance) can result in very high repair, rehabilitation, or replacement costs (which can include mitigation for removing the vegetation that has been allowed to grow and is now considered habitat). Deferred maintenance also leads to increased financial and public safety risk exposure. OMRR&R actions include:
	Inspections and Assessment. Inspection of facilities is important to identify potential weaknesses in the system from encroachments and penetrations through levees as well as the condition of dams and other facilities. In addition, levee condition is routinely inspected by local agencies as well as DWR and USACE on State or Federal sponsored projects.
	Operation and Maintenance. Routine or periodic operation and maintenance includes activities that have to be performed at a minimum on an annual or semiannual basis. This includes management of vegetation (such as invasive species and channel snags), sediment removal, rodent and burrowing vector control to maintain levee integrity, minor erosion, levee crown repairs, and bank stabilization. O&M of pumping plants, gates and closure structures, weirs and overflow structures, as well as other flood control facilities are also included.

Table B-1. Flood Management Actions and Types

Management Action Type	Management Action
	Repair and Rehabilitation. As flood systems and infrastructure ages it requires repair and rehabilitation to continue to function. The age and condition of current systems and inadequate O&M funding over the last several decades has resulted in substantial facility repair and rehabilitation needs. Repair and rehabilitation of portions of levees, channels, and other infrastructure is required and is exacerbated by significant storm events. Some facilities were not designed or constructed to accommodate current conditions. Once facilities are rehabilitated to proper condition, consistent O&M supports avoidance of future major repairs, although minor repairs including erosion, patrol roads, pumps, upgrades to SCADA and mechanical/electrical systems, and other facility wear and tear will always be required.
	Replacement. Some flood management structures and systems are aging and approaching the end of their designed useful life. If not rehabilitated or repaired, some structures may fail or become functionally obsolete. Replacement of such facilities (by either a functionally equivalent or upgraded structure) is necessary where repair or rehabilitation is not an option.
Watershed and Floodplain Management 	Watershed and floodplain management generally refers to actions that consider human and ecological needs and work to balance risk and reward within the floodplain. Watershed and floodplain management actions can include:
	Floodplain Mapping. Floodplain mapping allows for more reliable risk assessment and mitigation. Risk assessments provide better results if done on a large scale to include all of the watershed or river basin.
	Building Codes and Floodproofing. Building codes and floodproofing include specific measures that reduce flood damage and preserve egress routes during high-water events.
	Flood Insurance. Flood insurance is provided by the Federal government via NFIP to communities that adopt and enforce an approved floodplain management ordinance to reduce future flood risk. Annual premiums are based on the level of risk. Premiums are high for frequently flooded communities and can increase over time depending on claims and frequency of flood events.
	Land Acquisitions and Easements. Land acquisitions and easements can be used to restore or preserve natural floodplain lands and to reduce the damages from flooding by preventing urban development.
	Retreat. Retreat is the permanent relocation, abandonment, or demolition of buildings and other structures.

Table B-1. Flood Management Actions and Types

Management Action Type	Management Action
	 ***Flood Risk Awareness.*** Flood risk awareness can be raised through information and education efforts.
	 ***Land Use Planning.*** Policies, ordinances, regulations, and practices can be used to limit development in flood-prone areas and encourage land uses compatible with existing water resources and floodplain functions. This can include policies and practices that restrict or prohibit development within floodplains, restrict size and placement of structures, prevent new development from incorporating adverse flood impacts to existing structures, encourage reduction of impervious areas, require floodproofing of buildings, encourage efficient use of water, protect sensitive ecosystems, and encourage long-term restoration of streams and floodplains.
	 ***Studies and Analysis.*** Studies and analysis allow for more reliable risk assessment and a better understanding of the watershed or river basin.
	 ***Performance Tracking and Technical Support.*** Performance Tracking and Technical Support increase public agencies' capacity to monitor and synthetize information about the effectiveness of investments. Technical support includes monitoring, metric and tool development, resource capabilities, and scientific research.
Natural Floodplain and Ecosystem Functions 	Natural floodplain and ecosystem functions can be a preferred alternative to restricting flood flows to an existing channel. Actions that support these include the following:
	 ***Restoration of Riverine and Floodplain Habitats***. Targeted habitats include SRA cover, riparian, marsh, and other wetland habitats, as well as wildlife-friendly floodplain agriculture; and specific actions include protecting and restoring quantity, quality, and connectivity of these habitats. Implementing these improvements along a river corridor may have a positive impact on the overall hydraulic function of a drainage system, and contribute to meeting permitting and mitigation requirements.
	 ***Floodplain Reconnection***. Ecosystem processes that sustain both riverine and riparian ecosystems occur during floodplain inundation events. Implementing this management action provides opportunities to reduce costly maintenance to flood infrastructure (e.g., repetitive erosion issues), leverage non-traditional funding sources, and provide species benefits that may contribute to meeting permitting and mitigation requirements, as well as a reduction in permitting burden through delisting of endangered species.
	Reduce Stressors. Stressors to natural floodplain and ecosystem functions include invasive species, revetment along channel banks, and barriers to fish passage.
	 Invasive species eradication and maintenance addresses problems for both water management and ecosystems because those species can decrease channel capacity, increase rate of sedimentation, and increase maintenance costs.

Table B-1. Flood Management Actions and Types

Management Action Type	Management Action
	 Revetment can affect the hydraulics of river channels, constraining dynamic natural fluvial geomorphologic processes of erosion, deposition, and channel meander that contribute to healthy and sustainable ecosystems.
	 Barriers to fish passage have caused delays to fish migration, and in some cases have made historical spawning and rearing habitats inaccessible. Annual costs related to monitoring, fish rescue, and special maintenance activities would be alleviated by reducing these stressors.
Emergency Management 	Emergency management includes the following:
	 ***Emergency Preparedness.*** Emergency preparedness is the development of plans and procedures on how to respond to an emergency in advance of an event, including emergency response plans, evacuation procedures, and exercises to assess readiness.
	 ***Emergency Response.*** Emergency response is the aggregate of all those actions taken by responsible parties at the time of an emergency, including early warning of events, response, and emergency sheltering.
	 ***Recovery programs and actions.*** Recovery programs and actions include restoring utility services and public facilities, repairing damaged facilities, draining flooded areas, removing debris, and assisting individuals, businesses, and communities to protect lives and property.
Programmatic, or Project-Specific Permitting 	Permitting includes the following:
	 ***Project- or Program-Specific Permitting.*** Permitting on a project-by-project basis can increase administrative costs, permitting and mitigation costs, and construction costs as well as increase schedule delays.
	 ***Regional and Programmatic Permitting.*** Regional and programmatic permitting methods can increase efficiency of delivery of flood or water management activities, including operations, maintenance, repair, habitat enhancement and restoration, and minor infrastructure improvement or construction projects. Regional and programmatic permitting methods can be used to collectively manage permitting needs for multiple projects, over longer planning horizons, while consolidating mitigation and conservation efforts into larger, more viable conservation areas. A regional approach can accelerate permitting of system projects and lower per-unit costs versus project-by-project mitigation. Regional and programmatic permitting methods include regional Habitat Conservation Plans, Natural Community Conservation Plans, programmatic (Federal) Endangered Species Act Section 7 consultations, and regional general permits. The process may take 3 to 10 years. However, the long-term cost is relatively low because individual permits with continuously changing conditions are not necessary.

Table B-1. Flood Management Actions and Types

Management Action Type	Management Action
Policy and Regulations 	***Policy and Regulations.*** These actions can clarify flood management roles and responsibilities for local, regional, State, and Federal agencies to improve coordination across the large number of agencies and entities involved in flood management. Multiple jurisdictional and regional partnerships can facilitate emergency planning and emergency management activities, including permitting, financing, operation and maintenance, repair, and restoration. Policies and regulations can include investment in human and technological resources to encourage a river basin scale approach to water and flood management.
Finance and Revenue 	***Finance and Revenue.*** These strategies can increase the ability to fund water management projects. Aligning flood management projects with other existing or planned projects (such as roads or highways) leverages funding from different agencies and jurisdictions to help accomplish objectives. Consolidating projects on a regional or watershed level can also improve cost effectiveness and financial feasibility by pooling resources. The initial cost of collaborating on projects or programs can be significant to an agency. However, it can make building and maintaining water management systems affordable and sustainable. Also, identifying new or revising existing finance/revenue mechanisms can improve public agencies' ability to fund capital and O&M needs and provide avenues to work together within river-basin geographies.

Table B-2. Capital Management Action Types and Data Sources of the 2017 Refined SSIA Portfolio

Management Action Category and Area of Interest	Relevant Management Action Types and Management Actions	Data Source	Detailed Data Source
Systemwide			
Yolo Bypass multi-benefit improvements	■ **Flood Infrastructure:** Levees and Floodwalls, Levee Setback, Channels, Bypasses, Culverts and Pipes, Hydraulic Structures ■ **Operation, Maintenance, Repair, Rehabilitation, and Replacement:** Repair and Rehabilitation, Replacement ■ **Natural Floodplain and Ecosystem Functions:** Restoration of Riverine and Floodplain Habitats	BWFSs	■ **BWFSs:** Yolo Bypass State preferred option from the Sacramento BWFS November 2016. Multiple projects entries for levee improvements, levee setbacks, habitat enhancements etc.
Feather River–Sutter Bypass multi-benefit improvements	■ **N/A** – Single line project entry for Feather River-Sutter Bypass multi-benefit improvements	BWFSs	■ **BWFSs:** Feather River-Sutter Bypass multi-benefit improvements State preferred option from the Sacramento BWFS November 2016.
Paradise Cut multi-benefit improvements	■ **Flood Infrastructure:** Bypasses ■ **Watershed and Floodplain Management:** Land Acquisitions and Easements	BWFSs	■ **BWFSs:** Paradise Cut State preferred Option M – Agricultural focused from the San Joaquin BWFS November 2016. Land acquisition cost separate project entry.
Reservoir and floodplain storage	■ **Flood Infrastructure:** Retention and Detention Basins ■ Reservoir and Floodplain Storage and Operations: Reservoir and Floodplain Storage ■ **Watershed and Floodplain Management:** Land Acquisitions and Easements ■ **Natural Floodplain and Ecosystem Functions:** Floodplain Reconnection	BWFSs and RFMPs	■ **BWFSs:** Dos Rios/Hidden Valley Ranch Transitory Storage, Three Amigos Transitory Storage, Upstream Reservoir Enlargements, Western Madera and Merced County Subsidence Solution, Land Acquisitions for Dos Rios and Flowage Easements from San Joaquin BWFS November 2016. ■ **RFMPs:** Bullards Bar Outlet Modification, Upper San Joaquin River Upstream Reservoir Enlargements
Urban			
Levee improvements	■ **Flood Infrastructure:** Levees and Floodwalls	USACE	■ **USACE:** USACE-led improvements for urban areas: Natomas, Chico, Marysville, Yuba City, Sacramento, West Sacramento, American River Watershed, Stockton, and Merced.

Table B-2. Capital Management Action Types and Data Sources of the 2017 Refined SSIA Portfolio

Management Action Category and Area of Interest	Relevant Management Action Types and Management Actions	Data Source	Detailed Data Source
Other infrastructure and multi-benefit improvements	▪ **Flood Infrastructure:** Levee Setback, Channels, Bypasses, Retention and Detention Basins, Culverts and Pipes, Hydraulic Structures ▪ **Operation, Maintenance, Repair, Rehabilitation, and Replacement:** Repair and Rehabilitation, Replacement ▪ **Reservoir and Floodplain Storage and Operations**: Reservoir and Floodplain Storage ▪ **Watershed and Floodplain Management:** Land Acquisitions and Easements ▪ **Natural Floodplain and Ecosystem Functions:** Restoration of Riverine and Floodplain Habitats, Floodplain Reconnection	BWFSs, RFMPs, and OMRR&R Workgroup	▪ **BWFSs:** Mormon Channel Bypass, RD 17 Multi-benefit improvements and RM 52 levee setback from San Joaquin BWFS November 2016. ▪ **RFMPs:** Misc. levee setbacks, bypasses, retention and detention basins, channel improvements, hydraulic structures, reservoir and floodplain storage. Deferred repair, rehabilitation, and replacement for levees, channels, major and minor structures. ▪ **OMRR&R Work Group:** Future repair, rehabilitation, and replacement of levees, channels, major and minor structures including pipe penetrations.
Rural			
Levee repair and infrastructure improvements	▪ **Flood Infrastructure:** Levees and Floodwalls, Channels, Retention and Detention Basins, Culverts and Pipes, Hydraulic Structures ▪ **Operation, Maintenance, Repair, Rehabilitation, and Replacement:** Repair and Rehabilitation, Replacement	BWFSs, RFMPs, and OMRR&R Workgroup	▪ **BWFSs:** Raise Levees (Baseline, SJRRP Reach 4B1, Bypass Alternative) in Subsidence Area, Chowchilla Bypass Bifurcation Structure Rehabilitation from the Sacramento BWFS November 2016. ▪ **RFMPs:** Misc. levees, floodwalls, channels, culverts and pipes, hydraulic structures, retention and detention basins. Deferred repair, rehabilitation, and replacement. ▪ **OMRR&R Work Group:** Future repair, rehabilitation, and replacement of levees, channels, major and minor structures including pipe penetrations.
Small-scale levee setbacks and floodplain storage	▪ **Flood Infrastructure:** Levees Setbacks, Bypasses ▪ **Reservoir and Floodplain Storage and Operations**: Reservoir and Floodplain Storage	BWFSs and RFMPs	▪ **BWFSs:** Levee setback RM 60-65 from the Sacramento BWFS November 2016. ▪ **RFMPs:** Misc. Levee setbacks, bypass, reservoir and floodplain storage project entries.

Table B-2. Capital Management Action Types and Data Sources of the 2017 Refined SSIA Portfolio

Management Action Category and Area of Interest	Relevant Management Action Types and Management Actions	Data Source	Detailed Data Source
Land acquisitions and easements	■ **Watershed and Floodplain Management:** Land Acquisitions and Easements	RFMPs and floodplain management effort	■ **RFMPs:** Misc. agricultural easements or access easements ■ **Floodplain management effort:** land acquisition buffer for densely populated areas
Habitat restoration/reconnection	■ **Natural Floodplain and Ecosystem Functions:** Restoration of Riverine and Floodplain Habitats, Floodplain Reconnection	RFMPs	■ **RFMPs:** Misc. restoration of riverine and floodplain habitats and floodplain reconnection project entries
Small Community			
Levee repair and infrastructure improvements	■ **Flood Infrastructure:** Levees and Floodwalls, Channels, Retention and Detention Basins, Culverts and Pipes, Hydraulic Structures ■ **Operation, Maintenance, Repair, Rehabilitation, and Replacement:** Repair and Rehabilitation, Replacement	BWFSs, RFMPs, and OMRR&R Workgroup	■ **BWFS:** Rio Vista improvements and Firebaugh improvements Option C from the Sacramento BWFS November 2016. ■ **RFMPs:** Misc. levees, floodwalls, channels, culverts and pipes, hydraulic structures, retention and detention basins. Deferred repair, rehabilitation, and replacement. ■ **OMRR&R Work Group:** Future repair, rehabilitation, and replacement of levees, channels, major and minor structures including pipe penetrations and chronic giant reed removal.
Levee setbacks, land acquisitions, and habitat restoration	■ **Flood Infrastructure:** Levees Setbacks, Bypasses ■ **Reservoir and Floodplain Storage and Operations:** Reservoir and Floodplain Storage ■ **Natural Floodplain and Ecosystem Functions:** Restoration of Riverine and Floodplain Habitats, Floodplain Reconnection ■ **Watershed and Floodplain Management:** Land Acquisitions and Easements	RFMPs and floodplain management effort	■ **RFMPs:** Misc. levee setbacks, bypass, reservoir and floodplain storage project entries ■ **Floodplain management effort:** Land/property acquisitions

Table B-3. Ongoing Management Action Types and Data Sources of the 2017 Refined SSIA Portfolio

Management Action Category and Area of Interest	Relevant Management Action Types and Management Actions	Data Source	Detailed Data Source
Systemwide			
State Operations, planning and performance tracking	■ **Watershed and Floodplain Management:** floodplain Mapping, Building Codes and Floodproofing, Flood Risk Awareness, Land Use Planning, Studies and Analysis, Performance Tracking and Technical Support ■ **Programmatic, or Project-Specific Permitting:** Programmatic, or Project-Specific Permitting, ■ **Policy and Regulations:** Policy and Regulation ■ **Finance and Revenue:** Finance and Revenue	RFMPs and State operations/planning effort	■ **RFMPs:** Misc. policy, management & regulations, finance and revenue project entries. ■ **State operations/planning effort:** State operation in support of 30-year implementation, activities associated with State policy, planning and performance tracking.
Emergency management	■ **Emergency Management:** Emergency Preparedness, Emergency Response and Recovery programs and actions	RFMPs and emergency management effort	■ **RFMPs:** Misc. emergency preparedness project entries. ■ **Emergency management effort:** Local/operational and State flood emergency planning and preparedness.
Reservoir operations	■ **Reservoir and Floodplain Storage and Operations:** Storage Operations	RFMPs and BWFSs	■ **RFMPs:** Forecast-Coordinated Operations for Yuba and Feather Rivers (F-CO), Forecast-Based Operations for Oroville (F-BO), Coordinated Reservoir Ops for Lower San Joaquin LMAs. ■ **BWFSs:** Increase Objective Release from New Don Pedro in the Tuolumne River Watershed from San Joaquin BWFS November 2016.
Routine maintenance	■ **Operation, Maintenance, Repair, Rehabilitation, and Replacement:** Inspections and Assessment, Operation and Maintenance	RFMPs and OMRR&R Workgroup	■ **RFMPs:** Systemwide routine operation and maintenance (mostly sediment removal in bypass systems), channel dredging, vegetation and invasive species management, rodent control. ■ **OMRR&R Work Group:** Future routine maintenance of levees, channels, major and minor structures including rodent control, vegetation management, and sediment management.

Table B-3. Ongoing Management Action Types and Data Sources of the 2017 Refined SSIA Portfolio

Management Action Category and Area of Interest	Relevant Management Action Types and Management Actions	Data Source	Detailed Data Source
Urban			
Risk awareness, floodproofing and land use planning	▪ **Watershed and Floodplain Management:** Floodplain Mapping, Building Codes and Floodproofing, Flood Risk Awareness, Land Use Planning, Performance Tracking and Technical Support	RFMPs and floodplain management effort	▪ **RFMPs:** Misc. floodplain mapping, building codes and floodproofing, flood risk awareness, land use planning, performance tracking and technical support project entries. ▪ **Floodplain management effort:** mapping, risk awareness and land use planning, elevating and floodproofing structures, nonstructural berms and interior drainage.
Studies and analysis	▪ **Watershed and Floodplain Management:** Studies and Analysis	RFMPs and USACE	▪ **RFMPs:** Misc. studies and analysis project entries for 200-year level of protection and local system performance.
Rural			
Risk awareness, floodproofing and land use planning	▪ **Watershed and Floodplain Management:** Floodplain Mapping, Building Codes and Floodproofing, Flood Risk Awareness, Land Use Planning, Performance Tracking and Technical Support	RFMPs and floodplain management effort	▪ **RFMPs:** Misc. floodplain mapping, building codes and floodproofing, flood risk awareness, land use planning, performance tracking and technical support project entries. ▪ **Floodplain management effort:** mapping, risk awareness and land use planning, elevating and floodproofing structures, nonstructural berms and interior drainage.
Studies and analysis	▪ **Watershed and Floodplain Management:** Studies and Analysis	RFMPs	▪ **RFMPs:** Misc. studies and analysis project entries for 100-year level of protection and local system performance.

Table B-3. Ongoing Management Action Types and Data Sources of the 2017 Refined SSIA Portfolio

Management Action Category and Area of Interest	Relevant Management Action Types and Management Actions	Data Source	Detailed Data Source
Small Community			
Risk awareness, floodproofing and land use planning	■ **Watershed and Floodplain Management:** Floodplain Mapping, Building Codes and Floodproofing, Flood Risk Awareness, Land Use Planning, Performance Tracking and Technical Support	RFMPs and floodplain management effort	■ **RFMPs:** Misc. floodplain mapping, building codes and floodproofing, flood risk awareness, land use planning, performance tracking and technical support project entries. ■ **Floodplain management effort:** mapping, risk awareness and land use planning, elevating and floodproofing structures, nonstructural berms and interior drainage.
Studies and analysis	■ **Watershed and Floodplain Management:** Studies and Analysis	RFMPs and Small Communities Program	■ **RFMPs and Small Communities Program:** Misc. studies and analysis project entries for 100-year level of protection and local system performance.

Table B-4. Sacramento Basin Management Actions Included within the 2017 Refined SSIA Portfolio

#	Data Set Source	Lead Agency	Project Name	Project Description	Estimated Cost - Provided by Source	Estimated Cost - Adjusted for Portfolio	Area of Interest and Management Action Category	Management Action Type
1	RFMP	Wheatland	100 year alternatives for Dry Creek Levee and Bear River	This is a feasibility study to evaluate 100 year alternatives for repairs on the southern portion of the Dry Creek Levee and Bear River in RD 817 protecting the city of Wheatland.This project constitutes Phase 2 of RD 2103's goal of providing up to 200 year protection. Phase 1 included the design and repair of 5 miles on the Bear River North Levee south of Wheatland and was partially funded by DWR.	$ 797,000	$ 797,000	Small Community - Studies and analysis	Watershed and Floodplain Management
2	RFMP	California Department of Water Resources	100-year/200-year WS Profiles for Sacramento River and Butte Basin	Develop 100-year/200year WS Profiles for Sacramento River and Butte Basin	$ 500,000	$ 500,000	Rural - Studies and analysis	Watershed and Floodplain Management
3	RFMP	Sutter Butte Flood Control Agency	Additional levee improvement projects to achieve 100-year flood protection for the southern portions of the basin	Despite the ongoing improvements to the Feather River west levee, the Southern Sub-basin, with a population of 3,000 and valuable agricultural infrastructure, will continue to be imperiled by the low level of flood protection provided by the remaining levees surrounding the basin. These levees, including the lower Feather River west levee, the Sutter Bypass east levee and Wadsworth Canal levees are estimated to currently provide 10-year level of flood protection. While pursuing the long term goal of 100-year flood protection for the southern sub-basin that achieves the dual goals of reducing flood risk and regulatory/financial burden in the FEMA floodplain, SBFCA will concurrently pursue a two-track approach. First, SBFCA will prioritize limited improvements of critically deficient levees that provide the greatest risk reduction at least cost. Second, SBFCA and its partners will seek appropriate FEMA regulatory relief for the agricultural floodplain.	$ 191,277,000	$ 191,277,000	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
4	RFMP	Reclamation District 1001, Nicolaus	Address specific seepage, under seepage, erosion, and stability concerns for the Feather River levee	Address specific seepage, under seepage, erosion, and stability concerns for the Feather River levee, from the Natomas Cross Canal to the River Oaks Golf Course. This would include filling the land side scour hole created when this levee was breached near Verona to drain flood waters in December 1955. 50% of 8.2 miles of seepage berm; seepage berm 80' X 4' w/collection pipe levee from the Natomas Cross Canal to the River Oaks Golf Course (Levee Unit 4, Levee Miles 5.2 to 13.4) and repairs to the Natomas Cross Canal downstream of Highway 99.	$ 5,400,000	$ -	Small Community - Levee repair and infrastructure improvements	Operation and Maintenance
5	RFMP	Reclamation District 2068, Yolano	Adoption into California Water Code 8361	Preferred Solution to funding long-term O&M requirements of the flood protection system is for the State to adopt Reclamation District 2068 levee system into the California Water Code Section 8361. Estimated cost: $350,000 per year, present value for 30 years at 3% $6,860,154.	$ 6,860,154	$ 6,860,155	Systemwide - State operations, planning and performance tracking	Policy and Regulations
6	RFMP	N/A	Advanced Regional Mitigation Banks	Advanced mitigation of flood management improvements provides a means of making flood maintenance less expensive and timelier.	$ 10,000,000	$ 10,000,000	Systemwide - Routine maintenance	Operation and Maintenance
7	Other	California Department of Water Resources	Agricultural Land Easements: Small Community 1/2 mile Buffer	Small Community 1/2 Mile Buffer for Agricultural Land Acquisition. Acquisitions include property for permanent and non-permanent crops within the 100-year floodplain only.	$ 183,270,000	$ 183,270,000	Rural - Land acquisitions and easements	Watershed and Floodplain Management
8	Other	California Department of Water Resources	Agricultural Land Easements: Small Community 1/2 mile Buffer	Small Community 1/2 Mile Buffer for Agricultural Land Acquisition. Acquisitions include property for permanent and non-permanent crops within the 100-year floodplain only.	$ 69,320,000	$ 69,320,000	Rural - Land acquisitions and easements	Watershed and Floodplain Management

Table B-4. Sacramento Basin Management Actions Included within the 2017 Refined SSIA Portfolio

#	Data Set Source	Lead Agency	Project Name	Project Description	Estimated Cost - Provided by Source	Estimated Cost - Adjusted for Portfolio	Area of Interest and Management Action Category	Management Action Type
9	Other	California Department of Water Resources	Agricultural Land Easements: Small Community 1/2 mile Buffer	Small Community 1/2 Mile Buffer for Agricultural Land Acquisition. Acquisitions include property for permanent and non-permanent crops within the 100-year floodplain only.	$ 79,450,000	$ 79,450,000	Rural - Land acquisitions and easements	Watershed and Floodplain Management
10	Other	California Department of Water Resources	Agricultural Land Easements: Urban 2-mile Buffer	Urban 2 Mile Buffer for Agricultural Land Acquisition. Acquisitions include property for permanent and non-permanent crops within the 100-year floodplain only.	$ 147,250,000	$ 147,250,000	Rural - Land acquisitions and easements	Watershed and Floodplain Management
11	Other	California Department of Water Resources	Agricultural Land Easements: Urban 2-mile Buffer	Urban 2 Mile Buffer for Agricultural Land Acquisition. Acquisitions include property for permanent and non-permanent crops within the 100-year floodplain only.	$ 49,050,000	$ 49,050,000	Rural - Land acquisitions and easements	Watershed and Floodplain Management
12	Other	California Department of Water Resources	Agricultural Land Easements: Urban 2-mile Buffer	Urban 2 Mile Buffer for Agricultural Land Acquisition. Acquisitions include property for permanent and non-permanent crops within the 100-year floodplain only.	$ -	$ -	Rural - Land acquisitions and easements	Watershed and Floodplain Management
13	RFMP	City of Rio Vista	Airport Drive Drainage Improvements	Inadequate drainage during heavy storms at Church and Airport Road intersection. City would like to increase size of culverts and realign drainage ditches. Similar project estimated costs: Seven Mile Slough French Drain $413,000, Georgiana Slough French Drain $2,067,000, Mokelumne River French Drain $258,000. Average of three projects: $912,667	$ 912,667	$ 912,667	Small Community - Levee repair and infrastructure improvements	Flood Infrastructure
14	RFMP	Marysville Levee District	All-weather patrol road improvements	Project for improvements in the levee patrol road surface to assure all weather access during high water events.	$ 50,000	$ 50,000	Systemwide - Emergency management	Emergency Management
15	RFMP	Reclamation District 10, Honcut	All-weather patrol road improvements - RD 10	Project for ensuring the integrity of the all-weather patrol road on the levee crown.	$ 1,380,000	$ 1,380,000	Systemwide - Emergency management	Emergency Management
16	USACE	Sacramento Area Flood Control Agency, United States Army Corp of Engineers	American River Levee Improvements	Anticipatory erosion control program to protect the improved levees from failure due to erosion induced by sustained high flows in the river channel. Completed by 2030.	$ 32,000,000	$ -	Urban - Levee improvements	Flood Infrastructure
17	USACE	Sacramento Area Flood Control Agency, United States Army Corp of Engineers	American River Levee Improvements (Erosion Control Component)		$ 350,000,000	$ -	Urban - Levee improvements	Flood Infrastructure

Table B-4. Sacramento Basin Management Actions Included within the 2017 Refined SSIA Portfolio

#	Data Set Source	Lead Agency	Project Name	Project Description	Estimated Cost - Provided by Source	Estimated Cost - Adjusted for Portfolio	Area of Interest and Management Action Category	Management Action Type
18	RFMP	Reclamation District 2098, Cache Haas Area	Back Levee Erosion Repair Project - RD 2098	A portion of the levees comprising the western boundary of RD-2098 have a history of waterside levee slope and toe erosion primarily associated with the close proximity of a water supply canal. The reach from approximately LM 9.7 to 12.2 experiences minor but constant erosion from continuous water deliveries through the canal for a significant portion of every year. An erosion protection feature is required to ensure waterside levee toe stability and avoid recurring waterside slope and toe repairs. The water supply canal through this reach was constructed and operational prior to construction of the levee. Rock armoring needs to be applied all along the toe of the irrigation canal side of the back levee. Similar project estimated costs: rock slope protection lisbon $4,216,000, rock slope protection ryer $7,337,000, rock slope protection tyler $841,000. Average of three projects: $4,131,333.	$ 4,131,333	$ 4,131,333	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
19	RFMP	Reclamation District 2068, Yolano	Back Levee Erosion Repair Project - Yolano	A portion of the levees comprising the western boundary of RD-2068 have a history of waterside levee slope and toe erosion primarily associated with the close proximity of a water supply canal. The reach from approximately LM 0.0 to 2.0 experiences minor but constant erosion from continuous water deliveries through the canal for a significant portion of every year. An erosion protection feature is required to ensure waterside levee toe stability and avoid recurring waterside slope and toe repairs. The water supply canal, through this reach, was constructed and operational prior to construction of the levee. Rock armoring needs to be applied all along the toe of the irrigation canal side of the back levee. Similar project estimated costs: rock slope protection lisbon $4,216,000, rock slope protection ryer $7,337,000, rock slope protection tyler $841,000. Average of three projects: $4,131,333.	$ 4,131,333	$ 4,131,333	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
20	RFMP	Wheatland	Bear River north levee ULDC compliance evaluation.	Project should be combined with project Sac_006. Redundant project. Bear River North Levee Rehabilitation Project June 2010. Work completed, just need evaluation.	$ 250,000	$ -	Systemwide - Routine maintenance	Operation and Maintenance
21	RFMP	Reclamation District 1001, Nicolaus	Bear River south bank, Pleasant Grove Road to high ground	Phased improvements to the RD1001 levee system, Segment 246, to achieve 100-year FEMA levee protection. Reference: Non-Urban Levee Evaluations Project Remedial Alternatives and Cost Estimates Report (NULE RACER).	$ 109,742,000	$ 109,742,000	Small Community - Levee repair and infrastructure improvements	Flood Infrastructure
22	RFMP	Reclamation District 1001, Nicolaus	Bear River south bank, Yankee Slough to Pleasant Grove Road	Phased improvements to the RD1001 levee system, Segment 283, to achieve 100-year FEMA levee protection. Reference: Non-Urban Levee Evaluations Project Remedial Alternatives and Cost Estimates Report (NULE RACER).	$ 75,148,000	$ 75,148,000	Small Community - Levee repair and infrastructure improvements	Flood Infrastructure
23	USACE	Butte County, City of Chico	Big Chico Creek, Little Chico Creek, and Comanche Creek Flood Reduction Improvements	Evaluate flood carrying capacity of Big Chico Creek, Little Chico Creek, and Comanche Creek in light of increased flows due to urbanization of surrounding areas.	$ 100,000	$ 100,000	Urban - Levee improvements	Flood Infrastructure
24	BWFS	California Department of Water Resources	Bryte Landfill Remediation	The old Bryte Landfill, now closed, lies adjacent to the existing north levee of the Sacramento Bypass near its junction with the Yolo Bypass east levee. The alignment of the new Yolo Bypass and Sacramento Bypass levees could potentially leave this landfill site within the floodway, which could result in dispersal of its toxic materials. Reasonable methods for preventing such dispersal could include full avoidance or excavating the contaminated material and hauling it to an appropriate licensed landfill site (depending upon the toxicity of contaminants), moving the material to create an elevated staging area in the northwest corner of the new junction of the two bypass levees (with appropriate contamination barriers, drainage, and monitoring), or combinations of these actions.	$ -	$ 5,000,000	Systemwide - Yolo Bypass multi-benefit improvements	Flood Infrastructure
25	BWFS	California Department of Water Resources	Build Prospect Island Cross Levee	Prospect Island, currently flooded and under development as improved fisheries and wildlife habitat by DWR, could provide incremental flood storage and conveyance improvements in the lower Yolo Bypass by breaching about 30 % of the DWSC east levee (Figure 5-19). This would expand the lower Yolo Bypass active floodplain by 1,200 acres.	$ 7,000,000	$ 7,000,000	Systemwide - Yolo Bypass multi-benefit improvements	Flood Infrastructure

Table B-4. Sacramento Basin Management Actions Included within the 2017 Refined SSIA Portfolio

#	Data Set Source	Lead Agency	Project Name	Project Description	Estimated Cost - Provided by Source	Estimated Cost - Adjusted for Portfolio	Area of Interest and Management Action Category	Management Action Type
26	RFMP	Yuba County Water Agency	Bullard's Bar Outlets Modification	Project to increase flood capacity by adding a second gated spillway tunnel to the outlet works at New Bullard's Bar Dam. The additional spillway which was analyzed in the operation consisted of three 15.5-foot wide by 26-foot high gated openings set at an invert elevation of 1,893 feet. The sill of the additional gates would be about nine feet lower than the invert of the existing gates, which would increase the reservoir release capacity by 20,000 CFS when the reservoir flood pool is not encroached.	$ 140,000,000	$ 140,000,000	Systemwide - Reservoir and floodplain storage	Reservoir and Floodplain Storage and Operation
27	RFMP	Westervelt	Bullock Bend Mitigation Bank	Create a mitigation bank for salmonids	$ 10,000,000	$ 10,000,000	Systemwide - State operations, planning and performance tracking	Policy and Regulations
28	RFMP	California Department of Water Resources	Butte Basin Overflow Weir Maintenance	Improved maintenance by DWR is needed following flood events (cleaning debris, repairing washout damage, etc.) at Goose Lake and M&T weirs.	$ 100,000	$ 100,000	Systemwide - Routine maintenance	Operation and Maintenance
29	RFMP	N/A	Butte City 100-Year Level of Protection	Provide Butte City with a 100-Year level of protection	$ -	$ -	Small Community - Studies and analysis	Watershed and Floodplain Management
30	RFMP	California Department of Water Resources	Butte Slough Outfall Gates Replacement	Replacement of the Butte Slough outfall gates to improve O&M and fish passage.	$ 5,000,000	$ 5,000,000	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
31	RFMP	California Department of Water Resources	Cache Creek Erosion/Bank Protection Project	DWR Maintenance Yard Rehabilitation of 4 critical erosion sites on Cache Creek, LM 2.54 to 5.58, 2.8 to 2.84, 3.86 to 3.95 and 4.13 to 4.27, about 1,600 LF.	$ 1,814,000	$ 1,814,000	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
32	USACE	California Department of Water Resources	Cache Creek Settling Basin	Includes measures to extend the functional life of CCSB. CCSB is nearing the end of its current design life. Sediment within the basin has elevated levels of mercury and CCSB has been identified as a source of MeHg, with environmental implications for the Yolo Bypass and the Delta. DWR is developing alternatives that will extend the functional life of CCSB by at least 50 years while being responsive to the RWQCB, CVR directives of reducing Hg and MeHg TMDLs by 14 and 50 percent, respectively.	$ -	$ 51,000,000	Systemwide - Yolo Bypass multi-benefit improvements	Flood Infrastructure
33	Other	California Department of Water Resources	Cache Creek Settling Basin General Reevaluation Report	State-Federal Feasibility Study projects that DWR could partner in.	$ 4,000,000	$ 4,000,000	Urban - Studies and analysis	Watershed and Floodplain Management
34	RFMP	Reclamation District 2060, Hastings Tract	Cache Slough Bank Protection Project – Hastings	Waterside Bank protection and Rehabilitation project 2420 LF along Cache Slough at a serious erosion site, LM 1.3 to 2.23. Enhanced lower waterside slope habitat area with possible Riparian Forest, Scrub-Shrub, and emergent/freshwater marsh to mitigate or enhance the habitat value.	$ 2,744,000	$ 2,744,000	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
35	RFMP	Reclamation District 2098, Cache Haas Area	Cache Slough Freeboard Project	Freeboard deficiency due to subsidence. 100 LF crown repair along Cache Slough at LM 7.41	$ 29,000	$ 29,000	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
36	RFMP	Reclamation District 2098, Cache Haas Area	Cache Slough Stability Project	Construct a 60 LF stability protection project along Cache Slough at LM 5.9.	$ 35,000	$ 35,000	Rural - Levee repair and infrastructure improvements	Operation and Maintenance

Table B-4. Sacramento Basin Management Actions Included within the 2017 Refined SSIA Portfolio

#	Data Set Source	Lead Agency	Project Name	Project Description	Estimated Cost - Provided by Source	Estimated Cost - Adjusted for Portfolio	Area of Interest and Management Action Category	Management Action Type
37	RFMP	Reclamation District 108	Canal 14A Habitat Corridor	Create a terrestrial habitat corridor linking the Sacramento River to the Colusa Basin.	$ 5,000,000	$ 5,000,000	Rural - Habitat restoration/reconnection	Natural Floodplain and Ecosystem Functions
38	Other	California Department of Water Resources	Central Valley Integrated Flood Management Study (CVIFMS), Phase 2	State-Federal Feasibility Study projects that DWR could partner in.	$ 4,000,000	$ 4,000,000	Urban - Studies and analysis	Watershed and Floodplain Management
39	RFMP	Butte County	Cherokee Canal Bridge Crossing Improvement	Bridge crossings pose flood conveyance problems due to capacity constraints and floating debris accumulation. From upstream to downstream, the main bridge crossings include: 1. Nelson Road Bridge 2. Nelson-Shippee Road Bridge 3. Richvale Road Bridge 4. UPRR Bridge 5. Highway 162 Bridge This Plan recommends that these road crossings be improved to eliminate flow constrictions and debris buildup during high water events, beginning with the UPRR railroad crossing and Richvale Highway Bridge.	$ -	$ -	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
40	RFMP	California Department of Water Resources	Cherokee Canal Corridor Management	Phase 1 Sediment Removal within Cherokee Canal is proposed to rehabilitate the channel to its 25 year flood design capacity. The design flood carrying capacity is not being met from Cottonwood Creek to the Union Pacific RR crossing. Segment between the Richvale Hwy and the RR crossing can pass only approximately 2/3 of the 25 year design flow of 11,500 cfs without encroaching on the design freeboard. DWR is proposing to remove sediment and address erosion issues in 4 mile section of Cherokee canal. Approximately 750,000 cu yds. of sediment may be removed to store creek to 25 year capacity.	$ -	$ -	Systemwide - Routine maintenance	Operation and Maintenance
41	RFMP	California Department of Water Resources	Cherokee Canal Improvements	Restore Cherokee Canal to authorized protection level.	$ 50,000,000	$ 50,000,000	Systemwide - Routine maintenance	Operation and Maintenance
42	RFMP	California Department of Water Resources	Cherokee Canal Levee Improvements - Right Bank near Richvale		$ -	$ -	Rural - Levee repair and infrastructure improvements	Flood Infrastructure
43	RFMP	California Department of Water Resources	Cherokee Canal Relief Weir, Left bank upstream of Richvale	Construct an overflow relief weir along left bank levee to limit water stages within the canal during times of high flow and secure flood flowage easements on local agricultural areas which become inundated as a result. Preliminary review of existing studies indicates that overflows escaping outside of the channel would flow somewhat adjacent to the existing canal and eventually end up in the Butte Sink. This option could direct flood impacts away from existing infrastructure, however, it should only be implemented with the willing consent of impacted local landowners.	$ -	$ -	Rural - Levee repair and infrastructure improvements	Flood Infrastructure
44	RFMP	California Department of Water Resources	Cherokee Canal Sedimentation Basin(s)	DWR has proposed to remove up to 750,000 cu yds. of sediment up to the Cottonwood Creek confluence, with an undetermined amount of sediment to be removed between Cottonwood Creek and State Highway 99, to restore channel capacity, to improve habitat conditions for a variety of species, including the giant garter snake, and to reduce ongoing channel maintenance needs. In addition to these actions, additional habitat restoration actions could be implemented downstream of the RID siphon, in reaches that have excess channel capacity where riparian vegetation could be planted without adversely affecting floodwater conveyance. Planting of riparian vegetation throughout Cherokee Canal would create a continuous corridor of riparian habitat from the foothills to the Butte Sink that would provide a valuable migration corridor for wildlife from the Central Valley to the foothills and Cascade/Sierra Nevada Mountains.	$ -	$ -	Rural - Levee repair and infrastructure improvements	Flood Infrastructure
45	USACE	Butte County, City of Chico	City of Chico 200-Year Level of Protection	Provide the City of Chico with a 200-Year level of protection	$ 100,000,000	$ -	Urban - Levee improvements	Flood Infrastructure

Table B-4. Sacramento Basin Management Actions Included within the 2017 Refined SSIA Portfolio

#	Data Set Source	Lead Agency	Project Name	Project Description	Estimated Cost - Provided by Source	Estimated Cost - Adjusted for Portfolio	Area of Interest and Management Action Category	Management Action Type
46	RFMP	City of Colusa	City of Colusa 100-Year Level of Protection	Provide City of Colusa with a 100-Year level of protection	$ 50,000,000	$ 50,000,000	Small Community - Studies and analysis	Watershed and Floodplain Management
47	RFMP	N/A	City of Durham 100-Year Level of protection.	Evaluate feasibility of bringing the Butte Creek levees which protect Durham up to 100-yr FEMA standard.	$ -	$ -	Small Community - Studies and analysis	Watershed and Floodplain Management
48	RFMP	N/A	City of Williams Flood Hazard Mitigation Project	Implement alternative methods of reducing flood damages to the City of Willows and surrounding agricultural lands while increasing ecological value within the South Fork Willow Creek, North Fork Willow Creek, and Wilson Creek Sub-basins in Glenn County.	$ 1,000,000	$ 1,000,000	Systemwide - State operations, planning and performance tracking	Policy and Regulations
49	USACE	City of Woodland	City of Woodland Feasibility Study Alternatives Analysis	Feasibility Study for identifying alternatives for flood risk reduction relating to levee construction.	$ 500,000	$ 500,000	Urban - Studies and analysis	Watershed and Floodplain Management
50	RFMP	Clarksburg Local Maintaining Agency	Clarksburg Improvements Feasibility Study	The RFMP is pre-feasibility, and thus a feasibility study is a recommended course of action for the area. Potential solutions to be explored include non-structural structure raising ($10.4M), a ring levee ($34.7M), fix-in-place of existing perimeter levees ($529M), and FEMA Zone D designation ($N/A) or a combination of those solutions.	$ 500,000	$ 500,000	Small Community - Studies and analysis	Watershed and Floodplain Management
51	RFMP	Lake County Watershed Protection District	Clover Creek Diversion Modifications	Regrade Clover Diversion Channel and possibly Clover Creek to improve conveyance and potentially improve spawning habitat for the Clear Lake ditch. Remove Clover Diversion Structure as is non functional and potential weak point in levee system. Project will improve level of flood protection to Upper Lake and State Highway 20.	$ 10,000,000	$ 10,000,000	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
52	RFMP	Yuba County Water Agency	Colgate Tailwater Suppression	Tailwater suppression to result from coupling of Outlets Modification and Forecast-Based Operations. The peak downstream flow for the Yuba River at Marysville would be reduced from about 240,000 CFS to 200,000 CFS with these improvements.	$ 4,900,000	$ 4,900,000	Rural - Levee repair and infrastructure improvements	Flood Infrastructure
53	RFMP	Colusa County Resource Conservation District	Colusa Basin WMP	Action items of the Water Management Plan including: 1) Assess the status and functionality of flood control infrastructure (e.g., drainage canals, ditches, canal banks, levees) and identify areas of risk, work with other agencies, coordinate efforts, support maintenance of flood control infrastructure and levees, 2) Manage flood water for short term retention and groundwater recharge where appropriate and promote recharge infrastructure, 3) Develop and implement measures to control runoff in foothills and on agricultural lands. Utilize vegetation to increase infiltration and create “sponge effect” in foothills. Create natural floodplains and detention ponds where appropriate.	$ 1,000,000	$ 1,000,000	Rural - Small-scale levee setbacks and floodplain storage	Reservoir and Floodplain Storage and Operation
54	RFMP	Colusa County Office of Emergency Services, Cities of Colusa and Williams	Colusa County Local Hazard Mitigation Plan (LHMP)	Implement County Local Hazard Mitigation Plan	$ 500,000	$ 500,000	Systemwide - Emergency management	Emergency Management
55	RFMP	N/A	Comprehensive Bypass Management Plan	Develop a Comprehensive Bypass Management Plan for Sutter Bypass, Tisdale Bypass, and Cherokee Canal.	$ 500,000	$ 500,000	Systemwide - Routine maintenance	Operation and Maintenance

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56	RFMP		Confluence of Sutter Bypass and Sacramento River	Improvements could include excavating a floodplain bench along the channel margins and oxbow to accommodate planting with riparian species. Riparian forest should propagate naturally with increased flooding. Because it is a backwater area, changes in roughness would likely not affect flood stages. Additionally, the disconnected oxbow channel could be lowered to increase connectivity to mainstem river flows and reduce stranding risks.	$ 22,000,000	$ 22,000,000	Rural - Habitat restoration/reconnection	Natural Floodplain and Ecosystem Functions
57	RFMP	Reclamation District 827, Elkhorn	Consolidation for Maintaining Agencies	The Sac-Yolo North levee system is currently maintained and operated by four separate agencies. Consolidation of LMAs could result in greater efficiencies and consistency in how the system is maintained and operated. Project cost estimate: $50,000 for study to develop consolidation plan.	$ 50,000	$ 50,000	Rural - Studies and analysis	Watershed and Floodplain Management
58	RFMP	Reclamation District 1001, Nicolaus	Construct a replacement pumping plant on the Cross Canal at end of Lateral 4	Preliminary, Planning Level project. Detailed project description not available at this time.	$ 1,000,000	$ 1,000,000	Rural - Levee repair and infrastructure improvements	Flood Infrastructure
59	RFMP	N/A	Continuance in Federal Program Feasibility Study	A feasibility level analysis to identify levees that while providing critical flood protection, may benefit from being removed from the Federal program, while remaining in the State Plan of Flood Control. In this study, consideration should be given to the ability of LMAs and the State to meet standards which would provide emergency and rehabilitation assistance, the ability to fund levee improvement projects without Federal cost-share dollars, and liability for damages in the event of failures. Further consideration should be given for evaluating where levees may not be necessary and could altogether be removed from the Federal program.	$ 100,000	$ 100,000	Rural - Studies and analysis	Watershed and Floodplain Management
60	RFMP	Reclamation District 1001, Nicolaus	Coon Creek Group Interceptor Canal Levee, Natomas Cross Canal to high ground	Phased improvements to the RD1001 levee system, Segment 285, to achieve 100-year FEMA levee protection. Reference: Non-Urban Levee Evaluations Project Remedial Alternatives and Cost Estimates Report (NULE RACER).	$ 13,503,000	$ 13,503,000	Small Community - Levee repair and infrastructure improvements	Flood Infrastructure
61	RFMP		Cordova Creek Naturalization Project	The objectives of the Naturalization Project are to create a functioning, living stream, to improve the creek habitat, and to create a place for people to gather, learn, and enjoy nature. The project includes replacing the existing Clifton's Drain with a naturalized channel that will restore natural function to the stream. The channel design includes installing a low flow channel with inset floodplain terraces of gently varying width on both the left and right sides. Habitat restoration would take place along the channel boundary and within the floodplain terraces. Preliminary 15% designs have been completed for this project. Project cost range: $1,500,000-$2,400,000.	$ 2,400,000	$ 2,400,000	Urban - Other infrastructure and multi-benefit improvements	Natural Floodplain and Ecosystem Functions
62	RFMP	California Department of Water Resources	Corridor Management Plan - Nelson Weir	4 million CY of sediment removal Downstream of Nelson Weir (Corridor Management Plan)	$ 40,000,000	$ 40,000,000	Systemwide - Routine maintenance	Operation and Maintenance
63	RFMP	N/A	Corridor Management Strategy	The Corridor Management Strategy (CMS) approach is a concept for improving flood management and ecological conditions through developing a vision, strategy, and plan (CMP) for managing a corridor that integrates flood risk management, improved ecosystem function and integrated water management over a long-term (greater than 30 years) planning horizon.	$ 1,000,000	$ 1,000,000	Systemwide - State operations, planning and performance tracking	Policy and Regulations
64	RFMP	Courtland Local Maintaining Agency	Courtland Improvements Feasibility Study	The RFMP is pre-feasibility, and thus a feasibility study is a recommended course of action for the area. Potential solutions to be explored include non-structural structure raising ($14M), a ring levee ($14M), fix-in-place of existing perimeter levees ($179.5M), and FEMA Zone D designation ($N/A) or a combination of those solutions.	$ 500,000	$ 500,000	Small Community - Studies and analysis	Watershed and Floodplain Management
65	RFMP	California Department of Water Resources	Critical Levee Repairs - Replaced RFMP Estimates	Critical levee repair sites provided by the Flood System Repair Program (FSRP) for seepage, erosion, and stability. Estimate of $4M per site, 30 sites identified by FSRP.	$ 120,000,000	$ 120,000,000	Rural - Levee repair and infrastructure improvements	Operation and Maintenance

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66	RFMP	California Department of Water Resources	Critical Levee Repairs - Replaced RFMP Estimates	Critical levee repair sites provided by the Flood System Repair Program (FSRP) for seepage, erosion, and stability. Estimate of $4M per site, 13 sites identified by FSRP.	$ 52,000,000	$ 52,000,000	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
67	RFMP	California Department of Water Resources	Critical Levee Repairs - Replaced RFMP Estimates	Critical levee repair sites provided by the Flood System Repair Program (FSRP) for seepage, erosion, and stability. Estimate of $4M per site, 23 sites identified by FSRP.	$ 92,000,000	$ 92,000,000	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
68	USACE	Reclamation District 900, West Sacramento	Critical Levee Seepage Repair Site	The West Sacramento GRR identified a critical seepage site along the east levee of the Yolo Bypass in RD-900. This site was associated with an Annual Exceedance Probability (AEP) of 0.089 (1 in 11). It is approximately 3,600-feet long and would be repaired through the installation of a seepage cutoff wall. The repair is estimated to cost less than $5M and is eligible for Federal credit through the West Sacramento GRR.	$ 5,000,000	$ -	Urban - Levee improvements	Flood Infrastructure
69	USACE	Reclamation District 537, Lovdal	Critical Levee Seepage Repair Site	The West Sacramento GRR identified a critical seepage site along the east levee of the Yolo Bypass in RD-537. This site was associated with an Annual Exceedance Probability (AEP) of 0.089 (1 in 11). It is approximately 2,000-feet long and would be repaired through the installation of a seepage cutoff wall. The repair is estimated to cost less than $5M and is eligible for Federal credit through the West Sacramento GRR.	$ 5,000,000	$ -	Urban - Levee improvements	Flood Infrastructure
70	RFMP		CVP/SWP Fish Passage BiOp-locally preferred plan	Develop a locally preferred plan consistent with the CMP for addressing habitat, flood management, water supply, recreation, and drainage infrastructure issues in the YB–CS Complex that includes locally–identified drainage and infrastructure projects within the Complex (e.g., the projects identified in the Yolo Bypass Drainage and Water Infrastructure Improvement Study, April 2014). Costs are TBD when the NMFS BiOp has identified a preferred alternative.	$ -	$ -	Systemwide - State operations, planning and performance tracking	Watershed and Floodplain Management
71	USACE	City of West Sacramento	Deep Water Ship Channel East Levee	Slope flattening, installation of cutoff wall and stabilization with revetment at each existing pump station location.	$ 6,141,000	$ -	Urban - Levee improvements	Flood Infrastructure
72	RFMP	Reclamation District 999, Netherlands	Deep Water Ship Channel Stability Project – Netherlands	2,640 LF Stability site LM 0.5 to 1.0 along the Deep Water Ship Channel and 500 LF Stability site from LM 1.8 to 1.9.	$ 1,822,000	$ 1,822,000	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
73	USACE	City of West Sacramento	Deep Water Ship Channel West Levee	11 miles of revetment, levee raise, slope flattening.	$ 144,814,000	$ -	Urban - Levee improvements	Flood Infrastructure
74	RFMP	N/A	Deer Special Hunt Permits	Manage deer populations through special hunt permits.	$ 100,000	$ 100,000	Systemwide - State operations, planning and performance tracking	Policy and Regulations
75	BWFS	California Department of Water Resources	Degrade Levees near Prospect Island	Prospect Island, currently flooded and under development as improved fisheries and wildlife habitat by DWR, could provide incremental flood storage and conveyance improvements in the lower Yolo Bypass by breaching about 30 % of the DWSC east levee (Figure 5-19). This would expand the lower Yolo Bypass active floodplain by 1,200 acres.	$ 10,000,000	$ 17,000,000	Systemwide - Yolo Bypass multi-benefit improvements	Flood Infrastructure
76	BWFS	California Department of Water Resources	Degrade Lower Egbert	Degrade portions of the Lower Egbert Tract (RD 2084) levees. A portion of the northwestern levee and southeastern levee of Lower Egbert Tract (RD 2084) would be degraded to a crown elevation of approximately 7 feet (NAVD 88) and armored to facilitate more efficient overflow during flood events (Figure 5-18). The lower Yolo Bypass is constricted by high ground on the west at its lower end, so improving conveyance in this region area is critical to reducing localized increases in stage to the extent possible.	$ 6,000,000	$ 6,000,000	Systemwide - Yolo Bypass multi-benefit improvements	Flood Infrastructure
77	BWFS	California Department of Water Resources	Degrade Step Levees	Degrading remaining step levee segments in the lower bypass.	$ 2,000,000	$ 2,000,000	Systemwide - Yolo Bypass multi-benefit improvements	Flood Infrastructure

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78	RFMP		Delta Smelt BiOp-locally preferred plan	Develop a locally preferred plan that addresses habitat, flood management, water supply, recreation, and drainage infrastructure issues in the YB–CS Complex and that includes locally–identified drainage and infrastructure projects within the Complex. Work with relevant state and federal agencies, and other organizations to meet fish habitat requirements in the Cache Slough Complex consistent with the CMP.	$ 600,000	$ 600,000	Systemwide - State operations, planning and performance tracking	Watershed and Floodplain Management
79	RFMP	Wheatland	Develop more accurate FEMA 100-year maps for the existing developed area around Dry Creek	Preliminary, Planning Level project. Detailed project description not available at this time.	$ 40,000	$ 40,000	Small Community - Risk awareness, floodproofing and land use planning	Watershed and Floodplain Management
80	RFMP	Brannan-Andrus Levee Maintenance District	Dredge Material Rehandling Site Habitat Bank Development	Develop tidal marsh, shrub upland, and tree upland habitat in a portion of a dredge disposal site for mitigation for current and future projects and allow for future habitat expansion.	$ 750,000	$ 750,000	Rural - Habitat restoration/reconnection	Natural Floodplain and Ecosystem Functions
81	RFMP	Wheatland	Dry Creek develop new hydrology	Project will be evaluating what additional steps may need to be taken to ensure 100- and 200-year flood protection from Dry Creek flood flows.	$ 75,000	$ 75,000	Small Community - Studies and analysis	Watershed and Floodplain Management
82	RFMP		Dry Creek Floodplain Grazing Unit Restoration Projects	The project consists of several restoration concepts. These include: • Dry Creek: Install a cattle exclusion fence along Dry Creek and plant with riparian vegetation. Grade the channel at several locations to create more inset floodplain and promote riparian habitat. Enhance the riparian corridor of the secondary channel with native riparian planting. • Robla Creek: Enhance connectivity to Steelhead Creek at outlet to allow proper drainage. Remove non–native vegetation and plant native riparian species. • Enhance upland areas on Hansen and Coyle ranch by restoring native grasses (while avoiding vernal pools). • Remove berms and fill ditches throughout the properties.	$ 21,000,000	$ 21,000,000	Urban - Other infrastructure and multi-benefit improvements	Natural Floodplain and Ecosystem Functions
83	RFMP	Wheatland	Dry Creek south levee and San Joaquin ditch (3.9 mi) improvements feasibility study	Project will be evaluating what additional steps may need to be taken to ensure 100- and 200-year flood protection from Dry Creek flood flows and includes feasibility study and environmental documents.	$ 760,000	$ 760,000	Small Community - Studies and analysis	Watershed and Floodplain Management
84	RFMP	Solano County Public Works	Eastern Solano Regional Drainage and Flood Improvement Projects	Develop and implement the City of Dixon's regional watershed drainage project improvements and drainage water reuse for both levee protected lands and other lands dependent on drainage discharges into the YB–CS Complex.	$ 3,500,000	$ 3,500,000	Urban - Other infrastructure and multi-benefit improvements	Operation and Maintenance
85	RFMP	City of Rio Vista	Edgewater Drive Improvements	Construction of a permanent floodwall pump station to reduce flooding along Edgewater Drive. However, limited room and private property issues complicate matters. Similar project cost estimate: Pump Station #5 Modernization $3,000,000.	$ 3,000,000	$ 3,000,000	Small Community - Levee repair and infrastructure improvements	Flood Infrastructure
86	RFMP	Tehama County Flood Control and Water Conservation District	Elder Creek Flood Management, Restoration, and Invasive Species Removal	Undertake flood management, restoration and invasive species removal actions.	$ 500,000	$ 500,000	Systemwide - Routine maintenance	Operation and Maintenance

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87	Other	California Department of Water Resources	Elevating & Floodproofing Structures		$ 10,038,080	$ 10,038,080	Small Community - Risk awareness, floodproofing and land use planning	Watershed and Floodplain Management
88	Other	California Department of Water Resources	Elevating & Floodproofing Structures		$ 5,019,040	$ 5,019,040	Small Community - Risk awareness, floodproofing and land use planning	Watershed and Floodplain Management
89	Other	California Department of Water Resources	Elevating & Floodproofing Structures		$ 10,038,080	$ 10,038,080	Small Community - Risk awareness, floodproofing and land use planning	Watershed and Floodplain Management
90	RFMP	Reclamation District 150, Merritt Island	Elk Slough Bank Protection Project – Merritt Island	Waterside Bank Protection and Rehabilitation project at four areas of Elk Slough. Enhanced lower waterside slope habitat area with possible Riparian Forest, Scrub-Shrub, and emergent/freshwater marsh to mitigate or enhance the habitat value. Estimated 120,000 to 160,000 tons of rip rap quarry stone and 50,000 tons of imported fill will be used. 3 year completion time.	$ 4,960,000	$ 4,960,000	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
91	RFMP	Reclamation District 999, Netherlands	Elk Slough Feasibility Study – Netherlands	Evaluate existing levee conditions and habitat types and evaluate alternatives for improvements and sustainability. Large habitat corridor with valuable Riparian Forest and Shaded Riverine Aquatic habitat. 4 year completion time.	$ 775,000	$ 775,000	Rural - Studies and analysis	Watershed and Floodplain Management
92	RFMP	Reclamation District 150, Merritt Island	Elk Sough Bank Feasibility Study – Merritt Island	Evaluate Elk Slough channel and adjacent levee features to define the geometry of the system, catalog all features, and assess possible alternatives that can sustain, enhance, and protect both the flood protection and ecosystem values. 3 year completion time.	$ 775,000	$ 775,000	Rural - Studies and analysis	Watershed and Floodplain Management
93	RFMP	Reclamation District 0070, Reclamation District 1660, Meridian, Reclamation District 1500	Emergency Response Flood Safety Plan	RD 70/RD 1660 Emergency Response Plan: Prepare Emergency Response Plan that contains contact information for every resident within the basin. Pre-design of a future Meridian emergency berm is needed (alignment agreements, interior drainage, top of berm elevations, etc.) Improve coordination with E.R. responders in order to allow District staff access to the levees during an emergency.	$ 100,000	$ 100,000	Systemwide - Emergency management	Emergency Management
94	RFMP	N/A	Emergency Response Planning	Prepare Emergency Response Plans & Improve coordination with Emergency Response responders.	$ 1,000,000	$ 1,000,000	Systemwide - Emergency management	Emergency Management
95	RFMP	N/A	Emergency Responses Training	Training for Emergency Response Responders	$ 1,000,000	$ 1,000,000	Systemwide - Emergency management	Emergency Management

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96	RFMP	Reclamation District 3, Grand Island	Encroachment Modification Project – Grand Island	Encroachment modification just north of the Ryde Hotel where the main pumping plant connects to the drainage canal along Highway 220. Project will consist of Environmental documentation, permitting, design, mitigation, construction, and enhancement components and est. 200 tons of riprap quarry stone, 500 tons of gravel and 10,000 tons of fill.	$ 2,635,000	$ 2,635,000	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
97	RFMP	Reclamation District 2068, Yolano	Encroachment Removal and Enforcement	Monitoring and enforcement by CVFPB to remove or bring into compliance encroachments.	$ 100,000	$ 100,000	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
98	USACE	Sacramento Area Flood Control Agency, United States Army Corp of Engineers	Environmental Enhancements	SAFCA flood risk reduction program also includes congressionally authorized environmental enhancements along the American River Parkway and at Folsom Dam. These projects reflect SAFCA's statutory mandate to carry out the Agency's flood control responsibilities in a manner that provides optimum protection to the environment.	$ 45,000,000	$ -	Urban - Other infrastructure and multi-benefit improvements	Natural Floodplain and Ecosystem Functions
99	RFMP	Reclamation District 10, Honcut	Erosion protection at identified sites vulnerable sites	Preliminary, Planning Level project. Detailed project description not available at this time.	$ 1,006,236	$ -	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
100	RFMP	Reclamation District 3, Grand Island	Erosion/Bank Protection Project – Grand Island	Rehabilitation of three sites on Steamboat Slough and two sites on the Sacramento River. Approx. 1,500 LF of eroding levee on the waterside of Steamboat Slough at LM 0.18 to 0.25, 0.92 to 0.97 and 1.04 to 1.08 and approx. 600 LF on the Sacramento River at LM 11.3 to 11.4 and 16.8 to 16.9. Imported fill and quarry stone est. at 5-10 tons per LF for the four large scour locations and 1-2 tons per LF for the last site. All sites that have vegetation impacts and in-water work will have on-site mitigation considered as the primary mitigation component for the repair. Completion time of 2-years.	$ 1,550,000	$ 1,550,000	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
101	RFMP	Reclamation District 3, Grand Island	Erosion/Bank Protection Project 2 – Grand Island	Bank protection project on the Sacramento River and Steamboat Slough based on the District Trustees and engineer's knowledge of how the levee has performed and the District's knowledge of existing conditions at the southern end of the District.	$ 1,498,000	$ 1,498,000	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
102	RFMP	N/A	Establish Flood Structure Protection Area Zones	Creation of “Flood Structure Protection Areas” directly adjacent to levees and other flood control structures would provide LMAs an opportunity for input on land-use decisions occurring in the vicinity of their facilities. These areas would be identified in county and city floodplain management ordinances and/or general plans as zones in which input is required from LMAs before land-use decisions are finalized.	$ 1,000,000	$ 1,000,000	Rural - Risk awareness, floodproofing and land use planning	Watershed and Floodplain Management
103	RFMP	Yuba City	Expand Willow Island Recreation Area, Yuba City	Expand the 172 acre park in the Feather River floodway to remove overgrown vegetation, provide ecosystem restoration improvements including plantings and wat along the old river channelerways, and improve recreational amenities in the park. The project will improve flood flows by removing non-native and invasive vegetation and will improve maintenance by forming a financially self-supported and actively managed recreational area to reduce channel maintenance obligations to DWR.	$ -	$ 150,000	Urban - Risk awareness, floodproofing and land use planning	Watershed and Floodplain Management
104	RFMP	Three Rivers Levee Improvement Authority	Feather Restoration Site - Phase 1 Design & Construction		$ 5,360,000	$ 5,360,000	Rural - Habitat restoration/reconnection	Natural Floodplain and Ecosystem Functions
105	RFMP	Three Rivers Levee Improvement Authority	Feather Restoration Site - Phase 2 Design & Construction		$ 18,200,000	$ 18,200,000	Rural - Habitat restoration/reconnection	Natural Floodplain and Ecosystem Functions

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106	Other	California Department of Water Resources	Feather River - Channel RR&R - Arrundo Removal	Sources included meetings with regional representatives and information from DWR. No LMAs reported costs. Giant reed removal estimated cost range is from $7,000/acre to $10,000/acre based on DWR input. Upper end of was range chosen for unit cost given other regions identified costs as high as $25,000/acre.	$ 3,332,075	$ 3,332,075	Systemwide - Routine maintenance	Operation and Maintenance
107	Other	California Department of Water Resources	Feather River - Channel Sediment Removal	Channel maintenance activities including sediment, vegetation, and debris removal are conducted by DWR with respect to the Sacramento River Flood Control Project and generally by LMAs in the San Joaquin Valley. Estimated costs for the Sacramento Basin were developed by using historical projects overseen by DWR, which have occurred as funding has been available, as well as input from regional experts. Estimated costs for the San Joaquin Basin were based on direct interviews with LMAs and staff.	$ 4,900,110	$ 4,900,110	Systemwide - Routine maintenance	Operation and Maintenance
108	Other	California Department of Water Resources	Feather River - Channel Vegetation and Debris Removal	Channel maintenance activities including sediment, vegetation, and debris removal are conducted by DWR with respect to the Sacramento River Flood Control Project and generally by LMAs in the San Joaquin Valley. Estimated costs for the Sacramento Basin were developed by using historical projects overseen by DWR, which have occurred as funding has been available, as well as input from regional experts. Estimated costs for the San Joaquin Basin were based on direct interviews with LMAs and staff.	$ 29,400,662	$ 29,400,662	Systemwide - Routine maintenance	Operation and Maintenance
109	Other	California Department of Water Resources	Feather River - Large Structure O&M	Major structures involve those facilities described in CWC Section 8361 and administered by DWR, and include weirs, bypass outflow control structures, outfall gate facilities, and large regional pumping plants.	$ -	$ -	Systemwide - Routine maintenance	Operation and Maintenance
110	Other	California Department of Water Resources	Feather River - Large Structures RR&R	Based on discussions with DWR and LMA staff, major structures have historically been repaired and well maintained, and there is not an immediate need to repair, replace, or rehabilitate these facilities. As such, RR&R costs were not identified for this TM given major structures were assumed not to require significant repairs over the next 50 years. However, it is recommended that funding reserves be established to ensure adequate funding is available in the future to continue needed repairs or to replace aged facilities.	$ -	$ -	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
111	Other	California Department of Water Resources	Feather River - Non-urban Levee O&M (Rural)	Levee O&M costs were separated between urban and rural LMAs to capture the additional costs associated with urban area LMAs. Levee O&M included the following activities: vegetation maintenance, rodent control, encroachment and pipe maintenance, minor repairs (erosion, levee crown repairs etc.)	$ 86,041,625	$ 86,041,625	Systemwide - Routine maintenance	Operation and Maintenance
112	Other	California Department of Water Resources	Feather River - Non-urban Levee RR&R (Rural)	Levee-related RR&R costs have generally been driven by necessary flood-event repairs and known erosion or levee stability issues. The OMRR&R Work Group determined the Delta Subventions Program data set is the most robust data set for estimating RR&R cost on SPFC levees because the existence of the funding program has encouraged more regular analysis and repair of levees. Although urban levees are being improved to a higher standard to meet urban level of protection standards, the OMRR&R Work Group determined that repair and rehabilitation costs for urban and non-urban levees would not differ substantially, and the cost for ULDC compliance would be the only significant differentiating factor for RR&R of urban SPFC levees.	$ 24,316,112	$ 24,316,112	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
113	Other	California Department of Water Resources	Feather River - Small Community Levee O&M	Levee O&M costs were separated between urban and rural LMAs to capture the additional costs associated with urban area LMAs. Levee O&M included the following activities: vegetation maintenance, rodent control, encroachment and pipe maintenance, minor repairs (erosion, levee crown repairs etc.)	$ 115,589,291	$ 115,589,291	Systemwide - Routine maintenance	Operation and Maintenance
114	Other	California Department of Water Resources	Feather River - Small Community Levee RR&R	Levee-related RR&R costs have generally been driven by necessary flood-event repairs and known erosion or levee stability issues. The OMRR&R Work Group determined the Delta Subventions Program data set is the most robust data set for estimating RR&R cost on SPFC levees because the existence of the funding program has encouraged more regular analysis and repair of levees. Although urban levees are being improved to a higher standard to meet urban level of protection standards, the OMRR&R Work Group determined that repair and rehabilitation costs for urban and non-urban levees would not differ substantially, and the cost for ULDC compliance would be the only significant differentiating factor for RR&R of urban SPFC levees.	$ 34,172,782	$ 34,172,782	Small Community - Levee repair and infrastructure improvements	Operation and Maintenance

Table B-4. Sacramento Basin Management Actions Included within the 2017 Refined SSIA Portfolio

#	Data Set Source	Lead Agency	Project Name	Project Description	Estimated Cost - Provided by Source	Estimated Cost - Adjusted for Portfolio	Area of Interest and Management Action Category	Management Action Type
115	Other	California Department of Water Resources	Feather River - Small Structures O&M	Minor structures include stop log or gated closure structures, pumping plants, monitoring wells and piezometers, retaining walls and floodwalls, pipe penetrations, and encroachments. Routine O&M of these types of structures is critical, but often overlooked for budgeting purposes. As became evident in the LMA data received, LMAs typically only account for routine power costs for pumping plants and do not separately account for other activities associated with minor structures such as video inspections of pipes, lubrication and minor repairs of pipe closure valves, routine inspection and maintenance of closure structure gates or stop logs, and inspection and minor repairs of floodwalls. The OMRR&R Work Group determined that costs for minor-structure O&M are likely included in the general overhead expenses for the LMAs who have structures, and no further estimates were developed. However, it is anticipated that video inspections of pipes will be required in the future (once every 5 years) for pipes crossing SPFC levees and as such these projected costs were included in the overall estimates.	$ 1,348,510	$ 1,348,510	Systemwide - Routine maintenance	Operation and Maintenance
116	Other	California Department of Water Resources	Feather River - Small Structures RR&R	Small structures such as stop logs or gated closure structures, monitoring wells and piezometers, retaining walls and floodwalls, pipes, and encroachments are typically accounted for in levee RR&R costs, except for pipes. Many of these pipes were installed before or during original project construction prior to the 1950s, but no plans were implemented to assure these facilities could be replaced when they exceed their useful life. As a result, many pipes have reached their useful life with many of these structures in need of repair, replacement, or proper pipe abandonment.	$ 39,671,293	$ 39,671,293	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
117	Other	California Department of Water Resources	Feather River - Urban Levee O&M	Levee O&M costs were separated between urban and rural LMAs to capture the additional costs associated with urban area LMAs. Levee O&M included the following activities: vegetation maintenance, rodent control, encroachment and pipe maintenance, minor repairs (erosion, levee crown repairs etc.)	$ 61,309,005	$ 61,309,005	Systemwide - Routine maintenance	Operation and Maintenance
118	Other	California Department of Water Resources	Feather River - Urban Levee RR&R	Levee-related RR&R costs have generally been driven by necessary flood-event repairs and known erosion or levee stability issues. The OMRR&R Work Group determined the Delta Subventions Program data set is the most robust data set for estimating RR&R cost on SPFC levees because the existence of the funding program has encouraged more regular analysis and repair of levees. Although urban levees are being improved to a higher standard to meet urban level of protection standards, the OMRR&R Work Group determined that repair and rehabilitation costs for urban and non-urban levees would not differ substantially, and the cost for ULDC compliance would be the only significant differentiating factor for RR&R of urban SPFC levees.	$ 19,026,932	$ 19,026,932	Urban - Other infrastructure and multi-benefit improvements	Operation and Maintenance
119	RFMP	Reclamation District 1001, Nicolaus	Feather River east levee, Cross Canal to River Oaks Golf Course	Phased improvements to the RD1001 levee system, Segment 247, to achieve 100-year FEMA levee protection. Reference: Non-Urban Levee Evaluations Project Remedial Alternatives and Cost Estimates Report (NULE RACER).	$ 349,758,000	$ 349,758,000	Small Community - Levee repair and infrastructure improvements	Flood Infrastructure
120	RFMP	Sutter Butte Flood Control Agency	Feather River West Levee Project (FRWLPI), Thermalito to Laurel Avenue	A nearly 41-mile levee improvement project from Thermalito Afterbay to approximately Laurel Avenue. The goals of the project are to reduce flood risk and remove more than 34,000 properties from FEMA Special Flood Hazard Areas. This includes increasing public safety by providing 200-year flood protection to Biggs, Gridley, Live Oak, and Yuba City, and providing 100‑year flood protection for the less populated areas south of Yuba City	$ 290,000,000	$ -	Small Community - Levee repair and infrastructure improvements	Flood Infrastructure

Table B-4. Sacramento Basin Management Actions Included within the 2017 Refined SSIA Portfolio

#	Data Set Source	Lead Agency	Project Name	Project Description	Estimated Cost - Provided by Source	Estimated Cost - Adjusted for Portfolio	Area of Interest and Management Action Category	Management Action Type
121	RFMP	California Department of Fish and Wildlife, Sutter Butte Flood Control Agency	Feather River Wildlife Area – Abbot Lake Unit	The Feather River Wildlife Area -Abbott Lake Unit is a 439-acre CDFW-managed property. The wildlife area is managed to provide riparian habitat for migratory birds and special-status species and public opportunities for wildlife-oriented recreation. A variety of ecosystem restoration actions have been planned for the Abbot Lake Unit (e.g., River Partners 2010). These actions include strategically lowering the banks of the Feather River and creating side channels within the Abbot Lake Unit that would become inundated during frequent high-flow events, providing spawning habitat and high-water refugia for anadromous fish. These side channels would also improve floodwater conveyance. Along with the side channels, strategic grading could create benches and shelves that would provide additional frequently inundated floodplain habitat. Aside from these grading and excavation activities, ecosystem restoration actions for the Abbot Lake Unit could include the expansion of Abbot Lake to create additional marsh habitats. Much of the Abbot Lake Unit away from Abbott Lake is characterized by open grassland habitat. The wildlife habitat values of this area could be further enhanced by planting trees and shrubs to create riparian and SRA habitat in locations where additional woody vegetation would not adversely affect flood water conveyance.	$ 944,480	$ 944,480	Rural - Habitat restoration/reconnection	Natural Floodplain and Ecosystem Functions
122	RFMP	California Department of Fish and Wildlife	Feather River Wildlife Area – Nelson Slough Unit	Ecosystem restoration actions for the Nelson Slough Unit would primarily rely on the rehabilitation of the weir and lowering of the floodway to create a variety of flood surface elevations that would support a diversity of habitats, including riparian woodland and scrub, marsh, native grassland, and frequently inundated floodplain while also providing additional flood conveyance through the removal of accumulated sediment. Additionally, side channels could be excavated to provide spawning areas for anadromous fish and to limit fish stranding after flood events. Along with side channels, benches, and shelves could be graded from the floodplain to reconnect the flows or re-engineer the floodplain. Because the Nelson Slough Unit occurs at the junction of the Feather River with the Sutter Bypass, large volumes of sediment are deposited in the area during flood events. Thus, ongoing maintenance of the area would likely be required to maintain the ecosystem functions and services of any habitats that were created within the Nelson Slough Unit.	$ 10,000,000	$ 10,000,000	Rural - Habitat restoration/reconnection	Natural Floodplain and Ecosystem Functions
123	RFMP	California Department of Fish and Wildlife	Feather River Wildlife Area – O'Connor Lakes Unit	The O'Connor Lakes Unit is managed to provide riparian habitat for migratory birds and special-status species and public opportunities for wildlife-oriented recreation. Riparian forest is sparse in the northern portion of the O'Connor Lakes Unit but is dense in the southern portion. Restoration actions for the O'Connor Lakes Unit could include strategically grading the banks of the Feather River to create a connection to the river during more frequent high flow events. This notch in the river bank would allow water to enter into a side channel that could be created by expanding and enhancing the existing low spots that were created to obtain borrow for repairs to the Feather River levee following the 1997 flood. New side channels could provide spawning areas for anadromous fish and refugia during high-flow events. In addition to the side channels, benches and shelves could be graded from the floodplain to reconnect the flows or re-engineer the floodplain. The connection would continue to the south to provide a continuous channel back to the river in an effort to minimize fish stranding and to provide an alternative flow pathway during flood events. Additionally, the size of O'Conner Lakes could potentially be expanded or additional ponds could be constructed to provide additional marsh habitat, and riparian vegetation could be planted in scattered locations, particularly within the northern portion of the area, to increase riparian and SRA habitat.	$ 2,500,000	$ 2,500,000	Rural - Habitat restoration/reconnection	Natural Floodplain and Ecosystem Functions
124	BWFS	California Department of Water Resources	Feather River-Sutter Bypass Improvements	Study of the Feather River-Sutter Bypass future options.	$ 2,300,000,000	$ 2,300,000,000	Systemwide - Feather River-Sutter Bypass multi-benefit improvements	N/A
125	RFMP		FEMA NFIP Relief for Rural Areas	Facilitate a working group to explore alternative approaches to regulating the floodplain in agricultural areas that provides relief to rural communities where a structural solution to reduce flood risk is not practical or affordable.	$ 50,000	$ 50,000	Rural - Risk awareness, floodproofing and land use planning	Watershed and Floodplain Management

Table B-4. Sacramento Basin Management Actions Included within the 2017 Refined SSIA Portfolio

#	Data Set Source	Lead Agency	Project Name	Project Description	Estimated Cost - Provided by Source	Estimated Cost - Adjusted for Portfolio	Area of Interest and Management Action Category	Management Action Type
126	RFMP	California Department of Water Resources, Three Rivers Levee Improvement	FESSRO/TRLIA Advance Mitigation Site Restoration		$ 4,400,000	$ 4,400,000	Rural - Habitat restoration/reconnection	Natural Floodplain and Ecosystem Functions
127	RFMP	Reclamation District 554, Walnut Grove	Fill of Former Tyler Island Slough along Old Walnut Grove Road – Walnut Grove	Two crucial long term goals maintain levee height and improve stability. Proposed projects include fill of the former Tyler Island Slough along Old Walnut Grove Road.	$ 275,000	$ 275,000	Small Community - Levee repair and infrastructure improvements	Operation and Maintenance
128	RFMP	Three Rivers Levee Improvement Authority	Flood Control O&M Consolidation Study		$ 200,000	$ 200,000	Rural - Studies and analysis	Watershed and Floodplain Management
129	RFMP	Tehama County Flood Control and Water Conservation District	Flood Detention Basin FS	A Feasibility Study for constructing flood detention basins on foothill streams.	$ 500,000	$ 500,000	Rural - Studies and analysis	Watershed and Floodplain Management
130	Other	California Department of Water Resources	Flood ER Planning - Local/Operational Area and State Level	Includes local flood information and flood risk mapping activities, local flood forecasting and dissemination, local stream gage network enhancement, flood evacuation maps, flood ER plans, and levee safety plans. Includes State flood information and flood risk mapping, state flood forecasting and dissemination, levee advanced warning systems, and Flood ER Information Mgmt Systems.	$ 64,800,000	$ 64,800,000	Systemwide - Emergency management	Emergency Management
131	Other	California Department of Water Resources	Flood ER Planning - Local/Operational Area and State Level	Includes local flood information and flood risk mapping activities, local flood forecasting and dissemination, local stream gage network enhancement, flood evacuation maps, flood ER plans, and levee safety plans. Includes State flood information and flood risk mapping, state flood forecasting and dissemination, levee advanced warning systems, and Flood ER Information Mgmt Systems.	$ 63,700,000	$ 63,700,000	Systemwide - Emergency management	Emergency Management
132	Other	California Department of Water Resources	Flood ER Planning - Local/Operational Area and State Level	Includes local flood information and flood risk mapping activities, local flood forecasting and dissemination, local stream gage network enhancement, flood evacuation maps, flood ER plans, and levee safety plans. Includes State flood information and flood risk mapping, state flood forecasting and dissemination, levee advanced warning systems, and Flood ER Information Mgmt Systems.	$ 63,700,000	$ 63,700,000	Systemwide - Emergency management	Emergency Management
133	Other	California Department of Water Resources	Flood ER Preparedness - Local/Operational Level and State Level	Includes flood alert and warning systems, er training and exercising, local flood er materials, equipment and facilities, and all weather roads on levee crowns. Includes ER Training and drills, tabletop and functional exercises, full-scale exercises, and flood fight methods training. Also includes State flood fight materials and storage facilities, and funding for the State Flood Ops Center.	$ 50,400,000	$ 50,400,000	Systemwide - Emergency management	Emergency Management
134	Other	California Department of Water Resources	Flood ER Preparedness - Local/Operational Level and State Level	Includes flood alert and warning systems, er training and exercising, local flood er materials, equipment and facilities, and all weather roads on levee crowns. Includes ER Training and drills, tabletop and functional exercises, full-scale exercises, and flood fight methods training. Also includes State flood fight materials and storage facilities, and funding for the State Flood Ops Center.	$ 52,000,000	$ 52,000,000	Systemwide - Emergency management	Emergency Management
135	Other	California Department of Water Resources	Flood ER Preparedness - Local/Operational Level and State Level	Includes flood alert and warning systems, er training and exercising, local flood er materials, equipment and facilities, and all weather roads on levee crowns. Includes ER Training and drills, tabletop and functional exercises, full-scale exercises, and flood fight methods training. Also includes State flood fight materials and storage facilities, and funding for the State Flood Ops Center.	$ 52,900,000	$ 52,900,000	Systemwide - Emergency management	Emergency Management

Table B-4. Sacramento Basin Management Actions Included within the 2017 Refined SSIA Portfolio

#	Data Set Source	Lead Agency	Project Name	Project Description	Estimated Cost - Provided by Source	Estimated Cost - Adjusted for Portfolio	Area of Interest and Management Action Category	Management Action Type
136	RFMP	Richvale Sanitation District	Flood Protection for Richvale WWTP	Develop and implement flood protection improvements for Richvale Sanitation District's wastewater treatment plant and associated 18-acre pond system.	$ 500,000	$ 500,000	Small Community - Risk awareness, floodproofing and land use planning	Watershed and Floodplain Management
137	RFMP	N/A	Floodplain Delineations	Develop more detailed 100-year/200-year/500-year floodplain delineations and base flood elevations for the region to aid with will floodplain management policy and decision making.	$ 500,000	$ 500,000	Rural - Risk awareness, floodproofing and land use planning	Watershed and Floodplain Management
138	RFMP	Reclamation District 1001, Nicolaus	Floodproofing the Main Drain Pumping Plant	The RD 1001 Main Drain Pumping Plant is an SPFC facility along the Natomas Cross Canal right bank. The levee and pumping plant are below the Design Water Surface Elevation and requires sandbagging to avoid overtopping. Project would make improvements to raise the doors and windows above the DWSE. The pumping plant is an SPFC facility installed when the NCC cutoff natural drainage to the Feather River.	$ 500,000	$ 500,000	Rural - Risk awareness, floodproofing and land use planning	Watershed and Floodplain Management
139	USACE	Sacramento Area Flood Control Agency, United States Army Corp of Engineers	Folsom Dam Flood Control Manual Update Project	Congress has directed USACE to update the 1987 flood control manual so as to reflect the operation capacities created by Folsom Dam JFP and Folsom Dam Raise and to take advantage of the National Weather Service's improving ability to forecast extreme precipitation and runoff in the American River watershed. USACE is currently working with Reclamation, SAFCA, DWR and the CVFPB to prepare an updated flood control manual by the winter of 2017. http://www.spk.usace.army.mil/Missions/CivilWorks/FolsomDamAuxiliarySpillway.aspx.	$ 900,000,000	$ -	Systemwide - Reservoir operations	Reservoir and Floodplain Storage and Operation
140	USACE	Sacramento Area Flood Control Agency, United States Army Corp of Engineers	Folsom Dam Joint Federal Project	2007 Federally Authorized project consists of physical modifications to Folsom Dam and Reservoir that would improve efficiency and effectiveness of flood control operations and fed safety requirements. New Gated auX. spillway on a natural ridge east of the main dam. Includes concrete lined approach channel, discharge chute in the left abutment and enlargement of existing stilling basin, and installation of six submerged tainter gates. Initiated in 2010 and expected to be completed in spring of 2017.	$ 161,000,000	$ -	Systemwide - Reservoir and floodplain storage	Reservoir and Floodplain Storage and Operation
141	USACE	Sacramento Area Flood Control Agency, United States Army Corp of Engineers	Folsom Dam Raise	2007 Federally Authorized project, consists of raising Folsom Dam's earthen dikes and wing dams by 3.5 FT so as to equal the height of the Folsom's main dam and modifying the dam's five main spillway gates and three emergency spillway gates so as to allow dam operators to add approx. 40,000 acre-feet of additional surcharge storage. This is expected to being by USACE in 2018 and completed by 2022.	$ 150,000,000	$ -	Systemwide - Reservoir and floodplain storage	Reservoir and Floodplain Storage and Operation
142	RFMP	Colusa County Resource Conservation District	Foothill Stream Restoration and Recharge Enhancement	Ten acre foothill stream corridor restoration project that will achieve multiple resource objectives including: Remove and/or control invasive vegetation; Reestablish riparian vegetation and improve connectivity; Reduce existing and potential bank erosion; Reestablish flood plain(s) to facilitate groundwater recharge, retain floodwater and provide habitat; Utilize the project as a demonstration site to facilitate education and outreach through workshops and field days, and studies to evaluate project effectiveness.	$ 1,000,000	$ 1,000,000	Rural - Habitat restoration/reconnection	Natural Floodplain and Ecosystem Functions
143	RFMP	California Department of Water Resources, Yuba County Water Agency	Forecast-Based Operations (F-BO)	Project includes the concept of F-BO, as applied to operation of Oroville Dam and Reservoir, with a 200-year flood and an assumed forecast lead time of 72 hours. Previous studies suggest that F-BO can provide modest, but significant reductions in downstream peak flood flows.	$ 20,000,000	$ 20,000,000	Systemwide - Reservoir operations	Reservoir and Floodplain Storage and Operation

Table B-4. Sacramento Basin Management Actions Included within the 2017 Refined SSIA Portfolio

#	Data Set Source	Lead Agency	Project Name	Project Description	Estimated Cost - Provided by Source	Estimated Cost - Adjusted for Portfolio	Area of Interest and Management Action Category	Management Action Type
144	RFMP	California Department of Water Resources, Yuba County Water Agency	Forecast-Coordinated Operations for Yuba and Feather Rivers (F-CO)	F-CO has been an ongoing effort, intensified since 2005, to jointly operate Oroville and New Bullard's Bar reservoirs to meet downstream flow objectives and minimize the risk of flooding. Continuing improvements in flood modeling tools, risk evaluation tools, real-time information, and flood forecasts would be implemented under F-CO.	$ 2,000,000	$ 2,000,000	Systemwide - Reservoir operations	Reservoir and Floodplain Storage and Operation
145	BWFS	California Department of Water Resources	Fremont Weir Expansion	1.0 mile expansion of the Fremont Weir	$ 120,000,000	$ 120,000,000	Systemwide - Yolo Bypass multi-benefit improvements	Flood Infrastructure
146	RFMP	Wheatland	FSRP Identified Critical Repairs, Bear River north levee, RD 817 [setback levee]	Project to ensure 200-year flood protection for Wheatland's urban and urbanizing areas from Bear River flooding, preliminarily identified a critical reach of Bear River levee in RD 817 just downstream of Oakley Lane that will need to be protected from erosion or set back to meet current criteria. Included design and construction of a setback levee, project ID L1.	$ 8,500,000	$ 8,500,000	Rural - Small-scale levee setbacks and floodplain storage	Flood Infrastructure
147	RFMP	Brannan-Andrus Levee Maintenance District	Georgiana Slough Bank Protection	Bank protection project on Sta. 17+00 to Sta. 24+00, rehabilitated length of 700 LF.	$ 794,000	$ 794,000	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
148	RFMP	Brannan-Andrus Levee Maintenance District	Georgiana Slough French Drain	The existing toe ditch will be filled with gravel and an 8" diameter drain line placed in the lowered existing ditch and a drainage blanket will be constructed on the levee slope. If necessary, a new irrigation ditch will be placed away from the toe to separate functions.	$ 2,067,000	$ 2,067,000	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
149	RFMP	Reclamation District 556, Upper Andrus Island	Georgiana Slough Stability Project – Upper Andrus	4 stability sites that would be repaired through the construction of a stability protection project along Georgiana Slough roughly 1720 LF, LM 1.8 to 4.9.	$ 998,000	$ 998,000	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
150	BWFS	California Department of Water Resources	Geotechnical Levee Improvements	Fix any remaining geotechnical inadequacies for urban areas unaddressed in the future baseline condition and fix known critical geotechnical deficiencies for rural and small communities.	$ 22,000,000	$ 33,000,000	Systemwide - Yolo Bypass multi-benefit improvements	Flood Infrastructure
151	RFMP	N/A	Glenn 100-Year Level of Protection	Provide Glenn with a 100-Year level of protection	$ -	$ -	Small Community - Studies and analysis	Watershed and Floodplain Management
152	RFMP	Sutter Butte Flood Control Agency	Gridley Bridge Bank Erosion Repair Design, Permitting & Construction		$ 5,460,000	$ 5,460,000	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
153	RFMP	Sutter Butte Flood Control Agency	Gridley Open Space Restoration		$ -	$ -	Small Community - Levee setbacks, land acquisitions and habitat restoration	Natural Floodplain and Ecosystem Functions
154	RFMP	N/A	Grimes 100-Year Level of Protection	Provide Grimes with a 100-Year level of protection	$ -	$ -	Small Community - Studies and analysis	Watershed and Floodplain Management

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#	Data Set Source	Lead Agency	Project Name	Project Description	Estimated Cost - Provided by Source	Estimated Cost - Adjusted for Portfolio	Area of Interest and Management Action Category	Management Action Type
155	Yolo Bypass		Habitat Enhancement in the Yolo Bypass	The U.S. Army Corps of Engineers, in partnership with the State of California and the Sacramento Area flood Control Agency, have been evaluating the potential flood control benefits of widening the Sacramento Weir and Bypass. The widening being contemplated would expand the Bypass to the north, replacing what is currently agricultural land. If this widening occurred, habitat restoration could be implemented within the expanded Bypass footprint. Low–flow sluice gates could be constructed at the Sacramento Weir and a terraced low–flow channel (or swale) could be excavated to allow more frequent flow exchange between the Sacramento River and the Sacramento and Yolo Bypass areas, particularly the Tule Canal/Toe Drain. Creation of this low flow swale would allow increased connectivity for anadromous fish passage between the Tule Canal/Toe Drain and the Sacramento River. Currently there is no anadromous fish passage through the Sacramento Bypass until the 27.5–foot elevation in the Sacramento River is topped. Seasonal wetland areas would be constructed, and if it could be implemented in a way that is flood neutral, riparian vegetation would be established along the wetlands and low–flow channel margins.	$ 27,000,000	$ -	Systemwide - Reservoir and floodplain storage	Natural Floodplain and Ecosystem Functions
156	RFMP	N/A	Hamilton City 100-Year Level of Protection	Provide Hamilton City with a 100-Year level of protection	$ 50,000,000	$ 50,000,000	Small Community - Studies and analysis	Watershed and Floodplain Management
157	RFMP	Sutter Butte Flood Control Agency	Hamilton Slough	A previously constructed weir is no longer needed and presents an unnecessary encroachment into the Feather River floodway. Along with removing the non-functioning weir and planting riparian vegetation in its place, restoration actions in this area could include planting of additional riparian vegetation along the Feather River and in selected locations within Hamilton Slough to provide additional habitat for terrestrial species and shaded riverine aquatic habitat that would benefit anadromous fish.	$ 5,000,000	$ 5,000,000	Rural - Levee repair and infrastructure improvements	Flood Infrastructure
158	RFMP	Reclamation District 563	Hazard Mitigation Plan (HMP) Levee Improvement Project – Tyler Island	Bring portions of the levee currently below the HMP Criteria to six inches above the PL 84-99 Standards. Will include portions of the levee that meet the HMP Criteria, but do not meet the design template for this project that are in close proximity to stretches that do not meet the HMP Standards. Total length of improvements is 6,507 LF. Completion time of 1-year.	$ 728,000	$ 728,000	Rural - Levee repair and infrastructure improvements	Flood Infrastructure
159	RFMP	Caltrans	Highway 84 Closure Structure	The floodwall, however, could still be outflanked by high water from the Yolo Bypass. Highway 84, which is owned and maintained by Caltrans, runs along the Sacramento River and the downstream end of the Yolo Bypass floods in high water. A levee or seawall is needed along Highway 84, from the Rio Vista Bridge to the Mellin Levee, to protect the City's Industrial area along the river and to prevent flood water from entering the downtown area through the bridge underpass. There will need to be a gate across Highway 84 at the Mellin Levee to prevent flood water from rushing in through the gap and flooding the industrial area. Any flood protection solution along Highway 84 will need to be coordinated with Caltrans. A solution could be addressed as part of the realignment of the Rio Vista Bridge. Additional alternatives would be to raise Highway 84 or construct a floodwall along the Sacramento River. Comparison between Highway 12 underpass stop logs or closure structure or a re- alignment/relocation of the Highway 12 crossing of the Sacramento River to prevent flood flows from flooding Highway 84.	$ 500,000	$ 500,000	Small Community - Levee repair and infrastructure improvements	Flood Infrastructure
160	RFMP	Hood Local Maintaining Agency	Hood Improvements Feasibility Study	The RFMP is pre-feasibility, and thus a feasibility study is a recommended course of action for the area. Potential solutions to be explored include non-structural structure raising ($10.4M), a ring levee ($31.2M), fix-in-place of existing perimeter levees ($161M), and FEMA Zone D designation ($N/A) or a combination of those solutions.	$ 500,000	$ 500,000	Small Community - Studies and analysis	Watershed and Floodplain Management
161	BWFS	California Department of Water Resources	Hydraulic Mitigation		$ 76,000,000	$ 76,000,000	Systemwide - Yolo Bypass multi-benefit improvements	Flood Infrastructure

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#	Data Set Source	Lead Agency	Project Name	Project Description	Estimated Cost - Provided by Source	Estimated Cost - Adjusted for Portfolio	Area of Interest and Management Action Category	Management Action Type
162	RFMP	Butte County Department of Water and Resource Conservation	Identification and Evaluation of Groundwater Recharge	To provide a more comprehensive, defensible characterization of this important asset, Butte County is proposing a Project that will characterize countywide groundwater recharge areas, identify potential areas for active recharge projects, and investigate possible groundwater recharge processes at one location. The first task involves preparing a countywide map identifying areas based on their potential to recharge groundwater. The purpose of the map will be to provide technical assistance to local land managers and planners to fulfill obligations to protect groundwater recharge areas. The second task will further identify specific areas in the county where groundwater recharge projects (e.g., flood detention basins, storm water or similar facilities) could provide benefits and may be viable. A third task will involve an investigation of groundwater recharge processes in a defined study area. The location will be chosen based on results from task one and two, availability of existing data, and site accessibility. Although data exists to reasonably characterize recharge conditions in some areas of Butte County, uncertainty exists in specific locations due to complex hydrology and geology. Therefore, the site investigation will use a suite of data types and analyses, including a geophysical investigation to better characterize the subsurface and possibly quantify recharge. Qualitifier: This does have ties to SPFC and to the upcoming Small Community Feasibility Studies. For example, this could be part of a multi-benefit solution for Cherokee Canal or Butte Creek. See Attachment 8 - Groundwater Analysis, funding may be more appropriate from SGMA implementation but will include as long as the study includes use of flood peak water, could be a refinement in 2022 for future BWFS elements	$ 100,000	$ 100,000	Rural - Studies and analysis	Watershed and Floodplain Management
163	RFMP	Wheatland	Implement RD 2103 Dry Creek south levee 200-year ULDC levee improvements	The Dry Creek levee in RD 2103 protects the City of Wheatland, an urbanizing area by definition, in RD 2103. A feasibility study was completed in 2016 identifying repairs to meet ULDC design criteria and this project will be to complete those repairs.	$ 24,470,000	$ 16,630,600	Rural - Levee repair and infrastructure improvements	Flood Infrastructure
164	RFMP	Reclamation District 10, Honcut	Improve drainage along levee landside toe to improve visibility, flood fight access, and levee stability	Preliminary, Planning Level project. Detailed project description not available at this time.	$ 742,500	$ -	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
165	RFMP	Reclamation District 1001, Nicolaus	Improve erosion protection along the Bear River south levee	Project to improve erosion protection along the Bear River south levee for 12.6 mi. total. Project would provide 50% erosion protection with 2' thick protection measures.	$ 2,561,328	$ -	Small Community - Levee repair and infrastructure improvements	Operation and Maintenance
166	RFMP	N/A	Improve Flood Reservoir Operations	Implement Flood-Coordinated Operations for Shasta Dam and Black Butte Dam	$ -	$ -	Systemwide - Reservoir operations	Reservoir and Floodplain Storage and Operation
167	BWFS	California Department of Water Resources	Improved Flood Protection for Rio Vista and Highway 84	The Rio Vista waterfront is vulnerable to flooding along a 2.4-mile reach that extends along the waterfront from downtown near California Street to the Mellin Levee and northward along the Mellin Levee to high ground. Rio Vista has proposed a combination of floodwalls, closure structures, and levee improvements to protect the city from 200-year flooding and higher sea level rise due to climate change. In the event that changes in the Yolo Bypass contribute to stage increases in the vicinity of Rio Vista, the State could potentially participate in the implementation of the local 200-year flood protection project as mitigation for such effects.	$ -	$ 16,000,000	Small Community - Levee repair and infrastructure improvements	Flood Infrastructure
168	RFMP	Three Rivers Levee Improvement Authority	Incorporate Oliverhurst Detention Basin into the SPFC to adequately tie the project levee into high ground.	The Olivehurst Detention basin and Ring levee were constructed in 2006 to mitigate the fact that the SRFCP levee on the right (west) bank of the WPIC terminated into a railroad embankment, not in to high ground. As a result, the SRFCP induced flooding in South Olivehurst. TRLIA, as part of its program to improve the levees in RD 784 to provide 200-year protection, constructed the ring levee and detention basin to mitigate this flooding, provide GGS habitat, and alleviate this system deficiency. The ODB project needs to be incorporated into the SPFC and consideration should be given to incorporating these features into the Federally Authorized project. In this way the federal and State authorizations will appropriately reflect the functional system, as it now exists.	$ 50,000	$ 50,000	Systemwide - State operations, planning and performance tracking	Policy and Regulations

Table B-4. Sacramento Basin Management Actions Included within the 2017 Refined SSIA Portfolio

#	Data Set Source	Lead Agency	Project Name	Project Description	Estimated Cost - Provided by Source	Estimated Cost - Adjusted for Portfolio	Area of Interest and Management Action Category	Management Action Type
169	RFMP	N/A	In-lieu Recharge in North-Eastern Glenn County	Provide surface water in-lieu of groundwater pumping to provide for greater flexibility and supply reliability for property operators as well as providing in-lieu recharge to the aquifer below.	$ 1,000,000	$ 1,000,000	Rural - Small-scale levee setbacks and floodplain storage	Reservoir and Floodplain Storage and Operation
170	RFMP	Isleton Local Maintaining Agency	Isleton Improvements Feasibility Study	The RFMP is pre-feasibility, and thus a feasibility study is a recommended course of action for the area. Potential solutions to be explored include Non-structural structure raising ($69.2M), a ring levee ($47.4M), fix-in-place of existing perimeter levees ($253M) and FEMA Zone D ($N/A) designation or a combination of those solutions.	$ 500,000	$ 500,000	Small Community - Studies and analysis	Watershed and Floodplain Management
171	RFMP	Knights Landing Drainage District	Knights Landing Feasibility Study	The RFMP is pre-feasibility, and thus a feasibility study is a recommended course of action for the area. Potential solutions to be explored include Non-structural structure raising ($32.8M), a ring levee ($N/A), fix-in-place of existing perimeter levees ($184.7M), and FEMA Zone D designation ($N/A) or a combination of those solutions.	$ 500,000	$ 500,000	Small Community - Studies and analysis	Watershed and Floodplain Management
172	RFMP	Knights Landing Drainage District	Knights Landing Ridge Cut Repair	The project is the repair of three non-urban levee sites along the Knights Landing Ridge Cut. The repair of these three sites would complete the levee rehabilitation identified as necessary to restore the District levee to their authorized level of flood protection.	$ 7,242,000	$ 7,242,000	Small Community - Levee repair and infrastructure improvements	Operation and Maintenance
173	RFMP	Tehama County, City of Corning, The Nature Conservancy, California State Parks, California Department of Water Resources, Sacramento River Conservation Area Forum	Kopta Slough	The Kopta project is within the SPFC and modifies a SPFC facility (the revetment is part of the Chico Landing to Red Bluff Project). While technically not a reauthorization, the project would modify the federal project by either 408 permit or 1135 program. In addition, the project has the potential to reduce erosion damage to a State park and ultimately to the county bridge. The bridge is critical infrastructure. Tehama County is bisected by the Sacramento River and this bridge is critical for emergency services. The revetment removal (along with an associated berm removal) will restore natural hydraulic processes. It would increase natural bank and meander potential, as well as increase the frequency, depth, and duration of overbank flooding on the floodplain. • Remove revetment along 5,600 feet of the riverbank at the Kopta Slough property to restore fluvial and floodplain processes and mitigate for the loss of SRA habitat from DWR Flood Control Projects • Facilitate reestablishment of the river's historical channel alignment through Kopta Slough. • Establish erosion protection for the west abutment of Woodson Bridge and the City of Corning sewer outfall. • Restore 176 acres of mixed riparian forest habitat on the Kopta Slough property as mitigation for DWR flood control Projects, • Transfer the 708- acre Kopta Slough property from the California State Controller's Environmental Trust to a resource agency for long-term management. This element may include expansion of the Woodson Bridge SRA to the west side of the Sacramento River, with consideration for increasing public recreational opportunities.	$ 10,000,000	$ 10,000,000	Rural - Habitat restoration/reconnection	Natural Floodplain and Ecosystem Functions
174	RFMP	United States Fish and Wildlife Service	Laurel Avenue Levee Setback	A multi-benefit project at this location would expand the floodway to increase floodwater conveyance capacity, and it would provide additional opportunities for compatible ecosystem restoration actions, similar to those planned for the TRLIA Feather River Levee Setback, as well as implementation of wildlife-friendly farming practices.	$ 70,000,000	$ 70,000,000	Rural - Small-scale levee setbacks and floodplain storage	Flood Infrastructure
175	RFMP	Sutter Butte Flood Control Agency	Laurel to Cypress Critical Repair	Strengthen the existing levee by constructing deep cut-off walls, seepage-berms and other measures	$ 13,500,000	$ 13,500,000	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
176	RFMP	Sutter Butte Flood Control Agency, Levee District 1	LD1 Star Bend Levee Setback Ecosystem enhancement	Levee District 1 (LD 1) constructed an approximately 3,400-ft-long setback levee on the right bank of the Feather River at Star Bend. In addition to providing 200-yr flood protection, construction of the setback area created opportunities for restoration of approximately 45 acres of riparian habitat to benefit terrestrial wildlife and to provide SRA habitat that would enhance fish habitat in the Feather River. LD 1 has already planted approximately 20 acres of riparian habitat as mitigation for construction of the setback levee. SBFCA recently initiated a project to plant another 20 acres in accord with FRWLP mitigation requirements and CVFPP goals.	$ 650,000	$ 650,000	Rural - Habitat restoration/reconnection	Natural Floodplain and Ecosystem Functions

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#	Data Set Source	Lead Agency	Project Name	Project Description	Estimated Cost - Provided by Source	Estimated Cost - Adjusted for Portfolio	Area of Interest and Management Action Category	Management Action Type
177	RFMP	N/A	Levee Easement and Property Line Survey	Research and survey the existing levee easements and adjacent property lines. There is no existing clear definition regarding the locations of LMA's legal boundaries. Qualifier: please coordinate with the CVFPB for official surveys.	$ 1,000,000	$ 1,000,000	Systemwide - State operations, planning and performance tracking	Policy and Regulations
178	RFMP	N/A	Levee Maintenance Issues	Develop a Regional Roundtable including LMA, Resource Agencies, State, and USACE representatives to develop strategies, programs, and projects to address the O&M issues discussed in Chapter 4 of the MUSR RFMP.	$ 100,000	$ 100,000	Systemwide - State operations, planning and performance tracking	Policy and Regulations
179	RFMP	Reclamation District 2098, Cache Haas Area	Levee Penetration Removals & Replacements	The RD-2098 levees along Cache and Haas Slough include a number of dilapidated levee penetrations installed during construction of the SRFCP levees. The primary penetrations at Lookout, Sycamore, and Duck Sloughs allow for both water supply and drainage. Project would include the prioritized removal or replacement of levee penetrations to reduce the flood risk associated with unreliable performance of the conduits during high water.	$ 2,000,000	$ 2,000,000	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
180	BWFS	California Department of Water Resources	Levee Setback near Putah Creek	5,000-feet levee setbacks on the west side of the bypass north of Putah Creek.	$ -	$ 80,000,000	Systemwide - Yolo Bypass multi-benefit improvements	Flood Infrastructure
181	BWFS	California Department of Water Resources	Levee Setback near Putah Creek - Ecosystem Assessments and Implementation	Ecosystem Assessments and Implementation I-80 to Putah Creek. Expand riparian corridor, enhance existing canals, preserve levee remnants for upland refugia, and maintain existing seasonal wetlands to enhance habitat connectivity for target species. Expand and enhance the riparian corridor and existing canals to improve habitat connectivity to west side of Yolo Bypass.	$ -	$ 3,810,000	Systemwide - Reservoir and floodplain storage	Natural Floodplain and Ecosystem Functions
182	BWFS	California Department of Water Resources	Levee Setback near Willow Slough Bypass	4,000-feet levee setbacks on the west side of the bypass north of Willow Slough and south of I-80.	$ 225,000,000	$ 125,000,000	Systemwide - Yolo Bypass multi-benefit improvements	Flood Infrastructure
183	BWFS	California Department of Water Resources	Levee Setback near Willow Slough Bypass - Ecosystem Assessments and Implementation	Ecosystem Assessments and Implementation for North of Willow Slough Setback, and I-80. Expand riparian corridor, enhance existing canals, preserve levee remnants for upland refugia, and maintain existing seasonal wetlands to enhance habitat connectivity for target species. Expand and enhance the riparian corridor and existing canals to improve habitat connectivity to west side of Yolo Bypass.	$ -	$ 2,481,600	Systemwide - Reservoir and floodplain storage	Natural Floodplain and Ecosystem Functions
184	RFMP	Reclamation District 2060, Hastings Tract	Lindsey and Cache Slough Bank Protection Project – Hastings	Repair/Rehabilitation of multiple sites along 12,000 LF of lower sections closest to Yolo Bypass flows of Cache Slough and Lindsey Slough. Project components could include: Rehabilitation of waterside bank to withstand flood flows, and incorporate an enhanced lower waterside slope habitat area with possible riparian forest, scrub shrub, emergent/freshwater marsh to mitigate and enhance habitat values.	$ 2,067,000	$ 2,067,000	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
185	RFMP	Reclamation District 536, Egbert Track	Lindsey Slough Bank Protection Project – Egbert	Waterside Bank protection and Rehabilitation project 460 LF along the Lindsey Slough, LM 4.83 to 5.03.	$ 522,000	$ 522,000	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
186	RFMP	Reclamation District 2060, Hastings Tract	Lindsey Slough Bank Protection Project – Hastings	Waterside Bank Protection and Rehabilitation project 750 LF between LM 2.43 to 2.45 and 4.29. Enhanced lower waterside slope habitat area with possible Riparian Forest, Scrub- Shrub, and emergent/freshwater marsh to mitigate or enhance the habitat value.	$ 850,000	$ 850,000	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
187	RFMP	Reclamation District 536, Egbert Track	Lindsey Slough Seepage Repair Project – Egbert	Seepage protection project 300 LF along the Lindsey Slough, LM 3.3 to 3.35. Project would consist of rock and fill.	$ 194,000	$ 194,000	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
188	RFMP	Reclamation District 536, Egbert Track	Lindsey Slough Stability Project – Egbert	Levee Stability protection project 1,600 LF along the Lindsey Slough, LM 0.52 to 0.88.	$ 1,102,000	$ 1,102,000	Rural - Levee repair and infrastructure improvements	Operation and Maintenance

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#	Data Set Source	Lead Agency	Project Name	Project Description	Estimated Cost - Provided by Source	Estimated Cost - Adjusted for Portfolio	Area of Interest and Management Action Category	Management Action Type
189	RFMP	DWR Maintenance Area 05	Little Chico Creek Diversion to Butte Creek	Evaluate flood carrying capacity of Little Chico Creek diversion to Butte Creek.	$ 100,000	$ 100,000	Rural - Studies and analysis	Watershed and Floodplain Management
190	RFMP	Sutter County	Live Oak Park	Restoration actions could include planting riparian vegetation downstream from the boat ramp to create a wider strip of habitat and replacing some or all turf grass and other non-native species with appropriate native plants to increase wildlife habitat values.	$ 750,000	$ 750,000	Small Community - Levee setbacks, land acquisitions and habitat restoration	Natural Floodplain and Ecosystem Functions
191	BWFS	California Department of Water Resources	Lower Elkhorn Ecosystem Assessment and Implementation	Improve fish passage and habitat connectivity along the Tule Canal by removing barriers to fish passage, providing a seasonally inundated low-flow channel, and improving riparian and wetland habitat. Additionally, a low-flow channel would be created, and riparian areas would be enhanced and expanded. Providing a more functional Tule Canal with a seasonally inundated low-flow channel, bordered by a wetland terrace, would improve water quality and provide expanded wetland and inundated floodplain habitat for target fish species. A wider riparian corridor would benefit Draft CS target species including Least Bell's vireo and Swainson's hawk. Additionally, existing canals would be extended and sections of the existing levees would be retained as habitat and refugia for giant garter snake (GGS), respectively.	$ 18,000,000	$ 7,507,100	Systemwide - Reservoir and floodplain storage	Natural Floodplain and Ecosystem Functions
192	BWFS	California Department of Water Resources	Lower Elkhorn Levee Setback Assessment and Implementation	A 3,500-feet levee setback along the Lower Elkhorn basin and associated ecosystem restoration actions eastward from the existing alignment for a distance of about 5.5 miles to the new Sacramento Bypass levee, adding 2,300 acres to the Yolo Bypass floodway.	$ 158,000,000	$ 161,492,900	Systemwide - Yolo Bypass multi-benefit improvements	Flood Infrastructure
193	Other	California Department of Water Resources	Lower Sacramento/Delta North - Channel RR&R - Arrundo Removal	Sources included meetings with regional representatives and information from DWR. No LMAs reported costs.	$ 2,352,053	$ 2,352,053	Systemwide - Routine maintenance	Operation and Maintenance
194	Other	California Department of Water Resources	Lower Sacramento/Delta North - Channel Sediment Removal	Channel maintenance activities including sediment, vegetation, and debris removal are conducted by DWR with respect to the Sacramento River Flood Control Project and generally by LMAs in the San Joaquin Valley. Estimated costs for the Sacramento Basin were developed by using historical projects overseen by DWR, which have occurred as funding has been available, as well as input from regional experts. Estimated costs for the San Joaquin Basin were based on direct interviews with LMAs and staff.	$ 29,400,662	$ 29,400,662	Systemwide - Routine maintenance	Operation and Maintenance
195	Other	California Department of Water Resources	Lower Sacramento/Delta North - Channel Vegetation and Debris Removal	Channel maintenance activities including sediment, vegetation, and debris removal are conducted by DWR with respect to the Sacramento River Flood Control Project and generally by LMAs in the San Joaquin Valley. Estimated costs for the Sacramento Basin were developed by using historical projects overseen by DWR, which have occurred as funding has been available, as well as input from regional experts. Estimated costs for the San Joaquin Basin were based on direct interviews with LMAs and staff.	$ 29,400,662	$ 29,400,662	Systemwide - Routine maintenance	Operation and Maintenance
196	Other	California Department of Water Resources	Lower Sacramento/Delta North - Large Structure O&M	Major structures involve those facilities described in CWC Section 8361 and administered by DWR, and include weirs, bypass outflow control structures, outfall gate facilities, and large regional pumping plants.	$ -	$ -	Systemwide - Routine maintenance	Operation and Maintenance
197	Other	California Department of Water Resources	Lower Sacramento/Delta North - Large Structures RR&R	Based on discussions with DWR and LMA staff, major structures have historically been repaired and well maintained, and there is not an immediate need to repair, replace, or rehabilitate these facilities. As such, RR&R costs were not identified for this TM given major structures were assumed not to require significant repairs over the next 50 years. However, it is recommended that funding reserves be established to ensure adequate funding is available in the future to continue needed repairs or to replace aged facilities.	$ -	$ -	Urban - Other infrastructure and multi-benefit improvements	Operation and Maintenance

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#	Data Set Source	Lead Agency	Project Name	Project Description	Estimated Cost - Provided by Source	Estimated Cost - Adjusted for Portfolio	Area of Interest and Management Action Category	Management Action Type
198	Other	California Department of Water Resources	Lower Sacramento/Delta North - Non-urban Levee O&M (Rural)	Levee O&M costs were separated between urban and rural LMAs to capture the additional costs associated with urban area LMAs. Levee O&M included the following activities: vegetation maintenance, rodent control, encroachment and pipe maintenance, minor repairs (erosion, levee crown repairs etc.)	$ 255,041,335	$ 255,041,335	Systemwide - Routine maintenance	Operation and Maintenance
199	Other	California Department of Water Resources	Lower Sacramento/Delta North - Non-urban Levee RR&R (Rural)	Levee-related RR&R costs have generally been driven by necessary flood-event repairs and known erosion or levee stability issues. The OMRR&R Work Group determined the Delta Subventions Program data set is the most robust data set for estimating RR&R cost on SPFC levees because the existence of the funding program has encouraged more regular analysis and repair of levees. Although urban levees are being improved to a higher standard to meet urban level of protection standards, the OMRR&R Work Group determined that repair and rehabilitation costs for urban and non-urban levees would not differ substantially, and the cost for ULDC compliance would be the only significant differentiating factor for RR&R of urban SPFC levees.	$ 72,076,899	$ 72,076,899	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
200	Other	California Department of Water Resources	Lower Sacramento/Delta North - Small Community Levee O&M	Levee O&M costs were separated between urban and rural LMAs to capture the additional costs associated with urban area LMAs. Levee O&M included the following activities: vegetation maintenance, rodent control, encroachment and pipe maintenance, minor repairs (erosion, levee crown repairs etc.)	$ 43,304,823	$ 43,304,823	Systemwide - Routine maintenance	Operation and Maintenance
201	Other	California Department of Water Resources	Lower Sacramento/Delta North - Small Community Levee RR&R	Levee-related RR&R costs have generally been driven by necessary flood-event repairs and known erosion or levee stability issues. The OMRR&R Work Group determined the Delta Subventions Program data set is the most robust data set for estimating RR&R cost on SPFC levees because the existence of the funding program has encouraged more regular analysis and repair of levees. Although urban levees are being improved to a higher standard to meet urban level of protection standards, the OMRR&R Work Group determined that repair and rehabilitation costs for urban and non-urban levees would not differ substantially, and the cost for ULDC compliance would be the only significant differentiating factor for RR&R of urban SPFC levees.	$ 12,238,320	$ 12,238,320	Small Community - Levee repair and infrastructure improvements	Operation and Maintenance
202	Other	California Department of Water Resources	Lower Sacramento/Delta North - Small Structures O&M	Minor structures include stop log or gated closure structures, pumping plants, monitoring wells and piezometers, retaining walls and floodwalls, pipe penetrations, and encroachments. Routine O&M of these types of structures is critical, but often overlooked for budgeting purposes. As became evident in the LMA data received, LMAs typically only account for routine power costs for pumping plants and do not separately account for other activities associated with minor structures such as video inspections of pipes, lubrication and minor repairs of pipe closure valves, routine inspection and maintenance of closure structure gates or stop logs, and inspection and minor repairs of floodwalls. The OMRR&R Work Group determined that costs for minor-structure O&M are likely included in the general overhead expenses for the LMAs who have structures, and no further estimates were developed. However, it is anticipated that video inspections of pipes will be required in the future (once every 5 years) for pipes crossing SPFC levees and as such these projected costs were included in the overall estimates.	$ 1,709,158	$ 1,709,158	Systemwide - Routine maintenance	Operation and Maintenance
203	Other	California Department of Water Resources	Lower Sacramento/Delta North - Small Structures RR&R	Small structures such as stop logs or gated closure structures, monitoring wells and piezometers, retaining walls and floodwalls, pipes, and encroachments are typically accounted for in levee RR&R costs, except for pipes. Many of these pipes were installed before or during original project construction prior to the 1950s, but no plans were implemented to assure these facilities could be replaced when they exceed their useful life. As a result, many pipes have reached their useful life with many of these structures in need of repair, replacement, or proper pipe abandonment.	$ 91,102,851	$ 91,102,851	Urban - Other infrastructure and multi-benefit improvements	Operation and Maintenance
204	Other	California Department of Water Resources	Lower Sacramento/Delta North - Urban Levee O&M	Levee O&M costs were separated between urban and rural LMAs to capture the additional costs associated with urban area LMAs. Levee O&M included the following activities: vegetation maintenance, rodent control, encroachment and pipe maintenance, minor repairs (erosion, levee crown repairs etc.)	$ 168,250,188	$ 168,250,188	Systemwide - Routine maintenance	Operation and Maintenance

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#	Data Set Source	Lead Agency	Project Name	Project Description	Estimated Cost - Provided by Source	Estimated Cost - Adjusted for Portfolio	Area of Interest and Management Action Category	Management Action Type
205	Other	California Department of Water Resources	Lower Sacramento/Delta North - Urban Levee RR&R	Levee-related RR&R costs have generally been driven by necessary flood-event repairs and known erosion or levee stability issues. The OMRR&R Work Group determined the Delta Subventions Program data set is the most robust data set for estimating RR&R cost on SPFC levees because the existence of the funding program has encouraged more regular analysis and repair of levees. Although urban levees are being improved to a higher standard to meet urban level of protection standards, the OMRR&R Work Group determined that repair and rehabilitation costs for urban and non-urban levees would not differ substantially, and the cost for ULDC compliance would be the only significant differentiating factor for RR&R of urban SPFC levees.	$ 52,215,576	$ 52,215,576	Urban - Other infrastructure and multi-benefit improvements	Operation and Maintenance
206	BWFS	California Department of Water Resources	Lower Yolo Bypass - West Setback - Ecosystem Assessment and Implementation	Restore tidal and subtidal marsh ecosystems via strategic levee breaches and channel grading. Preserve levee remnants for upland refugia for target species.	$ 20,000,000	$ 11,019,900	Systemwide - Reservoir and floodplain storage	Natural Floodplain and Ecosystem Functions
207	BWFS	California Department of Water Resources	Lower Yolo Bypass Assessment and Implementation	A levee setback south of RD 2068 to Rio Vista, and associated ecosystem restoration actions.	$ 185,000,000	$ 184,980,100	Systemwide - Yolo Bypass multi-benefit improvements	Flood Infrastructure
208	RFMP	Yuba County Water Agency	Lower Yuba River Native Fish Habitat Enhancement	The Lower Yuba River Accord River Management Team Planning Group (RMT) implements the Lower Yuba River Accord, which is an agreement between 17 stakeholders, which enables the Yuba County Water Agency to successfully operate the Yuba River Development Project. Apart from management of flows to benefit native salmon and steelhead, habitat enhancement is part of the relicensing agreement for the Project. Actions to benefit Feather and Yuba River native fish should be coordinated with the RMT, and opportunities may exist to pursue projects to benefit Yuba River native fish that would also benefit flood management. The RMT is conducting extensive studies, monitoring and evaluations that could be of great benefit for the development of ecosystem enhancement and restoration actions on the Yuba River.	$ -	$ -	Rural - Habitat restoration/reconnection	Natural Floodplain and Ecosystem Functions
209	RFMP	Deer Creek Watershed Conservancy, Tehama County Flood Control and Water Conservation District, California Department of Fish and Wildlife Northern Region (Region 1)	Lwr Deer Creek Levee Improvements & Habitat Restoration	All phases are needed to meet project conveyance and ecosystem restoration. Phase 2 only included design for the DCID dam replacement with implementation deferred to other funding sources as written for the Flood Corridor Grant Project. The design capacity needs both DCID dam and Red Bridge replacement to met design capacity, manage sediment, and restore ecosystem function. All components together help to make this a multi-objective project. - Phase 1 will conduct an overall evaluation of the project as described in the 2011 feasibility study. - Phase 2 will evaluate options to improve the existing SVRIC Diversion Dam and fish ladders. - Phase 3 will be the final design and construction of a new 4,620 LF levee. The new levee will be setback will create approximately 40 acres of new floodway with floodway and migration easements, which will be contoured to greatly assist fish passage (e.g. Salmon). - Phase 4 will consist of rebuilding Leininger Road Bridge (Red Bridge) with a conveyance width of about 450 feet. The section of the north bank levee upstream of Red Bridge (PL2) would be removed, and the spoils would be used to raise the north bank road abutment, thus maintaining the flooding use of the flood easement on the Leininger property. Additional engineering of the north bank road abutment is likely. - Phase 5 will consist of miscellaneous improvements to non project levees, and removal of rock revetment and spurs will further enhance the flood benefits and habitat restoration efforts for the reach.	$ 34,000,000	$ 34,000,000	Rural - Small-scale levee setbacks and floodplain storage	Flood Infrastructure

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210	RFMP	Deer Creek Watershed Conservancy, Tehama County Flood Control and Water Conservation District, California Department of Fish and Wildlife Northern Region (Region 1)	Lwr Deer Creek Levee Improvements & Habitat Restoration Ph1	Phase 1 will conduct an overall evaluation of the project as described in the 2011 feasibility study.	$ 50,000,000	$ -	Rural - Studies and analysis	Watershed and Floodplain Management
211	RFMP	Deer Creek Watershed Conservancy, Tehama County Flood Control and Water Conservation District, California Department of Fish and Wildlife Northern Region (Region 1)	Lwr Deer Creek Levee Improvements & Habitat Restoration Ph2	Phase 2 will evaluate options to improve the existing SVRIC Diversion Dam and fish ladders.	$ -	$ -	Rural - Studies and analysis	Watershed and Floodplain Management
212	RFMP	Deer Creek Watershed Conservancy, Tehama County Flood Control and Water Conservation District, California Department of Fish and Wildlife Northern Region (Region 1)	Lwr Deer Creek Levee Improvements & Habitat Restoration Ph3	Phase 3 will be the final design and construction of a new 4,620 LF levee. The new levee will be setback will create approximately 40 acres of new floodway with floodway and migration easements, which will be contoured to greatly assist fish passage (e.g. Salmon).	$ -	$ -	Rural - Small-scale levee setbacks and floodplain storage	Flood Infrastructure
213	RFMP	Deer Creek Watershed Conservancy, Tehama County Flood Control and Water Conservation District, California Department of Fish and Wildlife Northern Region (Region 1)	Lwr Deer Creek Levee Improvements & Habitat Restoration Ph4	Leininger Road Bridge (Red Bridge) would be rebuilt with a conveyance width of about 450 feet. The section of the north bank levee upstream of Red Bridge (PL2) would be removed, and the spoils would be used to raise the north bank road abutment, thus maintaining the flooding use of the flood easement on the Leininger property. Additional engineering of the north bank road abutment is likely.	$ -	$ -	Rural - Levee repair and infrastructure improvements	Operation and Maintenance

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214	RFMP	Deer Creek Watershed Conservancy, Tehama County Flood Control and Water Conservation District, California Department of Fish and Wildlife Northern Region (Region 1)	Lwr Deer Creek Levee Improvements & Habitat Restoration Ph5	Miscellaneous improvements to non project levees, and removal of rock revetment and spurs will further enhance the flood benefits and habitat restoration efforts for the reach.	$ -	$ -	Rural - Habitat restoration/reconnection	Natural Floodplain and Ecosystem Functions
215	Other	California Department of Water Resources	Mapping, Risk Awareness and Land Use Planning (Rural)	Covers the State's floodplain risk mgmt programs, information mgmt systems, channel capacity updates, land use planning, mitigation planning, etc	$ 787,800	$ 15,441,228	Rural - Risk awareness, floodproofing and land use planning	Watershed and Floodplain Management
216	Other	California Department of Water Resources	Mapping, Risk Awareness and Land Use Planning (Small Comm)	Covers the State's floodplain risk mgmt programs, information mgmt systems, channel capacity updates, land use planning, mitigation planning, etc	$ 3,151,200	$ 61,764,911	Small Community - Risk awareness, floodproofing and land use planning	Watershed and Floodplain Management
217	Other	California Department of Water Resources	Mapping, Risk Awareness and Land Use Planning (Urban)	Covers the State's floodplain risk mgmt programs, information mgmt systems, channel capacity updates, land use planning, mitigation planning, etc	$ 3,939,000	$ 77,206,138	Urban - Risk awareness, floodproofing and land use planning	Watershed and Floodplain Management
218	USACE	Marysville Levee District	Marysville Ring Levee Phase 2B Design & Construction	Strengthen the existing levee by constructing deep cut-off walls, seepage-berms and other measures	$ 19,000,000	$ -	Urban - Levee improvements	Flood Infrastructure
219	USACE	Marysville Levee District	Marysville Ring Levee Phase 2C Design & Construction	Strengthen the existing levee by constructing deep cut-off walls, seepage-berms and other measures	$ 13,000,000	$ -	Urban - Levee improvements	Flood Infrastructure
220	USACE	Marysville Levee District	Marysville Ring Levee Phase 3 Design & Construction	Strengthen the existing levee by constructing deep cut-off walls, seepage-berms and other measures	$ 21,200,000	$ -	Urban - Levee improvements	Flood Infrastructure
221	RFMP	Solano County Public Works	Mellin Levee Vegetation Control	Levee vegetation management and DWR to determine if Mellin Levee is actually an SPFC levee. Similar project estimated costs: Lisbon $378,000, Ryer $3,927,000, Tyler $1,481,000. Average of three projects: $1,928,667.	$ 1,928,667	$ 1,928,667	Systemwide - Routine maintenance	Operation and Maintenance
222	RFMP	N/A	Meridian 100-Year Level of Protection	Provide Meridian with a 100-Year level of protection	$ -	$ -	Small Community - Studies and analysis	Watershed and Floodplain Management

Table B-4. Sacramento Basin Management Actions Included within the 2017 Refined SSIA Portfolio

#	Data Set Source	Lead Agency	Project Name	Project Description	Estimated Cost - Provided by Source	Estimated Cost - Adjusted for Portfolio	Area of Interest and Management Action Category	Management Action Type
223	RFMP	United States Army Corp of Engineers	Middle Creek Flood Damage Reduction and Ecosystem Restoration Project	De-authorize and breach the lower east Middle Creek levees in multiple locations and restoring about 1,650 acres of floodplain. The project provides water quality benefits to Clear Lake (alleviates sediment inflow), and the depths of flooding within the Southern zone of benefit are estimated to be between 5' and 10' during the 100-year event. Restores lost wetland/riparian habitat and provides up to 6,500 ac-ft. new water supply.	$ 48,000,000	$ 48,000,000	Rural - Habitat restoration/reconnection	Natural Floodplain and Ecosystem Functions
224	Other	California Department of Water Resources	Mid-Upper Sacramento - Channel RR&R - Arrundo Removal	Sources included meetings with regional representatives and information from DWR. No LMAs reported costs. Giant reed removal estimated cost range is from $7,000/acre to $10,000/acre based on DWR input. Upper end of was range chosen for unit cost given other regions identified costs as high as $25,000/acre.	$ 5,488,124	$ 5,488,124	Systemwide - Routine maintenance	Operation and Maintenance
225	Other	California Department of Water Resources	Mid-Upper Sacramento - Channel Sediment Removal	Channel maintenance activities including sediment, vegetation, and debris removal are conducted by DWR with respect to the Sacramento River Flood Control Project and generally by LMAs in the San Joaquin Valley. Estimated costs for the Sacramento Basin were developed by using historical projects overseen by DWR, which have occurred as funding has been available, as well as input from regional experts. Estimated costs for the San Joaquin Basin were based on direct interviews with LMAs and staff.	$ 73,501,655	$ 73,501,655	Systemwide - Routine maintenance	Operation and Maintenance
226	Other	California Department of Water Resources	Mid-Upper Sacramento - Channel Vegetation and Debris Removal	Channel maintenance activities including sediment, vegetation, and debris removal are conducted by DWR with respect to the Sacramento River Flood Control Project and generally by LMAs in the San Joaquin Valley. Estimated costs for the Sacramento Basin were developed by using historical projects overseen by DWR, which have occurred as funding has been available, as well as input from regional experts. Estimated costs for the San Joaquin Basin were based on direct interviews with LMAs and staff.	$ 29,400,662	$ 29,400,662	Systemwide - Routine maintenance	Operation and Maintenance
227	Other	California Department of Water Resources	Mid-Upper Sacramento - Large Structure O&M	Major structures involve those facilities described in CWC Section 8361 and administered by DWR, and include weirs, bypass outflow control structures, outfall gate facilities, and large regional pumping plants.	$ 10,388,234	$ 10,388,234	Systemwide - Routine maintenance	Operation and Maintenance
228	Other	California Department of Water Resources	Mid-Upper Sacramento - Large Structures RR&R	Based on discussions with DWR and LMA staff, major structures have historically been repaired and well maintained, and there is not an immediate need to repair, replace, or rehabilitate these facilities. As such, RR&R costs were not identified for this TM given major structures were assumed not to require significant repairs over the next 50 years. However, it is recommended that funding reserves be established to ensure adequate funding is available in the future to continue needed repairs or to replace aged facilities.	$ -	$ -	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
229	Other	California Department of Water Resources	Mid-Upper Sacramento - Non-urban Levee O&M (Rural)	Levee O&M costs were separated between urban and rural LMAs to capture the additional costs associated with urban area LMAs. Levee O&M included the following activities: vegetation maintenance, rodent control, encroachment and pipe maintenance, minor repairs (erosion, levee crown repairs etc.)	$ 163,202,291	$ 163,202,291	Systemwide - Routine maintenance	Operation and Maintenance
230	Other	California Department of Water Resources	Mid-Upper Sacramento - Non-urban Levee RR&R (Rural)	Levee-related RR&R costs have generally been driven by necessary flood-event repairs and known erosion or levee stability issues. The OMRR&R Work Group determined the Delta Subventions Program data set is the most robust data set for estimating RR&R cost on SPFC levees because the existence of the funding program has encouraged more regular analysis and repair of levees. Although urban levees are being improved to a higher standard to meet urban level of protection standards, the OMRR&R Work Group determined that repair and rehabilitation costs for urban and non-urban levees would not differ substantially, and the cost for ULDC compliance would be the only significant differentiating factor for RR&R of urban SPFC levees.	$ 46,122,387	$ 46,122,387	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
231	Other	California Department of Water Resources	Mid-Upper Sacramento - Small Community Levee O&M	Levee O&M costs were separated between urban and rural LMAs to capture the additional costs associated with urban area LMAs. Levee O&M included the following activities: vegetation maintenance, rodent control, encroachment and pipe maintenance, minor repairs (erosion, levee crown repairs etc.)	$ 139,381,483	$ 139,381,483	Systemwide - Routine maintenance	Operation and Maintenance

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#	Data Set Source	Lead Agency	Project Name	Project Description	Estimated Cost - Provided by Source	Estimated Cost - Adjusted for Portfolio	Area of Interest and Management Action Category	Management Action Type
232	Other	California Department of Water Resources	Mid-Upper Sacramento - Small Structures O&M	Minor structures include stop log or gated closure structures, pumping plants, monitoring wells and piezometers, retaining walls and floodwalls, pipe penetrations, and encroachments. Routine O&M of these types of structures is critical, but often overlooked for budgeting purposes. As became evident in the LMA data received, LMAs typically only account for routine power costs for pumping plants and do not separately account for other activities associated with minor structures such as video inspections of pipes, lubrication and minor repairs of pipe closure valves, routine inspection and maintenance of closure structure gates or stop logs, and inspection and minor repairs of floodwalls. The OMRR&R Work Group determined that costs for minor-structure O&M are likely included in the general overhead expenses for the LMAs who have structures, and no further estimates were developed. However, it is anticipated that video inspections of pipes will be required in the future (once every 5 years) for pipes crossing SPFC levees and as such these projected costs were included in the overall estimates.	$ 2,399,094	$ 2,399,094	Systemwide - Routine maintenance	Operation and Maintenance
233	Other	California Department of Water Resources	Mid-Upper Sacramento - Small Structures RR&R	Small structures such as stop logs or gated closure structures, monitoring wells and piezometers, retaining walls and floodwalls, pipes, and encroachments are typically accounted for in levee RR&R costs, except for pipes. Many of these pipes were installed before or during original project construction prior to the 1950s, but no plans were implemented to assure these facilities could be replaced when they exceed their useful life. As a result, many pipes have reached their useful life with many of these structures in need of repair, replacement, or proper pipe abandonment.	$ 58,958,128	$ 58,958,128	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
234	Other	California Department of Water Resources	Mid-Upper Sacramento - Urban Levee O&M	Levee O&M costs were separated between urban and rural LMAs to capture the additional costs associated with urban area LMAs. Levee O&M included the following activities: vegetation maintenance, rodent control, encroachment and pipe maintenance, minor repairs (erosion, levee crown repairs etc.)	$ 11,936,669	$ 11,936,669	Systemwide - Routine maintenance	Operation and Maintenance
235	Other	California Department of Water Resources	Mid-Upper Sacramento - Urban Levee RR&R	Levee-related RR&R costs have generally been driven by necessary flood-event repairs and known erosion or levee stability issues. The OMRR&R Work Group determined the Delta Subventions Program data set is the most robust data set for estimating RR&R cost on SPFC levees because the existence of the funding program has encouraged more regular analysis and repair of levees. Although urban levees are being improved to a higher standard to meet urban level of protection standards, the OMRR&R Work Group determined that repair and rehabilitation costs for urban and non-urban levees would not differ substantially, and the cost for ULDC compliance would be the only significant differentiating factor for RR&R of urban SPFC levees.	$ 3,704,483	$ 3,704,483	Urban - Other infrastructure and multi-benefit improvements	Operation and Maintenance
236	Other	California Department of Water Resources	Mid-Upper Sacramento - Small Community Levee RR&R	Levee-related RR&R costs have generally been driven by necessary flood-event repairs and known erosion or levee stability issues. The OMRR&R Work Group determined the Delta Subventions Program data set is the most robust data set for estimating RR&R cost on SPFC levees because the existence of the funding program has encouraged more regular analysis and repair of levees. Although urban levees are being improved to a higher standard to meet urban level of protection standards, the OMRR&R Work Group determined that repair and rehabilitation costs for urban and non-urban levees would not differ substantially, and the cost for ULDC compliance would be the only significant differentiating factor for RR&R of urban SPFC levees.	$ 39,390,419	$ 39,390,419	Small Community - Levee repair and infrastructure improvements	Operation and Maintenance
237	RFMP	Reclamation District 999, Netherlands	Miner Slough Bank Protection Control – Netherlands	Waterside Bank Protection and Rehabilitation project 400 LF LM 0.64. Enhanced lower waterside slope habitat area with possible Riparian Forest, Scrub-Shrub, and emergent/freshwater marsh to mitigate or enhance the habitat value.	$ 454,000	$ 454,000	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
238	RFMP	Reclamation District 999, Netherlands	Miner Slough Seepage Repair Project – Netherlands	The construction of seepage control berms, drains or membranes along Miner Slough. Easement issues. Estimated 30,000 tons of gravel and 40,000 tons of imported fill. 3 year completion time.	$ 1,240,000	$ 1,240,000	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
239	RFMP	Brannan-Andrus Levee Maintenance District	Mokelumne River Crown Raising	Crown raising to occur to repair PL 84-99 deficiencies in the levee crown.	$ 517,000	$ 517,000	Rural - Levee repair and infrastructure improvements	Flood Infrastructure
240	RFMP	Brannan-Andrus Levee Maintenance District	Mokelumne River French Drain	The existing toe ditch will be removed. A drain will be placed in the existing irrigation ditch and toe ditch will be replaced with a French drain and slope drainage blanket.	$ 258,000	$ 258,000	Rural - Levee repair and infrastructure improvements	Operation and Maintenance

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#	Data Set Source	Lead Agency	Project Name	Project Description	Estimated Cost - Provided by Source	Estimated Cost - Adjusted for Portfolio	Area of Interest and Management Action Category	Management Action Type
241	RFMP	Brannan-Andrus Levee Maintenance District	Mokelumne River Stability Berm	A stability berm, estimated to be approximately 80 feet wide by 5 feet high will be constructed along the landside toe of the levee.	$ 930,000	$ 930,000	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
242	RFMP	Reclamation District 537, California Department of Water Resources, Yolo County	Monument Bend Maintenance	River side levee toe needs to be rebuilt along Old River Road and Monument Bend.	$ 1,000,000	$ 1,000,000	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
243	RFMP		Natomas Cross Canal	Several multi–benefit design concepts could be adopted to improve habitat values at this site while still maintaining agricultural production including: • Maintaining existing rice fields while allowing seasonally inundation prior to spring planting, thus providing habitat value for waterfowl and simulated rearing habitat for salmonids. The installation of several egress areas for juvenile salmonids would be required within the rice fields to ensure the entrainment of salmonids does not occur. • Creating seasonal wetlands at the confluence of the East Side and Pleasant Grove • Creek Canals, while also potentially allowing concurrent rice production. • Installing seasonal wetland enhancements at the confluence of Pleasant Grove Creek and Pleasant Grove Creek Canal to add flood detention for Sankey Gap. • Installing floodplain benching and terracing and riparian enhancements along Pleasant Grove Creek. • feathering the edges of the Natomas Cross Canal in a way that is flood neutral to enhance shaded riverine aquatic (SRA) habitat. The site provides an opportunity for over 3,400 acres of multi–benefit use including providing habitat for salmonids, migratory birds and waterfowl while maintaining a proportion of the site in agricultural production.	$ 115,000,000	$ 115,000,000	Rural - Habitat restoration/reconnection	Natural Floodplain and Ecosystem Functions
244	USACE	Reclamation District 1001, Nicolaus	Natomas Cross Canal north levee	Phased improvements to the RD1001 levee system, Segment 284, to achieve 100-year FEMA levee protection. Reference: Non-Urban Levee Evaluations Project Remedial Alternatives and Cost Estimates Report (NULE RACER).	$ 123,878,000	$ -	Urban - Levee improvements	Flood Infrastructure
245	USACE	Sacramento Area Flood Control Agency, United States Army Corp of Engineers	Natomas Levees	Intended to address identified levee embankment and foundation stability issues as well as levee height deficiencies in the perimeter levee system protection the Natomas Basin east of the Sacramento River and north of the American River. Initiated by SAFCA in 2007 and to date roughly 50% of the project (approx. 18 miles) have been completed and it is anticipated that construction of the remainder will begin in 2016 and completed within 6 years. This includes 6 miles of the Sacramento River east levee, 2 miles of the American River north levee, 7 miles of the Natomas East Main Drainage Canal west levee and 3 miles of the Pleasant Grove Creek Canal west levee.	$ 700,000,000	$ -	Urban - Levee improvements	Flood Infrastructure
246	RFMP	N/A	Nelson 100-Year Level of Protection	Provide Nelson with a 100-Year level of protection	$ 50,000,000	$ 50,000,000	Small Community - Studies and analysis	Watershed and Floodplain Management
247	RFMP	Reclamation District 1001, Nicolaus	Nelson Weir removal or modification to reduce erosion and improve habitat	Project consists of 2200 ' of rock weir being removed @ 5' tall (60 CY/ LF of weir) to reduce erosion and improve habitat.	$ 2,640,000	$ 2,640,000	Small Community - Levee repair and infrastructure improvements	Operation and Maintenance
248	RFMP	N/A	Nelson/Richvale Small 100-Year Level of protection	Evaluate feasibility of providing 100-yr protection to Richvale and Nelson. Look at the feasibility of using existing agricultural lands as temporary detention basins to relieve high flows within Butte Creek.	$ 100,000	$ 100,000	Small Community - Studies and analysis	Watershed and Floodplain Management

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249	RFMP	Reclamation District 827, Elkhorn	New East-West Cross Levee	The on-and off ramps to Interstate 5, at the northern end of the District, provide a critical route for basin ingress and egress. This access also provides a potential emergency evacuation route for West Sacramento. A levee failure upstream for RD 827 has the potential to inundate the Interstate 5 on-and off ramps. Constructing a new east-west cross levee north of Old River Road to redirect inundation flows back into the Yolo Bypass, would improve public safety for the region.	$ 8,000,000	$ 8,000,000	Rural - Levee repair and infrastructure improvements	Flood Infrastructure
250	Other	California Department of Water Resources	Nonstructural Berms & Interior Drainage		$ 9,727,600	$ 9,727,600	Small Community - Risk awareness, floodproofing and land use planning	Watershed and Floodplain Management
251	Other	California Department of Water Resources	Nonstructural Berms & Interior Drainage		$ 4,863,800	$ 4,863,800	Small Community - Risk awareness, floodproofing and land use planning	Watershed and Floodplain Management
252	Other	California Department of Water Resources	Nonstructural Berms & Interior Drainage		$ 9,727,600	$ 9,727,600	Small Community - Risk awareness, floodproofing and land use planning	Watershed and Floodplain Management
253	RFMP	N/A	Nord 100-Year Level of Protection	Provide Nord with a 100-Year level of protection	$ 50,000,000	$ 50,000,000	Small Community - Studies and analysis	Watershed and Floodplain Management
254	RFMP		North Bay Aqueduct Alternate Intake Project	Develop and implement an alternate intake on the Sacramento River and connect it to the existing North Bay Aqueduct system. This project allows operational flexibility of the existing Barker Slough Pumping Plant to support multi-beneficial uses of the Yolo Bypass and Cache Slough Complex for a balance between flood management, habitat restoration, and water supply needs. Collaborative implementation of this project provides continued deliveries of reliable and sustainable drinking water supply by promoting improved water quality and protection of endangered species, achieving an equitable balance of these multiple public benefits in this finite landscape.	$ 550,000,000	$ 550,000,000	Systemwide - Yolo Bypass multi-benefit improvements	Flood Infrastructure
255	USACE	Sacramento Area Flood Control Agency, United States Army Corp of Engineers	North Sacramento Streams	Located east of Natomas, contains several urbanized floodplains that are threatened by peak flood flows; Arcade Creek, Magpie Creek and the lower portion of the Natomas East Main Drainage Canal (NEMDC). Past improvements in the 1990's however recent preliminary embankment and foundation stability analyses indicate that up to four miles of additional improvement may be required along portions of the north and south levees of Arcade Creek and the east levee of NEMDC between Arcade Creek and Northgate Boulevard.	$ 150,000,000	$ -	Urban - Levee improvements	Flood Infrastructure
256	RFMP	Northern California Regional Land Trust	Northern Sacramento Valley Regional Atlas	Development of a centralized GIS database and Digital Atlas for the Northern Sacramento Valley Region to build a comprehensive collection of water and resource management-related spatial information.	$ 100,000	$ 100,000	Rural - Risk awareness, floodproofing and land use planning	Watershed and Floodplain Management

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#	Data Set Source	Lead Agency	Project Name	Project Description	Estimated Cost - Provided by Source	Estimated Cost - Adjusted for Portfolio	Area of Interest and Management Action Category	Management Action Type
257	RFMP		Northgate Culvert Replacement	The principal project would be to construct a bridge spanning 25 feet along the northern levee in the basin, replacing the existing undersized culvert. Additionally, a new culvert would be constructed under the bike trail in the southeast portion of the basin to increase circulation. The project would include basin grading to improve positive drainage and minimize stranding hazards, as well as native riparian vegetation planting.	$ 1,000,000	$ 1,000,000	Urban - Other infrastructure and multi-benefit improvements	Flood Infrastructure
258	Yolo Bypass		Old Bryte Landfill Remediation	The relocation and/or remediation of an abandoned domestic landfill is required to setback the north levee of the Sacramento Bypass. Expansion of the Sacramento Bypass included setback of the north levee is included in the Common Features GRR recommended plan. The relocation and/or remediation of the landfill is estimated to cost less than $10M.	$ 10,000,000	$ -	Systemwide - Yolo Bypass multi-benefit improvements	Flood Infrastructure
259	RFMP	N/A	Ord Bend 100-Year Level of Protection	Provide Ord Bend with a 100-Year level of protection	$ -	$ -	Small Community - Studies and analysis	Watershed and Floodplain Management
260	RFMP	Sutter Butte Flood Control Agency	Oroville Wildlife Area Flood Stage Reduction Project Design, Permitting & Construction	Includes the design of weir improvements and ecosystem restoration to improve connectivity to historic floodway and reduce stages in main channel of the Feather River. The primary goal of the project is to divert water from the Feather River through the Oroville Wildlife Area to accommodate up to 80,000 cfs for a 200-year flood event. Project will fund project management, hydraulic modeling, feasibility, design, environmental documentation, and permitting. The site encompasses about 1,000 acres.	$ 5,853,800	$ 5,853,800	Rural - Studies and analysis	Watershed and Floodplain Management
261	RFMP	Sutter Butte Flood Control Agency	Oroville Wildlife Area Multi-Benefit Project	The Oroville Wildlife Area is managed by the CDFW and comprises approximately 11,000 acres west of Oroville that are managed for wildlife habitat and recreational activities. The FERC Agreement describes numerous multi-benefit habitat restoration actions that are required for this reach of the Feather River. These actions include excavation of the Feather River banks and lowering of adjacent, landside areas to re-connect the river with its disconnected floodplain. The FERC Agreement also requires the excavation of additional side channels that would provide important salmonid spawning habitat and refugia during high-water events as well as the restoration of riparian and wetland habitats to provide habitat for a variety of terrestrial species and shaded riverine aquatic habitat for fish.	$ 5,000,000	$ 5,000,000	Rural - Habitat restoration/reconnection	Natural Floodplain and Ecosystem Functions
262	USACE	Three Rivers Levee Improvement Authority	Phase IV—Complete WPRR levee improvements	Project for additional work that needed to be completed along the Western Pacific Railroad Canal levee to meet the State 200-year levee design criteria.	$ 15,228,000	$ -	Urban - Levee improvements	Flood Infrastructure
263	RFMP	Reclamation District 563	PL 84-99 Levee Improvement Project – Tyler Island	After the entire levee meets or exceeds the HMP Criteria, the District will bring any remaining portions of levee below the PL 84-99 Standard to six inches above the PL 84-99 Standard. Divided into several phases as funding is available. Est. Total length of additional improvements of 64,054 LF. Completion time of 2 year.	$ 15,122,000	$ 15,122,000	Rural - Levee repair and infrastructure improvements	Flood Infrastructure
264	USACE	City of West Sacramento	Port North Levee	Improve with a floodwall approximately oriented at an offset, internally, to the property line of the Port. That alignment would maintain a minimum 25-ft offset from local railways and would require two closure structures at the east end of the property.	$ 37,650,000	$ -	Urban - Levee improvements	Flood Infrastructure
265	USACE	City of West Sacramento	Port South Levee	Improve with a combination of waterside slope flattening, a section of floodwall, and a section of cutoff wall.	$ 9,049,000	$ -	Urban - Levee improvements	Flood Infrastructure
266	RFMP	N/A	Princeton 100-Year Level of Protection	Provide Princeton with a 100-Year level of protection	$ -	$ -	Small Community - Studies and analysis	Watershed and Floodplain Management

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267	Other	California Department of Water Resources	Property acquisition, demo & disposal - Phase 2		$ 228,928,672	$ 75,546,462	Small Community - Levee setbacks, land acquisitions and habitat restoration	Watershed and Floodplain Management
268	Other	California Department of Water Resources	Property acquisition, demo & disposal - Phase 2		$ 114,464,336	$ 37,773,231	Small Community - Levee setbacks, land acquisitions and habitat restoration	Watershed and Floodplain Management
269	Other	California Department of Water Resources	Property acquisition, demo & disposal - Phase 2		$ 228,928,672	$ 75,546,462	Small Community - Levee setbacks, land acquisitions and habitat restoration	Watershed and Floodplain Management
270	Other	California Department of Water Resources	Property acquisition, demo & disposal - Phase 3		$ 228,928,672	$ 153,382,210	Small Community - Levee setbacks, land acquisitions and habitat restoration	Watershed and Floodplain Management
271	Other	California Department of Water Resources	Property acquisition, demo & disposal - Phase 3		$ 114,464,336	$ 76,691,105	Small Community - Levee setbacks, land acquisitions and habitat restoration	Watershed and Floodplain Management
272	Other	California Department of Water Resources	Property acquisition, demo & disposal - Phase 3		$ 228,928,672	$ 153,382,210	Small Community - Levee setbacks, land acquisitions and habitat restoration	Watershed and Floodplain Management
273	RFMP	N/A	Property Line Survey	Surveying property lines and sign posting on private lands so CDFW enforcement staff can help keep the public off of private lands adjacent to CDFW owned or managed lands.	$ 1,000,000	$ 1,000,000	Systemwide - State operations, planning and performance tracking	Policy and Regulations
274	RFMP	M&T Ranch	Protect M&T/Llano Seco Pumping Facilities	Develop a long term solution to address current meandering of the Sacramento River which is resulting in the need for dredging of the river to keep M&T/Llano Seco pump facilities operational.	$ 500,000	$ -	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
275	RFMP	Reclamation District 2068, Yolano	Pump State #5 Modernization	Pump Station #5 is the only large capacity pump station capable of evacuating interior drainage from the Cache – Haas Area during large storm events. The pump house and discharge pipes are in need replacement. The modernization of this pump station on Shag Slough at LM 5.5 of Unit 1 is necessary to avoid flood damages. Pump station modernization is estimated to cost less than $3M.	$ 3,000,000	$ 3,000,000	Rural - Levee repair and infrastructure improvements	Operation and Maintenance

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#	Data Set Source	Lead Agency	Project Name	Project Description	Estimated Cost - Provided by Source	Estimated Cost - Adjusted for Portfolio	Area of Interest and Management Action Category	Management Action Type
276	RFMP	TBD	Purchase of Agricultural Easements	Agricultural easements could be purchased from willing sellers on farmland along the landside of the Feather River levee. Agricultural easements would support ongoing agricultural activities and local communities while limiting urban development within the Feather River floodplain and providing opportunities for the implementation of wildlife-friendly farming practices and targeted habitat restoration actions. Compatible habitat restoration actions could include planting of native plant hedgerows along drainage canals and roadsides, construction or enhancement of ponds and other wetland habitats, and integration of native species, particularly native grasses, into agricultural areas where compatible with normal farming practices.	$ -	$ -	Rural - Land acquisitions and easements	Watershed and Floodplain Management
277	RFMP	City of Davis	Putah Creek Capacity Study	Experience in 1997 shows that Putah Creek will flood, but the extent of possible flooding is not known. An existing capacity study of Putah Creek is recommended to determine if it meets design flow objectives in its current condition.	$ 500,000	$ 500,000	Urban - Studies and analysis	Watershed and Floodplain Management
278	RFMP	Reclamation District 10, Honcut	RD 10 Critical Seepage Repair		$ 310,000	$ -	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
279	RFMP	Wheatland	RD 2103 Bear River ULDC Design and Repairs	Project to evaluate the Bear River to determine what, if any, additional repairs would be required to meet ULDC for the urbanizing City of Wheatland and then perform teh work identified. Repairs were completed in 2010 for a 200-year design water surface, but additional repairs may be required to meet ULDC. The Bear River protects the City of Wheatland, an urbanizing area by definition.	$ 7,600,000	$ 7,600,000	Rural - Studies and analysis	Watershed and Floodplain Management
280	RFMP	Wheatland	RD 2103 Dry Creek Study, Design & Construction	Implement Dry Creek south levee 200-year ULDC levee improvements based on results of the feasibility study.	$ 56,767,000	$ 56,767,000	Small Community - Levee repair and infrastructure improvements	Flood Infrastructure
281	RFMP	Wheatland	RD 2103 Flood System Repair Project All Weather Patrol Roads Construction		$ 240,000	$ 240,000	Systemwide - Emergency management	Emergency Management
282	RFMP	Wheatland	RD 2103 Levee Improvements	Evaluate, design, and construct levee improvements to achieve USACE project levee geometry and stability standards- prioritized based on risk remaining segments in RD 2103.	$ 4,252,000	$ 4,252,000	Small Community - Levee repair and infrastructure improvements	Flood Infrastructure
283	RFMP	Reclamation District 784	RD 784 Pump Station 10 Improvements Construction		$ 3,625,000	$ 3,625,000	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
284	RFMP	Reclamation District 784	RD 784 Pump Station 2 Improvements Construction		$ 825,000	$ 825,000	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
285	RFMP	Reclamation District 784	RD 784 Pump Station 5 Improvements Construction		$ 3,500,000	$ 3,500,000	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
286	RFMP	Reclamation District 784	RD 784 Pump Station 7 Improvements Construction		$ 2,525,000	$ 2,525,000	Rural - Levee repair and infrastructure improvements	Operation and Maintenance

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287	RFMP	Reclamation District 784	RD 784 Pump Station 9 Back up generators Construction		$ 210,000	$ 210,000	Rural - Levee repair and infrastructure improvements	Flood Infrastructure
288	RFMP	Three Rivers Levee Improvement Authority	RD 784 Site 7 Relief Well Rehabilitation Construction		$ 100,000	$ 100,000	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
289	RFMP	Wheatland	RD 817 Flood System Repair Project All Weather Patrol Roads Construction		$ 270,000	$ 270,000	Systemwide - Emergency management	Emergency Management
290	RFMP	Wheatland	RD 817 Levee Improvements	Evaluate, design, and construct levee improvements to achieve USACE project levee geometry and stability standards- prioritized based on risk; remaining segments in RD 817.	$ 100,058,000	$ 100,058,000	Small Community - Levee repair and infrastructure improvements	Flood Infrastructure
291	RFMP	Reclamation District 10, Honcut	Reclamation District 10 Rural levee Repair Project	Evaluate, design, and construct levee improvements in RD 10 to achieve USACE standards for this rural community	$ 175,657,000	$ 175,657,000	Rural - Levee repair and infrastructure improvements	Flood Infrastructure
292	RFMP	N/A	Regional Programmatic Permitting	Develop regional program level permitting to streamline permit acquisition, similar to the DWR approach with the Small Erosion Repair Program (SERP). Actions to be considered for inclusion: • Programmatic EIR for series' of actions that can be characterized as one large project. • Master or Programmatic Streambed Alteration Agreements: obtained to cover a large, multi-phased project consisting of smaller specific projects for which detailed project plans are not available at the time the SAA is applied for. • USACE Regional General Permit (RGP): issued by a USACE district or division and authorizes a class of activities within a geographic region that are similar in nature and have minimal individual and cumulative environmental effects.	$ 500,000	$ 500,000	Systemwide - State operations, planning and performance tracking	Programmatic, or Project-Specific Permitting
293	RFMP	City of West Sacramento	Regional Trails Initiative	Develop a plan for a world class system of recreational corridors, greenways and bicycle-pedestrian trail connections in the greater Sacramento region portion of the Delta, which provides enriching experiences and ties into and enhances the existing flood protection system, providing not only recreational value, but also serving to promote agri-tourism, alternative commutes and other regional economic opportunities. Recreation, including bicycle and pedestrian access, is critical to agri-tourism and the long term viability of a sustainable ag economy.	$ 300,000	$ 300,000	Systemwide - State operations, planning and performance tracking	Policy and Regulations
294	RFMP	N/A	Repair Critical Erosion Site	A critical erosion site exists in the Phelan levee upstream of the M&T weir at R.M. 192.5. A breach at this site would result in major changes to the hydraulics of the Butte Basin.	$ 100,000	$ 100,000	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
295	RFMP	Reclamation District 1001, Nicolaus	Repair, replace, or abandon existing drains and pipes through the levees	Project for replacement and repair expected to be completed by farmer. District would only abandon. Grouting 2/mile. 14" pipe 70' total length. Assumed 10' below WSE	$ 86,680	$ -	Small Community - Levee repair and infrastructure improvements	Operation and Maintenance
296	RFMP	Reclamation District 1001, Nicolaus	Replace or improve Main Drain pumping plant	The RD 1001 Main Drain Pumping Plant is an SPFC facility along the Natomas Cross Canal right bank. The levee and pumping plant were constructed in 1917 and require significant (60KV dedicated) power to operate. This project would upgrade the pumps, power supply, and add redundancy and backup power to the facility. The pumping plant is an SPFC facility installed when the NCC cutoff natural drainage to the Feather River.	$ 8,000,000	$ 8,000,000	Rural - Risk awareness, floodproofing and land use planning	Watershed and Floodplain Management
297	RFMP	Reclamation District 1001, Nicolaus	Re-Rock levee crown patrol roads	Project to re-rock levee crown patrol roads – AB for 75% of levees in district	$ 943,811	$ 943,811	Systemwide - Emergency management	Emergency Management

Table B-4. Sacramento Basin Management Actions Included within the 2017 Refined SSIA Portfolio

#	Data Set Source	Lead Agency	Project Name	Project Description	Estimated Cost - Provided by Source	Estimated Cost - Adjusted for Portfolio	Area of Interest and Management Action Category	Management Action Type
298	RFMP	Three Rivers Levee Improvement Authority	Resolve ROW and encroachment issues for levees protecting urban areas	Project to resolve ROW and encroachment issues for levees protecting urban areas.	$ 10,000,000	$ 10,000,000	Systemwide - State operations, planning and performance tracking	Policy and Regulations
299	RFMP	N/A	Richvale 100-Year Level of Protection	Provide Richvale with a 100-Year level of protection	$ -	$ -	Small Community - Studies and analysis	Watershed and Floodplain Management
300	RFMP	City of Rio Vista	Rio Vista Flood Risk Reduction	Develop and implement a 200−year flood protection program for the City of Rio Vista that also anticipates and accommodates any increased stages associated with upstream bypass expansion, sea level rise, or climate change. $500,000 for feasibility study.	$ 500,000	$ 500,000	Small Community - Studies and analysis	Watershed and Floodplain Management
301	RFMP	N/A	Robbins 100-Year Level of Protection	Provide Robbins with a 100-Year level of protection	$ -	$ -	Small Community - Studies and analysis	Watershed and Floodplain Management
302	RFMP	Sutter County	Robbins Backup Power Supply	Install a new backup power supply at the Robbins' wastewater treatment plant. An alternative power source at the pump station is needed. During a high water situation in the Valley, if the pumps fail because the power goes out, the town of Robbins and the entire Sutter basin could flood.	$ 500,000	$ 500,000	Small Community - Risk awareness, floodproofing and land use planning	Watershed and Floodplain Management
303	RFMP	United States Army Corp of Engineers, Rock Creek Reclamation District	Rock Creek and Sand Creek Flood Mitigation Project	Evaluate flood reduction alternatives for Rock Creek and Sand Creek.	$ -	$ -	Rural - Studies and analysis	Watershed and Floodplain Management
304	RFMP	Rock Creek Reclamation District	Rock Creek and Sand Creek Flood Mitigation Project	The proposed Rock and Sand Creek Flood Mitigation Project will build upon the work already completed by the USACE to develop and assess potential solutions to flooding from Rock Creek, focusing on the potential floodwater detention on Sand Creek. The project will assess potential hydrologic benefits of alternative detention strategies including creation of seasonal wetland habitats. The magnitude and timing of flood flows down Sand Creek and down the mainstem of Rock Creek will be analyzed. The analysis will be carried out through hydrologic modeling of storm runoff from the Sand Creek basin using HEC-HMS. The calculated runoff will be used as input to a HEC-RAS hydraulic model to evaluate the magnitude of flooding below the confluence of Sand and Rock Creeks under existing and proposed detention scenarios. The project will include an assessment of potential detention dam sites and examine the potential ecological benefits of new seasonal wetlands and groundwater recharge. Deliverables will include a feasibility analysis and conceptual designs for the detention project.	$ -	$ -	Rural - Studies and analysis	Watershed and Floodplain Management

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#	Data Set Source	Lead Agency	Project Name	Project Description	Estimated Cost - Provided by Source	Estimated Cost - Adjusted for Portfolio	Area of Interest and Management Action Category	Management Action Type
305	RFMP	Rock Creek Reclamation District	Rock Creek Groundwater Recharge Feasibility Study	Feasibility Study to examine potential groundwater recharge sites to address depleting groundwater levels in the area while also providing flood reduction benefits.	$ 500,000	$ 500,000	Rural - Studies and analysis	Watershed and Floodplain Management
306	RFMP	Rock Creek Reclamation District	Rock Creek Interior Drainage Improvements	Develop interior drainage solution for flood waters which currently pond up against the railroad tracks. Potentially need to install larger culverts through the tracks in order to relieve ponding.	$ 500,000	$ 500,000	Rural - Studies and analysis	Watershed and Floodplain Management
307	RFMP	Rock Creek Reclamation District	Rock Creek/Keefer Slough Flow Split	Implement improvements at the Rock Creek/Keefer Slough flow split in order to re-establish Rock Creek as the main channel	$ 500,000	$ 500,000	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
308	RFMP	Reclamation District 307, Lisbon Island	Rock Slope Protection Project – Lisbon	RD 307 plans first to ensure the protection of the existing levee by adding supplementary quarry stone riprap above the existing riprap to any portions of the waterside slope of the levee requiring additional rock slope protection. This will prevent erosion and avoid ongoing repairs.	$ 4,216,000	$ 4,216,000	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
309	RFMP	Reclamation District 501, Ryer Island	Rock Slope Protection Project – Ryer Island	RD 501 plans first to ensure the protection of the existing levee by adding supplementary quarry stone riprap above the existing riprap to any portions of the waterside slope of the levee requiring additional rock slope protection. This will prevent erosion and avoid ongoing repairs.	$ 7,337,000	$ 7,337,000	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
310	RFMP	Reclamation District 563	Rock Slope Protection Project – Tyler Island	RD 563 plans first to ensure the protection of the existing levee by adding supplementary quarry stone riprap above the existing riprap to any portions of the waterside slope of the levee requiring additional rock slope protection. This will prevent erosion and avoid ongoing repairs.	$ 841,000	$ 841,000	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
311	RFMP	Reclamation District 10, Honcut	Rodent Control - Reclamation District 10	Project for rodent control and burrow mitigation to address known seepage and structural levee issues.	$ 949,850	$ 949,850	Systemwide - Routine maintenance	Operation and Maintenance
312	Other	California Department of Water Resources	Rural Agricultural Easements - Basic	To be confirmed by DWR. Assumption $10,000 per acrea and 30,000 acres in each basin. Example project from San Joaquin BWFS.	$ -	$ -	Rural - Land acquisitions and easements	Watershed and Floodplain Management
313	Other	California Department of Water Resources	Rural Agricultural Easements - Multi-Benefit	To be confirmed by DWR. Assumption $10,000 per acrea and 10,000 acres in each basin. Example project from San Joaquin BWFS.	$ -	$ -	Rural - Land acquisitions and easements	Watershed and Floodplain Management
314	BWFS	California Department of Water Resources	Rural/Small Communities Freeboard Raise	Deleted from BWFS.	$ 8,000,000	$ -	Small Community - Levee repair and infrastructure improvements	Flood Infrastructure
315	BWFS	California Department of Water Resources	Sacramento BWFS Contingency on all Projects		$ -	$ 365,000,000	Systemwide - Yolo Bypass multi-benefit improvements	Flood Infrastructure

Table B-4. Sacramento Basin Management Actions Included within the 2017 Refined SSIA Portfolio

#	Data Set Source	Lead Agency	Project Name	Project Description	Estimated Cost - Provided by Source	Estimated Cost - Adjusted for Portfolio	Area of Interest and Management Action Category	Management Action Type
316	BWFS	California Department of Water Resources	Sacramento Bypass Ecosystem Implementation	Improve fish passage, reduce stranding, preserve levee remnants for upland refugia, and preserve existing riparian, wetland and upland grassland areas.	$ 14,000,000	$ 4,437,800	Systemwide - Reservoir and floodplain storage	Natural Floodplain and Ecosystem Functions
317	BWFS	California Department of Water Resources	Sacramento Bypass Levee Setback	A corresponding 1,500-feet expansion of the Sacramento Bypass, and associated ecosystem restoration actions. The riparian corridor along the southern channel would be 330 feet wide.	$ 429,000,000	$ 430,562,200	Systemwide - Yolo Bypass multi-benefit improvements	Flood Infrastructure
318	RFMP	Brannan-Andrus Levee Maintenance District	Sacramento River Bank Protection Project - LM 3 to LM 7	Bank protection project LM 3 to 7, Rehabilitated Length of 2,145 LF.	$ 2,432,000	$ 2,432,000	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
319	RFMP	Reclamation District 150, Merritt Island	Sacramento River Bank Protection Project – Merritt Island	Waterside Bank Protection and Rehabilitation project at 4 sites, 1,200 LF, LM 2.04 to 2.16, 3.38, 3.48 and 4.58 to 4.65. Enhanced lower waterside slope habitat area with possible Riparian Forest, Scrub-Shrub, and emergent/freshwater marsh to mitigate or enhance the habitat value.	$ 1,361,000	$ 1,361,000	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
320	RFMP	Reclamation District 341, Sherman Island	Sacramento River Bank Protection Project – Sherman Island	4 erosion sites along the Sacramento River that can be improved through the construction of a bank protection project along Cache Slough which will rehabilitate the waterside bank from levee mile 4.12 to 6.09, 1,994 LF.	$ 2,261,000	$ 2,261,000	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
321	RFMP	Reclamation District 556, Upper Andrus Island	Sacramento River Bank Protection Project – Upper Andrus	2 erosion sites that would be improved through the construction of a bank protection project along that Sacramento River Slough, rehabilitated length of 1,700 LF, LM 0.31 to 3.25.	$ 1,928,000	$ 1,928,000	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
322	RFMP	Reclamation District 999, Netherlands	Sacramento River Erosion Repair Project – Netherlands	1,600 LF erosion repair south of the Clarksburg Marina. At one point was listed 'high' on USACE Sac Bank Project, but has since been reduced on the list. Estimated 35,000 tons of gravel and 40,000 tons of imported fill will be used. 3 year completion time.	$ 2,067,000	$ 2,067,000	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
323	Other	California Department of Water Resources	Sacramento River General Reevaluation Report	State-Federal Feasibility Study projects that DWR could partner in.	$ 4,000,000	$ 4,000,000	Urban - Studies and analysis	Watershed and Floodplain Management
324	RFMP	Knights Landing Drainage District	Sacramento River Levee (sites 9, 10, and 11)	Work on the Sacramento River levee would be conducted at sites 9, 10, and 11, between river miles 70 and 113 southeast of Knights Landing. These sites are located on the gravel maintenance road on top of the levee between the river and Yolo County Road 116B. - Site 9 starts approximately 1 mile east of Knights Landing at river mile (RM) 87.2 and extends 793 feet downstream to RM 87.1. - Site 10 starts approximately 1,584 feet downstream of site 9 at RM 86.8 and extends 878 feet downstream to RM 86.7. - Site 11 starts approximately 1.5 miles downstream of site 10 at RM 85.2 and extends 1.05 miles (5,555 feet) downstream to RM 84.1 along County Road 116B, just down river from sites 9 and 10. Remediation work at sites 9, 10, and 11 would consist of installing a soil/bentonite cutoff wall, of various lengths and depths, to reduce seepage. The work would involve (1) degrading the existing top of the levee down 4 to 5 feet to create a level working surface to install the cutoff wall and (2) excavating a trench 3 feet wide and at least 21 feet deep down through the crown of the levee, as follows: - Site 9 cutoff wall depth would vary from 26.27 feet to 31.08 feet deep. - Site 10 cutoff wall depth would vary from 23.04 feet to 26.38 feet deep. - Site 11 cutoff wall depth would vary from 21.00 feet to 116.75 feet deep, as follows: .900 feet (Stations 0+00 to 9+00) would be 21.00 feet to 27.04 feet deep. . 700 feet (Stations 9+00 to 16+00) would be 24.95 feet to 26.15 feet deep	$ 32,000,000	$ 32,000,000	Small Community - Levee repair and infrastructure improvements	Operation and Maintenance

Table B-4. Sacramento Basin Management Actions Included within the 2017 Refined SSIA Portfolio

#	Data Set Source	Lead Agency	Project Name	Project Description	Estimated Cost - Provided by Source	Estimated Cost - Adjusted for Portfolio	Area of Interest and Management Action Category	Management Action Type
325	USACE	Sacramento Area Flood Control Agency, United States Army Corp of Engineers	Sacramento River Levee Improvements	Sacramento River downstream of the mouth of the American River focus of substantial erosion control and seepage remediation efforts. Additional work will be needed to address levee embankment and foundation vulnerabilities which is likely to include construction of a combination of cutoff walls and relief wells over a distance of up to eight miles along various segments of the east levee between Freeport and Sutterville Road as well as remedial work to the floodwall between Interstate 50 and the Tower Bridge. $390M USACE, $147M DWR, $63M SAFCA	$ 600,000,000	$ -	Urban - Levee improvements	Flood Infrastructure
326	RFMP	Brannan-Andrus Levee Maintenance District	Sacramento River Revetment and Shaded Riverine Aquatic (SRA) Habitat Enhancement	Rebuild the slope and create a stable foundation for an eco-berm and a SRA habitat bench.	$ 2,584,000	$ 2,584,000	Rural - Habitat restoration/reconnection	Natural Floodplain and Ecosystem Functions
327	RFMP		Sacramento River RT 35 to 46 Left and Right Bank Enhancements	The project involves the planting of small trees and shrubs along the shoreline of the cobble lined banks of the Sacramento River. Potential exists for the narrow but extensive creation of shallow cover for ¡juvenile fish along currently barren banks.	$ 2,600,000	$ 2,600,000	Urban - Other infrastructure and multi-benefit improvements	Natural Floodplain and Ecosystem Functions
328	RFMP		Sacramento River RT 49.5 Left Bank Enhancements	The potential project involves planting riparian species in the unvegetated gaps along the left bank of the Sacramento River.	$ 1,900,000	$ 1,900,000	Urban - Other infrastructure and multi-benefit improvements	Natural Floodplain and Ecosystem Functions
329	RFMP		Sacramento River RT 49.5 Right Bank Enhancements	The potential design concept includes creating a shallow water bench and planting riparian species in unvegetated gaps along the right bank downstream of the existing riparian forest at the Babel Slough confluence.	$ 1,900,000	$ 1,900,000	Urban - Other infrastructure and multi-benefit improvements	Natural Floodplain and Ecosystem Functions
330	RFMP	Reclamation District 1600, Mull	Sacramento River Scour Hole Repair	8 Miles north of Road 117 and Old River, there are 3 large, deep scour holes, 8 ft. off the water side levee toe that would need to be repaired to increase the levee stability. Similar project cost estimate: Grand Island Erosion/Bank $1,550,000	$ 1,550,000	$ 1,550,000	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
331	RFMP	Reclamation District 3, Grand Island	Sacramento River Seepage Control Project 2 – Grand Island	Critical seepage site located between LM 8.24 and 8.30 along the Sacramento River, with a total rehabilitated length of 300 LF which consists of rock and fill placement to control seepage.	$ 194,000	$ 194,000	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
332	RFMP	California Department of Water Resources	Sacramento River Seepage Protection Project – Cache Creek	8,150 LF repair for multiple serious and critical seepage sites in Maintenance Area 9 that DWR plans to construct a seepage protection project along the Sacramento River to repair these locations. Project would consist of rock and fill to control the seepage. LM 10.7 to 18.1.	$ 5,264,000	$ 5,264,000	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
333	RFMP	Reclamation District 150, Merritt Island	Sacramento River Seepage Protection Project – Merritt Island	275 LF Seepage protection project along the Sacramento River, from LM 5.9 to 5.95. Will consist of rock and fill to control seepage.	$ 178,000	$ 178,000	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
334	RFMP	Reclamation District 755, Randall Island	Sacramento River Seepage Repair Project – Randall	4,000 LF repair for multiple seepage sites that can be repaired through construction of a seepage protection project along the Sacramento River which would consist of rock and fill to control the seepage. LM 0.1 to 0.9.	$ 2,583,000	$ 2,583,000	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
335	RFMP	Reclamation District 556, Upper Andrus Island	Sacramento River Seepage Repair Project – Upper Andrus	Critical seepage site that would be repaired with the construction of a seepage protection project along the Sacramento River that would be 1950 LF from LM 3.58 to 3.95 that would consist of rock and fill to control seepage.	$ 1,259,000	$ 1,259,000	Rural - Levee repair and infrastructure improvements	Operation and Maintenance

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#	Data Set Source	Lead Agency	Project Name	Project Description	Estimated Cost - Provided by Source	Estimated Cost - Adjusted for Portfolio	Area of Interest and Management Action Category	Management Action Type
336	RFMP		Sacramento River Tile 70 Right Floodplain Lowering and Backwater Slough Enhancement	The design concept is to excavate the existing floodplain to create more frequently activated floodplain (FAF) and enhance the existing backwater slough. This would require the removal of onsite vegetation, which includes a mix of mature riparian vegetation and non–native vegetation. Due to the vegetation density, the removal of some mature riparian vegetation would be inevitable and would require mitigation.	$ 1,000,000	$ 1,000,000	Rural - Habitat restoration/reconnection	Natural Floodplain and Ecosystem Functions
337	USACE	City of West Sacramento	Sacramento River West North Levee Balance of Reaches	Combination of cutoff walls (conventional and deep soil mixed) and raised levees, with waterside slope flattening.	$ 77,702,000	$ -	Urban - Levee improvements	Flood Infrastructure
338	USACE	City of West Sacramento	Sacramento River West South Levee (Southport Early Implementation Project)	3.6 mile combination of setback levee, adjacent levee, slope flattening, cutoff walls and landside seepage berms, with offset areas that are to be converted to floodplain and habitat restoration features.	$ 190,000,000	$ -	Urban - Other infrastructure and multi-benefit improvements	Flood Infrastructure
339	Yolo Bypass		Sacramento Weir and Bypass	Support widening through authorization and implementation of the American River Watershed, Common Features, General Reevaluation Report (GRR) currently under development by the US Army Corps of Engineers (USACE).	$ 435,000,000	$ -	Systemwide - Yolo Bypass multi-benefit improvements	Flood Infrastructure
340	BWFS	California Department of Water Resources	Sacramento Weir Expansion	A 1,500 feet expansion of Sacramento Weir.	$ -	$ -	Systemwide - Yolo Bypass multi-benefit improvements	Flood Infrastructure
341	RFMP	Reclamation District 827, Elkhorn	Sac-Yolo North Systemwide Improvements Framework Plan	RD 827 levees are currently inactive in the NFIP and are ineligible for PL84-99 post flood assistance. RD 827 would like to work with its neighboring LMAs to prepare a Sac-Yolo North Systemwide Improvement Framework (SWIF) Plan so the system could regain PL84-99 eligibility. However, the LMAs currently lack the resources to develop a SWIF and would require grant funding assistance to do so.	$ 300,000	$ 300,000	Rural - Studies and analysis	Watershed and Floodplain Management
342	RFMP	N/A	Safe Harbor Agreements	A Safe Harbor Agreement is a voluntary agreement between any non-Federal property owner(s) and the USFWS or the National Oceanic and Atmospheric Administration (NOAA) National Marine Fisheries Service (collectively, the Services) whereby performing actions that contribute to the recovery of listed species and fulfilling the conditions of the Safe Harbor Agreement, the property owner(s) will receive formal assurances from the Services that they will not require any additional or different management activities by the parties without their consent.	$ -	$ -	Systemwide - State operations, planning and performance tracking	Policy and Regulations
343	RFMP	Tehama County Flood Control and Water Conservation District	Salt Creek Flood Hydraulics Study	Evaluate alternatives to manage flooding along Salt Creek which currently impacts Highway 36, the local Sheriff's facility and a Cal Fire station.	$ 50,000	$ 50,000	Rural - Studies and analysis	Watershed and Floodplain Management
344	RFMP	Reclamation District 1601, Twitchell Island	San Joaquin River Levee Improvement Project	Several high-priority waterside embankments identified as having steep slopes that may be susceptible to deterioration with further slope erosion. Critical sites identified as sta 381+00, 456+00, 569+00 and 599+00. Repair should be initiated ASAP. Four seriously deficient high-priority areas on the landside have also been identified as having seepage problems; these sites are sta 615+50, 524+80 to 530+70, 510+00, and 450+30 to 452+30. Interim approach of extending levee landward and then excavate waterside to achieve a 2:1 slope and to provide a seepage berm on the landside. Medium priority sites identified as 365+00 to 627+79.01 which have landside stability issues would be addressed with a berm and setback levee. Low priority sites identified as 570+00 to 600+00 addressed as to raise the crown to elevation 11.5. Completion time of 10-years.	$ 121,519,000	$ 121,519,000	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
345	RFMP	Reclamation District 10, Honcut	Seepage and under seepage site remediation	Preliminary, Planning Level project. Detailed project description not available at this time.	$ 1,623,050	$ -	Rural - Levee repair and infrastructure improvements	Operation and Maintenance

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#	Data Set Source	Lead Agency	Project Name	Project Description	Estimated Cost - Provided by Source	Estimated Cost - Adjusted for Portfolio	Area of Interest and Management Action Category	Management Action Type
346	RFMP	Reclamation District 1601, Twitchell Island	Sevenmile Slough Crown Raising to Hazard Mitigation Plan (HMP) Project	Bring portions of the levee currently below the HMP Criteria above the PL 84-99 Standard. Would not likely be initiated until the San Joaquin River Levee Improvement Project is complete, which could take approximately 10 years.	$ 22,331,000	$ 22,331,000	Rural - Levee repair and infrastructure improvements	Flood Infrastructure
347	RFMP	Brannan-Andrus Levee Maintenance District	Seven-mile Slough French Drain	The existing toe ditch will be removed. A drain will be placed in the existing irrigation ditch and toe ditch will be replaced with a French drain and slope drainage blanket.	$ 413,000	$ 413,000	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
348	RFMP	Brannan-Andrus Levee Maintenance District	Seven-mile Slough Stability Berm	A stability berm, estimated to be approximately 60 feet wide by 5 feet high will be constructed along the landside toe of the levee.	$ 827,000	$ 827,000	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
349	RFMP	Sites Reservoir Joint Powers Authority	Sites Reservoir (NODOS)	Proposed off-stream storage reservoir. 1.8 MAF off-stream storage project with meeting co-equals of water supply and environmental enhancement. This project would provide water supplies in average and dry years for urban, agricultural, and environmental purposes. Sites Reservoir will add flexibility to the State's water management system and can provide unique benefits, which include: · Enhanced water supply reliability for urban, agricultural, and environmental uses · Improved Delta water quality · Mitigation of snowpack storage losses due to climate change · Contribute to flood damage reduction in the Central Valley · Ecosystem restoration actions in the Sacramento River · Dedicated storage that can be adaptively managed to respond to Delta emergencies and help with restoration actions	$ -	$ -	Systemwide - Reservoir and floodplain storage	Reservoir and Floodplain Storage and Operation
350	BWFS	California Department of Water Resources	Small Communities Implementation	Deleted from BWFS.	$ -	$ -	Small Community - Levee repair and infrastructure improvements	Flood Infrastructure
351	BWFS	California Department of Water Resources	Small Communities Protection Feasibility Studies associated with System Improvements	Deleted from BWFS.	$ -	$ -	Small Community - Levee repair and infrastructure improvements	Flood Infrastructure
352	RFMP	Yolo County	Small Community Flood Risk Reduction	Develop feasibility study to identify cost effective means to achieve protection against the base flood for the towns of Knights Landing and Yolo and implement the identified solution. Both towns appear to have viable levee improvement projects. $500,000 per Small Community.	$ 1,000,000	$ 1,000,000	Small Community - Studies and analysis	Watershed and Floodplain Management
353	RFMP	Sutter Butte Flood Control Agency	Small Community Levee Reliability Study	Study to evaluate risk reduction alternatives for small communities of Sutter and Wilson in Sutter County. Small Community Study. Communities are protected by SPFC Facilities.	$ 995,000	$ 995,000	Small Community - Studies and analysis	Watershed and Floodplain Management
354	RFMP	Tehama County Flood Control and Water Conservation District	Small Community of Gerber Feasibility Study	Feasibility Study for providing a 100-year level of protection to Gerber.	$ 500,000	$ 500,000	Small Community - Studies and analysis	Watershed and Floodplain Management
355	RFMP	Reclamation District 554, Walnut Grove	Snodgrass Slough Landside Fill and Minor Crown Raising – Walnut Grove	Two crucial long term goals maintain levee height and improve stability. Proposed projects include landside fill and minor crown-raising on the Snodgrass Slough levee.	$ 1,126,000	$ 1,126,000	Small Community - Levee repair and infrastructure improvements	Operation and Maintenance

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#	Data Set Source	Lead Agency	Project Name	Project Description	Estimated Cost - Provided by Source	Estimated Cost - Adjusted for Portfolio	Area of Interest and Management Action Category	Management Action Type
356	RFMP	Reclamation District 554, Walnut Grove	Snodgrass Slough Road and Old Walnut Grove Road Crown Raising – Walnut Grove	Two crucial long term goals maintain levee height and improve stability. Proposed projects include crown- raising on the Snodgrass Slough Road and Old Walnut Grove Road.	$ 103,000	$ 103,000	Small Community - Levee repair and infrastructure improvements	Operation and Maintenance
357	USACE	City of West Sacramento	South Cross Levee	Combination of slope flattening, short cutoff wall and an adjacent levee raise with an interior drainage system.	$ 11,684,000	$ -	Urban - Levee improvements	Flood Infrastructure
358	USACE	Sacramento Area Flood Control Agency, United States Army Corp of Engineers	South Sacramento Streams Group	Authorized by Congress in 1999, the project includes levee, channel, and flood wall improvements along Morrison Creek and its tributaries generally west of Franklin Boulevard. Work is now substantially complete with only a series of floodwall improvements and a detention basin along Florin Creek remaining and is expected to be carried out by the end of 2014. Improvements to the major levees included in the South Sacramento Streams Group (SSSG) Project have been underway for several years in order to provide increased flood protection to the southern portions of the City of Sacramento and relieve property owners in this area of the NFIP requirement to maintain high cost flood insurance. Floodwall improvements and a detention basin along Florin Creek are being constructed in 2014 and 2015 at a cost of approximately $15.0 million. This work will complete the project and raise total project expenditures to approximately $104.0 million.	$ 15,000,000	$ -	Urban - Levee improvements	Flood Infrastructure
359	RFMP		Southport Early Implementation Project (EIP) Riparian Enhancement	The potential project involves enhancing the levee setback areas by planting native riparian species. The north setback area encompasses approximately 36 acres, the south setback area encompasses approximately 113 acres. These setback areas would be frequently inundated with implementation.	$ 7,200,000	$ 7,200,000	Urban - Other infrastructure and multi-benefit improvements	Natural Floodplain and Ecosystem Functions
360	RFMP	Sutter Butte Flood Control Agency	Star Bend South Critical Repair		$ 8,800,000	$ 8,800,000	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
361	RFMP	Sutter Butte Flood Control Agency	Star Bend to Laurel Avenue	Levee Improvements from Star Bend to Laurel Avenue.	$ 60,000,000	$ 60,000,000	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
362	Other	California Department of Water Resources	State Operation in Support of 30-year Implementation	Activities and costs associated with State Operations for implementation of a 30 year program.	$ -	$ 180,000,000	Systemwide - State operations, planning and performance tracking	Policy and Regulations
363	Other	California Department of Water Resources	State Policy, Planning, and Performance Tracking	Activities and costs associated with State Policy, Planning and Performance tracking.	$ -	$ 250,000,000	Systemwide - State operations, planning and performance tracking	Policy and Regulations
364	RFMP	Reclamation District 349, Sutter Island	Steamboat Slough Bank Protection Project – Sutter Island	Two erosion sites along Steamboat Slough that can be improved through the construction of a bank protection project along Cache Slough which will rehabilitate 300 LF of the waterside bank from LM 1.3 to 1.4 and 2.5.	$ 340,000	$ 340,000	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
365	RFMP	Reclamation District 3, Grand Island	Steamboat Slough Seepage Control Project – Grand Island	Seepage control project on Steamboat Slough, between Stations 280+00 to 290+00. The project would consist of rock and fill to control the flow to the drainage pipes that will capture seepage and discharge in the lateral, and eventually into a district canal. Est. 40,000 tons of fill and 35,000 tons of gravel. Completion time of 3-years.	$ 1,757,000	$ 1,757,000	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
366	RFMP	California Department of Fish and Wildlife, Federal Energy Regulatory Commission	Sunset Weir	Sunset Weir forms a forebay for Sunset Pumping Plant on the Feather River near Live Oak. The rock weir is the number one fish barrier on the Feather River to migrating salmonids and other species. It also impedes flood flows and is a recreation barrier. Removal would provide benefits to flood conveyance, fish passage, recreation, and channel maintenance. Project provides multiple benefits along the Feather River right bank levee near the City of Live Oak.	$ 2,000,000	$ 2,000,000	Rural - Habitat restoration/reconnection	Natural Floodplain and Ecosystem Functions

Table B-4. Sacramento Basin Management Actions Included within the 2017 Refined SSIA Portfolio

#	Data Set Source	Lead Agency	Project Name	Project Description	Estimated Cost - Provided by Source	Estimated Cost - Adjusted for Portfolio	Area of Interest and Management Action Category	Management Action Type
367	RFMP	United States Fish and Wildlife Service	Sutter Bypass Sediment Removal	Remove sediment from the bypass to improve flood conveyance and reduce impediments to fish passage	$ 50,000,000	$ 50,000,000	Systemwide - Routine maintenance	Operation and Maintenance
368	RFMP	California Department of Fish and Wildlife	Sutter Bypass Wildlife Area	Opportunities to improve aquatic habitat, restore riparian woodland, or create other habitats are limited by the narrow strips of State-owned land that characterize much of the wildlife area. However, selective planting of riparian vegetation could occur in locations that currently lack riparian habitat to provide a continuous corridor of habitat along the Sutter Bypass levees, so long as the vegetation does not reduce the conveyance capacity of the bypass. Additionally, there are significant opportunities to encourage wildlife-friendly farming practices within the Sutter Bypass since the majority of the Bypass is privately-owned and actively farmed.	$ 3,000,000	$ 3,000,000	Rural - Habitat restoration/reconnection	Natural Floodplain and Ecosystem Functions
369	RFMP	Sutter Butte Flood Control Agency	Sutter Bypass/Wadsworth Critical Repairs		$ 460,000	$ 460,000	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
370	RFMP	Sutter Butte Flood Control Agency, Yuba County Water Agency, Three Rivers Levee Improvement Authority	Sutter Main Canal relocation to enhance salmonid temperature control and improve maintenance efficiency (FERC Process)	Project to relocate of the this canal along the Feather River right bank levee that poses seepage risk, causes frequent levee sloughing, and impedes maintenance and flood fighting activities. In addition to flood benefits, relocation of the Sutter Canal as proposed by DWR would move the intake to Thermalito therefore eliminating the need for an intake on the river which would also result in improvements to fish passage and recreation due to the elimination of the existing weir diversion. Project provides multiple benefits along the Feather River right bank levee near the City of Live Oak.	$ -	$ -	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
371	RFMP	United States Fish and Wildlife Service	Sutter National Wildlife Refuge	Ducks Unlimited and California Waterfowl have completed some improvements to the canal system, but additional improvements to the water supply system would be beneficial. Habitat restoration actions could include targeted treatment of invasive species, particularly Bermuda grass (Cynodon dactylon), to improve the habitat values of existing wetlands and the targeted restoration of riparian habitat where needed to create a continuous corridor of riparian vegetation throughout the Sutter Bypass and where the planting of riparian vegetation would not adversely affect the Sutter Bypass' ability to convey water during flood events. Finally, there are also extensive opportunities to introduce and encourage wildlife friendly farming practices on private lands within the Sutter Bypass.	$ 1,500,000	$ 1,500,000	Rural - Habitat restoration/reconnection	Natural Floodplain and Ecosystem Functions
372	RFMP	Reclamation District 999, Netherlands	Sutter Slough Erosion Repair Project – Netherlands	The Sutter Slough erosion repairs are along multiple sites that have developed over many years. The primary concern with repairing these sites is the heavy vegetation which could require expensive mitigation. This Plan recommends that the vegetation be avoided or, where not able to be avoided, the loss be mitigated. Prior to initiating the planning phase, the sites along Sutter Slough will be surveyed or evaluated. The unknown depths of the erosion scour at these sites are a major concern to the District. The cost of the construction of the project includes: the environmental documentation, permitting, design, mitigation, construction, and enhancement components. It is anticipated that approximately 10,000 tons of riprap quarry stone and 2,500 tons of imported fill will be used. Assuming the financing is secured, the project will take approximately two years to complete.	$ 775,000	$ 775,000	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
373	RFMP	Reclamation District 349, Sutter Island	Sutter Slough Seepage Repair Project - Sutter Island	There are two critical seepage sites in RD 349 identified in the FSRP. The sites would be repaired with the construction of a seepage protection project along Sutter Slough. The seepage protection project would be 1,000 feet long from approximately levee mile 0.04 and 3.01 to 3.05. The seepage control project would consist of multiple gradations of rock and fill to control the seepage.	$ 646,000	$ -	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
374	RFMP	Sacramento Area Flood Control Agency, United States Army Corp of Engineers	System Operation and Maintenance	Long-term operation and maintenance risk based program that will address levee vegetation and access issues consistent with the requirements of the NFIP and DWR's urban levee design criteria. Lower risk veg and encroachments will be monitored and addressed as part of long term System Wide Improvement Frameworks (SWIF's) developed by the local maintaining agencies. Estimated cost: $4,800,000 per year, present value for 30 years at 3% $94,082,118.	$ 94,082,118	$ 94,082,118	Systemwide - Routine maintenance	Operation and Maintenance

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#	Data Set Source	Lead Agency	Project Name	Project Description	Estimated Cost - Provided by Source	Estimated Cost - Adjusted for Portfolio	Area of Interest and Management Action Category	Management Action Type
375	RFMP	Reclamation District 827, Elkhorn	Systemwide Beneficiaries O&M Subvention Program	The levees maintained by RD 827 provide systemwide, regional benefits, and are integral to the overall region's flood safety. RD 827 would like to evaluate the potential development of an O&M subventions-type program to augment the District's funding of O&M for systemwide facilities.	$ 100,000	$ 100,000	Systemwide - Routine maintenance	Operation and Maintenance
376	RFMP	N/A	Systemwide Improvement Framework	Prepare System Wide Improvement Frameworks for project levee systems to restore PL84-99 eligibility	$ 1,000,000	$ 1,000,000	Rural - Studies and analysis	Watershed and Floodplain Management
377	RFMP	Knights Landing Drainage District	Systemwide Improvement Framework (SWIF)	This project is one of Knights Landing's recommendation alternatives to accompany the feasibility study that will address the community's levee embankment and foundation stability problems.	$ 150,000	$ 150,000	Small Community - Studies and analysis	Watershed and Floodplain Management
378	RFMP	Tehama County Flood Control and Water Conservation District, Tehama County	Tehama Flood Mitigation Plan (FMP) Projects	Implement Flood Mitigation Plan	$ 1,000,000	$ 1,000,000	Systemwide - State operations, planning and performance tracking	Policy and Regulations
379	RFMP	Tehama County Public Works, Tehama County	Tehama Hazard Mitigation Plan (HMP) City of Tehama Projects	Implement a plan to keep brush & debris clear from Tehama Simpson Slough. Analyze solutions to Gyle Rd flooding & funding sources. Improve barricading of Gyle Rd during flooding, & repair culvert on Gyle Rd for drainage of Oak Creek, Elevate or move City Hall to a structure with lower risk for flooding,	$ 1,000,000	$ 1,000,000	Systemwide - Routine maintenance	Operation and Maintenance
380	RFMP	Tehama County Public Works, Tehama County	Tehama Hazard Mitigation Plan (HMP) County Wide Projects	Implement HMP measures	$ 500,000	$ 500,000	Systemwide - Emergency management	Emergency Management
381	RFMP	Tehama County Public Works, Tehama County	Tehama Hazard Mitigation Plan (HMP) Unincorporated County Projects	Identify and implement a feasible risk reduction solution to the flooding problems around Corning along the Jewett and Burch Creek flood plain.	$ 1,000,000	$ 1,000,000	Rural - Studies and analysis	Watershed and Floodplain Management
382	RFMP	California Department of Water Resources	The 3B's Weir Improvements	Restore 3B's Weir elevation so overflows into Butte Basin when the Sacramento River do not occur below flood stage. Improvements are needed to raise the weir and then harden it so that the weir does not degrade in the future. Premature overflows from the 3B's weir result in damages to agricultural lands and infrastructure, and result in numerous road and bridge closures such as Hwy 162 and Ord Ferry (in 1995, Hwy 162 east of Butte City was closed for 26 days).	$ 1,000,000	$ 1,000,000	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
383	RFMP	California Department of Water Resources	Thermalito Afterbay Brood Ponds	The FERC Agreement requires the installation of additional ponds around the Thermalito Afterbay, and it could be possible to create up to 13 of the 22 ponds identified by the Thermalito Afterbay Duck Ponds Alternatives study to further enhance waterfowl habitat in the area.	$ 9,000,000	$ 9,000,000	Rural - Habitat restoration/reconnection	Natural Floodplain and Ecosystem Functions

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#	Data Set Source	Lead Agency	Project Name	Project Description	Estimated Cost - Provided by Source	Estimated Cost - Adjusted for Portfolio	Area of Interest and Management Action Category	Management Action Type
384	RFMP	Reclamation District 1601, Twitchell Island	Three-mile Slough Bank Protection Project	There are additional critical and serious erosion and seepage sites in RD 1601 from the FSRP that are not addressed by improvements from its 5 year plan. RD 1601 plans to construct a large bank protection project along Threemile Slough to protect erosion and seepage sites. The project will rehabilitate the waterside bank and incorporate an enhanced lower waterside slope habitat area with possible riparian forest, scrub-shrub, and emergent/freshwater marsh features to mitigate for loss of habitat and enhance the habitat value along the slough. The erosion protection will be approximately 1,320 feet from levee mile 1.09 to 1.1, and the seepage protection will be approximately 2,500 feet from levee mile 1.5 to 1.95.	$ 4,332,000	$ -	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
385	BWFS	California Department of Water Resources	Tie in to Deep Water Ship Channel	A gated weir to tie into the DWSC (Central or South tie-in). With appropriate agreements with USACE, local land use agencies, and Port of West Sacramento operators, a 1,000-foot gated weir structure would be constructed in the navigation levee on the west side of the DWSC to allow more than 60,000 cfs of flood waters to spill into it during a major flood event. This would restore the flow capacity of the Yolo Bypass that existed before the DWSC was completed in 1963. The Weir would be located immediately downstream of the South Cross Levee, which defines the southern boundary of RD 900.	$ 240,000,000	$ 240,000,000	Systemwide - Yolo Bypass multi-benefit improvements	Flood Infrastructure
386	RFMP	Three Rivers Levee Improvement Authority	Toe Access Corridor - Upper Bear River	Acquire toes access corridor along urban levee to meet ULDC criteria	$ 20,000	$ 20,000	Rural - Land acquisitions and easements	Watershed and Floodplain Management
387	RFMP	Three Rivers Levee Improvement Authority	Toe Access Corridor - Yuba River at Silver Wood	Acquire toes access corridor along urban levee to meet ULDC criteria	$ 10,000,000	$ 10,000,000	Rural - Land acquisitions and easements	Watershed and Floodplain Management
388	RFMP	Three Rivers Levee Improvement Authority	Toe Access Corridor - Yuba River from Silver Wood to Simpson Ln	Acquire toes access corridor along urban levee to meet ULDC criteria	$ 500,000	$ 500,000	Rural - Land acquisitions and easements	Watershed and Floodplain Management
389	RFMP	Three Rivers Levee Improvement Authority	Toe Access Corridor - Yuba River from UPRR to Silver Wood	Acquire toes access corridor along urban levee to meet ULDC criteria	$ 500,000	$ 500,000	Rural - Land acquisitions and easements	Watershed and Floodplain Management
390	RFMP	Three Rivers Levee Improvement Authority	TRLIA Feather River Levee Setback Ecosystem enhancement	The new levee created 200-year flood protection for surrounding communities by setting back approximately 4 miles of the existing levee on the left bank of the Feather River opposite Star Bend upstream toward Yuba City. The new levee also created opportunities to restore approximately 1,600 acres of riparian and wetland habitat on former agricultural lands that became part of the Feather River floodway with construction of the setback levee. Planning habitat restoration plans have been developed for the area (PWA 2008, River Partners 2009), and DWR's Flood Safe Environmental Sustainability and Statewide Resources Office (FESSRO) recently awarded approximately $4.4 million to TRLIA to pay for a portion of the estimated $9.1 million restoration project.	$ 9,100,000	$ 9,100,000	Rural - Habitat restoration/reconnection	Natural Floodplain and Ecosystem Functions

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#	Data Set Source	Lead Agency	Project Name	Project Description	Estimated Cost - Provided by Source	Estimated Cost - Adjusted for Portfolio	Area of Interest and Management Action Category	Management Action Type
391	BWFS	California Department of Water Resources	Tule Canal Improvements	Eliminate fish stranding and barriers and improve connectivity to Tule Canal and the Sacramento River for fish species in the Sacramento weir and bypass and Lower Elkhorn setbacks.	$ -	$ 12,000,000	Systemwide - Reservoir and floodplain storage	Natural Floodplain and Ecosystem Functions
392	BWFS	California Department of Water Resources	Upper Elkhorn Setback	A new setback levee, aligned north to south, would approximately bisect the existing Upper Elkhorn basin. The new setback levee would extend from the Sacramento River northwest of Verona southward for about six miles where it would tie into the Sacramento River levee just north of I-5. The setback levee would expand the Yolo Bypass by 2,695 acres (including the 500 acres north of the weir), most of which would continue to be farmed with a shift in cropping patterns consistent with periodic inundation. The new setback levee would connect with the existing Elkhorn west levee north of the Sierra Northern railway.	$ 210,000,000	$ 237,000,000	Systemwide - Yolo Bypass multi-benefit improvements	Flood Infrastructure
393	BWFS	California Department of Water Resources	Upper Elkhorn Setback Ecosystem Implementation	Improve habitat connectivity between the Sacramento River, Tule Canal and Yolo Bypass via channel grading to reduce stranding, and construction of a low-flow channel and riparian corridor within new setback area to improve fish passage from Fremont Weir. Water levels would be optimized within setback area to improve fish rearing habitat and agricultural water supply. Tule Canal riparian habitat and fish passage would be enhanced and SRA habitat would be preserved and enhanced.	$ 40,000,000	$ 17,651,200	Systemwide - Reservoir and floodplain storage	Natural Floodplain and Ecosystem Functions
394	RFMP	Lake County Watershed Protection District	Upper Lake 100-year Feasibility Study	Conduct Feasibility Study for achieving 100-year protection for Upper Lake	$ 500,000	$ 500,000	Small Community - Studies and analysis	Watershed and Floodplain Management
395	USACE	California Department of Water Resources	Urban Levee Improvements	All urban levee improvements and associated cost estimates provided by USACE.	$ -	$ 3,380,000,000	Urban - Levee improvements	Flood Infrastructure
396	RFMP		Urrutia Pit Reclamation and Enhancement	The potential project includes regrading approximately 10 acres of the property between the river and pond to allow more frequent inundation and development of shaded riparian aquatic habitat (SRA). The shoreline, which is currently at approximately a 10–year floodplain elevation, would be re–contoured to three terrace elevations to create topographic heterogeneity. The cut material would be used to construct a berm along the southern pond margin to minimize connectivity between the river and the pond, and to fill the southeast portion of the pond. Riparian enhancement along the pond margins would be completed, and access to the pond for fish from the Natomas East Main Drain Canal (NEMDC) Steelhead Creek, which runs along the northern boundary of the site just south of the Garden Highway, would be minimized. Project cost range: $5,200,000-$6,400,000.	$ 6,400,000	$ 6,400,000	Urban - Other infrastructure and multi-benefit improvements	Natural Floodplain and Ecosystem Functions
397	RFMP	River Partners	USFWS Riparian Sanctuary project	Riparian Sanctuary project. This project is on hold while information is gathered for CVFPB so they can issue permits for rock removal. This project is riparian restoration on the Llano Seco Riparian Sanctuary Unit (USFWS) and to protect alignment of the Sac River at the Princeton-Codora-Glenn- Provident Irrigation District. Environmental Documentation has been complete, but the project has stalled in the permitting process.	$ 5,000,000	$ 5,000,000	Rural - Habitat restoration/reconnection	Natural Floodplain and Ecosystem Functions
398	RFMP	Butte County Public Works Department	Various Locations	Levee Repairs and Rehabilitation. Mud Creek and Big Chico Creek.	$ 37,723,000	$ -	Urban - Other infrastructure and multi-benefit improvements	Operation and Maintenance
399	RFMP	DWR Maintenance Area 05, Butte Creek	Various Locations	Levee Repairs and Rehabilitation	$ 256,306,000	$ -	Rural - Levee repair and infrastructure improvements	Operation and Maintenance

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#	Data Set Source	Lead Agency	Project Name	Project Description	Estimated Cost - Provided by Source	Estimated Cost - Adjusted for Portfolio	Area of Interest and Management Action Category	Management Action Type
400	RFMP	State Maintenance Area 03	Various Locations	Levee Repairs and Rehabilitation	$ 127,627,000	$ -	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
401	RFMP	DWR Maintenance Area 01	Various Locations	Levee Repairs & Rehabilitation	$ 97,100,000	$ -	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
402	RFMP	DWR Maintenance Area 12	Various Locations	Levee Repairs & Rehabilitation	$ 20,284	$ -	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
403	RFMP	Reclamation District 0108	Various Locations	Levee Repairs & Rehabilitation	$ 179,264,000	$ -	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
404	RFMP	Reclamation District 787	Various Locations	Levee Repairs & Rehabilitation	$ 62,105,000	$ -	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
405	RFMP	Sacramento River West Side Levee District	Various Locations	Levee Repairs & Rehabilitation	$ 244,646,000	$ -	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
406	RFMP	Levee District 01G	Various Locations	Levee Repairs & Rehabilitation	$ 94,718,000	$ -	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
407	RFMP	Levee District 02	Various Locations	Levee Repairs & Rehabilitation	$ 52,998,000	$ -	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
408	RFMP	Levee District 03	Various Locations	Levee Repairs & Rehabilitation	$ 72,836,000	$ -	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
409	RFMP	Lake County Watershed Protection District	Various Locations	Levee Repairs & Rehabilitation	$ 85,541,000	$ -	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
410	RFMP	Reclamation District 0070	Various Locations	Levee Repairs & Rehabilitation	$ 196,764,000	$ -	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
411	RFMP	Reclamation District 1500	Various Locations	Levee Repairs & Rehabilitation	$ 993,761,000	$ -	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
412	RFMP	Reclamation District 1660	Various Locations	Levee Repairs & Rehabilitation	$ 285,228,000	$ -	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
413	RFMP	State Maintenance Area 09	Various Locations	Levee Repairs & Rehabilitation	$ 99,781,000	$ -	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
414	RFMP	Tehama County Flood Control and Water Conservation District	Various Locations	Levee Repairs & Rehabilitation	$ 97,529,000	$ -	Rural - Levee repair and infrastructure improvements	Operation and Maintenance

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415	RFMP	Reclamation District 827, Elkhorn	Vegetation Control Program	The December 2013 USACE Period Inspection identified the current level of vegetation as being "unacceptable" for ELK 1 and ELK 2. RD 827 would like to develop a project to remove vegetation from the levee slope and 15 feet from the levee toe. This would also include the removal of invasive species, which currently impede visibility, thinning and trimming of existing trees; and removal of tree stumps if deemed necessary. The goal of this work would be to meet, at a minimum, the Central Valley Flood Protection Plan Levee Vegetation Management Strategy criteria. Similar project estimated costs: Lisbon $378,000, Ryer $3,927,000, Tyler $1,481,000. Average of three projects: $1,928,667.	$ 1,928,667	$ 1,928,667	Systemwide - Routine maintenance	Operation and Maintenance
416	RFMP	Reclamation District 307, Lisbon Island	Vegetation Control Project – Lisbon	Vegetation removal/thinning/trimming and mitigation from the levee slope and 15 feet from the levee toe. The goal of this project is to meet the Central Valley Flood Protection Plan Levee Vegetation Management Strategy criteria. 2 year completion time.	$ 378,000	$ 378,000	Systemwide - Routine maintenance	Operation and Maintenance
417	RFMP	Reclamation District 501, Ryer Island	Vegetation Control Project – Ryer Island	Vegetation removal/thinning/trimming and mitigation from the levee slope and 15 feet from the levee toe. The goal of this project is to meet the Central Valley Flood Protection Plan Levee Vegetation Management Strategy criteria. 2 year completion time.	$ 3,927,000	$ 3,927,000	Systemwide - Routine maintenance	Operation and Maintenance
418	RFMP	Reclamation District 563	Vegetation Maintenance and Removal Project – Tyler Island	Vegetation removal/thinning/trimming and mitigation from the levee slope and 15 feet from the levee toe. The goal of this project is to meet the Central Valley Flood Protection Plan Levee Vegetation Management Strategy criteria. 1-year completion time.	$ 1,481,000	$ 1,481,000	Systemwide - Routine maintenance	Operation and Maintenance
419	RFMP	Reclamation District 1600, Mull	Vegetation Mitigation Management	DWR has 3 mitigation sites along the Sac. River on the waterside of the levees that require vegetation maintenance and gravel for the access road. Similar project estimated costs: Lisbon $378,000, Ryer $3,927,000, Tyler $1,481,000. Average of three projects: $1,928,667.	$ 1,928,667	$ 1,928,667	Systemwide - Routine maintenance	Operation and Maintenance
420	RFMP	Tehama County Flood Control and Water Conservation District	Veterans/Cottonwood Lake No-Pump Off-Stream Surface Storage	Veterans Lake (up to 1 million AF) and Cottonwood Lake (up to 1.4 million AF) no-pump off-stream surface storage reservoirs would be constructed on minor tributaries of Cottonwood Creek that do not support/impact anadromous fish and will not impact sediment flow/gravel migration. Water Sources: A portion of Trinity River water already headed to the Sacramento River could be diverted via Whiskeytown w/new 13 mile tunnel. Increased releases from Shasta Lake would replace flows diverted to Veterans/Cottonwood. In addition, fish/sediment/gravel friendly diversions within the Cottonwood Creek watershed could also be used. Water Releases: Releases in the Cottonwood Creek watershed can be limited to just the amount needed to enhance anadromous fish spawning, with the remainder sent back through Whiskeytown/Keswick. Fishery Enhancement: A DWR study outlines spectacular increases in spawning salmon within the Cottonwood watershed with managed releases w/ similar benefits for steelhead expected.	$ -	$ -	Systemwide - Reservoir and floodplain storage	Reservoir and Floodplain Storage and Operation
421	RFMP	Walnut Grove Local Maintaining Agency	Walnut Grove Improvements Study	The RFMP is pre-feasibility, and thus a feasibility study is a recommended course of action for the area. Potential solutions to be explored include non-structural structure raising ($301M), a ring levee ($71.5M), fix-in-place of existing perimeter levees ($642.9M), and FEMA Zone D designation ($N/A) or a combination of those solutions.	$ 500,000	$ 500,000	Small Community - Studies and analysis	Watershed and Floodplain Management
422	USACE	City of Davis	Wastewater Treatment Plant Flood Protection Measures	100-year flood protection measures during the upgrade of the WWTP to comply with NPDES permit requirements. Measures include floodwall or levee around the key facilities and the Willow Slough Bypass north levee would need to be raised along the project area. Key facilities are not entirely clear in permit and it may be possible to negotiate with the RWQCB to which facilities do or do not need protection.	$ 9,966,000	$ -	Urban - Levee improvements	Flood Infrastructure
423	RFMP	City of Rio Vista	Waterfront Floodwall and Public Access Project	Highest priority improvement for the City is the development of the Waterfront Floodwall and Public Access Project. 2,500 LF concrete floodwall along the current shoreline of the Sac River and would also include construction of a promenade in the same area for public access.	$ 7,793,000	$ -	Small Community - Levee repair and infrastructure improvements	Flood Infrastructure

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#	Data Set Source	Lead Agency	Project Name	Project Description	Estimated Cost - Provided by Source	Estimated Cost - Adjusted for Portfolio	Area of Interest and Management Action Category	Management Action Type
424	Other	California Department of Water Resources	West Sacramento River General Reevaluation Report	State-Federal Feasibility Study projects that DWR could partner in.	$ 4,000,000	$ 4,000,000	Urban - Studies and analysis	Watershed and Floodplain Management
425	RFMP	N/A	Wildlife Area improvements- Princeton SE	Wildlife Area improvements- Princeton SE restoration of 50 acres and addition of a parking lot, Invasive removal and restoration on 8 acres at the Stegman Unit.	$ 1,000,000	$ 1,000,000	Rural - Habitat restoration/reconnection	Natural Floodplain and Ecosystem Functions
426	RFMP	Reclamation District 2035, Conaway Tract	Willow Slough Bypass Stability Project	Serious stability site along Willow Slough Bypass about 100 LF that requires the construction of stability protection.	$ 58,000	$ 58,000	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
427	RFMP		Woodlake	The potential concepts for this site are organized into three priority levels and/or phases: • Excavate floodplain terrace and lower high ground adjacent to the river along the right bank to introduce higher inundation frequency. • Enhance shaded riverine aquatic (SRA) habitat along the right bank and secondary channel. Restore recently burned perennial native grassland, oak savanna, and riparian woodland habitats. • Lower 10–year floodplain elevation in eastern portion of the project site.	$ 43,000,000	$ 43,000,000	Urban - Other infrastructure and multi-benefit improvements	Natural Floodplain and Ecosystem Functions
428	Other	California Department of Water Resources	Woodland Lower Cache Creek Feasibility Study	State-Federal Feasibility Study projects that DWR could partner in.	$ 4,000,000	$ 4,000,000	Urban - Studies and analysis	Watershed and Floodplain Management
429	USACE	City of Woodland	Woodland's Flood Risk Reduction and Railroad Relocation	Feasibility study to develop and implement a 200–year flood protection program for the City of Woodland that incorporates the relocation of rail facilities that impact regional flood protection infrastructure and includes conversion of the Sierra Northern Rail line between West Sacramento and Woodland into a regional trail for enriching experiences.	$ 200,000,000	$ 200,000,000	Urban - Levee improvements	Flood Infrastructure
430	RFMP	N/A	Working Landscapes	Encourage farmers to invest in habitat on farmland in a manner that is mutually beneficial to production agriculture and the ecosystem	$ 100,000	$ 100,000	Systemwide - State operations, planning and performance tracking	Policy and Regulations
431	RFMP	Three Rivers Levee Improvement Authority	WPIC ULDC Remediation Design & Construction	Improvements to the Western Pacific Interceptor Canal levee in RD 784 to meet ULDC criteria. This project is a follow on to the EIP Western Pacific Interceptor Canal project.	$ 15,150,000	$ 15,150,000	Urban - Other infrastructure and multi-benefit improvements	Operation and Maintenance
432	RFMP	Reclamation District 2060, Hastings Tract	Wright Cut Bank Protection Project – Hastings	Rehabilitation of 3,500 LF of waterside bank to withstand Yolo Bypass flood flows, and incorporate an enhanced lower waterside slope habitat area with possible riparian forest, scrub shrub, emergent/freshwater marsh to mitigate and enhance habitat values.	$ 3,100,000	$ 3,100,000	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
433	RFMP	Reclamation District 1001, Nicolaus	Yankee Slough north and south bank, from confluence to Pleasant Grove Road	Phased improvements to the RD1001 levee system, Segment 144 & 145, to achieve 100-year FEMA levee protection. Reference: Non-Urban Levee Evaluations Project Remedial Alternatives and Cost Estimates Report (NULE RACER).	$ 57,547,000	$ 57,547,000	Small Community - Levee repair and infrastructure improvements	Flood Infrastructure
434	RFMP		YB-CS Complex Management Plan	CMP will focus on addressing policy issues associated with the implementation of any project in the existing YB–CS Complex. Development of the CMP will be led by a team of local agencies with participation from key state and federal government agencies.	$ 200,000	$ 200,000	Systemwide - State operations, planning and performance tracking	Policy and Regulations

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435	Yolo Bypass	Reclamation District 1600, Mull	Yolo Bypass Bank Protection	On the Yolo bypass levee (Levee Segment 295), 3 miles south of the Freemont Weir 6,800 LF needs repair of erosion; requires gravel to improve access and repair 3:1 slope.	$ 7,679,000	$ -	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
436	Yolo Bypass	Reclamation District 785, Driver	Yolo Bypass Bank Protection Project	Bank protection project to repair a serious erosion site along the Yolo Bypass at LM 2.2 about 200 LF.	$ 227,000	$ -	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
437	BWFS	California Department of Water Resources	Yolo Bypass Freeboard Raise	Six feet of freeboard over the estimated 1997 110 % water surface profile for urban areas.	$ 28,000,000	$ 73,000,000	Systemwide - Yolo Bypass multi-benefit improvements	Flood Infrastructure
438	Yolo Bypass	Reclamation District 827, Elkhorn	Yolo Bypass Freeboard Restoration	The existing bypass levee does not, currently, have the recommended six foot of freeboard above the 1957 Design Water Surface Profile prescribed in the USACE O&M manual. With this project the levee crown elevation should be restored to the authorized elevation.	$ 6,000,000	$ -	Rural - Levee repair and infrastructure improvements	Flood Infrastructure
439	Yolo Bypass	City of West Sacramento	Yolo Bypass Levee	Stability berm and 2 miles of cutoff wall. Future Closure structure will be required for the I-80 crossing.	$ 51,531,000	$ -	Urban - Levee improvements	Flood Infrastructure
440	Yolo Bypass	Reclamation District 1600, Mull	Yolo Bypass Levee Crown Repair	On the Yolo bypass levee, 2 miles south of the Fremont Weir and running for 2.3 miles the levee crown road needs an addition 5.-6 inches of base and gravel added to ensure safe driving during patrols in wet weather and high water events. Also landward side, the levee needs improved stability and additional soil to have a 3:1 slope.	$ 3,503,000	$ -	Rural - Levee repair and infrastructure improvements	Flood Infrastructure
441	Yolo Bypass	Reclamation District 785, Driver	Yolo Bypass Levee Flattening Project	Project in coordination with RD 785. Details to be provided by RD 827. Similar project estimated costs: DWSC East $6,141,000, Port South $9,049,000, South Cross $11,684,000. Average of three projects: $8,958,000	$ 8,958,000	$ -	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
442	Yolo Bypass	Reclamation District 785, Driver	Yolo Bypass Levee Improvements	2 miles of the Yolo Bypass levee need repairs including rip rap and rock placed on the crown to allow for winter patrol access and emergency access.	$ 3,046,000	$ -	Rural - Levee repair and infrastructure improvements	Flood Infrastructure
443	Yolo Bypass	Reclamation District 827, Elkhorn	Yolo Bypass Levee Relocation	Relocation of the Yolo Bypass levee is currently being evaluated as part of Sacramento Weir and Bypass Project, described in Section 5.6.1 of the FloodProtect plan. RD 827 is supportive of the relocation evaluation and looks forward to further discussions regarding this potential project.	$ 200,000,000	$ -	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
444	Yolo Bypass	Reclamation District 2068, Yolano	Yolo Bypass Outflanking	Approx. 0.5-miles of the RD-2068 Unit 1 levee from King Road north to Yolano Mills Road was never constructed as part of the Sacramento River Flood Control Project (SRFCP). Flood fighting was required in 1986 and 1997 to prevent outflanking of the existing Yolo Bypass levee. Project would include the construction of approx. 0.5 miles of levee coincident with County Road 104. $2300/linear foot for new levee.	$ 6,000,000	$ -	Rural - Levee repair and infrastructure improvements	Flood Infrastructure
445	Yolo Bypass	Reclamation District 2068, Yolano	Yolo Bypass Seepage Repair Project – Yolano	Rock and fill repair for serious seepage site along the Yolo Bypass; roughly 700 ft. long.	$ 452,000	$ -	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
446	Yolo Bypass	Reclamation District 827, Elkhorn	Yolo Bypass Stability Berm	Single site along the Yolo Bypass, LM 0.3 to 0.5 about 110 LF requires a stability berm and is considered to be a serious stability problem.	$ 64,000	$ -	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
447	Yolo Bypass	Reclamation District 2068, Yolano	Yolo Bypass Waterside Enhancement Project – Yolano	Project would provide additional slope material (bypass side of levee) at a possible 10:1 or flatter slope. Providing protection from high water flood erosion, habitat friendly slopes, and includes a large enhancement and mitigation component. (Est. 1M tons of imported fill).	$ 6,821,000	$ -	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
448	Yolo Bypass	Reclamation District 2098, Cache Haas Area	Yolo Bypass West Levee Erosion Repair - RD 2098	Repair of erosion caused by interior drainage from LM 0.0 to 3.5. Landside erosion protection features are needed to ensure toe stability and to avoid recurring landside slope and toe repairs. Similar project estimated costs: rock slope protection lisbon $4,216,000; rock slope protection ryer $7,337,000; rock slope protection tyler $841,000; Cache Creek Erosion $1,814,000. Average of three projects: $3,552,000	$ 3,552,000	$ -	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
449	Yolo Bypass	Reclamation District 2068, Yolano	Yolo Bypass West Levee Erosion Repair Project – Yolano	Rock reinforcement at critical erosion site located between levee miles 3.2 and 5.5 on both sides of levee and at both bypass and landside toes. Similar project estimated costs: rock slope protection lisbon $4,216,000; rock slope protection ryer $7,337,000; rock slope protection tyler $841,000; Cache Creek Erosion $1,814,000. Average of three projects: $3,552,000	$ 3,552,000	$ -	Rural - Levee repair and infrastructure improvements	Operation and Maintenance

Table B-4. Sacramento Basin Management Actions Included within the 2017 Refined SSIA Portfolio

#	Data Set Source	Lead Agency	Project Name	Project Description	Estimated Cost - Provided by Source	Estimated Cost - Adjusted for Portfolio	Area of Interest and Management Action Category	Management Action Type
450	Yolo Bypass	Reclamation District 2068, Yolano	Yolo Bypass West Levee Improvement Project – Yolano	Freeboard deficiency results in overtopping during high water events in the bypass combined with high winds and resulting wave fetch. 5 to 6 feet of freeboard is needed to assure no overtopping.	$ 12,000,000	$ -	Rural - Levee repair and infrastructure improvements	Flood Infrastructure
451	Yolo Bypass	Reclamation District 2068, Yolano	Yolo Bypass West Levee Interior Erosion Repair Project	Repair of erosion caused by interior drainage from LM 3.2 to 5.5. Landside erosion protection features are needed to ensure toe stability and to avoid recurring landside slope and toe repairs. Similar project estimated costs: rock slope protection lisbon $4,216,000; rock slope protection ryer $7,337,000; rock slope protection tyler $841,000; Cache Creek Erosion $1,814,000. Average of three projects: $3,552,000	$ 3,552,000	$ -	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
452	RFMP		Yolo County Park Gravel Pit Connection and Riparian Enhancement	The proposed project would involve construction of frequently inundated inflow and outflow channels between Sacramento River and the pit to provide off–channel habitat and minimize stranding hazards. Design considerations should include whether to passively or actively control connectivity and ensuring the project design does not increase the exposure of salmonids to warm water fish predators within the gravel pit. Riparian vegetation would be planted along the margins of the pond and inflow/outflow channels. The terrace to the east of the pond and adjacent to the river would be lowered to inundate more frequently and support riparian vegetation.	$ 7,200,000	$ 7,200,000	Urban - Other infrastructure and multi-benefit improvements	Natural Floodplain and Ecosystem Functions
453	RFMP	Yolo County	Yolo Feasibility Study	The RFMP is pre-feasibility, and thus a feasibility study is a recommended course of action for the area. Potential solutions to be explored include Non-structural structure raising ($18.6M), a ring levee ($N/A), fix-in-place of existing perimeter levees ($45.4M), and FEMA Zone D designation ($N/A) or a combination of those solutions.	$ 500,000	$ 500,000	Rural - Studies and analysis	Watershed and Floodplain Management
454	RFMP	Three Rivers Levee Improvement Authority	Yuba 86 Break Site Berm Design & Construction	Project complete.	$ 1,500,000	$ -	Rural - Levee repair and infrastructure improvements	Flood Infrastructure
455	RFMP	Three Rivers Levee Improvement Authority	Yuba Goldfields Design & Construction	Project to develop and implement plan to ensure and sustain 200-year protection. The first step was to work with mining interests to construct non-leveed embankments in 2011 to address the highest risk areas. Step 2 is to construct features that address moderate risk in 2014 that will meet FEMA standards. Step 3 is to construct features that will meet the State of California's 200-year requirements and will be completed prior to 2025. Step 4: Will implement the 200-year plan developed in Step 3.	$ 20,000,000	$ 20,000,000	Urban - Levee improvements	Flood Infrastructure
456	Other	California Department of Water Resources	Yuba Goldfields Proposed Study	State-Federal Feasibility Study projects that DWR could partner in.	$ 4,000,000	$ 4,000,000	Urban - Studies and analysis	Watershed and Floodplain Management
457	Other	California Department of Water Resources	Yuba River General Reevaluation Report	State-Federal Feasibility Study projects that DWR could partner in.	$ 4,000,000	$ 4,000,000	Urban - Studies and analysis	Watershed and Floodplain Management
458	RFMP	Three Rivers Levee Improvement Authority	Yuba River South Levee ULDC Remediation	TRLIA is planning to perform additional explorations and implement a levee widening project to provide up to 200 year level of protection on a small section of the Yuba River South Levee. The proposed reach is a site of a 1986 levee break in which the USACE repaired using large rocks and unknown material. The proposed project will fund geotechnical explorations, design, construction, and management.	$ 1,500,000	$ 1,500,000	Rural - Levee repair and infrastructure improvements	Flood Infrastructure

Table B-4. Sacramento Basin Management Actions Included within the 2017 Refined SSIA Portfolio

#	Data Set Source	Lead Agency	Project Name	Project Description	Estimated Cost - Provided by Source	Estimated Cost - Adjusted for Portfolio	Area of Interest and Management Action Category	Management Action Type
459	RFMP		Zacharias Island / Snodgrass Slough Enhancements	The concept design includes breaching the western levee to allow a connection to Snodgrass Slough. The existing farmland would be excavated and terraced to create backwater sloughs, SRA, riparian forest, and frequently inundated floodplain. Potential also exists for other beneficial uses of the property.	$ 3,800,000	$ 3,800,000	Rural - Habitat restoration/reconnection	Natural Floodplain and Ecosystem Functions

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Table B-5. San Joaquin Basin Management Actions Included within the 2017 Refined SSIA Portfolio

#	Data Set Source	Lead Agency	Project Name	Project Description	Estimated Cost - Provided by Source	Estimated Cost - Adjusted for Portfolio	Area of Interest and Management Action Category	Management Action Type
1	RFMP	San Joaquin County, City of Stockton	200-year Floodplain Maps & Master Plan		$ 2,100,000	$ 2,100,000	Rural - Risk awareness, floodproofing and land use planning	Watershed and Floodplain Management
2	USACE	San Joaquin County, City of Stockton	200-year ULDC Analysis	The goal for most of the Stockton Metropolitan area is to maintain 100-year protection in the near-term and seek 200-year level of protection in the long-term. The first critical step in developing a plan to comply with SB5 is to determine where a ULOP finding is required (i.e. where the 200-year floodplain, assuming levees fail, is greater than 3-feet). This will inform land use agencies on where findings will be required, and where findings are not required. For areas where ULOP findings are required, land use agencies will need to complete an evaluation of levees against ULDC criteria. Land use agencies may elect to pursue this evaluation in phases. For levee systems found to currently meet ULDC as-is, land use agencies may make ULOP findings for areas protected by these levee systems. For levee systems that do not currently meet ULDC criteria, a land use agency will have to make adequate progress toward improvements to make ULOP findings.	$ 5,000,000	$ 5,000,000	Urban - Studies and analysis	Watershed and Floodplain Management
3	RFMP	Delta South Region	Additional Forecasting/Notification - Delta South Region	Regional project in the Delta South region to reduce residual risk through additional forecasting/notification.	$ 10,000,000	$ -	Systemwide - Emergency management	Emergency Management
4	RFMP	Lower San Joaquin River Region	Additional Forecasting/Notification - Lower San Joaquin Region	Regional project in the Lower San Joaquin region to reduce residual risk through additional forecasting/notification.	$ 10,000,000	$ -	Systemwide - Emergency management	Emergency Management
5	RFMP	Delta South Region	Additional Information Collection/Sharing - Delta South Region	Regional project in the Delta South region to reduce residual risk through additional information collection/sharing.	$ 11,300,000	$ -	Rural - Studies and analysis	Watershed and Floodplain Management
6	RFMP	Lower San Joaquin River Region	Additional Information Collection/Sharing - Lower San Joaquin Region	Regional project in the Lower San Joaquin region to reduce residual risk through additional information collection/sharing.	$ 15,000,000	$ -	Rural - Studies and analysis	Watershed and Floodplain Management
7	Other	California Department of Water Resources	Agricultural Land Easements: Small Community 1/2 mile Buffer	Small Community 1/2 Mile Buffer for Agricultural Land Acquisition. Acquisitions include property for permanent and non-permanent crops within the 100-year floodplain only.	$ -	$ -	Rural - Land acquisitions and easements	Watershed and Floodplain Management
8	Other	California Department of Water Resources	Agricultural Land Easements: Small Community 1/2 mile Buffer	Small Community 1/2 Mile Buffer for Agricultural Land Acquisition. Acquisitions include property for permanent and non-permanent crops within the 100-year floodplain only.	$ -	$ -	Rural - Land acquisitions and easements	Watershed and Floodplain Management

Table B-5. San Joaquin Basin Management Actions Included within the 2017 Refined SSIA Portfolio

#	Data Set Source	Lead Agency	Project Name	Project Description	Estimated Cost - Provided by Source	Estimated Cost - Adjusted for Portfolio	Area of Interest and Management Action Category	Management Action Type
9	Other	California Department of Water Resources	Agricultural Land Easements: Small Community 1/2 mile Buffer	Small Community 1/2 Mile Buffer for Agricultural Land Acquisition. Acquisitions include property for permanent and non-permanent crops within the 100-year floodplain only.	$ 81,750,000	$ 81,750,000	Rural - Land acquisitions and easements	Watershed and Floodplain Management
10	Other	California Department of Water Resources	Agricultural Land Easements: Urban 2-mile Buffer	Urban 2 Mile Buffer for Agricultural Land Acquisition. Acquisitions include property for permanent and non-permanent crops within the 100-year floodplain only.	$ 208,420,000	$ 208,420,000	Rural - Land acquisitions and easements	Watershed and Floodplain Management
11	Other	California Department of Water Resources	Agricultural Land Easements: Urban 2-mile Buffer	Urban 2 Mile Buffer for Agricultural Land Acquisition. Acquisitions include property for permanent and non-permanent crops within the 100-year floodplain only.	$ 9,020,000	$ 9,020,000	Rural - Land acquisitions and easements	Watershed and Floodplain Management
12	Other	California Department of Water Resources	Agricultural Land Easements: Urban 2-mile Buffer	Urban 2 Mile Buffer for Agricultural Land Acquisition. Acquisitions include property for permanent and non-permanent crops within the 100-year floodplain only.	$ 12,520,000	$ 12,520,000	Rural - Land acquisitions and easements	Watershed and Floodplain Management
13	RFMP	Reclamation District 1	All-weather Road Reclamation District 1	All-Weather Road	$ 2,000,000	$ -	Systemwide - Emergency management	Emergency Management
14	RFMP	Reclamation District 2	All-weather Road Reclamation District 2	The levees surrounding the District are narrow, and are often impassable when wet. Widening Levee crown and adding all weather access road in identified areas will help improve O&M operations, emergency access, and egress in the event of a flood. Many improvements have already been made, so additional work would be in the distant future.	$ 1,000,000	$ -	Systemwide - Emergency management	Emergency Management
15	RFMP	Reclamation District 2058	All-weather Road Reclamation District 2058	The field data and inspections along Paradise Cut show that levee crown widths are narrower than HMP standards. The levee crown between Alder Avenue and Cedar Avenue poses vehicular access limitations due to narrow levee crown. This section is approximately 6,000 feet long and would require placing engineered fill on the landside of the levee to widen the crown by approximately 5-6 feet.	$ 100,000	$ 100,000	Systemwide - Emergency management	Emergency Management
16	RFMP	Reclamation District 2064	All-Weather Road Reclamation District 2064	The project levee along the San Joaquin River and Stanislaus River is too narrow and lacks an all-weather access road. The levee crown should be widened and an all-weather road installed to ensure travel along the levee is possible during a flood fight.	$ 1,000,000	$ 1,000,000	Systemwide - Emergency management	Emergency Management
17	RFMP	Reclamation District 2089	All-weather Road Reclamation District 2089	The SPFC levee along RD 2089 needs supplemental aggregate base to improve the all-weather road.	$ 600,000	$ 600,000	Systemwide - Emergency management	Emergency Management
18	RFMP	Reclamation District 684	All-weather Road Reclamation District 684	All weather roads are needed for the levee along the San Joaquin River and Burns Cutoff.	$ 400,000	$ -	Systemwide - Emergency management	Emergency Management

Table B-5. San Joaquin Basin Management Actions Included within the 2017 Refined SSIA Portfolio

#	Data Set Source	Lead Agency	Project Name	Project Description	Estimated Cost - Provided by Source	Estimated Cost - Adjusted for Portfolio	Area of Interest and Management Action Category	Management Action Type
19	RFMP	Reclamation District 773	All-weather Road Reclamation District 773	Many unidentified segments of levee around the District do not have adequate crown widths or an all-weather access road. The District will increase width of levee crown where current width is not up to standards and install an all-weather road.	$ 6,000,000	$ -	Systemwide - Emergency management	Emergency Management
20	RFMP	San Joaquin River Restoration Program	Arroyo Canal Screening and Sack Dam Passage	The SJRRP and HMRD will be constructing the new Sack Dam and providing a fish screen at Arroyo Canal. The new Sack Dam could improve the operational ability to release water into Reach 4A during flood conditions.	$ 25,000,000	$ -	Rural - Levee repair and infrastructure improvements	Flood Infrastructure
21	RFMP	Madera County	Ash Slough Arundo and Channel Cleaning	Approximately 21 miles of channel clearing and arundo eradication and channel clearing within Ash Slough. arundo is an aggressive bamboo weed which requires continual herbicide treatment to fully eradicate. Due to the high cost and lack of funding, arundo has been allowed to grow unabated and is now constricting flood flows and reducing channel capacity. USACE has indicated that Ash Slough is no longer PL 84-99 eligible.	$ 1,500,000	$ 1,500,000	Systemwide - Routine maintenance	Operation and Maintenance
22	RFMP	Merced Streams Group	Bear Creek Diversion Channel Feasibility Study	Based upon review of existing information, a diversion channel located upstream of Merced may significantly reduce flood risk within the City. The diversion channel would run in a south/southwest direction from Bear Creek. A feasibility study is needed to evaluate different options for the system improvement and define benefits and applicability.	$ 100,000	$ 100,000	Rural - Studies and analysis	Watershed and Floodplain Management
23	RFMP	Lower San Joaquin Levee District	Bear Creek Diversion Structure	In 1963, the State Department of Water Resources (DWR) constructed the Bear Creek siphon and diversion structure (BCSDS) at the intersection of Bear Creek and the East Side Canal. The facility was intended to channel Bear Creek flows over the East Side Canal Siphon during the winter and to divert these flows into the East Side Canal during the irrigation season. The invert of the structure is higher than the upstream channel which constrains flood flows, causes upstream ponding and migration of flood flows around the system improvement levee unit, and results in landside flooding. The proposed system improvement will enlarge the BCSDS by building additional bays to extend the structure to the south. These bays would be used at times of unusual storm runoff when properties, both agricultural and residential, are threatened by rising flood waters in Bear Creek. Design would incorporate fish passage elements. The Bear Creek Diversion Structure system improvement could also be developed in conjunction with proposed improvements on the Sno-Bird Unit of the San Luis Nat'l Wildlife Refuge Complex, as described in projects 67 and 68 on this list, to enhance the ability of this project to provide multiple benefits	$ 260,000	$ 260,000	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
24	USACE	San Joaquin County, City of Stockton	Bear Creek System PL 84-99 Improvements		$ 37,000,000	$ -	Urban - Levee improvements	Flood Infrastructure
25	BWFS	California Department of Water Resources	Bear Creek/Mariposa Transitory Storage	Promoting transitory storage concept as a key opportunity for State interest in the SJ Basin strikes the right balance of acknowledging environmental interests/goals while avoiding local agency/agricultural/land owner concern over unsupported, site-specific transitory storage.	$ 250,000,000	$ -	Systemwide - Reservoir and floodplain storage	Reservoir and Floodplain Storage and Operation
26	RFMP	Merced Streams Group	Bear Reservoir Enlargement and Downstream Levee and Channel Improvements	Bear Reservoir was constructed in the early 1950's as an element of the Merced Streams Group Project authorized by Congress's 1944 Flood Control Act. The Flood Control Act of 1970 called for three additional flood control reservoirs, enlargement of existing reservoirs, and 52 miles of levee and channel modifications. To date only one additional reservoir has been built (Castle Dam). The enlargement of Bear Reservoir and downstream levee and channel improvements would increase the level of flood protection to the most populated areas of Merced County. Bear Reservoir was originally constructed to provide protection for up to a 50-year storm event. The State of California has adopted legislation that calls for a minimum of 200-year flood protection for urbanized areas. This system improvement would meet the requirements of the new flood control legislation. As part of this project, opportunities for riparian and wetland habitat enhancements will be considered.	$ 202,940,000	$ 202,940,000	Systemwide - Reservoir and floodplain storage	Flood Infrastructure

Table B-5. San Joaquin Basin Management Actions Included within the 2017 Refined SSIA Portfolio

#	Data Set Source	Lead Agency	Project Name	Project Description	Estimated Cost - Provided by Source	Estimated Cost - Adjusted for Portfolio	Area of Interest and Management Action Category	Management Action Type
27	BWFS	California Department of Water Resources	Bear, Burns, Mariposa, and Owens Reservoir Raises (+85 TAF)	Could be included as part of a wide range of actions that could potentially be utilized as part of a package to provide Merced with an urban LOP. These actions include enlargement of reservoirs upstream of Merced and associated downstream levee and channel improvements that were identified in the Upper San Joaquin RFMP. Studies of these potential improvements are still in the early stages, and a package of actions to provide Merced with 200-year LOP has not yet been determined.	$ 118,000,000	$ -	Systemwide - Reservoir and floodplain storage	Reservoir and Floodplain Storage and Operation
28	RFMP	Madera Irrigation District	Berenda Creek Arundo Removal and Channel Clearing	Approximately 13 miles of channel clearing and arundo eradication and channel clearing within Berenda Creek. arundo is an aggressive bamboo weed which requires continual herbicide treatment to fully eradicate. Due to the high cost and lack of funding, arundo has been allowed to grow unabated and is now constricting flood flows and reducing channel capacity.	$ 500,000	$ 500,000	Systemwide - Routine maintenance	Operation and Maintenance
29	RFMP	Madera County	Berenda Slough Arundo and Channel Clearing	Approximately 18 miles of channel clearing and arundo eradication and channel clearing within Berenda Slough. arundo is an aggressive bamboo weed which requires continual herbicide treatment to fully eradicate. Due to the high cost and lack of funding, arundo has been allowed to grow unabated and is now constricting flood flows and reducing channel capacity.	$ 1,300,000	$ 1,300,000	Systemwide - Routine maintenance	Operation and Maintenance
30	RFMP	City of Patterson	Black Gulch Storm Drainage Study	There is a permitted spillway into the Delta Mendota Canal (DMC) from Black Gulch, a drainage situated between Salado and Del Puerto Creek, which keeps a local commercial area in Patterson from flooding. A study needs to be performed to determine what alternative solutions might be appropriate if/when the DMC Authority decides to not renew the permit.	$ 28,000	$ 28,000	Urban - Studies and analysis	Watershed and Floodplain Management
31	BWFS	California Department of Water Resources	Black Rascal Creek Detention Basin (1 TAF) to protect City of Merced	Could be included as part of a wide range of actions that could potentially be utilized as part of a package to provide Merced with an urban LOP. These actions include implementation of a flood detention basin on Black Rascal Creek. Studies of these potential improvements are still in the early stages, and a package of actions to provide Merced with 200-year LOP has not yet been determined.	$ 32,980,000	$ -	Systemwide - Reservoir and floodplain storage	Flood Infrastructure
32	RFMP	Merced County	Black Rascal Creek Flood Control Project	Construction of a regulating reservoir on the Black Rascal Creek Watershed. System improvement location is immediately north of Yosemite Avenue and Arboleda Drive in northeast Merced. System improvement will provide protection against a 200-year storm event and much needed flood control on the currently unprotected Black Rascal Creek Watershed. System improvement will benefit all downstream areas of watershed. The reservoir will maintain a deadpool for wildlife purposes. During flood season the reservoir would be used primarily as a flood retention basin. During irrigation season the reservoir would regulate irrigation flows and improve efficiency of Merced Irrigation District's water system without impacting power generation scheduling by the Independent System Operator (ISO) at New Exchequer Dam. Based upon initial review of existing information, reducing flood flows in Black Rascal Creek at the Yosemite Ave. diversion to less than about 3,000 cubic feet per second (cfs) by use of upstream detention will substantially reduce the flooding in the City of Merced. The completed system improvement could protect houses in the Franklin-Beachwood area, where over 80 homes were flooded during the 2006 flood. A flood control structure on Black Rascal Creek could also offer protection to other areas situated along Bear Creek. Merced County retained a consultant to investigate the feasibility of alternative flood control improvements, including alternative operation procedures and infrastructure improvements to the Lake Yosemite facilities, to reduce the peak flows at the Black Rascal Creek diversion. The study identified four different sites along Black Rascal Creek for	$ 32,980,000	$ -	Urban - Other infrastructure and multi-benefit improvements	Flood Infrastructure
33	RFMP	Lower San Joaquin Levee District	Bridge Enlargement over Eastside Bypass at Sandy Mush Road	The Sandy Mush Road crossing of the Eastside Bypass Channel includes a bridge deck and piles with elevated road embankments at each end of the bridge. The flow area under the bridge and between the embankments is much less than the upstream flow area of the Bypass. This constricts flood flows and causes upstream freeboard encroachment. The elevated road embankments have been cut three times in the past to allow the flood flows to pass. Cutting the road is problematic for Merced County because the road is designated as an arterial evacuation route. The bridge needs to be lengthened to reduce the flow restriction. An alternative option could be to install culverts in the embankments to reduce the flow area. As part of this project, opportunities for riparian and wetland habitat enhancements will be considered.	$ 1,610,000	$ 1,610,000	Rural - Levee repair and infrastructure improvements	Operation and Maintenance

Table B-5. San Joaquin Basin Management Actions Included within the 2017 Refined SSIA Portfolio

#	Data Set Source	Lead Agency	Project Name	Project Description	Estimated Cost - Provided by Source	Estimated Cost - Adjusted for Portfolio	Area of Interest and Management Action Category	Management Action Type
34	RFMP	Merced Streams Group	Burns Reservoir Enlargement and Downstream Levee and Channel Improvement	Burns Reservoir was constructed in the early 1950's as an element of the Merced Streams Group Project authorized by Congress's 1944 Flood Control Act. The enlargement of Burns Reservoir and downstream levee and channel improvements would increase the level of flood protection to the most populated areas of Merced County. Burns Reservoir was originally constructed to provide protection for up to a 50-year storm event. The State of California has adopted legislation that calls for a minimum of 200-year flood protection for urbanized areas. This project could help to meet the requirements of the new flood control legislation while also providing increased flood protection to the most urbanized areas of Merced County. This project calls for design, environmental documents, and construction funding. Due to the length of time since the project was identified, a new feasibility study may need to be completed to deal with changes in legislation. (MIRWMP, 2013c)	$ 39,180,000	$ 39,180,000	Systemwide - Reservoir and floodplain storage	Flood Infrastructure
35	BWFS	California Department of Water Resources	Calaveras River Upstream Flood Storage	This element of the San Joaquin BWFS includes additional 42 TAF dedicated flood storage in the Calaveras River watershed, which could be achieved by conjunctive use or FIO. BWFS analysis found that this amount of storage was found to mitigate for stage increases caused by climate change and reduce the need for some levee improvements.	$ 105,000,000	$ 105,000,000	Systemwide - Reservoir and floodplain storage	Reservoir and Floodplain Storage and Operation
36	USACE	San Joaquin County, City of Stockton	Calaveras System PL 84-99 Improvements		$ 24,000,000	$ -	Urban - Levee improvements	Flood Infrastructure
37	RFMP	Central California Irrigation District, San Luis Canal Company	Camp 13 Area Surface Storage	The Camp 13 Area surface storage project includes construction of a reservoir project west of Firebaugh between the CCID Outside Canal and Main Canal. A 2013 report evaluated about 5,200 acres of land for potential storage (San Luis & Delta Mendota Water Authority, 2013). The evaluation considered options for 500, 1,000, and 1,800 acre reservoir sites, at specific locations to be determined in the future. The project would receive surface water from the SJRECWA or flood flows off the SJR or Kings River. CCID facilities would be used to convey water to the project lands	$ 44,000,000	$ 44,000,000	Small Community - Levee setbacks, land acquisitions and habitat restoration	Reservoir and Floodplain Storage and Operation
38	RFMP	Merced County	Channel Dredging and/or Vegetation Removal	Streams, creeks, and rivers within the Merced Region are periodically choked with vegetation causing channel capacities to be exceeded during major floods. Removing some of this vegetation and/or excavating the channel would increase the carrying capacity and decrease the flood risk for select areas. This option may benefit reaches of Bear Creek, Black Rascal Creek, and Black Rascal Slough where current channel capacities are well below the 100-year level. This option may be implemented as a capital improvement project, or implemented via current Operations and Maintenance activities.	$ 2,200,000	$ 2,200,000	Systemwide - Routine maintenance	Operation and Maintenance
39	RFMP	3F Group (Trout Unlimited, Ducks Unlimited, and American Rivers)	Cinnamon Slough Study (Merced Wildlife Refuge)	This unit of the Merced National Wildlife Refuge, adjacent to the Eastside Bypass, has recently been restored for wetlands by Ducks Unlimited. The U.S. Fish and Wildlife Service staff at the refuge complex is very supportive of a system improvement that would connect the Bypass to the Unit and thereby provide additional irrigation for wetlands while also providing rearing opportunities for spring and fall-run Chinook salmon. Water is supplied by a low-lift pump on the northwest end of the site. Additional lands within the Refuge boundaries, adjacent to the Unit and inside the Bypass, could also serve as rearing habitat if the topography were slightly modified. This system improvement would provide flood attenuation, juvenile salmonid rearing, groundwater recharge, more stable wetlands, and recreation.	$ 100,000	$ 100,000	Rural - Studies and analysis	Watershed and Floodplain Management
40	RFMP	City of Modesto, Potential Project Partners: Stanislaus County	City of Modesto - SB5 Compliance	Comply with SB 5 regulations through update of the City's relevant planning documents and completion of a preliminary engineering report to identify potential alternatives on how the City can provide 200-year flood protection.	$ 130,000	$ 130,000	Urban - Studies and analysis	Watershed and Floodplain Management

Table B-5. San Joaquin Basin Management Actions Included within the 2017 Refined SSIA Portfolio

#	Data Set Source	Lead Agency	Project Name	Project Description	Estimated Cost - Provided by Source	Estimated Cost - Adjusted for Portfolio	Area of Interest and Management Action Category	Management Action Type
41	RFMP	City of Newman	City of Newman - SB5 Compliance	Comply with SB 5 regulations through update of the City's relevant planning documents and completion of a preliminary engineering report to identify potential alternatives on how the City can provide 200-year flood protection.	$ 125,000	$ 125,000	Urban - Studies and analysis	Watershed and Floodplain Management
42	RFMP	City of Newman, Bureau of Reclamation	City of Newman/Bureau of Reclamation Flood Levee Rehabilitation	Rehabilitate a flood protection levee on Bureau of Reclamation property between the Newman Wasteway and the City of Newman Wastewater Treatment Plant (WWTP).	$ 225,000	$ 225,000	Urban - Other infrastructure and multi-benefit improvements	Operation and Maintenance
43	RFMP	City of Patterson	City of Patterson - SB5 Compliance	Comply with SB 5 regulations through update of the City's relevant planning documents and completion of a preliminary engineering report to identify potential alternatives on how the City can provide 200-year flood protection.	$ 205,000	$ 205,000	Urban - Studies and analysis	Watershed and Floodplain Management
44	RFMP	Reclamation District 2092, Potential Project Partners: One or more Reclamation Districts (RDs), so far interested parties include: RD 2031, 2101, 2092, 2091, 1602; City of Modesto, California Department of Water Resources, Stanislaus County	Consolidation of O&M, RD 2092	Two or more Reclamation Districts form a formal partnership to share technical, financial and/or operational capacity to perform necessary O&M. As an initial step, investigate potential governance options and design and implement a pilot maintenance agreement project.	$ 200,000	$ 200,000	Systemwide - Routine maintenance	Operation and Maintenance
45	RFMP	Merced County	Construct Levees or Channel Widening Projects Along Creeks/Streams in the Region	Levees and/or channel widening projects would contain flood flows in existing channels for Bear Creek, Black Rascal Creek and Slough, Deadman Creek, Dry Creek, Fahrens Creek, and Mariposa Creek, which are subject to flooding. As part of this project, opportunities for riparian and wetland habitat enhancements will be considered.	$ -	$ -	Rural - Levee repair and infrastructure improvements	Flood Infrastructure
46	USACE	Merced County	Construct Ring Levees Around Flood Prone Areas	A ring levee is a levee that completely encircles an area subject to inundation from all directions. These can effectively protect structures or areas from shallow flooding. Ring levees are generally less than 5-feet tall, and have minor impacts to the floodplain outside the ring. Ring levees may be constructed around single facilities, or could encircle larger areas. For example, Marysville, CA is encircled by a ring levee. A recent residential subdivision on Hotchkiss Tract (RD799) included a ring levee to reduce the likelihood of flood damage to these structures. A key to the feasibility of ring levees, particularly on discrete facilities, is the availability of right-of-way and the acceptability of risk of remaining inside during a flood with evacuation routes cut off.	$ -	$ -	Urban - Levee improvements	Flood Infrastructure
47	BWFS	California Department of Water Resources	Conveyance of flood flows to O'Neil Forebay	Implement a cross valley conveyance system to convey flood flows from the San Joaquin River and its tributaries to the San Luis Reservoir Afterbay. This 5,000 CFS intake facility will be downstream of the Merced River with a 1000 acres Forebay and a pumping plant. The Forebay will be gated and will only divert water from the San Joaquin River when flow in the river is over 10,000 cfs and would allow such flows maintained during the flooding. This would reduce flood flows along the San Joaquin River while maintain riverine processes to continue in San Joaquin River.	$ 2,600,000,000	$ -	Systemwide - Reservoir and floodplain storage	Reservoir and Floodplain Storage and Operation

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#	Data Set Source	Lead Agency	Project Name	Project Description	Estimated Cost - Provided by Source	Estimated Cost - Adjusted for Portfolio	Area of Interest and Management Action Category	Management Action Type
48	RFMP	Lower San Joaquin River Region	Coordinated Reservoir Ops	Regional project for all LMAs in the Lower San Joaquin River region.	$ 6,000,000	$ 6,000,000	Systemwide - Reservoir operations	Reservoir and Floodplain Storage and Operation
49	RFMP	Madera Irrigation District	Cottonwood Creek Arundo and Channel Clearing	Approximately 13 miles of channel clearing and invasive species removal within Cottonwood Creek. Due to the high cost and lack of funding, vegetation has been allowed to grow unabated and is now constricting flood flows and reducing channel capacity.	$ 500,000	$ -	Systemwide - Routine maintenance	Operation and Maintenance
50	RFMP	California Department of Water Resources	Critical Levee Repairs - Replaced RFMP Cost	Critical levee repair sites provided by the Flood System Repair Program (FSRP) for seepage, erosion, and stability. Estimate of $4M per site, 33 sites identified by FSRP.	$ 132,000,000	$ 132,000,000	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
51	RFMP	California Department of Water Resources	Critical Levee Repairs - Replaced RFMP Cost	Critical levee repair sites provided by the Flood System Repair Program (FSRP) for seepage, erosion, and stability. Estimate of $4M per site, 17 sites identified by FSRP.	$ 68,000,000	$ 68,000,000	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
52	RFMP	California Department of Water Resources	Critical Levee Repairs - Replaced RFMP Cost	Critical levee repair sites provided by the Flood System Repair Program (FSRP) for seepage, erosion, and stability. Estimate of $4M per site, 18 sites identified by FSRP.	$ 72,000,000	$ 72,000,000	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
53	RFMP	Reclamation District 404	Cut-off Wall along French Camp Slough	The right bank of French Camp Slough is prone to seepage. The District has identified the need for a cutoff wall along the right bank of French Camp Slough, just downstream of Walker Slough. The proposed cutoff wall would extend along French Camp Slough for approximately 1,200 feet.	$ 1,100,000	$ 1,100,000	Rural - Levee repair and infrastructure improvements	Flood Infrastructure
54	RFMP	Tuolumne River Trust	Dennett Dam Removal	Removal of Dennett Dam, an abandoned low-head dam located on the lower Tuolumne River in Modesto, California. The dam has been an instream barrier to anadromous fish passage, controlling local hydraulic and sediment transport conditions, for over 60 years, while also impeding water flow in the river. It is also a significant safety hazard adjacent to a major park, and has been the location of three drowning deaths in the last five years, including two children. US Fish and Wildlife Service contributed $105,000 and City of Modesto contributed $10,000 towards completing the Basis of Design Report. This project can be completed in conjunction with other flood damage reduction, parks development, and habitat restoration projects, such as the development of the Tuolumne River Regional Park, the replacement of the 7th Street Bridge, or other projects in the vicinity.	$ 700,000	$ 600,000	Urban - Other infrastructure and multi-benefit improvements	Flood Infrastructure
55	RFMP	Merced County	Develop Emergency Response Plans	The objective of an emergency response plan is the prevent loss of life; reduce physical damage to public and private property (evacuation equipment, pre and post flood fight materials, etc.); plan for speedy recovery; and disaster management and communication. The development of emergency response plans are typically a low-cost/high benefit option for mitigating flood risk.	$ 100,000	$ 100,000	Systemwide - Emergency management	Emergency Management
56	RFMP	Delta South Region	Develop Enhanced O&M - Delta South Region	Develop practices and procedures to implement enhanced O&M.	$ 15,000,000	$ 15,000,000	Systemwide - Routine maintenance	Operation and Maintenance
57	RFMP	Lower San Joaquin River Region	Develop Enhanced O&M - Lower San Joaquin Region	Develop practices and procedures to implement enhanced O&M.	$ 15,000,000	$ 15,000,000	Systemwide - Routine maintenance	Operation and Maintenance
58	RFMP		Develop Expedited Permitting Programs for Maintenance Actions	Coordinate with all permitting agencies to develop a permitting program that will reduce the time and cost required to permit routine maintenance actions.	$ -	$ -	Systemwide - State operations, planning and performance tracking	Policy and Regulations

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#	Data Set Source	Lead Agency	Project Name	Project Description	Estimated Cost - Provided by Source	Estimated Cost - Adjusted for Portfolio	Area of Interest and Management Action Category	Management Action Type
59	RFMP	Merced County	Divert Flood Flows to Agricultural Lands	Diverting flood flows out of Bear Creek, east of City of Merced, onto nearby agricultural land could decrease peak flows within the channel. Depending on the topography, the types of crops, and the willingness of the landowners, agricultural land could be utilized as detention basins where excess flood flows would be temporarily stored until water percolates back into the ground. Agricultural lands would be temporarily flooded and the waters would be routed back into the channel after the high flows recede.	$ -	$ -	Rural - Small-scale levee setbacks and floodplain storage	Reservoir and Floodplain Storage and Operation
60	RFMP		Divert Flood Flows to Agricultural Lands (both in the Mid and the Upper San Joaquin River Regions)	Large areas exist along the San Joaquin River that could be used for temporary flood flow storage. With agriculture as the primary land use in the floodplains of the Mid and Upper San Joaquin River regions and the presence of large wildlife refuges along the river, a series of designated areas could be managed in a coordinated way to reduce peak flow and provide temporary storage during a flood event. In some places, this is essentially a "no-action" alternative since it already occurs. Depending on the topography, the types of crops, and the willingness of the landowners, agricultural properties and refuge lands could be utilized as detention basins where excess flood flows would be stored temporarily until water percolates back into the ground. Other agricultural lands would be temporarily flooded and the waters would be routed back into the channel after the high flows recede. The United States Army Corps of Engineers Reconnaissance Report, San Joaquin River, Mainstem (January 1993) describes this concept and identifies specific sites that could be used in a network of temporary flood storage areas.	$ -	$ -	Rural - Small-scale levee setbacks and floodplain storage	Reservoir and Floodplain Storage and Operation
61	RFMP	River Partners, Potential Project Partners: Wildlife Conservation Board (WCB), California Department of Water Resources, USBR, United States Fish and Wildlife Service, Natural Resources Conservation Service, SFPUC, CDFW (funding partners, technical assistance)	Dos Rios Ranch Floodplain Expansion and Ecosystem Restoration Project and Hidden Valley Ranch Mitigation Project	Project to restore flooding and transient floodwater storage to approximately 1,000 acres of historic floodplain, restore riparian habitats, and promote river physical processes of scour and deposition along 6 river miles. Remove levee maintenance obligations from State Plan of Flood Control (SPFC) and modify USACE O&M manual to allow breaching and other modification to the existing levees. Provide 191 acres of habitat mitigation for future regional SPFC environmental impacts.	$ 5,100,000	$ -	Systemwide - Reservoir and floodplain storage	Reservoir and Floodplain Storage and Operation
62	BWFS	California Department of Water Resources	Dos Rios/Hidden Valley Ranch Transitory Storage	DWR has partnered with other local, State and federal agencies and River Partners to fund the acquisition of Dos Rios Ranch, a 1,603-acre agricultural property west of Modesto. BWFS analysis showed this does not have system-scale hydraulic effects but provides significant ecosystem restoration benefit. The Levee Breaching Option of Dos Rios Transitory Storage was included in the State Recommended Plan because this element would provide an additional 700 acres of riparian and marsh habitat, and large recreational benefits, at low cost.	$ 34,000,000	$ 13,000,000	Systemwide - Reservoir and floodplain storage	Reservoir and Floodplain Storage and Operation
63	RFMP	Lower San Joaquin River LMAs	Dredge SJ River from Paradise Cut to Stanislaus River	Regional project for all LMAs in the Lower San Joaquin River region.	$ 60,000,000	$ 60,000,000	Systemwide - Routine maintenance	Operation and Maintenance
64	RFMP	Madera Irrigation District	Dry Creek Arundo and Channel Clearing	Approximately 13 miles of channel clearing and invasive species removal within Dry Creek. Due to the high cost and lack of funding, vegetation has been allowed to grow unabated and is now constricting flood flows and reducing channel capacity.	$ 500,000	$ 500,000	Systemwide - Routine maintenance	Operation and Maintenance

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#	Data Set Source	Lead Agency	Project Name	Project Description	Estimated Cost - Provided by Source	Estimated Cost - Adjusted for Portfolio	Area of Interest and Management Action Category	Management Action Type
65	BWFS	California Department of Water Resources	Dry Creek Detention Dam (30 TAF)	Dry Creek Detention Basin; a detention basin with a weir and control gate located on Dry Creek downstream of Don Pedro Reservoir to address the choke point at the City of Modesto, provide for enhanced operation of the New Don Pedro Reservoir, create wetland areas within the detention basin, enhance groundwater recharge, and reduce flood peaks in the San Joaquin River. Expected to perform similarly to 50 TAF FBO. (Control point is downstream of Dry Creek/Tuolumne confluence)	$ 75,000,000	$ -	Systemwide - Reservoir and floodplain storage	Flood Infrastructure
66	RFMP	Stanislaus County, City of Modesto, Potential Project Partners: United States Army Corp of Engineers	Dry Creek Watershed Detention Reconnaissance Study	Complete a reconnaissance study of potential options for reducing flood risks by detaining flood flows in the Dry Creek watershed, upstream of the City of Modesto. While the main purpose of this project is to reduce flood risk for lands in and around the City of Modesto, it would also have the effect of reducing flood flows entering the Tuolumne River and thence the San Joaquin River. To our knowledge, the effect of a hypothetical detention facility in the Dry Creek basin has not been quantitatively evaluated. According to the current FEMA Flood Insurance Study, the 100-year flow on Dry Creek at Modesto (192.3 sq.mi.) is 11,800 cfs; whereas the 100-year peak flow on the Tuolumne River at Modesto (1884 sq.mi.) is 70,000 cfs. In a 10-year event, the values are 4,730 cfs and 10,500 cfs, respectively. The much smaller Dry Creek watershed would no doubt peak prior to the Tuolumne River watershed, which is regulated by the New Don Pedro reservoir. As a back-of-the-envelope assessment, a 30,000 AF storage facility could contain 24 hours of an average 15,000 cfs flow. This suggests that such a facility would have the capacity to detain most or all of Dry Creek's flood flows in a large event, perhaps creating a 2,000-8,000 cfs reduction in Dry Creek contributions to the Tuolumne River and on the San Joaquin River at the time of peak flows in those larger systems. This opportunity to reduce inflows to the San Joaquin River may be similar to, or larger than, the flow reduction resulting from managed detention on the San Joaquin River at the National Wildlife Refuge, which was evaluated at approximately 3,000 cfs in a 35,000 cfs event on the San Joaquin River (ESA, 2015).	$ 250,000	$ 250,000	Rural - Studies and analysis	Watershed and Floodplain Management
67	RFMP	Madera County	Eastside Acres San Joaquin River Levee Project	The Community of Eastside Acres, a housing subdivision consisting of about 70 residences and one commercial business, is located east of the City of Firebaugh along the right bank of the San Joaquin River in Madera County. Eastside Acres is in the 100-year flood plain and sand bagging is required during routine flood events. The conceptual levee project layout consists of a ring levee system that would encircle the housing subdivision. The ring levee would be approximately 1.32 miles in length, and have an average height of 4.63 feet.	$ 1,210,000	$ 1,210,000	Small Community - Levee repair and infrastructure improvements	Flood Infrastructure
68	BWFS	California Department of Water Resources	Eastside Bypass Levee Improvements in Subsidence Area	The SJRRP Reach 4B, Eastside Bypass, and Mariposa Bypass Channel and Structural Improvements Project (Reach 4B Project) includes channel and structural improvements to ensure flows and fish passage through Reach 4B of the San Joaquin River, the Sand Slough Control Structure, the Reach 4B Headgate, and the Eastside and Mariposa bypasses. The passing for flood design flows through the Eastside Bypass may require a combination of levee setbacks, channel grading, and levee raises due to subsidence. Levee raises would restore the Eastside Bypass design capacity of 16,500 cfs and provide 4 feet of freeboard. Levee improvements could be potentially implemented in coordination with the Reach 4B Project. In coordination with DWR's efforts to support the SJRRP, costs of incremental levee improvements with and without the SJRRP Reach 4B project. SJRRP Reach 4B Project Alternative 2 assumed a 1,000-foot setback levee along one side of Middle Eastside Bypass and 500 feet of setback along the right side of the Mariposa Bypass. Alternative 1 assumed 4,500 cfs capacity in Reach 4B1. Potential levee improvements along the Mariposa Bypass to address subsidence were not included in the cost estimate. Costs include the levee improvement without the SJRRP Reach 4B Project.	$ 120,000,000	$ 100,000,000	Rural - Levee repair and infrastructure improvements	Flood Infrastructure
69	RFMP	Merced County	Ecosystem Restoration Along Waterways	An alternative similar to routing flood flows onto agricultural land (system improvement 33) would be to acquire riparian areas of agricultural land and restore natural floodplains. This type of flood control system improvement could be implemented as an ecosystem mitigation bank. A secondary benefit to this option would be the direct recharge of groundwater. This type of system improvement may be feasible for reaches of Bear Creek located upstream and downstream of City of Merced. Costs would vary on the number of parcels acquired, willingness of landowner to sell all or part of their property, and environmental impacts.	$ -	$ -	Rural - Habitat restoration/reconnection	Natural Floodplain and Ecosystem Functions

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70	RFMP		Ecosystem Restoration Along Waterways (both in the Mid SJR and the Upper San Joaquin Regions)	Similar to routing flood flows onto agricultural land, an alternative approach would be to acquire agricultural properties along the San Joaquin River and allow for seasonal floodplain inundation to provide fish rearing habitat as well as the diversion of flood flows, and, in some areas, the direct recharge of groundwater. This type of project could be implemented as a conservation easement, part of the Central Valley Habitat Exchange, or an ecosystem mitigation bank.	$ -	$ -	Rural - Habitat restoration/reconnection	Natural Floodplain and Ecosystem Functions
71	Other	California Department of Water Resources	Elevating & Floodproofing Structures		$ 14,430,240	$ 14,430,240	Small Community - Risk awareness, floodproofing and land use planning	Watershed and Floodplain Management
72	Other	California Department of Water Resources	Elevating & Floodproofing Structures		$ 7,215,120	$ 7,215,120	Small Community - Risk awareness, floodproofing and land use planning	Watershed and Floodplain Management
73	Other	California Department of Water Resources	Elevating & Floodproofing Structures		$ 14,430,240	$ 14,430,240	Small Community - Risk awareness, floodproofing and land use planning	Watershed and Floodplain Management
74	RFMP		Emergency Response Improvement	Implement the following measures to improve emergency response in the planning area: 1) develop local flood fight plans with support from larger agencies, such as Modesto and Stanislaus County; 2) develop public safety agency evacuation plans; 3) clarify and document the command structure for areas with flood risk; 4) better define operational area logistical support for flood fight operations; and 5) form a Stanislaus Operational Area flood response working group.	$ -	$ -	Systemwide - Emergency management	Emergency Management
75	RFMP	Stanislaus County Office of Emergency Services, Potential Project Partners: Stanislaus County Public Works, cities within Stanislaus County, city public works departments within Stanislaus County, Patterson Irrigation District, West Stanislaus Irrigation District	Emergency Response Plan – Debris Management	A debris management plan is needed to better prepare to restore public services and ensure public health and safety in the aftermath of a flood or earthquake and to better position the Mid SJR Region for emergency response funding from the State of California, Federal Emergency Management Agency (FEMA), and other participating entities. Stanislaus County Office of Emergency Services proposes the development of a comprehensive, countywide debris management plan.	$ 110,000	$ 110,000	Systemwide - Emergency management	Emergency Management

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76	RFMP	Stanislaus County Office of Emergency Services, Potential Project Partners: Stanislaus County; City of Modesto; City of Patterson; City of Newman; Reclamation Districts 1602, 2063, and 2091; Patterson Irrigation District; West Stanislaus Irrigation District	Emergency Response Plan – Local Planning and Training	Planning and training are necessary to improve coordination between local agencies so that emergency response can be improved in the planning area. A program would be developed and implemented to address this need.	$ 110,000	$ 110,000	Systemwide - Emergency management	Emergency Management
77	RFMP	Lower San Joaquin Levee District	Enlarge Chowchilla Canal Bypass Control Structure	The control structure at the head waters of the Chowchilla Canal Bypass should be enlarged with two additional gate bays to minimize upstream seepage and levee failure. This will increase the emergency flow capacity and operational flexibility of the structure. The bypass channel may need to be evaluated for increased channel capacity. System improvement will require geotechnical analyses and would include fish passage.	$ 3,380,000	$ 3,380,000	Rural - Levee repair and infrastructure improvements	Flood Infrastructure
78	RFMP	Reclamation District 404	Erosion Protection along Reclamation District 404 Levees	This project is aimed at addressing erosion issues along RD 404 levees. It will include the placement of approximately 7,000 feet of 18-inch minus riprap at various locations along the right bank of the San Joaquin River, French Camp Slough, and Walker Slough, all at elevations above USACE jurisdiction.	$ 600,000	$ 600,000	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
79	RFMP	Madera County	Erosion Repair Project	Perform erosion repairs in Fresno River and Berenda Slough.	$ 1,500,000	$ -	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
80	RFMP	San Joaquin River Restoration Program	Firebaugh Habitat Projects	SJRRP is appraising several properties that may be impacted by shallow groundwater seepage in Reach 3 of the San Joaquin River due to the SJRRP. Acquisition of these properties by SJRRP could result in multi-benefit projects for transitory flood storage near Firebaugh, floodplain habitat and associated flood benefits, and could be rented or leased back to growers (estimated farmable in 80% of years) to eliminate or minimize the amount of agricultural land taken out of production. Habitat work could be done by economically disadvantaged communities of Firebaugh and Mendota to provide flood benefits. This project should be coordinated with the City of Firebaugh levee improvement projects (44-46 on this list) to provide mitigation and multi-benefit system improvements for this area.	$ -	$ -	Rural - Land acquisitions and easements	Watershed and Floodplain Management
81	BWFS	California Department of Water Resources	Firebaugh Small Community Improvements (BWFS Option C)	This project would include multi-benefit levee improvements consistent with Firebaugh Option C of the San Joaquin BWFS. It would include a mix of fix-in-place levee improvements, levee raises, new levees, and strategic setback levees to provide 100 year LOP for Firebaugh and the adjacent Eastside Acres development. This element is included because it provides effective flood damage reduction for a disadvantaged small community, while also providing 623 acres of riparian and marsh habitat, and recreational benefits. A recreational trail system consistent with the Firebaugh General Plan is incorporated with the levee improvements. Option C was selected as the preferred option because it provided the most ecosystem, recreation, and open space benefits for only moderately increased cost, especially considering potential cost-share from the SJRRP.	$ 100,000,000	$ 105,600,000	Small Community - Levee repair and infrastructure improvements	Flood Infrastructure
82	RFMP	San Joaquin River Restoration Program	Fish passage improvement at flood control structures	Flood control structures in the Mariposa Bypass, Eastside Bypass, and the San Joaquin River including the Sand Slough Control Structure, Reach 4B headgates, and the Chowchilla Bifurcation Structure are partial barriers to fish passage at higher flows and may be complete barriers at lower flows. Some of these structures may be in need of repair or replacement by SJRRP in order to adequately serve their intended flood management purpose and meet fish passage requirements.	$ -	$ -	Systemwide - State operations, planning and performance tracking	Natural Floodplain and Ecosystem Functions

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83	RFMP	Reclamation District 1	Flood Contingency Map Reclamation District 1	The current flood contingency map for RD 1 needs to be updated.	$ 20,000	$ -	Rural - Risk awareness, floodproofing and land use planning	Watershed and Floodplain Management
84	RFMP	Reclamation District 2	Flood Contingency Map Reclamation District 2	The current flood contingency map for RD 2 needs to be updated.	$ 20,000	$ -	Rural - Risk awareness, floodproofing and land use planning	Watershed and Floodplain Management
85	RFMP	Reclamation District 2089	Flood Contingency Map Reclamation District 2089	The current flood contingency map for RD 2089 needs to be updated.	$ 20,000	$ -	Rural - Risk awareness, floodproofing and land use planning	Watershed and Floodplain Management
86	RFMP	Reclamation District 2115	Flood Contingency Map Reclamation District 2115	A Flood Contingency Map (FCM) does not exist for RD 2115. A FCM should be prepared to improve emergency response and reduce damage to crops / farm equipment in the event of flood.	$ 20,000	$ -	Rural - Risk awareness, floodproofing and land use planning	Watershed and Floodplain Management
87	RFMP	Reclamation District 2126	Flood Contingency Map Reclamation District 2126	A Flood Contingency Map (FCM) does not exist for RD 2126. A FCM should be prepared to improve emergency response and reduce damage to crops / farm equipment in the event of flood.	$ 20,000	$ -	Rural - Risk awareness, floodproofing and land use planning	Watershed and Floodplain Management
88	RFMP	Reclamation District 524	Flood Contingency Map Reclamation District 524	RD 524's Flood Contingency Map (FCM) is not up to date. The FCM should be updated to improve emergency response and reduce risk to people in the event of flood.	$ 20,000	$ -	Rural - Risk awareness, floodproofing and land use planning	Watershed and Floodplain Management
89	RFMP	Reclamation District 773	Flood Contingency Map Reclamation District 773	A Flood Contingency Map (FCM) does not exist for the "Old River" system. A FCM is needed in order to improve emergency response and reduce risk to people in the event of flood.	$ 20,000	$ -	Rural - Risk awareness, floodproofing and land use planning	Watershed and Floodplain Management
90	Other	California Department of Water Resources	Flood ER Planning - Local/Operational Area and State Level	Includes local flood information and flood risk mapping activities, local flood forecasting and dissemination, local stream gage network enhancement, flood evacuation maps, flood ER plans, and levee safety plans. Includes State flood information and flood risk mapping, state flood forecasting and dissemination, levee advanced warning systems, and Flood ER Information Mgmt Systems.	$ 52,100,000	$ 52,100,000	Systemwide - Emergency management	Emergency Management
91	Other	California Department of Water Resources	Flood ER Planning - Local/Operational Area and State Level	Includes local flood information and flood risk mapping activities, local flood forecasting and dissemination, local stream gage network enhancement, flood evacuation maps, flood ER plans, and levee safety plans. Includes State flood information and flood risk mapping, state flood forecasting and dissemination, levee advanced warning systems, and Flood ER Information Mgmt Systems.	$ 52,300,000	$ 52,300,000	Systemwide - Emergency management	Emergency Management

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92	Other	California Department of Water Resources	Flood ER Planning - Local/Operational Area and State Level	Includes local flood information and flood risk mapping activities, local flood forecasting and dissemination, local stream gage network enhancement, flood evacuation maps, flood ER plans, and levee safety plans. Includes State flood information and flood risk mapping, state flood forecasting and dissemination, levee advanced warning systems, and Flood ER Information Mgmt Systems.	$ 128,300,000	$ 128,300,000	Systemwide - Emergency management	Emergency Management
93	Other	California Department of Water Resources	Flood ER Preparedness - Local/Operational Level and State Level	Includes flood alert and warning systems, er training and exercising, local flood er materials, equipment and facilities, and all weather roads on levee crowns. Includes ER Training and drills, tabletop and functional exercises, full-scale exercises, and flood fight methods training. Also includes State flood fight materials and storage facilities, and funding for the State Flood Ops Center.	$ 35,500,000	$ 35,500,000	Systemwide - Emergency management	Emergency Management
94	Other	California Department of Water Resources	Flood ER Preparedness - Local/Operational Level and State Level	Includes flood alert and warning systems, er training and exercising, local flood er materials, equipment and facilities, and all weather roads on levee crowns. Includes ER Training and drills, tabletop and functional exercises, full-scale exercises, and flood fight methods training. Also includes State flood fight materials and storage facilities, and funding for the State Flood Ops Center.	$ 37,800,000	$ 37,800,000	Systemwide - Emergency management	Emergency Management
95	Other	California Department of Water Resources	Flood ER Preparedness - Local/Operational Level and State Level	Includes flood alert and warning systems, er training and exercising, local flood er materials, equipment and facilities, and all weather roads on levee crowns. Includes ER Training and drills, tabletop and functional exercises, full-scale exercises, and flood fight methods training. Also includes State flood fight materials and storage facilities, and funding for the State Flood Ops Center.	$ 46,600,000	$ 46,600,000	Systemwide - Emergency management	Emergency Management
96	RFMP	River Partners, Potential Project Partners: California Department of Water Resources and United States Army Corp of Engineers levee maintenance and inspection staff; Central Valley Flood Protection Board; San Joaquin River Flood Control Agency (SJRFCA); San Joaquin	Flood Risk Education	Develop and implement a regional flood risk management educational program to raise awareness of flood risks and elevate the level of public understanding with respect to flood risk management needs and the value of investments to address them. For the local maintaining agencies (LMAs), include education on their role in flood risk management and provide technical guidance/assistance on levee maintenance activities and permitting requirements.	$ 30,000	$ -	Rural - Risk awareness, floodproofing and land use planning	Watershed and Floodplain Management
97	RFMP	Gravelly Ford Water District	Flooding Existing Pasture Lands	This project would divert San Joaquin River flood waters from the Chowchilla Canal Bypass to reduce flood flows, provide water supply, recharge local groundwater, and help prevent local subsidence. The Madera IRWMP supports projects that reduce flooding and promote efficient water use and groundwater recharge. There are two blocks of existing pasture land located immediately north of Firebaugh Avenue which crosses the Chowchilla Canal Bypass channel about 7 miles east of Firebaugh. On the west side of the Bypass channel there is approximately 1400 acres of non-irrigated pasture that could be flooded. A new turnout from the Bypass channel and a pipeline across the Chowchilla Canal would be needed to deliver flood water to this land. On the east side of the Bypass channel there is approximately 1700 acres of pasture that could be flooded. About half of this acreage already has an existing flood irrigation system that could be used to distribute flood water. The system irrigates from east to west so approximately 2 miles of new pipeline would be needed to divert Bypass water to the east side of the property.	$ -	$ -	Rural - Small-scale levee setbacks and floodplain storage	Reservoir and Floodplain Storage and Operation
98	RFMP	Lower San Joaquin River LMAs	Floodplain at Dos Rios (transitory storage)	DWR has partnered with other local, State and federal agencies and River Partners to fund the acquisition of Dos Rios Ranch, a 1,603-acre agricultural property west of Modesto. Phase 1 finalized in mid-April 2013, the $21.8 million acquisition is part of a multi-phase project designed to improve flood protection, increase inundated floodplain, and restore wildlife habitat at the confluence of the San Joaquin and Tuolumne Rivers. Phase 2 will comprise three major components: restoration planning and permitting, habitat restoration, and levee breaching study. The project will restore flooding and transient floodwater storage to 948 acres of historic floodplain, restore riparian habitats, and promote river physical processes of scour and deposition along six river miles.	$ 8,500,000	$ -	Systemwide - Reservoir and floodplain storage	Reservoir and Floodplain Storage and Operation

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#	Data Set Source	Lead Agency	Project Name	Project Description	Estimated Cost - Provided by Source	Estimated Cost - Adjusted for Portfolio	Area of Interest and Management Action Category	Management Action Type
99	BWFS	California Department of Water Resources	Flowage Easements in Subsidence Area	DWR performed hydraulic analysis to evaluate the anticipated impacts of subsidence on the hydraulic performance of the flood system. With the projected long-term subsidence the frequency of levee overtopping in some areas would increase, potentially increasing flood damages. Purchasing flowage easements for lands expected to experience increased flooding due to subsidence could reduce long-term flood damages. The flowage easement area was assumed to be the inundation area resulting from long-term subsidence at design capacity minus the inundation area under existing baseline conditions at design capacity. This increased inundation area is shown in Figure 5-12. Unlike the levee improvements analysis above, the inundation area was calculated for subsidence throughout the entire Eastside Bypass. This easement area totaled about 16,300 acres. Assuming $10,000 per acre for flowage easements, the total cost of flowage easements was estimated at approximately $163 million. Costs for flowage easements and levee improvements were similar to each other under this reconnaissance-level of analysis; especially considering levee improvements only addressed subsidence along the Middle Eastside Bypass.	$ 180,000,000	$ 163,000,000	Systemwide - Reservoir and floodplain storage	Watershed and Floodplain Management
100	BWFS	California Department of Water Resources	Forecast-Coordinated Operations	Forecast-Coordinated Operations (FCO), which would coordinate flood releases from multiple reservoirs located in various tributaries of a major river to optimize the use of downstream channel capacity, optimize the use of total available flood storage space in the system, and eventually reduce overall peak flood flows downstream from these reservoirs	$ -	$ -	Systemwide - Reservoir operations	Reservoir and Floodplain Storage and Operation
101	BWFS	California Department of Water Resources	Forecast-Informed Operations (50,100 TAF) for Merced River Watershed	1% peak flow reduction of 23,900 cfs at Cressey (65-year)	$ -	$ -	Systemwide - Reservoir operations	Reservoir and Floodplain Storage and Operation
102	BWFS	California Department of Water Resources	Forecast-Informed Operations (50,100 TAF) for Upper San Joaquin River Watershed	25 TAF: 55% peak flow reduction of 31,700 cfs at Gravely Ford (50-year) 50 TAF: 64% peak flow reduction at Gravely Ford (50-year) No change in stage at SJR or Eastside Bypass	$ -	$ -	Systemwide - Reservoir operations	Reservoir and Floodplain Storage and Operation
103	BWFS	California Department of Water Resources	Forecast-Informed Operations for Tuolumne River Watershed	This project of the San Joaquin BWFS would incorporate FIO pre-releases coupled with increasing objective release for Tuolumne River. This element was included in the State Recommended Plan because it provides large stage reduction along Tuolumne River and stage reduction along San Joaquin River near higher risk areas for a severely flood storage limited watershed for limited costs. FIO seeks to coordinate flood releases from multiple reservoirs located in various tributaries of a major river to optimize the use of downstream channel capacity, the use of total available flood storage space in the system, and eventually to reduce overall peak flood flows downstream from these reservoirs. While there could be an almost infinite number of FIO operational scenarios, this reconnaissance evaluation used a 46,000-cfs flow objective for San Joaquin River at Vernalis as an operational constraint, which is a key location for San Joaquin River flow conditions, to begin exploring FIO opportunities.	$ -	$ -	Systemwide - Reservoir operations	Reservoir and Floodplain Storage and Operation
104	RFMP	Reclamation District 1608, Lincoln Village West	Fourteen Mile Slough Sediment Removal Project	To ensure water side levee access along the entire reach of Fourteen Mile Slough for which RD1608 has flood control jurisdictional responsibility, RD 1608 has approved the design and construction of a Sediment Removal Project from Village Marina to the Feather River Drive Bridge. This project will allow for continuity of operations for levee maintenance, minor repair, major rehabilitation, and emergency flood fight activities in this reach. It will also resolve the very limited landside levee access issue along the SW Levee portion of this reach.	$ 2,500,000	$ 2,500,000	Systemwide - Routine maintenance	Operation and Maintenance
105	RFMP	Reclamation District 1608, Lincoln Village West	Fourteen Mile Slough Slurry Wall Project	The recommended remediation for seepage was to construct a 50-foot deep, 3-foot wide soil-bentonite slurry wall through the crown of the levee (from elevation +11.0 feet, NAVD 88 to elevation -40.0 feet, NAVD).	$ 1,500,000	$ 1,500,000	Urban - Levee improvements	Flood Infrastructure

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106	RFMP	Fresno Slough Improvement Group	Fresno Slough Sediment Removal	Remove sediment from Fresno Slough both inside and outside the Wildlife Refuge. It is uncertain, but probable to obtain permits to do this work. It would be easier and less costly if the work could be done at the same time that the Mendota Pool is dewatered for maintenance.	$ 720,000	$ 720,000	Systemwide - Routine maintenance	Operation and Maintenance
107	RFMP	Fresno Slough Improvement Group	Fresno Slough South Levee Repair and Floodplain Enhancement Project	Improve the south levee, which has open toe drains and inadequate freeboard. Improvements might include removing the toe drains, rebuilding the levees, and bringing the levees under the jurisdiction of a responsible stakeholder. Enhancements would involve the modification of existing levees surrounding a State-owned parcel of land. The levee modifications would improve flow over the land and reduce pressure on other nearby levees during flood events. The current configuration of levees and cuts concentrates channel flow and increases the pressure at a weak point of the nearby levees.	$ 1,340,000	$ -	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
108	RFMP	Gomes Lake Joint Powers Authority, Potential Project Partners: Turlock Irrigation District, City of Turlock, Stanislaus County, Reclamation District 2063, Reclamation District 2091	Gomes Lake / Harding Drain Improvements	This project includes multiple components to enhance the function, reliability, flexibility and capacity of the Gomes Lake facility, which stores and drains stormwater and return flows, providing flood risk reduction behind the east bank levees of the San Joaquin River. DWR asked for clarification on which levee was subject to erosion hazards. [Note: levee erosion protection or repair is not part of the project description.] It is the project levee adjacent to the Gomes Lake Bypass Channel, which enters Gomes Lake from the south. Flood fight operations are necessary for two distinct structures in this district; the project levee and the Gomes Lake dike. Failure of either structure could flood portions of the district damaging property and potentially critical assets. Failure of the Gomes Lake Dike could also create additional threats to the stability of the project levee. The emergency response organizational structure for coordinating these two operations is unclear as well as the process for resolving any conflicts between each operation that may arise. At least no written protocols or procedures addressing these issues were identified. In 1997, water elevations are reported to have reached within 1’ of the crown of the project levee at locations. The District levee experienced numerous boils north of Gomes Lake at an extreme bend in the levee and additional boils and the failure of a section of the levee back slope adjacent to the Gomes Lake Bypass Channel. While the project levee did not fail, the Gomes Lake Dike did subsequently fail. The open ditch Gomes Lake Bypass Channel runs immediately	$ 1,700,000	$ 1,700,000	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
109	RFMP	Gravelly Ford Water District	Gravelly Ford Madera Ranch Recharge Project	Gravelly Ford Water District is located north and east of the San Joaquin River in Madera County. The District has an existing diversion from the river located approximately 8 miles upstream of the Chowchilla bifurcation structures. The District's existing water delivery system includes open ditches, pipelines, control structures and pumps. The system runs west from the river diversion point then turns north. The proposed Madera Irrigation Water Bank land is located between Avenue 7, which is about 3 miles north of the turn, and Avenue 12. Gravelly Ford's system has the ability to convey water from the river to the water bank lands, but a number of improvements are needed to maximize capacity and improve the operating efficiency. The improvements would include replacement of existing road crossing culverts, modifications to control structures, water measurement improvements, and canal and pipeline enlargements. Flood water diverted to the land would be spread for groundwater recharge and then re-used for irrigation. The proposed improvements would allow the delivery system to operate in both directions to bring flood water in and then later distribute the recaptured groundwater for irrigation. With the proposed improvements the system could divert a maximum flow of 50 cubic-feet per second (cfs). A possible secondary benefit would be to make some of the banked water available to the Red Top area through transfers to help mitigate subsidence.	$ 1,970,000	$ 1,970,000	Rural - Small-scale levee setbacks and floodplain storage	Reservoir and Floodplain Storage and Operation

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#	Data Set Source	Lead Agency	Project Name	Project Description	Estimated Cost - Provided by Source	Estimated Cost - Adjusted for Portfolio	Area of Interest and Management Action Category	Management Action Type
110	RFMP	Stanislaus County	Grayson Multi-benefit Flood Risk Reduction	The Grayson Multi-benefit Flood Risk Reduction Project is designed to reduce flood hazards in the community of Grayson that are associated with flood flows escaping into the San Joaquin River channel at the entrance to Laird Slough, the primary channel for conveying flows in this reach. In addition to reducing flood risk in Grayson, the project will provide habitat enhancement and public recreation benefits, and help to provide transportation and infrastructure benefits by reducing flooding of Grayson Road, a major east-west corridor across the San Joaquin River. Based on early modeling for the Basinwide Feasibility Study, it appears that the Grayson Road Bridge constitutes a significant local impediment to flood flows on the San Joaquin River. This project would wholly or partially address that issue. This project will provide flood risk management, ecosystem, recreation, transportation, and groundwater recharge benefits. The community of Grayson, CA (population ~1000) is partially included in a mapped 100-year regulatory floodplain according to the Federal Emergency Management Agency (FEMA). This project will enhance flood conveyance in the San Joaquin River channel under the Grayson Road Bridge, thereby reducing flood stage and attendant flood risk in the community. Stage reduction is anticipated to reduce the frequency and depth to which Grayson Road is inundated during flood events, providing improved access and reducing infrastructure maintenance needs. Enhanced conveyance will be achieved by grading and vegetation management that avoids impacts to wetlands and sensitive species and potentially enhances habitats and ecological functions	$ 15,000,000	$ 15,000,000	Small Community - Levee repair and infrastructure improvements	Operation and Maintenance
111	RFMP	Great Valley Grassland State Park, Lower San Joaquin Levee District	Great Valley Grassland State Park (GVGSP) Levee De-Authorization	In 2011, the California Department of Parks and Recreation assessed the feasibility of restoring floodplain connectivity and dependent habitats to approximately 330 acres within the GVGSP. The system improvement would provide a more natural floodplain process to help control exotic species and restore geomorphic and ecological conditions similar to the pre-levee conditions. The system improvement would reduce flood flow constraints below Highway 165 thereby improving upstream flood conditions in Stevinson Water District. The levee along the river would be deauthorized to allow flood water to flow into State Park lands. System improvement will include wetland creation and invasive species removal. Proposed improvements on GVGSP should be coordinated with adjacent system improvements proposed on San Luis Nat'l Wildlife Refuge units (projects 60-65 on this list) to optimize attainment of flood and ecosystem benefits in this area.	$ 4,930,000	$ 4,930,000	Systemwide - State operations, planning and performance tracking	Policy and Regulations
112	RFMP	Stanislaus County Office of Emergency Services, Potential Project Partners: Reclamation District 2091, Gomes Lake Joint Powers Authority, City of Modesto, City of Newman, City of Patterson	Hydraulic and Channel Migration Studies	Two regional studies (mainstem San Joaquin River flood hydraulics and channel migration) and three focused hydraulic studies are needed to better inform flood management in the Mid SJR Region.	$ 200,000	$ 200,000	Rural - Studies and analysis	Watershed and Floodplain Management
113	BWFS	California Department of Water Resources	Hydraulic Structure Upgrades	Upgrade of hydraulic structures in the Upper San Joaquin Region because of facility age or operational problems was identified on a site-specific basis in the 2012 CVFPP SSIA at Chowchilla Canal Bypass Control Structure, San Joaquin River Control Structure, Eastside Bypass Control Structure, Mariposa Bypass Control Structure, and Mariposa Drop Structure. The objective of this element is to proactively prevent catastrophic failure of the Chowchilla Canal Bypass Control Structure and San Joaquin River Control Structure during large flood events. These structures would receive critical structural rehabilitation. Catastrophic failure of these structures would severely reduce the ability of operators to control the flow split between the Chowchilla Bypass and San Joaquin River, resulting in increased flood damages. The hydraulic model currently represents these hydraulic structures as fully functioning; therefore, no additional hydraulic evaluations were conducted. Estimated costs for these upgrades totaled approximately $2 million.	$ -	$ 2,000,000	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
114	RFMP	Delta South Region	Identify After-event Erosion - Delta South Region	Identification and repair of after event erosions.	$ 25,000,000	$ 25,000,000	Rural - Levee repair and infrastructure improvements	Operation and Maintenance

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#	Data Set Source	Lead Agency	Project Name	Project Description	Estimated Cost - Provided by Source	Estimated Cost - Adjusted for Portfolio	Area of Interest and Management Action Category	Management Action Type
115	RFMP	Lower San Joaquin River Region	Identify After-event Erosion - Lower San Joaquin Region	Identification and repair of after event erosions.	$ 25,000,000	$ 25,000,000	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
116	RFMP	San Joaquin County	Improve SJ County Alert System	Regional project in the Lower San Joaquin River region to reduce residual risk.	$ 600,000	$ 600,000	Systemwide - Emergency management	Emergency Management
117	RFMP		Improve Upstream Reservoir Operations	Update and improve upstream reservoir operations through enhancements to coordination among operating entities; use of additional information, including forecasting; broader communications with others, including local communities; improved and accessible gaging; and updated flood control manuals. Analyze and implement actions to modify upstream reservoir operations to improve flood management; aquatic, riparian, and floodplain habitat; water quality; and recreation.	$ -	$ -	Systemwide - Reservoir operations	Reservoir and Floodplain Storage and Operation
118	BWFS	California Department of Water Resources	Increase Objective Release (from 9K cfs to 15K, 20K, 25K cfs) from Lake McClure in the Merced River Watershed	Increase downstream channel capacities to remove choke points to increase reservoir release capabilities. 10K cfs: 58% peak flow reduction of 23,900 cfs at Cressey, 3% increase peak flow of 131,300 cfs at Vernalis (65-year) 20K cfs: 14% peak flow reduction at Cressey, 10% peak flow increase at Vernalis (65-year)	$ -	$ -	Systemwide - Reservoir operations	Reservoir and Floodplain Storage and Operation
119	BWFS	California Department of Water Resources	Increase Objective Release (from 9K cfs to 15K, 20K, 25K cfs) from Lake Millerton in the Upper San Joaquin River Watershed	Increase downstream channel capacities to remove choke points to increase reservoir release capabilities. 10K cfs: 2% peak flow reduction of 31,700 cfs at Gravely Ford (50-year) 15K cfs : 27% peak flow reduction No change in stage at SJR or Eastside Bypass	$ -	$ -	Systemwide - Reservoir operations	Reservoir and Floodplain Storage and Operation
120	BWFS	California Department of Water Resources	Increase Objective Release (from 9K cfs to 15K, 20K, 25K cfs) from New Don Pedro in the Tuolumne River Watershed	Increase downstream channel capacities to remove choke points to increase reservoir release capabilities for increased Objective Release (from 9K cfs to 15K, 20K, 25K cfs) from New Don Pedro in the Tuolumne River Watershed. This includes modifications to channels and adjacent levees as well as flood easements and commerical property acquisitions to accommodate levee/channel modifications. See BWFS cost estimates for more line item details. 15K cfs: 25% peak flow reduction of 68,200 cfs at Modesto (50-year) 7% of 86,000 cfs (120-year). 6% of 125,700 cfs at SJR at Vernalis (120-year) 20K cfs: 42% peak flow reduction (50-year), 17% (120-year). 14% at SJR at Vernalis (120-year) 25K cfs: 54% peak flow reduction (50-year), 30% (120-year). 21% at SJR at Vernalis (120-year). Up to 2.9 ft stage reduction on Tuolumne and 1 ft on SJR (120-year)	$ 126,892,000	$ -	Systemwide - Reservoir and floodplain storage	Reservoir and Floodplain Storage and Operation
121	BWFS	California Department of Water Resources	Increase Objective Release (from 9K cfs to 25K cfs) from New Don Pedro in the Tuolumne River Watershed	Operations component of the increased Objective Release (from 9K cfs to 25K cfs) from New Don Pedro at the Modesto Gage in the Tuolumne River Watershed.	$ -	$ 252,000,000	Systemwide - Reservoir operations	Reservoir and Floodplain Storage and Operation
122	RFMP	Merced County	Increase Public Awareness of Flooding	Increasing the public's knowledge about flood risk is another non-structural alternative for mitigating flood risk. In addition to improving safety during floods, the efforts can also enhance public support of flood control projects. Typical forms of outreach include press releases, individual mailer brochures, website development, posters, "flood awareness month", and social networking site involvement. Note that the public outreach efforts can often be completed in conjunction with other related projects in order to reduce costs. Merced and other communities are prone to flooding from the creeks in the region. Increasing public awareness of flood season, precautionary measures, and their location with respect to the floodplain may be effective in reducing flood damages.	$ 50,000	$ -	Rural - Risk awareness, floodproofing and land use planning	Watershed and Floodplain Management

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123	RFMP	San Joaquin County	Increase SJ County O&M	Regional project in the Lower San Joaquin River region to reduce residual risk.	$ 50,000,000	$ -	Systemwide - Routine maintenance	Operation and Maintenance
124	BWFS	California Department of Water Resources	Increase Upstream Flood Storage in Lake McClure or elsewhere in the Merced River Watershed (+100 TAF)	0% peak flow reduction of 130,000 cfs near Stockton (200-year) 16% peak flow re duction of 340,000 cfs (200-year + CC)	$ 250,000,000	$ -	Systemwide - Reservoir and floodplain storage	Reservoir and Floodplain Storage and Operation
125	BWFS	California Department of Water Resources	Increase Upstream Flood Storage in Lake McClure or elsewhere in the Merced River Watershed (+200 TAF)	0% peak flow reduction of 130,000 cfs near Stockton (200-year) 22% peak flow reduction of 340,000 cfs (200-year+CC)	$ 500,000,000	$ -	Systemwide - Reservoir and floodplain storage	Reservoir and Floodplain Storage and Operation
126	BWFS	California Department of Water Resources	Increase Upstream Flood Storage in New Don Pedro or elsewhere in the Tuolumne River Watershed (+100 TAF)	21% peak flow reduction of 130,000 cfs near Stockton (200-year)	$ 250,000,000	$ -	Systemwide - Reservoir and floodplain storage	Reservoir and Floodplain Storage and Operation
127	BWFS	California Department of Water Resources	Increase Upstream Flood Storage in New Don Pedro or elsewhere in the Tuolumne River Watershed (+200 TAF)	21% peak flow reduction of 130,000 cfs near Stockton (200-year)	$ 500,000,000	$ -	Systemwide - Reservoir and floodplain storage	Reservoir and Floodplain Storage and Operation
128	RFMP	Central California Irrigation District, San Luis Canal Company	Ingomar Reservoir Surface Storage	This project would divert San Joaquin River and Kings River flood water at Mendota Pool to reduce flood flows, provide water supply, recharge local groundwater, and help prevent local subsidence. The project protects SPFC facilities along the San Joaquin River by diverting flood flows and the objectives are consistent with SSIA. The Ingomar Reservoir surface storage project includes expansion of the existing Ingomar Reservoir. The project is located east of the CCID Main Canal and north of Henry Miller Road. A 2013 report evaluated the expansion of the existing 41-acre site to about 650 acres (San Luis & Delta Mendota Water Authority, 2013). The project would receive surface water from the SJRECWA or flood flows off the SJR or Kings River. CCID facilities would be used to convey water to the project lands.	$ 18,300,000	$ 18,300,000	Systemwide - Reservoir and floodplain storage	Reservoir and Floodplain Storage and Operation
129	RFMP	Lower San Joaquin Levee District	Install New Gaging Stations	Gaging stations to anticipate flows into the Eastside Bypass.	$ 330,000	$ -	Rural - Risk awareness, floodproofing and land use planning	Watershed and Floodplain Management

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130	RFMP	River Partners, Potential Project Partners: WCB; California Department of Water Resources; USBR; Natural Resources Conservation Service; landowners; RDs; environmental NGOs;	Integrated Levee Vegetation Management – Flood Maintenance and Habitat	This project includes re-establishing appropriate vegetation on levee slopes to promote terrestrial wildlife survival during floods – either native sod on active levees or native brush vegetation on inactive levees (RDs 2099, 2100, 2102, and 2092 in the future).	$ 6,400,000	$ 6,400,000	Rural - Habitat restoration/reconnection	Natural Floodplain and Ecosystem Functions
131	RFMP	Tuolumne River Trust, Potential Project Partners: Stanislaus County Parks and Recreation	La Grange Floodplain Restoration and Spawning Gravel Augmentation	Restore 77 acres of degraded floodplain habitat along the Tuolumne River in La Grange while developing a source of spawning gravel to improve and enhance existing spawning beds in the Tuolumne River.	$ 1,500,000	$ 1,500,000	Rural - Habitat restoration/reconnection	Natural Floodplain and Ecosystem Functions
132	RFMP	Delta South Region	Land Use and Floodplain Management - Delta South Region	Regional project in the Delta South region to reduce residual risk.	$ 10,000,000	$ 10,000,000	Rural - Risk awareness, floodproofing and land use planning	Watershed and Floodplain Management
133	RFMP	Lower San Joaquin River Region	Land Use and Floodplain Management - Lower San Joaquin River	Regional project in the Lower San Joaquin River region to reduce residual risk.	$ 20,000,000	$ 20,000,000	Rural - Risk awareness, floodproofing and land use planning	Watershed and Floodplain Management
134	RFMP	Merced Irrigation District	Le Grand Canal Flood Control Structure at Black Rascal Creek	Le Grand Canal is considered the official spillway to Lake Yosemite by the Division of Safety of Dams (DSOD). The canal commences at the lake and traverses southeasterly along the foothills toe contour toward the town of Planada. As a result , the canal intercepts or bypasses all creeks and ravines draining the foothills. The first major water way it crossed is Black Rascal Creek. The Canal crosses the creek with a double barrel reinforced concrete box. However, at the end of the irrigation season, Merced Irrigation District (MID) breaches the right bank of the canal and places a temporary dam, whereby all flood flows from Lake Yosemite are deposited to the creek. With the start of every irrigation season, the canal is repaired and flows could continue downstream. A control structure connected to Merced Irrigation District SCADA system would give Merced Irrigation District the flexibility to react timely and divert all or portion of flood flows as needed. As part of this project, opportunities for riparian and wetland habitat enhancements will be considered.	$ 490,000	$ 490,000	Rural - Levee repair and infrastructure improvements	Flood Infrastructure

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135	RFMP	Merced Irrigation District	Le Grand/Planada Flood Control/Conjunctive Use Expansion Study	The Le Grand canal was originally constructed to convey irrigation flows from Lake Yosemite (LY) south to the Planada and Le Grand area. The canal crosses multiple ravines and waterways along its course, including Black Rascal Creek (BRC) and Bear Creek (BC). The canal is the official spillway for Lake Yosemite. During flood season, MID breaches its southerly bank to discharge conveyed flows from the lake to BRC and prevent the canal from overtopping downstream due to limited channel capacity downstream. This multi-purpose system improvement study is to redirect and route the flood waters from LY, BRC, BC and the watershed between them safely downstream through various conveyance systems for beneficial uses in the southern Merced region where groundwater is the main supply. A series of checks and diversion structures would be constructed along the canal to control and manage flood flows. Various reaches of Le Grand and Planada Canals must be enlarged as well to accommodate for higher flow. The system improvement is needed to provide protection against the overtopping of Lake Yosemite, especially in the case of storms occurring within the irrigation season. The system improvement would allow MID to move from an irrigation season mode to flood management mode and vice versa with minimal impact to the system, UC Merced, the City of Merced, and Merced County. Additionally, the system improvement is needed to prevent the Le Grand and Planada Canals from breaching during high flood flows. The controlled flood waters may be re-routed to provide additional water supply downstream for various uses such as environmental, recharge, and counter subsidence measures.	$ 240,000	$ 240,000	Rural - Studies and analysis	Watershed and Floodplain Management
136	RFMP	Lower San Joaquin Levee District	Levee Breaches Unit 1, LM 9.90 ; Unit 5, LM 0.25	Levee breaches at Unit 1, levee mile (LM) 9.90 and Unit 5, LM 0.25 are the result of previous flood flow actions. Recent USACE inspection rated the levee units unacceptable to project standards (potential PL84-99). It is proposed to add structures with removable flash boards that would contain flood water in the river channel and permit landside flood water to drain into the river by removing the flash boards.	$ 535,000	$ 535,000	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
137	USACE	Reclamation District 17, Mossdale	Levee Improvement to 200-year ULOP - Phase IV	Included in USACE - The RD 17 Phase IV improvements would improve existing levees to 200-year ULOP. The ULDC evaluations are currently underway, which will determine what levee improvements are needed. As part of this analysis, preliminary cost estimates, subject to change, are becoming available. While reaches of levee are expected to already meet ULDC criteria, substantial work can be anticipated. $150M Combine this project with SJ_143, Walthall Levee Extension. This levee protects the District in the event of levee failures along the right bank of the San Joaquin River, upstream (south) of the District. The current levee is susceptible to being flanked during a flood event upstream of the District. Extending this levee easterly will help protect the District from future flood events entering from RD 2094. $18M	$ 168,000,000	$ -	Urban - Levee improvements	Flood Infrastructure
138	RFMP	San Joaquin River Restoration Program	Levee Improvements in Reach 2B, 3, 4B, Eastside Bypass, Mariposa Bypass, and Reach 5	The SJRRP is increasing channel capacity to 4,500 cfs in Reaches 2B and 4B through major projects. Levees in other reaches may also need improvements to increase capacity to 4,500 cubic feet per second (cfs). An initial hydraulic evaluation has been done and DWR has prioritized the next step in data collection and geotechnical evaluation. The result of the further evaluation will help the SJRRP identify future remediation needs for existing levees. Initial system improvement costs were developed assuming that all levees will need remediation; these costs will go down as geotechnical evaluations are complete. As a part of this project, inter-agency agreements, funding, and coordination will be formalized.	$ 235,000,000	$ -	Rural - Levee repair and infrastructure improvements	Flood Infrastructure
139	RFMP	Lower San Joaquin Levee District	Levee Improvements in Subsidence Area	Improve Eastside Bypass levees in areas of subsidence. As part of this project, opportunities for riparian and wetland habitat enhancements will be considered.	$ -	$ -	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
140	RFMP	Madera County	Levee Patrol Road Repair	Perform repair and place aggregated base for levee patrol roads on approximately 12 miles on the Fresno River, Berenda Slough and Ash Slough. Due to high cost and limited funding, repairs on levee patrol; roads have been delayed, and vegetation has been allowed to grow unabated. In addition, adjacent landowners have made modifications to levee patrol roads to access private properties.	$ 500,000	$ 500,000	Systemwide - Emergency management	Emergency Management
141	RFMP	Stanislaus County, Potential Project Partners: United States Army Corp of Engineers	Little Salado Creek	Construction of a project to partially divert, retain, and percolate up to 1,030 cubic feet per second (cfs) of flow from Little Salado Creek.	$ 5,000,000	$ 5,000,000	Rural - Small-scale levee setbacks and floodplain storage	Reservoir and Floodplain Storage and Operation

Table B-5. San Joaquin Basin Management Actions Included within the 2017 Refined SSIA Portfolio

#	Data Set Source	Lead Agency	Project Name	Project Description	Estimated Cost - Provided by Source	Estimated Cost - Adjusted for Portfolio	Area of Interest and Management Action Category	Management Action Type
142	RFMP	Delta South Region	Local ER Planning - Delta South Region	Regional project in the Delta South region to reduce residual risk.	$ 10,000,000	$ -	Rural - Studies and analysis	Watershed and Floodplain Management
143	RFMP	Lower San Joaquin River Region	Local ER Planning - Lower San Joaquin River Region	Regional project in the Lower San Joaquin River region to reduce residual risk.	$ 20,000,000	$ -	Rural - Studies and analysis	Watershed and Floodplain Management
144	RFMP	Central California Irrigation District	Los Banos Creek Recharge and Recovery	This project could divert San Joaquin River and Kings River flood water at Mendota Pool to reduce flood flows, provide water supply, recharge local groundwater, and help prevent local subsidence. The project protects SPFC facilities along the San Joaquin River by diverting flood flows and the objectives are consistent with SSIA. The Los Banos Creek Recharge & Recovery project includes construction of 103 acres of recharge ponds and 6 recovery wells along LBC between the California Aqueduct and the Central California Irrigation District's (CCID) Outside Canal. The project would receive surface water from LBC, the SJRECWA, San Luis Water District (SLWD), CCID Main and Outside Canals or through exchange from other contractors. The DMC and Outside Canal would be used to convey the water to the bank. Water wells will be piped to the DMC and CCID Outside canals.	$ 5,000,000	$ 5,000,000	Rural - Small-scale levee setbacks and floodplain storage	Reservoir and Floodplain Storage and Operation
145	Other	California Department of Water Resources	Lower San Joaquin Feasibility Study, Phase 2	State-Federal Feasibility Study projects that DWR could partner in.	$ 4,000,000	$ 4,000,000	Urban - Studies and analysis	Watershed and Floodplain Management
146	Other	California Department of Water Resources	Lower San Joaquin River/Delta South - Channel RR&R - Arrundo Removal	Regional input indicated giant reed removal cost at $25,000/acre.	$ 1,960,044	$ 1,960,044	Systemwide - Routine maintenance	Operation and Maintenance
147	Other	California Department of Water Resources	Lower San Joaquin River/Delta South - Channel Sediment Removal	Channel maintenance activities including sediment, vegetation, and debris removal are conducted by DWR with respect to the Sacramento River Flood Control Project and generally by LMAs in the San Joaquin Valley. Estimated costs for the Sacramento Basin were developed by using historical projects overseen by DWR, which have occurred as funding has been available, as well as input from regional experts. Estimated costs for the San Joaquin Basin were based on direct interviews with LMAs and staff.	$ 23,520,530	$ 23,520,530	Systemwide - Routine maintenance	Operation and Maintenance
148	Other	California Department of Water Resources	Lower San Joaquin River/Delta South - Channel Vegetation and Debris Removal	Channel maintenance activities including sediment, vegetation, and debris removal are conducted by DWR with respect to the Sacramento River Flood Control Project and generally by LMAs in the San Joaquin Valley. Estimated costs for the Sacramento Basin were developed by using historical projects overseen by DWR, which have occurred as funding has been available, as well as input from regional experts. Estimated costs for the San Joaquin Basin were based on direct interviews with LMAs and staff.	$ 5,880,132	$ 5,880,132	Systemwide - Routine maintenance	Operation and Maintenance
149	Other	California Department of Water Resources	Lower San Joaquin River/Delta South - Large Structure O&M	Major structures involve those facilities described in CWC Section 8361 and administered by DWR, and include weirs, bypass outflow control structures, outfall gate facilities, and large regional pumping plants.	$ 1,372,031	$ 1,372,031	Systemwide - Routine maintenance	Operation and Maintenance
150	Other	California Department of Water Resources	Lower San Joaquin River/Delta South - Large Structures RR&R	Based on discussions with DWR and LMA staff, major structures have historically been repaired and well maintained, and there is not an immediate need to repair, replace, or rehabilitate these facilities. As such, RR&R costs were not identified for this TM given major structures were assumed not to require significant repairs over the next 50 years. However, it is recommended that funding reserves be established to ensure adequate funding is available in the future to continue needed repairs or to replace aged facilities.	$ -	$ -	Urban - Other infrastructure and multi-benefit improvements	Operation and Maintenance

Table B-5. San Joaquin Basin Management Actions Included within the 2017 Refined SSIA Portfolio

#	Data Set Source	Lead Agency	Project Name	Project Description	Estimated Cost - Provided by Source	Estimated Cost - Adjusted for Portfolio	Area of Interest and Management Action Category	Management Action Type
151	Other	California Department of Water Resources	Lower San Joaquin River/Delta South - Non-urban Levee O&M (Rural)	Levee O&M costs were separated between urban and rural LMAs to capture the additional costs associated with urban area LMAs. Levee O&M included the following activities: vegetation maintenance, rodent control, encroachment and pipe maintenance, minor repairs (erosion, levee crown repairs etc.)	$ 70,438,106	$ 70,438,106	Systemwide - Routine maintenance	Operation and Maintenance
152	Other	California Department of Water Resources	Lower San Joaquin River/Delta South - Non-urban Levee RR&R (Rural)	Levee-related RR&R costs have generally been driven by necessary flood-event repairs and known erosion or levee stability issues. The OMRR&R Work Group determined the Delta Subventions Program data set is the most robust data set for estimating RR&R cost on SPFC levees because the existence of the funding program has encouraged more regular analysis and repair of levees. Although urban levees are being improved to a higher standard to meet urban level of protection standards, the OMRR&R Work Group determined that repair and rehabilitation costs for urban and non-urban levees would not differ substantially, and the cost for ULDC compliance would be the only significant differentiating factor for RR&R of urban SPFC levees.	$ 27,748,345	$ 27,748,345	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
153	Other	California Department of Water Resources	Lower San Joaquin River/Delta South - Small Community Levee O&M	Levee O&M costs were separated between urban and rural LMAs to capture the additional costs associated with urban area LMAs. Levee O&M included the following activities: vegetation maintenance, rodent control, encroachment and pipe maintenance, minor repairs (erosion, levee crown repairs etc.)	$ -	$ -	Systemwide - Routine maintenance	Operation and Maintenance
154	Other	California Department of Water Resources	Lower San Joaquin River/Delta South - Small Community Levee RR&R	Levee-related RR&R costs have generally been driven by necessary flood-event repairs and known erosion or levee stability issues. The OMRR&R Work Group determined the Delta Subventions Program data set is the most robust data set for estimating RR&R cost on SPFC levees because the existence of the funding program has encouraged more regular analysis and repair of levees. Although urban levees are being improved to a higher standard to meet urban level of protection standards, the OMRR&R Work Group determined that repair and rehabilitation costs for urban and non-urban levees would not differ substantially, and the cost for ULDC compliance would be the only significant differentiating factor for RR&R of urban SPFC levees.	$ -	$ -	Small Community - Levee repair and infrastructure improvements	Operation and Maintenance
155	Other	California Department of Water Resources	Lower San Joaquin River/Delta South - Small Structures O&M	Minor structures include stop log or gated closure structures, pumping plants, monitoring wells and piezometers, retaining walls and floodwalls, pipe penetrations, and encroachments. Routine O&M of these types of structures is critical, but often overlooked for budgeting purposes. As became evident in the LMA data received, LMAs typically only account for routine power costs for pumping plants and do not separately account for other activities associated with minor structures such as video inspections of pipes, lubrication and minor repairs of pipe closure valves, routine inspection and maintenance of closure structure gates or stop logs, and inspection and minor repairs of floodwalls. The OMRR&R Work Group determined that costs for minor-structure O&M are likely included in the general overhead expenses for the LMAs who have structures, and no further estimates were developed. However, it is anticipated that video inspections of pipes will be required in the future (once every 5 years) for pipes crossing SPFC levees and as such these projected costs were included in the overall estimates.	$ 3,230,153	$ 3,230,153	Systemwide - Routine maintenance	Operation and Maintenance
156	Other	California Department of Water Resources	Lower San Joaquin River/Delta South - Small Structures RR&R	Small structures such as stop logs or gated closure structures, monitoring wells and piezometers, retaining walls and floodwalls, pipes, and encroachments are typically accounted for in levee RR&R costs, except for pipes. Many of these pipes were installed before or during original project construction prior to the 1950s, but no plans were implemented to assure these facilities could be replaced when they exceed their useful life. As a result, many pipes have reached their useful life with many of these structures in need of repair, replacement, or proper pipe abandonment.	$ 96,434,171	$ 96,434,171	Urban - Other infrastructure and multi-benefit improvements	Operation and Maintenance
157	Other	California Department of Water Resources	Lower San Joaquin River/Delta South - Urban Levee O&M	Levee O&M costs were separated between urban and rural LMAs to capture the additional costs associated with urban area LMAs. Levee O&M included the following activities: vegetation maintenance, rodent control, encroachment and pipe maintenance, minor repairs (erosion, levee crown repairs etc.)	$ 71,639,613	$ 71,639,613	Systemwide - Routine maintenance	Operation and Maintenance

Table B-5. San Joaquin Basin Management Actions Included within the 2017 Refined SSIA Portfolio

#	Data Set Source	Lead Agency	Project Name	Project Description	Estimated Cost - Provided by Source	Estimated Cost - Adjusted for Portfolio	Area of Interest and Management Action Category	Management Action Type
158	Other	California Department of Water Resources	Lower San Joaquin River/Delta South - Urban Levee RR&R	Levee-related RR&R costs have generally been driven by necessary flood-event repairs and known erosion or levee stability issues. The OMRR&R Work Group determined the Delta Subventions Program data set is the most robust data set for estimating RR&R cost on SPFC levees because the existence of the funding program has encouraged more regular analysis and repair of levees. Although urban levees are being improved to a higher standard to meet urban level of protection standards, the OMRR&R Work Group determined that repair and rehabilitation costs for urban and non-urban levees would not differ substantially, and the cost for ULDC compliance would be the only significant differentiating factor for RR&R of urban SPFC levees.	$ 25,790,261	$ 25,790,261	Urban - Other infrastructure and multi-benefit improvements	Operation and Maintenance
159	USACE	San Joaquin County, City of Stockton	LSJRFS NED Plan, (use as a master plan)	In 2009 the LSJRFS was initiated by USACE to study deficiencies in the flood control system for the lower San Joaquin River from the confluence with the Stanislaus River downstream to the Lodi wastewater treatment plant. The LSJRFS also includes the eastside tributaries to the lower San Joaquin River. The LSJRFS is anticipated to be complete in spring-2016 and may provide justification for federal cost sharing on selected project features that are in the federal interest. The LSJRFS considered numerous incremental improvement alternatives to provide protection to North Stockton and Central Stockton which reasonably maximize net benefits. The elements shown below are currently the collection of incremental improvements to be selected as the NED plan. The NED plan includes provision sea level rise by raising levees.	$ 1,027,000,000	$ -	Urban - Levee improvements	Flood Infrastructure
160	RFMP	Madera Irrigation District	Madera Canal / Hidden Dam Pump Storage Project	The Madera Canal Hidden Dam Pump Storage Project has the potential to provide up to 6,000 AFY average of additional water supply for use by Madera ID as are direction of an existing water supply. Madera ID is currently seeking authorization from the USACE and will have to seek funding for the project. There are potential partnering opportunities for the Madera County and or other water agencies in the Madera County that should be pursued. Flows for this system improvement could be diverted from Hidden Dam during floods.	$ 11,500,000	$ 11,500,000	Rural - Levee repair and infrastructure improvements	Flood Infrastructure
161	RFMP	Madera Irrigation District	Madera Irrigation District Water Bank Facility	Develop water bank facility to capture flood flows and perform groundwater recharge. The facility can be used to bank water for future use.	$ 124,000,000	$ -	Rural - Small-scale levee setbacks and floodplain storage	Reservoir and Floodplain Storage and Operation
162	RFMP	Madera Irrigation District	Madera Lake Regulating and Recharge Project	Regulating and recharge at Madera Lake. As part of this project, opportunities for riparian and wetland habitat enhancements will be considered.	$ 3,500,000	$ 3,500,000	Rural - Small-scale levee setbacks and floodplain storage	Reservoir and Floodplain Storage and Operation
163	BWFS	California Department of Water Resources	Madera Ranch Recharge Projects	The Upper San Joaquin RFMP identified a series of projects to implement groundwater banking in the Madera Ranch area, which is located north of the San Joaquin River in Madera County. The projects would occur in partnership between Gravelly Ford Water District and Madera Irrigation District for conveying flood flows diverted from an existing diversion point on the San Joaquin River to a new water banking facility. Madera Irrigation District is pursuing a project that would develop groundwater recharge and banking facilities within Madera Ranch. In 2011, Reclamation released an environmental impact statement for groundwater recharge in Madera Irrigation District (Reclamation, 2011). The Madera Irrigation District Water Supply Enhancement Project in the Madera Ranch area could be used to capture diverted flood flows by Gravelly Foard Water District in wet years, provide local water supplies through reuse of recharged groundwater in dry years, and potentially make water available to help mitigate subsidence near the Red Top area. As such, this project would provide enhanced water supply reliability and flexibility and improved conjunctive use, reduce current aquifer overdrafting, and increase groundwater quality in the area (Reclamation, 2011). The Madera Ranch recharge lands and banking facilities would cover approximately 13,600 acres with 323 acres of recharge basins (Provost and Pritchard, 2014). In addition, approximately 3,000 acres of existing pastureland within the Gravelly Ford Water District east and west of the Chowchilla Canal Bypass Channel could be flooded with diverted flood flows to help reduce peak flows and further recharge the groundwater basin for future water supply.	$ -	$ -	Systemwide - Reservoir and floodplain storage	Reservoir and Floodplain Storage and Operation

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#	Data Set Source	Lead Agency	Project Name	Project Description	Estimated Cost - Provided by Source	Estimated Cost - Adjusted for Portfolio	Area of Interest and Management Action Category	Management Action Type
164	Other	California Department of Water Resources	Mapping, Risk Awareness and Land Use Planning (Rural)	Covers the State's floodplain risk mgmt programs, information mgmt systems, channel capacity updates, land use planning, mitigation planning, etc	$ 787,800	$ 15,441,228	Rural - Risk awareness, floodproofing and land use planning	Watershed and Floodplain Management
165	Other	California Department of Water Resources	Mapping, Risk Awareness and Land Use Planning (Small Comm)	Covers the State's floodplain risk mgmt programs, information mgmt systems, channel capacity updates, land use planning, mitigation planning, etc	$ 3,151,200	$ 61,764,911	Small Community - Risk awareness, floodproofing and land use planning	Watershed and Floodplain Management
166	Other	California Department of Water Resources	Mapping, Risk Awareness and Land Use Planning (Urban)	Covers the State's floodplain risk mgmt programs, information mgmt systems, channel capacity updates, land use planning, mitigation planning, etc	$ 3,939,000	$ 77,206,139	Urban - Risk awareness, floodproofing and land use planning	Watershed and Floodplain Management
167	RFMP	Merced Streams Group	Mariposa Reservoir Enlargement and Downstream Levee and Channel Improvements	Mariposa Reservoir was constructed in the early 1950's as an element of the Merced Streams Group Project authorized by Congress's 1944 Flood Control Act. The Flood Control Act of 1970 called for three additional flood control reservoirs, enlargement of existing reservoirs, and 52 miles of levee and channel modifications. To date only one additional reservoir has been built (Castle Dam). The enlargement of Mariposa Reservoir and downstream levee and channel improvements would increase the level of flood protection to Planada and Le Grand, both of which are DAC's in Merced County. Mariposa Reservoir was originally constructed to provide protection for up to a 50-year storm event. The State of California has adopted legislation that calls for a minimum of 200-year flood protection for urbanized areas. This system improvement would meet the requirements of the new flood control legislation. As part of this project, opportunities for riparian and wetland habitat enhancements will be considered.	$ 112,500,000	$ 112,500,000	Systemwide - Reservoir and floodplain storage	Flood Infrastructure
168	RFMP	San Joaquin County, Lower San Joaquin LMAs	Master Plan of San Joaquin River Corridor	Regional project for all LMAs in the Lower San Joaquin River region.	$ 2,000,000	$ 2,000,000	Rural - Studies and analysis	Watershed and Floodplain Management
169	RFMP	Merquin County Water District	McCullough Road Drainage Project	Installation of approximately 5,000 feet of pipeline to replace the use of existing on-farm ditches and roadside ditches to convey storm flood waters and drainage waters away from the intersection of 4th Avenue and McCullough Road. The make shift operation of using private and public facilities over the years has left the area flooded most wet years.	$ 2,700,000	$ 2,700,000	Rural - Levee repair and infrastructure improvements	Flood Infrastructure
170	RFMP	City of Mendota	Mendota Pool Park Flood Protection	Mendota Pool Park is located adjacent to the west bank of the San Joaquin River and would be inundated in a major flood event, leading to damage to the park, picnic equipment, and associated improvements. Construction of a flood protection levee along the park boundary could mitigate this risk.	$ 1,737,000	$ 1,737,000	Urban - Levee improvements	Flood Infrastructure
171	RFMP	Merced Streams Group	Merced County Flood Control District	In the past decade, established flood control agencies have had great success in mitigating flood risk throughout California, due to their singular focus. Example's include the Sacramento Area Flood Control Agency (SAFCA), the Sutter Butte Flood Control Agency (SBFCA), the San Joaquin Area Flood Control Agency (SJAFCA), and the San Joaquin County Flood Control and Water Conservation District (SJCFC & WCD). This option would involve the creation of a flood control agency for the region, either as an adjunct of Merced County, or as a joint powers authority. The agency would be responsible for planning, coordinating, and managing flood control projects for the region. A central flood control agency could also perform O&M functions.	$ 100,000	$ 100,000	Systemwide - State operations, planning and performance tracking	Policy and Regulations

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#	Data Set Source	Lead Agency	Project Name	Project Description	Estimated Cost - Provided by Source	Estimated Cost - Adjusted for Portfolio	Area of Interest and Management Action Category	Management Action Type
172	Other	California Department of Water Resources	Merced County Streams General Reevaluation Report	State-Federal Feasibility Study projects that DWR could partner in.	$ 4,000,000	$ 4,000,000	Urban - Studies and analysis	Watershed and Floodplain Management
173	RFMP	San Luis National Wildlife Refuge	Merced NWR - Modify water intake structures at selected refuge units	Existing pipes with flap-gates on flood control levee – further develop these sites to divert floodwaters onto refuge floodplain lands. There are numerous locations along the flood control levees at the Merced, Lonetree, and Sno-Bird units of Merced NWR where replacement of existing flap gates with new screw-gates and, where necessary, catwalks would allow controlled diversion of floodwaters onto refuge lands. In some locations water control structures and/or armoring of existing water conveyance facilities would be needed. This would allow controlled diversions onto refuge floodplain lands at approximately 15 locations, some of which are noted as follows: a) Merced Unit – there is potential for diverting water into Cinnamon Slough area. However there is a need to consider impacts to managed refuge wetlands adjacent to the north. b) Lonetree Unit – floodwater could be diverted to area outside levee. However there is a need to consider impacts to adjacent private farmlands to the east. c) Sno-Bird Unit – potential to divert waters into north, middle, and south subunits. However, there is a need to consider flood impacts to adjacent landowners. Control on volume and limits on amounts of water diverted at these locations would be necessary to prevent damage to refuge infrastructure, resource values, and adjacent private lands.	$ 580,000	$ 580,000	Rural - Levee repair and infrastructure improvements	Flood Infrastructure
174	RFMP	San Luis National Wildlife Refuge	Merced NWR Merced Unit - Enhance infrastructure to divert flood flows onto 1200 acres of existing wetlands and other refuge lands	There are numerous locations on the Merced Unit where pipes with flap-gates are present in the flood control levees of the Eastside Bypass, and are well situated to potentially divert floodwaters onto Refuge lands. However, there is no direct connection to move that water out into the Refuge water conveyance system. The refuge currently uses a pipeline to move water throughout the managed wetland units and other refuge lands. The pipeline is in close proximity to the flood control levee. Additionally there are refuge pumps in place which could be used to lift the water from the Bypass into the pipeline, but are currently not connected to the pipeline. At 2 locations along the levee existing pumps could be reconfigured and connected to the existing pipeline. The connection between the pumps and the pipeline would allow floodwater to be diverted from the Bypass into managed Refuge wetlands. Control on volume and limits on amounts of water diverted at these locations would be necessary to prevent damage to refuge infrastructure, resource values, and adjacent private lands.	$ 235,000	$ 235,000	Rural - Levee repair and infrastructure improvements	Flood Infrastructure
175	RFMP	San Luis National Wildlife Refuge	Merced NWR Sno-Bird Unit – Construct diversions off Eastside Canal	The Eastside Canal, which runs along the northern boundary of the Sno-Bird Unit is also impacted by flood events and can exceed its conveyance capacity and flood out downstream locations. There is an opportunity to divert excess floodwater from the canal onto Refuge floodplain lands. a) Remove sediment in the canal at the existing weir diversion structure and rehabilitate the first section of the existing canal downstream of the weir. Replace the weir boards and make minor repairs to the concrete structure. Install two canal gates where the refuge canal flows back into Bear Creek. One gate would be for an existing culvert and the other for a new culvert through the Bear Creek flood control levee. A new channel would be excavated inside the levee to connect the new culvert to the Bear Creek pilot channel. These improvements would allow floodwater to be spread in basins and swales in the north and middle subunits and then drain back into the Eastside Bypass. b) Install a new canal turnout structure in the Eastside Canal at the northwest corner of the Sno-Bird Unit. The site has been breached in the past to relieve pressure on the Eastside Canal and prevent downstream flooding. Controlled diversions could be spread out into basins and swales of the north subunit and then drain back into the Eastside Bypass.	$ 263,000	$ 263,000	Rural - Levee repair and infrastructure improvements	Flood Infrastructure

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#	Data Set Source	Lead Agency	Project Name	Project Description	Estimated Cost - Provided by Source	Estimated Cost - Adjusted for Portfolio	Area of Interest and Management Action Category	Management Action Type
176	RFMP	Merced Streams Group	Merced Region Programmatic Environmental Impact Report for Stream Bed and Vegetation Control	Flood management continues to be increasingly important and difficult at the local level. Vegetation and stream bed/channel management is critical to decrease flood related impacts in Merced County. Recent interpretations and application of Fish and Game codes have nearly halted Stream Bed and Channel maintenance. CEQA analyses required for the Streambed Alteration permitting on each project is expensive and defers maintenance, creating complex unintended outcomes. The Merced IRWM region should explore the effectiveness and expense of preparing a local Programmatic Environmental Impact Report (PEIR) to potentially create low-cost and faster-tearing in subsequent CEQA reviews related to flood management. (MIRWMP, 2013c)	$ 300,000	$ 300,000	Systemwide - State operations, planning and performance tracking	Programmatic, or Project-Specific Permitting
177	USACE	California Department of Water Resources	Merced Urban Improvements	The objective of this element is to achieve a 200 year urban LOP for City of Merced consistent with the 2012 CVFPP SSIA. USACE proposed several structural and nonstructural management actions for Merced during an earlier phase of the Merced County Streams Group Project, as described in the Draft Measures for Merced and General Design Memorandum, Phase II Merced County Streams, CA (USACE, 2001; USACE, 1981). A wide range of actions could potentially provide Merced with an urban LOP, many of which were identified in these previous studies. These actions include additional off stream storage, reservoir enlargement, diversion channels, levee improvements, and channel improvements that were identified in the Upper San Joaquin RFMP. Studies of these potential improvements are still in the early stages, and a package of actions to provide Merced with 200 year LOP has not yet been determined. Actions to provide 200-year LOP for Merced were not formulated and evaluated in this BWFS. Only a small portion of the city of Merced is protected by SPFC facilities. DWR hydraulic and economic models do not fully extend up to Merced, so Merced is not explicitly represented within BWFS systemwide modeling tools. However, consistent with the 2012 CVFPP, DWR supports development of the appropriate actions to achieve 200 year urban LOP for Merced.	$ -	$ -	Urban - Levee improvements	Flood Infrastructure
178	Other	California Department of Water Resources	Mid San Joaquin River - Large Structures RR&R	Based on discussions with DWR and LMA staff, major structures have historically been repaired and well maintained, and there is not an immediate need to repair, replace, or rehabilitate these facilities. As such, RR&R costs were not identified for this TM given major structures were assumed not to require significant repairs over the next 50 years. However, it is recommended that funding reserves be established to ensure adequate funding is available in the future to continue needed repairs or to replace aged facilities.	$ -	$ -	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
179	Other	California Department of Water Resources	Mid San Joaquin River - Non-urban Levee O&M (Rural)	Levee O&M costs were separated between urban and rural LMAs to capture the additional costs associated with urban area LMAs. Levee O&M included the following activities: vegetation maintenance, rodent control, encroachment and pipe maintenance, minor repairs (erosion, levee crown repairs etc.)	$ 28,492,182	$ 28,492,182	Systemwide - Routine maintenance	Operation and Maintenance
180	Other	California Department of Water Resources	Mid San Joaquin River - Urban Levee O&M	Levee O&M costs were separated between urban and rural LMAs to capture the additional costs associated with urban area LMAs. Levee O&M included the following activities: vegetation maintenance, rodent control, encroachment and pipe maintenance, minor repairs (erosion, levee crown repairs etc.)	$ -	$ -	Systemwide - Routine maintenance	Operation and Maintenance
181	Other	California Department of Water Resources	Mid San Joaquin River - Channel RR&R - Arrundo Removal	Regional input indicated giant reed removal cost at $25,000/acre.	$ -	$ -	Systemwide - Routine maintenance	Operation and Maintenance
182	Other	California Department of Water Resources	Mid San Joaquin River - Channel Sediment Removal	Channel maintenance activities including sediment, vegetation, and debris removal are conducted by DWR with respect to the Sacramento River Flood Control Project and generally by LMAs in the San Joaquin Valley. Estimated costs for the Sacramento Basin were developed by using historical projects overseen by DWR, which have occurred as funding has been available, as well as input from regional experts. Estimated costs for the San Joaquin Basin were based on direct interviews with LMAs and staff.	$ 3,062,569	$ 3,062,569	Systemwide - Routine maintenance	Operation and Maintenance
183	Other	California Department of Water Resources	Mid San Joaquin River - Channel Vegetation and Debris Removal	Channel maintenance activities including sediment, vegetation, and debris removal are conducted by DWR with respect to the Sacramento River Flood Control Project and generally by LMAs in the San Joaquin Valley. Estimated costs for the Sacramento Basin were developed by using historical projects overseen by DWR, which have occurred as funding has been available, as well as input from regional experts. Estimated costs for the San Joaquin Basin were based on direct interviews with LMAs and staff.	$ 5,880,132	$ 5,880,132	Systemwide - Routine maintenance	Operation and Maintenance
184	Other	California Department of Water Resources	Mid San Joaquin River - Large Structure O&M	Major structures involve those facilities described in CWC Section 8361 and administered by DWR, and include weirs, bypass outflow control structures, outfall gate facilities, and large regional pumping plants.	$ -	$ -	Systemwide - Routine maintenance	Operation and Maintenance

Table B-5. San Joaquin Basin Management Actions Included within the 2017 Refined SSIA Portfolio

#	Data Set Source	Lead Agency	Project Name	Project Description	Estimated Cost - Provided by Source	Estimated Cost - Adjusted for Portfolio	Area of Interest and Management Action Category	Management Action Type
185	Other	California Department of Water Resources	Mid San Joaquin River - Non-urban Levee RR&R (Rural)	Levee-related RR&R costs have generally been driven by necessary flood-event repairs and known erosion or levee stability issues. The OMRR&R Work Group determined the Delta Subventions Program data set is the most robust data set for estimating RR&R cost on SPFC levees because the existence of the funding program has encouraged more regular analysis and repair of levees. Although urban levees are being improved to a higher standard to meet urban level of protection standards, the OMRR&R Work Group determined that repair and rehabilitation costs for urban and non-urban levees would not differ substantially, and the cost for ULDC compliance would be the only significant differentiating factor for RR&R of urban SPFC levees.	$ 11,224,193	$ 11,224,193	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
186	Other	California Department of Water Resources	Mid San Joaquin River - Small Community Levee O&M	Levee O&M costs were separated between urban and rural LMAs to capture the additional costs associated with urban area LMAs. Levee O&M included the following activities: vegetation maintenance, rodent control, encroachment and pipe maintenance, minor repairs (erosion, levee crown repairs etc.)	$ 5,206,857	$ 5,206,857	Systemwide - Routine maintenance	Operation and Maintenance
187	Other	California Department of Water Resources	Mid San Joaquin River - Small Community Levee RR&R	Levee-related RR&R costs have generally been driven by necessary flood-event repairs and known erosion or levee stability issues. The OMRR&R Work Group determined the Delta Subventions Program data set is the most robust data set for estimating RR&R cost on SPFC levees because the existence of the funding program has encouraged more regular analysis and repair of levees. Although urban levees are being improved to a higher standard to meet urban level of protection standards, the OMRR&R Work Group determined that repair and rehabilitation costs for urban and non-urban levees would not differ substantially, and the cost for ULDC compliance would be the only significant differentiating factor for RR&R of urban SPFC levees.	$ 2,051,186	$ 2,051,186	Small Community - Levee repair and infrastructure improvements	Operation and Maintenance
188	Other	California Department of Water Resources	Mid San Joaquin River - Small Structures O&M	Minor structures include stop log or gated closure structures, pumping plants, monitoring wells and piezometers, retaining walls and floodwalls, pipe penetrations, and encroachments. Routine O&M of these types of structures is critical, but often overlooked for budgeting purposes. As became evident in the LMA data received, LMAs typically only account for routine power costs for pumping plants and do not separately account for other activities associated with minor structures such as video inspections of pipes, lubrication and minor repairs of pipe closure valves, routine inspection and maintenance of closure structure gates or stop logs, and inspection and minor repairs of floodwalls. The OMRR&R Work Group determined that costs for minor-structure O&M are likely included in the general overhead expenses for the LMAs who have structures, and no further estimates were developed. However, it is anticipated that video inspections of pipes will be required in the future (once every 5 years) for pipes crossing SPFC levees and as such these projected costs were included in the overall estimates.	$ 627,214	$ 627,214	Systemwide - Routine maintenance	Operation and Maintenance
189	Other	California Department of Water Resources	Mid San Joaquin River - Small Structures RR&R	Small structures such as stop logs or gated closure structures, monitoring wells and piezometers, retaining walls and floodwalls, pipes, and encroachments are typically accounted for in levee RR&R costs, except for pipes. Many of these pipes were installed before or during original project construction prior to the 1950s, but no plans were implemented to assure these facilities could be replaced when they exceed their useful life. As a result, many pipes have reached their useful life with many of these structures in need of repair, replacement, or proper pipe abandonment.	$ 14,739,532	$ 14,739,532	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
190	Other	California Department of Water Resources	Mid San Joaquin River - Urban Levee RR&R	Levee-related RR&R costs have generally been driven by necessary flood-event repairs and known erosion or levee stability issues. The OMRR&R Work Group determined the Delta Subventions Program data set is the most robust data set for estimating RR&R cost on SPFC levees because the existence of the funding program has encouraged more regular analysis and repair of levees. Although urban levees are being improved to a higher standard to meet urban level of protection standards, the OMRR&R Work Group determined that repair and rehabilitation costs for urban and non-urban levees would not differ substantially, and the cost for ULDC compliance would be the only significant differentiating factor for RR&R of urban SPFC levees.	$ -	$ -	Urban - Other infrastructure and multi-benefit improvements	Operation and Maintenance
191	RFMP	Reclamation District 1	Middle River Siltation Study	The District believes that Middle River needs to be dredged to restore flow capacity. A study of the problem and solutions should be conducted.	$ 300,000	$ 300,000	Rural - Studies and analysis	Watershed and Floodplain Management

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#	Data Set Source	Lead Agency	Project Name	Project Description	Estimated Cost - Provided by Source	Estimated Cost - Adjusted for Portfolio	Area of Interest and Management Action Category	Management Action Type
192	RFMP	Lower San Joaquin Levee District	Modernize Electrical Controls, Level Sensors & SCADA for Control Structures	The electrical controls and water level sensors for the primary control structures were installed in the 1960's with the original system improvement. They are antiquated and should be modernized for improved reliability and integration with a new SCADA system. System improvement location is at Chowchilla Canal Bypass Control Structure, San Joaquin River Control Structure, Eastside Bypass Control Structure, and Mariposa Bypass Control Structure.	$ 1,885,000	$ 1,885,000	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
193	RFMP	City of Modesto	Modesto WWTPs: Flood and Water Quality Risk Reduction	This project is focused on protecting Tuolumne and San Joaquin River water quality and reducing the risk of flooding for Modesto's Wastewater Treatment Plants. By relocating Primary Treatment, improving Flood Protection infrastructure, utilizing storage ponds, irrigating with captured water and incorporating vacated land into the Tuolumne River Regional Park Master Plan, we can reduce flood risk and protect the integrity of our rivers. This project is adjacent to another RFMP project site, the Tuolumne River Regional Parkway Carpenter Road Project, and would provide synergistic benefits to that project.	$ 80,000,000	$ 90,000,000	Urban - Risk awareness, floodproofing and land use planning	Watershed and Floodplain Management
194	RFMP	Merced County	Modify Land Use Designations	Merced County currently imposes development restrictions for Special Flood Hazard Areas (Chapter 18.34 of the County Code) in accordance with FEMA and the NFIP. Merced County's Floodplain Land Use Ordinance also provides formal primary and secondary floodplain zones along streams and describes limitations on land uses in these zones. Modifications to the existing land use designations within the Merced Region could direct growth outside of the floodplain. New options include: imposing elevation requirements for new development within the 200-yr or 500-year floodplain, limiting or restricting new development within the 200-yr or 500-year floodplain in accordance with SB-5 requirements, or designating permanent agricultural zones. While this option may inhibit economic growth in floodplains, it may reduce flood risk and ultimately cost less than flood control system capital improvements.	$ -	$ -	Rural - Risk awareness, floodproofing and land use planning	Watershed and Floodplain Management
195	RFMP	San Luis National Wildlife Refuge	Modify water intake structures at selected refuge units	There are 40 locations on the East Bear Creek Unit, West Bear Creek Unit, and San Luis Unit where pipes with flap-gates are present in the flood control levees of the San Joaquin River and Eastside Bypass. Some of these locations are well situated to divert floodwaters onto National Wildlife Refuge (NWR) lands. Screw-gates could be installed where needed and catwalks to these screw-gates could be placed on existing pipes. In some locations water control structures and/or armoring of existing water conveyance facilities would be needed. This would allow multiple controlled diversions onto refuge floodplain lands. Control on volume and limits on amounts of water diverted at these locations would be necessary to prevent damage to refuge infrastructure, resource values, and adjacent private lands. A study would be needed to determine which of these possible diversion points for floodwater would benefit wildlife conservation and floodwater storage objectives the best. At some locations enhancement of existing channels likely would be necessary to achieve the desired outcome -placing water into already defined managed wetlands, managed riparian habitat or low elevation uplands which evolved under conditions which included low depth (sheet water) flooding. This system improvement would seek to further develop a subset of the 40 available sites.	$ 1,540,000	$ 1,540,000	Rural - Levee repair and infrastructure improvements	Flood Infrastructure
196	RFMP	City of Merced	Monitor Creek Water Quality and Storm Drainage Discharges	This system improvement is to monitor the discharges from storm water run-off into the local creeks and monitor the quality of those creeks as it is affected by the discharges.	$ 100,000	$ 100,000	Urban - Risk awareness, floodproofing and land use planning	Watershed and Floodplain Management
197	BWFS	California Department of Water Resources	Montgomery Reservoir (250 TAF)	Montgomery Reservoir; a 250,000 acre-feet reservoir on Dry Creek north of Merced River to be operated and integrated with the New Exchequer Reservoir to address the channel capacity issues in Merced River at Stevinson, to provide additional water supply and recharge opportunities for Merced basin, and to reduce stage in the San Joaquin River. For Feasibility study assume his reservoir would provide up to 150,000 acre-feet of dedicated flood control reservation. 73% peak flow reduction of 23,900 cfs at Cressey (65-year) No change in SJR at Vernalis (65-year)	$ 527,000,000	$ -	Systemwide - Reservoir and floodplain storage	Reservoir and Floodplain Storage and Operation

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#	Data Set Source	Lead Agency	Project Name	Project Description	Estimated Cost - Provided by Source	Estimated Cost - Adjusted for Portfolio	Area of Interest and Management Action Category	Management Action Type
198	BWFS	California Department of Water Resources	Mormon Channel Bypass	The purpose of the Mormon Channel Bypass element is to reduce peak stages in the Stockton Diverting Canal and Old Calaveras River, provide terrestrial habitat, and provide recreation/open space benefits. This element includes a control structure and channel improvements to divert up to 1,200 cfs from the upstream end of the Stockton Diverting Canal to the Mormon Channel to provide additional resiliency from climate change by reducing flows in the Stockton Diverting Canal and Old Calaveras River. This element was included in the State Recommended Plan because it would provide stage reduction benefits along the urbanized reaches of the Calaveras River and Stockton Diverting Canal and provide potentially very significant recreational benefits at modest cost.	$ 39,000,000	$ 43,000,000	Urban - Other infrastructure and multi-benefit improvements	Flood Infrastructure
199	RFMP	City of Mendota	Municipal Well Relocation/ Flood-Proofing in City of Mendota Phase 1	The City relies on three municipal wells, all located south of the San Joaquin and east of the Mendota Pool. Each of these wells is in a location that would be inundated by the flood levees proposed for construction by the River Restoration project. Inundation of even one of the wells would result in loss of the City's ability to deliver clean, healthful water to its customers. The wells are in the only local general location known to overlie water of such quality. All wells west of the Mendota Pool are of much lower quality, containing levels of iron, manganese and turbidity exceeding CDPH MCLs. The first form of the project: A) Extend well casings to 3.0 feet above the maximum break over elevation of the new flood channel, and build corresponding improvements to access roads, power supplies site lighting, distribution piping, fencing and other associated construction, so that the wells could remain in operation and be fully accessible by City staff under the most extreme and potentially long-lasting flood conditions. The City has no other water resources and so cannot plan for these wells to be out of service for even 24 hours at a time.	$ 6,431,782	$ 6,431,782	Urban - Risk awareness, floodproofing and land use planning	Watershed and Floodplain Management
200	RFMP	City of Mendota	Municipal Well Relocation/ Flood-Proofing in City of Mendota Phase 2	The City relies on three municipal wells, all located south of the San Joaquin and east of the Mendota Pool. Each of these wells is in a location that would be inundated by the flood levees proposed for construction by the River Restoration project. Inundation of even one of the wells would result in loss of the City's ability to deliver clean, healthful water to its customers. The wells are in the only local general location known to overlie water of such quality. All wells west of the Mendota Pool are of much lower quality, containing levels of iron, manganese and turbidity exceeding CDPH MCLs. The second form of the project: B) Relocate all three wells outside of the proposed flood levee, further to the south and still north of SR 180. (This general location has already been validated with Dr. Kenneth D. Schmidt as being the best location for municipal water wells.) Relocate all power supply and SCADA equipment. Extend raw water transmission pipeline from the existing well area to the new wells. Construct new access roads as needed. No cost estimates are available at this time.	$ 23,110,603	$ 23,110,603	Urban - Risk awareness, floodproofing and land use planning	Watershed and Floodplain Management
201	BWFS	California Department of Water Resources	New Conveyance to Divert Flood Flows from Mendota Pool (1,000 cfs)	This project was not included in the Upper San Joaquin RFMP. The following is a general description: develop pumping facilities to enable reverse flowing of the DMC and inter-connecting the CCID Outside and Main Canals to the DMC to convey flood water from the Mendota Pool to the San Luis Reservoir for storage and/or direct use, or exchange. The project could include up to 1,000 cfs reverse flow in the DMC and 500 cfs of connections from CCID's system to the DMC. Wet year deliveries could reach over 200,000 acre feet with an average annual amount of 51,000 acre feet. 0.7-0.9 ft stage reduction for 5 miles (100-year)	$ 337,000,000	$ -	Systemwide - Reservoir and floodplain storage	Reservoir and Floodplain Storage and Operation
202	Other	California Department of Water Resources	Nonstructural Berms & Interior Drainage		$ 4,982,880	$ 4,982,880	Small Community - Risk awareness, floodproofing and land use planning	Watershed and Floodplain Management

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#	Data Set Source	Lead Agency	Project Name	Project Description	Estimated Cost - Provided by Source	Estimated Cost - Adjusted for Portfolio	Area of Interest and Management Action Category	Management Action Type
203	Other	California Department of Water Resources	Nonstructural Berms & Interior Drainage		$ 2,491,440	$ 2,491,440	Small Community - Risk awareness, floodproofing and land use planning	Watershed and Floodplain Management
204	Other	California Department of Water Resources	Nonstructural Berms & Interior Drainage		$ 4,982,880	$ 4,982,880	Small Community - Risk awareness, floodproofing and land use planning	Watershed and Floodplain Management
205	RFMP	City of Newman, Potential Partners: Stanislaus County, Orestimba Creek Flood Control District, USACE	Orestimba Creek Flood Risk Management Project	Construction of a 4.7-mile chevron levee along east bank of Central California Irrigation District (CCID) Main Canal and a 1-mile cross levee to reduce flood risk to Newman and adjacent agricultural areas, providing a 200-year level of protection. The chevron levee would include 3 feet of freeboard above the mean 200-year water surface elevation.	$ 44,000,000	$ 44,000,000	Urban - Levee improvements	Flood Infrastructure
206	RFMP	Central California Irrigation District, San Luis Canal Company	Orestimba Creek Recharge and Recovery Project	This project would divert San Joaquin River and Kings River flood water at Mendota Pool to reduce flood flows, provide water supply, recharge local groundwater, and help prevent local subsidence. The Westside-San Joaquin IRWM recommends this project as it provides multiple benefits to the region. The project protects SPFC facilities along the San Joaquin River by diverting flood flows and the objectives are consistent with SSIA. The Orestimba Creek Recharge & Recovery Project includes construction of 85 acres of recharge ponds and 5 recovery wells along Orestimba Creek between the DMC and the Eastin Water District boundary. The project would receive surface water from Orestimba Creek, SJR flood system, CCID and/or Del Puerto Water District (DPWD). The DMC and/or CCID Main Canal could be used to convey the SJR flood water to the bank. Water wells will be piped to the DMC or CCID Main Canal.	$ 8,200,000	$ 8,200,000	Rural - Small-scale levee setbacks and floodplain storage	Reservoir and Floodplain Storage and Operation
207	RFMP	Merced Streams Group	Owens Reservoir Enlargement and Downstream Levee and Channel Improvements	Owens Reservoir was constructed in the early 1950's as an element of the Merced Streams Group Project authorized by Congress's 1944 Flood Control Act. The Flood Control Act of 1970 called for three additional flood control reservoirs, enlargement of existing reservoirs, and 52 miles of levee and channel modifications. To date only one additional reservoir has been built (Castle Dam). The enlargement of Owens Reservoir would increase the level of flood protection to Planada and Le Grand, both of which are DAC's in Merced County. Owens Reservoir was originally constructed to provide protection for up to a 50-year storm event. The State of California has adopted legislation that calls for a minimum of 200-year flood protection for urbanized areas. This system improvement would meet the requirements of the new flood control legislation. As part of this project, opportunities for riparian and wetland habitat enhancements will be considered.	$ 8,850,000	$ 8,850,000	Systemwide - Reservoir and floodplain storage	Flood Infrastructure
208	BWFS	California Department of Water Resources	Paradise Cut Bypass Expansion - Land Acquisition	Near term cost estimate for Paradise Cut land acquisitions.	$ 35,000,000	$ 35,000,000	Systemwide - Paradise Cut multi-benefit improvements	Flood Infrastructure

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209	BWFS	California Department of Water Resources	Paradise Cut Bypass Expansion (BWFS Option M-Ag-Focused):	Paradise Cut, located on the southwestern side of Steward Tract in Lathrop, is a federal flood control bypass that diverts flows from the San Joaquin River during high flows. A Paradise Cut bypass expansion was broadly defined in the 2012 CVFPP as an element to improve flood risk management and provide ecosystem benefits in the San Joaquin River Basin. This element of the San Joaquin BWFS includes Paradise Cut Bypass Expansion Option M Ag-Focused. This option would include a combination of new secondary upstream weir, 4,000 to 7,000 feet of left bank setback levees on Paradise Cut, downstream levee improvements, and the Base Case improvements. This element removes revetment and restores shaded riverine aquatic habitat along the degraded San Joaquin River levee and restores the southern portion of the current in-channel bar for floodplain rearing habitat. However, most of the land within the setback area would be kept in agricultural production. This option was selected because it provided balanced mix of more than 2.5 feet stage reduction along the San Joaquin River for large flood events, significant ecosystem benefits through riparian habitat restoration and increased shaded riverine aquatic cover, and agricultural stewardship. Over the long-term future, portions of the setback areas could be converted to habitat with willing landowners and in coordination with local land use agencies.	$ 250,000,000	$ 274,000,000	Systemwide - Paradise Cut multi-benefit improvements	Flood Infrastructure
210	RFMP	California Department of Water Resources, Delta South LMAs	Paradise Cut Expansion	The Paradise Cut improvements consist of a "base case," "initial improvements," and five alts for an expansion of the Paradise Cut bypass. The initial improvements include these projects in addition to the base case: dredging of Salmon Slough/Doughty Cut, widening of Paradise Weir from 180 ft. to 400 ft., and performing a channel cut between Salmon Slough and Doughty Cut. alt 1 includes alts 1A and 1B. alt 1A includes a Short Bypass: San Joaquin River (SJR) RM 58.8 to Paradise Cut Station (PCS) 225 (u/s of I-5), and Initial Improvements. alt 1B includes a Short Bypass: SJR RM 58.8 to PCS 225 (upstream of I-5), Paradise Cut south levee setback d/s of bypass, and Initial Improvements. Alt 2 includes alts 2A and 2B. alt 2A includes a Medium Bypass: SJR RM 58.8 to PCS 155 (d/s of UPRR[SP]), and Initial Improvements. Alt 2B includes a Medium Bypass: SJR RM 58.8 to PCS 155 (d/s of UPRR[SP]), Paradise Cut south levee setback d/s of bypass, and Initial Improvements. alt 3 includes alt 3 and alt 3A. Alt 3 includes Paradise Weir widened to 900 ft., Paradise Cut south levee setback for entire length, all bridge crossings (UPRR, I-205, I-5, Man they Rd., UPRR[SP], Paradise Rd.) widened, and Initial Improvements. alt 3A includes Paradise Weir widened to 900 ft., Paradise Cut south levee setback for entire length, only Paradise Rd. bridge widened, and initial Improvements. Alt 4 includes alts 4A and 4A1. Alt 4A consists of a Long Bypass: SJR RM 61.5 (near Banta-Carbona Canal) to PCS 155 and Initial Improvements. alt 4A1 consists of a Long Bypass: SJR, RM 61.5 (near Banta-Carbona Canal) to PCS 155, bypass channel excavated 4 to 5 ft., and Initial Improvements. alt 5 includes only alt 5A. This consists of a Long Bypass: SJR, RM 61.5 (near Banta-Carbona Canal) to PCS 155, Mainstone and Mitten properties	$ 355,000,000	$ -	Systemwide - Paradise Cut multi-benefit improvements	Flood Infrastructure
211	RFMP	City of Patterson	Patterson Wastewater Treatment Plant – Reduce Flood Risks	Develop and evaluate potential solutions to existing flood hazards at the City of Patterson WWTP.	$ 27,000	$ 27,000	Urban - Studies and analysis	Watershed and Floodplain Management
212	USACE	San Joaquin County, City of Stockton, City of Lathrop	Plan for Stockton 200-year ULOP	Senate Bill 5 (passed in 2007) requires a 200-year level of flood protection for urban and urbanizing areas within California's Central Valley. Under SB5, development in moderate or special flood hazard areas (500-year and 100-year floodplains, respectively) would only be allowed within the Central Valley if the city or county can find, based on substantial evidence in the record, that the development will be subject to less than 3 ft. of flooding during a 200-year flood event. Additionally, the ULDC and ULOP requirements developed pursuant to SB5 pose onerous "findings" requirements on local land use authorities, which can make achieving an in many developed areas difficult due to the required system improvements necessary to meet increased levels of flood protection. The first step in developing a plan to comply with SB5 is to determine an accurate 200-year floodplain. DWR prepared preliminary floodplain maps for the cities of Stockton and Lathrop in August 2013, but these floodplains were arbitrarily clipped at the respective spheres of influence of each city, did not consider non-project levees, and used conservative breach parameters. A refined 200-year floodplain map showing the extent and depth of flooding for San Joaquin County should be prepared to enable land use agencies to move forward with developing a long-term plan to comply with SB5.	$ 200,000	$ -	Urban - Levee improvements	Flood Infrastructure

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213	Other	California Department of Water Resources	Property acquisition, demo & disposal - Phase 2		$ 27,531,936	$ 9,085,539	Small Community - Levee setbacks, land acquisitions and habitat restoration	Watershed and Floodplain Management
214	Other	California Department of Water Resources	Property acquisition, demo & disposal - Phase 2		$ 13,765,968	$ 4,542,769	Small Community - Levee setbacks, land acquisitions and habitat restoration	Watershed and Floodplain Management
215	Other	California Department of Water Resources	Property acquisition, demo & disposal - Phase 2		$ 27,531,936	$ 27,531,936	Small Community - Levee setbacks, land acquisitions and habitat restoration	Watershed and Floodplain Management
216	Other	California Department of Water Resources	Property acquisition, demo & disposal - Phase 3		$ 27,531,936	$ 18,446,397	Small Community - Levee setbacks, land acquisitions and habitat restoration	Watershed and Floodplain Management
217	Other	California Department of Water Resources	Property acquisition, demo & disposal - Phase 3		$ 13,765,968	$ 9,223,199	Small Community - Levee setbacks, land acquisitions and habitat restoration	Watershed and Floodplain Management
218	Other	California Department of Water Resources	Property acquisition, demo & disposal - Phase 3		$ 27,531,936	$ 18,446,397	Small Community - Levee setbacks, land acquisitions and habitat restoration	Watershed and Floodplain Management
219	USACE	Reclamation District 524, San Joaquin Office of Emergency Services, Reclamation District 404	Protect Stockton Wastewater Treatment Plant	The levees protecting the ponds are too low and have seepage issues. Increasing levee height and reducing seepage into the wastewater ponds was suggested as a potential project. This project is not a responsibility of the District.	$ 2,000,000	$ -	Urban - Levee improvements	Flood Infrastructure
220	RFMP	Reclamation District 524	Railroad Crossing Reinstallation	The Burlington Northern Santa Fe Railroad Company has railroad tracks that cross the San Joaquin River and impact the levee on the northeastern boundary of the District. These tracks also bisect the City of Stockton's Wastewater Treatment Ponds. Currently there is no road over the railroad which impairs levee inspections and patrols. This lack of access also obstructs emergency levee repairs. A railroad crossing over the BNSF tracks on the levee crown is needed so the District can fulfill its responsibilities effectively, especially during a high water event.	$ 400,000	$ 400,000	Systemwide - Emergency management	Emergency Management
221	RFMP	San Joaquin County	Raise Duck Creek Levees		$ 22,000	$ 22,000	Rural - Levee repair and infrastructure improvements	Flood Infrastructure

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222	RFMP	San Joaquin County	Raise Little Johns Levees		$ 460,000	$ 460,000	Rural - Levee repair and infrastructure improvements	Flood Infrastructure
223	RFMP	Lower San Joaquin Levee District	Raise Part of Left Bank Levee Unit 6	Portions of the left bank levee Unit 6 which are opposite right bank levee Units 5, 7, 8, 9 & 10, were constructed as much as 2 feet lower than the right bank levees and need to be raised to provide the design freeboard. System improvement would require modeling of the system in the area to set levee elevation. Project levee was never accepted by LSJLD (governance issue)	$ 4,250,000	$ 4,250,000	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
224	RFMP	Delta South Region	Raise Structures	Raising and waterproofing structures and building berms.	$ 20,000,000	$ 20,000,000	Rural - Risk awareness, floodproofing and land use planning	Watershed and Floodplain Management
225	USACE	City of Stockton	Raise WW Pond Dikes	Included in USACE	$ 2,000,000	$ -	Urban - Levee improvements	Flood Infrastructure
226	RFMP	Patterson Westside Farms	RD 1602 SPFC Modification Project	The property owners within RD 1602 propose to remove state and federal OMRR&R obligations for their levees. The LMA identified as Reclamation District (RD) 1602 does not currently exist as a formal entity, but Patterson Westside Farms/Twin Oaks Irrigation District have organized meetings of the property owners within the RD to develop this concept. The property owners are interested in continuing to farm their lands and maintain the levee system, but not be constrained by the state and federal standards. The staff time and dollar cost of meeting those standards are greater than the value of continuing to be part of the state-federal flood project. A preferred approach to accomplishing this change has not yet been identified.	$ 4,700,000	$ 500,000	Systemwide - State operations, planning and performance tracking	Policy and Regulations
227	BWFS	California Department of Water Resources	RD 17 Fix-in-Place Levee Improvements	This would include fix-in-place levee improvements of the RD 17 levee.	$ 250,000,000	$ -	Urban - Other infrastructure and multi-benefit improvements	Flood Infrastructure
228	USACE	California Department of Water Resources	RD 17 Levee Improvements (BWFS Option C)	DWR proposed the RD 17 cross levee option and a small setback levee near the Old River confluence (RM 52). The existing San Joaquin River levee would remain unchanged to protect rural-agricultural areas within deep floodplains of approximately 6 feet or higher, but the existing levee would not provide an urban level of protection. This option would include levee raises, geotechnical improvements, new levees, and 782 acres of additional ecosystem habitat. This option is included in the State Recommended Plan because it would effectively achieve 200-year level of protection for the existing urban populations within RD 17 while also promoting wise use of floodplains in the rural, deep floodplains of RD 17, and promote agricultural stewardship. The cross levee option also provides future flexibility in areas outside the cross levee. Land could be kept in agricultural production in perpetuity or some portions converted to habitat with willing landowners and in coordination with local land use agencies.	$ 455,000,000	$ -	Urban - Other infrastructure and multi-benefit improvements	Flood Infrastructure
229	BWFS	California Department of Water Resources	RD 17 Multi-benefit Improvements	This multi-benefit option would include fix-in-place levee improvements and a setback levee(s) of RD 17. The setback levee is strategically located to maximize shaded riverine aquatic habitat. Agricultural easements would limit urbanization in areas with flood depths of 6 feet or greater. An urban LOP would be provided for all areas behind the levee.	$ 411,000,000	$ -	Urban - Other infrastructure and multi-benefit improvements	Flood Infrastructure

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230	RFMP	Reclamation District 2031, Elliott, Potential Project Partners: Central Valley Flood Protection Board; landowners; California Department of Water Resources; United States Army Corp of Engineers; Stanislaus County	RD 2031 Resilience	Complete the necessary repairs and upgrades to bring RD levee system back into “Active” status for PL84-99 eligibility.	$ 2,000,000	$ -	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
231	RFMP	Reclamation District 2063, Crows Landing, Potential Project Partners: Central Valley Flood Protection Board; landowners, California Department of Water Resources; United States Army Corp of Engineers; Stanislaus County	RD 2063 Resilience	Complete the necessary repairs and upgrades to bring RD levee system back into “Active” status for PL84-99 eligibility.	$ 3,500,000	$ -	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
232	RFMP	Reclamation District 2091, Chase, Potential Project Partners: Central Valley Flood Protection Board; landowners, California Department of Water Resources; United States Army Corp of Engineers; Stanislaus County	RD 2091 Resilience	Complete the necessary repairs and upgrades to bring RD levee system back into “Active” status for PL84-99 eligibility.	$ 400,000	$ -	Rural - Levee repair and infrastructure improvements	Operation and Maintenance

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233	RFMP	Reclamation District 2101, Blewett, Potential Project Partners: Central Valley Flood Protection Board; landowners, California Department of Water Resources; United States Army Corp of Engineers; Stanislaus County	RD 2101 Resilience	Complete the necessary repairs and upgrades to bring RD levee system back into “Active” status for PL84-99 eligibility, including addressing a major levee erosion site.	$ 2,500,000	$ -	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
234	RFMP	San Joaquin River Restoration Program	Reach 2B Project - San Mateo Road Crossing	Construct a crossing across the San Joaquin River at San Mateo Avenue and build levee setbacks as part of the project in Reach 2B.	$ 9,600,000	$ -	Rural - Small-scale levee setbacks and floodplain storage	Flood Infrastructure
235	RFMP	San Joaquin River Restoration Program	Reach 2B/Mendota Pool Bypass	Reach 2B levees will be setback by the SJRRP to provide floodplain habitat for fish and increase the capacity of Reach 2B to 4,500 cfs (from an estimated 1,300 cfs). Floodplain could be used as transitory storage and this system improvement will repair any levee stability issues in this reach by replacing them. This system improvement would increase flood protection to lands in the area and could increase operational flexibility to manage flood releases. Continued coordination with flood agencies could result in additional benefits. The SJRRP will be constructing a means for fish passage over Mendota Dam, either through the Mendota Pool Bypass or the Fresno Slough Dam. Fresno Slough Dam may have benefits to improving the ability of CCID to manage flood flows in Mendota Pool through a new dam. The Mendota Pool Bypass could provide flood benefits by an expanded river width / floodplain and an alternate channel around Mendota Pool. As a part of this project, inter-agency agreements, funding, and coordination will be formalized.	$ 295,000,000	$ -	Rural - Small-scale levee setbacks and floodplain storage	Flood Infrastructure
236	RFMP	San Joaquin River Restoration Program	Reach 4B Improvements	The SJRRP is required in the Settlement to increase the capacity of Reach 4B1 of the San Joaquin River to 475 cfs (from an estimated 20 cfs). In addition, the SJRRP will be determining whether to route fish and flows up to 4,500 cfs through Reach 4B1 of the San Joaquin River, or through the Eastside Bypass, or some combination. Setback levees would be built in either case. If flows are to be routed into the Eastside Bypass, Mariposa Bypass, and then to Reach 4B2, Mariposa Bypass setback levees may also be built. Setback levees maintain flood capacity, repair existing flood levees, and allow for habitat improvements such as vegetation growth within the channels. As a part of this project, inter-agency agreements, funding, and coordination will be formalized.	$ 234,199,000	$ -	Rural - Small-scale levee setbacks and floodplain storage	Flood Infrastructure
237	RFMP	Reclamation District 1	Reclamation District 1 Dryland Levee Improvements (Border RD 2)	Improving these dryland levees to PL 84-99 standards would provide increased flood protection to RD 1 in the event neighboring Districts flood.	$ 32,000,000	$ 32,000,000	Rural - Levee repair and infrastructure improvements	Flood Infrastructure
238	RFMP	Reclamation District 1	Reclamation District 1 Dryland Levee Improvements (Border RD 2089)	Improving these dryland levees to PL 84-99 standards would provide increased flood protection to RD 1 in the event neighboring Districts flood.	$ 1,250,000	$ 1,250,000	Rural - Levee repair and infrastructure improvements	Flood Infrastructure
239	RFMP	Reclamation District 1	Reclamation District 1 Erosion Protection	A serious erosion protection site has been identified by the FSRP on the south-eastern side of the District. The District reported that the levees along Old River and Middle River are in need of additional erosion protection.	$ 3,100,000	$ 3,100,000	Rural - Levee repair and infrastructure improvements	Operation and Maintenance

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240	RFMP	Reclamation District 1	Reclamation District 1 Identify Areas that would benefit from Setback Levees	The District expressed interest in identifying areas where setback levees would be feasible/beneficial.	$ 50,000	$ 50,000	Rural - Studies and analysis	Watershed and Floodplain Management
241	RFMP	Reclamation District 1	Reclamation District 1 Pipe Raising Project	The District would like to raise all siphons and pipes which cross through the levee at an elevation that is above the adjacent waterway base flood elevation.	$ 286,000	$ -	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
242	RFMP	Reclamation District 1	Reclamation District 1 Seepage Repairs and Slope Stability Repairs	A serious seepage site has been identified by the FSRP on the south-eastern side of the District adjacent to RD 2062. The NULE program also identified needed seepage repairs along Middle River. Repair of both seepage sites is important to the District.	$ 43,396,000	$ -	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
243	RFMP	Reclamation District 1007	Reclamation District 1007 Geometry Improvements	Waterside slopes on the levees adjacent to Old River need to be flattened out, especially to hold erosion protection. The District engineer indicated that there is no immediate need for these improvements, but would need to be completed if Paradise Cut expansion is implemented. These improvements are expensive because of waterside habitat and land-side encroachments.	$ 30,375,000	$ 30,375,000	Rural - Levee repair and infrastructure improvements	Flood Infrastructure
244	RFMP	Reclamation District 1007	Reclamation District 1007 Maintain Protection of City of Tracy's Industrial Waste Treatment Ponds	The City of Tracy’s industrial waste treatment ponds are within RD 1007 and need to be protected from flood events.	$ 2,000,000	$ 2,000,000	Urban - Levee improvements	Flood Infrastructure
245	RFMP	Reclamation District 1007	Reclamation District 1007 Restore Design Capacity to Old River/Paradise Cut	Sedimentation in Old River should be dredged to restore the design capacity of the waterways, especially if Paradise Cut expansion is implemented.	$ 10,000,000	$ 10,000,000	Systemwide - Routine maintenance	Operation and Maintenance
246	RFMP	Reclamation District 2	Reclamation District 2 Address Penetrations & Encroachments	The District has issues with penetrations through their levees. Locating and removing abandoned floodgates and pipes throughout District levees was identified as a project for RD 2. Additionally, the District expressed interested in addressing encroachments that hinder routine inspection and O&M.	$ 1,000,000	$ -	Systemwide - Routine maintenance	Operation and Maintenance
247	RFMP	Reclamation District 2	Reclamation District 2 Address PL84-99 Deficiencies	Altogether, a total of 4,000 feet, or 5 percent, of the RD 2 levee does not meet the PL 84-99 Standard. The District will bring these portions of the levee up to PL 84-99 Standard plus six inches.	$ 541,000	$ 541,000	Rural - Levee repair and infrastructure improvements	Flood Infrastructure
248	RFMP	Reclamation District 2	Reclamation District 2 Erosion Protection	The District identified rock slope protection needs along North Canal and Grant Line Canal. Adding rock slope protection to the waterside slope of these levees will mitigate these erosive forces. This will be implemented by placing "launchable” rock on the existing slope.	$ 10,128,200	$ 10,128,200	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
249	RFMP	Reclamation District 2	Reclamation District 2 Geometry Improvements	The existing slopes where the erosion protection will be placed are very steep and will eventually need to be laid back. This may especially be needed if the Paradise Cut expansion occurs.	$ 30,000,000	$ 30,000,000	Rural - Levee repair and infrastructure improvements	Flood Infrastructure
250	RFMP	Reclamation District 2	Reclamation District 2 Identify Areas that would benefit from Setback Levees	The District expressed interest in identifying areas where setback levees would be feasible/beneficial.	$ 50,000	$ 50,000	Rural - Studies and analysis	Watershed and Floodplain Management
251	RFMP	Reclamation District 2	Reclamation District 2 Improve Dryland Levees	Improving this dryland levee between RD 2 and RD 1 to PL 84-99 standards would provide increased flood protection to RD 2 in the event neighboring Districts flood.	$ 26,338,000	$ 26,338,000	Rural - Levee repair and infrastructure improvements	Flood Infrastructure
252	RFMP	Reclamation District 2	Reclamation District 2 Seepage Repairs	The District has had seepage issues along North Canal/Victoria Canal and Old River. Seepage berms and/or cutoff walls have been identified by the District as needed improvements to address these issues. Seepage is generally along many short reaches.	$ 87,000,000	$ 87,000,000	Rural - Levee repair and infrastructure improvements	Operation and Maintenance

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253	RFMP	Reclamation District 2042, Bishop Tract	Reclamation District 2042 ULDC Analysis	The levees around RD 2042 are accredited by FEMA. There were no significant flood system deficiencies identified by the District. As development takes place in the District, RD 2042 will pursue 200-year protection in accordance with the ULDC. It is noted that RD 2042 did not participate in DWR's ULE program. RD 2042 will fund future geotechnical evaluation of its levees.	$ 1,500,000	$ 1,500,000	Rural - Studies and analysis	Watershed and Floodplain Management
254	RFMP	Reclamation District 2058	Reclamation District 2058 Conduct Endangered Species Habitat Mapping	The District needs to be aware of the location and extent of habitat that could contain riparian brush rabbit, giant garter snake, Elderberry, etc. A habitat survey could provide this information.	$ 50,000	$ 50,000	Rural - Risk awareness, floodproofing and land use planning	Watershed and Floodplain Management
255	RFMP	Reclamation District 2058	Reclamation District 2058 Erosion Protection	A critical erosion protection site has been identified by the FSRP on the western side of the District (along Sugar Cut) adjacent to RD 1007. Rip rap or other erosion protection measures are needed in these areas.	$ 754,000	$ 754,000	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
256	RFMP	Reclamation District 2058	Reclamation District 2058 Geometry Improvements	Approximately 2,380 feet of levee needs to be raised with imported engineered fill so that the levee crown will meet the minimum HMP elevation.	$ 2,594,000	$ 2,594,000	Rural - Levee repair and infrastructure improvements	Flood Infrastructure
257	RFMP	Reclamation District 2058	Reclamation District 2058 Seepage Repairs	Critical seepage sites have been identified by the FSRP on the north and eastern sides of the District adjacent to RD 2089 and RD 1007 respectively. A study on the necessary repair and subsequent implementation of the repair needs to be done. Decisions on repairing the levee reach along Paradise Cut may be influenced by the timing and/or results of the investigation for expansion of Paradise Cut.	$ 25,143,000	$ -	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
258	RFMP	Reclamation District 2058	Reclamation District 2058 Slope Stability Repairs	Serious slope stability sites have been identified by the FSRP along the northern side of the District. Identified stability concern sites are in need of repair. Decisions on repairing the levee reach along Paradise Cut may be influenced by the timing and/or results of the investigation for expansion of Paradise Cut.	$ 11,456,000	$ -	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
259	RFMP	Reclamation District 2062	Reclamation District 2062 Phase 2 ULOP	Phase 2 construction will bring the north central portion of the District to 200-year ULOP. This will include habitat improvements along a portion of Old River. The earthwork for this phase is planned for the 2015-2016 period.	$ 60,000,000	$ 60,000,000	Rural - Levee repair and infrastructure improvements	Flood Infrastructure
260	RFMP	Reclamation District 2062	Reclamation District 2062 Phase 3 ULOP	Phase 3 is the largest of the three phases and will complete work to bring the entire Stewart Tract to 200-year ULOP. Levee work along Old River will include habitat improvements. The levee along Paradise Cut will be set back 900 to 1200 feet, which will add approximately 250 acres to Paradise Cut for habitat. The existing Paradise Cut north levee will be left in place, but will be breached in several places to allow water to flow on both sides. This existing levee will provide a refuge area for the for the riparian brush rabbit to escape from flood waters. This phase of work also includes setback of a portion of the north Paradise Cut levee on RD 2107 between Interstate 5 and the upstream railroad. The bench (about 40 acres in size) downstream from the Paradise Cut weir will be lowered by about 5 feet to restore flow capacity to Paradise Cut. An alternative to bench removal may be an additional levee setback upstream from the railroad. These improvements will increase the existing flow capacity by about 1200 cfs and almost restore the original design capacity of 15,000 cfs. This work is planned to begin about year 2020.	$ 110,000,000	$ 110,000,000	Rural - Small-scale levee setbacks and floodplain storage	Flood Infrastructure
261	RFMP	Reclamation District 2062	Reclamation District 2062 Study Paradise Cut Expansion		$ 1,500,000	$ 1,500,000	Rural - Studies and analysis	Watershed and Floodplain Management
262	RFMP	Reclamation District 2064	Reclamation District 2064 Address PL84-99 Deficiencies	The District (RD 2064) would like to bring upgrade deficient levees to the PL 84-99 standard.	$ 800,000	$ 800,000	Rural - Levee repair and infrastructure improvements	Operation and Maintenance

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#	Data Set Source	Lead Agency	Project Name	Project Description	Estimated Cost - Provided by Source	Estimated Cost - Adjusted for Portfolio	Area of Interest and Management Action Category	Management Action Type
263	RFMP	Reclamation District 2064	Reclamation District 2064 Erosion Protection	The District noted erosion repairs are an expensive on-going part of their annual O&M. A specific problem area is at the northern boundary of the District near RD 2075. These erosion sites are in need of repair. The District would also like to have the west face of the Ten Mile dryland levee protected with riprap but does not have the financial resources to undertake the project.	$ 5,400,000	$ 5,400,000	Systemwide - Routine maintenance	Operation and Maintenance
264	RFMP	Reclamation District 2064	Reclamation District 2064 Seepage Repair	Critical seepage sites have been identified by DWR's FSRP along District levees. Seepage repairs need to be made at these sites along RD 2064 levees adjacent to both the San Joaquin and Stanislaus River.	$ 45,625,000	$ -	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
265	RFMP	Reclamation District 2074	Reclamation District 2074 Dryland Levee Improvements	Ten Mile Levee is a dry land levee that is part of the system of levees defending the Western portion of the City of Stockton from flooding from the West and protects State Plan of Flood Control levees along the Calaveras River in the event of the failure of levees on Wright-Elmwood Tract (RD 2119). The Project is to install a bentonite cut-off wall to protect against underseepage in a flood event.	$ 19,050,000	$ 19,050,000	Rural - Levee repair and infrastructure improvements	Flood Infrastructure
266	RFMP	Reclamation District 2074	Reclamation District 2074 Erosion Protection	The District would also like to have the west face of the Ten Mile dryland levee protected with riprap but does not have the financial resources to undertake the project.	$ 5,000,000	$ 5,000,000	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
267	RFMP	Reclamation District 2074	Reclamation District 2074 Seepage Repairs	The District would like to evaluate seepage along the Calaveras River and Fourteen Mile Slough and make repairs that are necessary to avoid future seepage occurrences.	$ 7,600,000	$ 7,600,000	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
268	RFMP	Reclamation District 2075	Reclamation District 2075 Erosion Protection	The District noted erosion repairs are an expensive on-going part of their annual O&M. Specific problem areas were not identified, as District staff believes that the whole levee along the San Joaquin River is in need of protective rock placement.	$ 4,500,000	$ 4,500,000	Systemwide - Routine maintenance	Operation and Maintenance
269	RFMP	Reclamation District 2075	Reclamation District 2075 Geometry Improvements	The District would like to upgrade deficient levee segments to meet the PL 84-99 Standard.	$ 32,156,000	$ 32,156,000	Rural - Levee repair and infrastructure improvements	Flood Infrastructure
270	RFMP	Reclamation District 2075	Reclamation District 2075 Restore Design Capacity of the SJ River	The District needs this silt buildup in the San Joaquin River to be removed to restore the design capacity and reduce the hydraulic load on its levees. This is a regional project that would benefit several Rds.	$ -	$ -	Systemwide - Routine maintenance	Operation and Maintenance
271	RFMP	Reclamation District 2075	Reclamation District 2075 Seepage Repair	Critical seepage sites have been identified by the FSRP along District levees. Identified seepage concern sites are in need of repair.	$ 20,300,000	$ -	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
272	RFMP	Reclamation District 2085	Reclamation District 2085 Erosion Protection	Critical erosion sites have been identified by the FSRP along District levees. One site is reported to be about 12 feet vertical for several hundred feet. These erosion sites are in need of repair.	$ 300,000	$ -	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
273	RFMP	Reclamation District 2085	Reclamation District 2085 Restore Design Capacity of the San Joaquin River	According to the District, the San Joaquin River adjacent to RD 2085 has experienced siltation and sediment buildup that has significantly decreased the capacity of the river channel from its original design capacity. The District needs this silt to be removed to restore the design capacity and reduce the hydraulic load on its levees. This project is envisioned as a regional study to determine potential actions and tied to the study of Paradise Cut rather than a project for the RD 2085.	$ -	$ -	Systemwide - Routine maintenance	Operation and Maintenance
274	RFMP	Reclamation District 2085	Reclamation District 2085 Seepage Repairs	Critical seepage sites have been identified by the FSRP along District levees. These seepage sites are in need of repair.	$ 33,375,000	$ -	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
275	RFMP	Reclamation District 2089	Reclamation District 2089 Address PL84-99 Deficiencies	The District would like to improve their levees to meet PL84-99 Standards. This applies to about 3% of the total levee length, located on the south-eastern side of the District near the confluence of Paradise Cut and Old River.	$ 500,000	$ 500,000	Rural - Levee repair and infrastructure improvements	Flood Infrastructure

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276	RFMP	Reclamation District 2089	Reclamation District 2089 Conduct a Study to Determine the Potential for Setback Levees	Conducting a study to determine the potential for setback levees will allow the District to understand how setback levees can help reduce flood risk within the District.	$ 100,000	$ 100,000	Rural - Studies and analysis	Watershed and Floodplain Management
277	RFMP	Reclamation District 2089	Reclamation District 2089 Erosion Protection	Critical erosion sites have been identified by the FSRP along District levees. Other sites have been identified by stakeholders. Identified erosion sites are in need of repair. The District also plans to ensure the protection of the existing levee by adding supplementary riprap above the existing riprap to any portions of the waterside slope of the levee requiring additional rock slope protection. This will prevent erosion and minimize future erosion repairs. The erosion protection is estimated to cost about $1.5 million plus an additional $1 million for mitigation.	$ 2,500,000	$ -	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
278	RFMP	Reclamation District 2089	Reclamation District 2089 Restore Capacity to Salmon Slough	Salmon Slough is badly silted, and has does not convey flood flows efficiently. In the past, the slough was used to relieve pressure from flows in Paradise Cut, but now is a bottleneck. Dredging to allow original capacity will relieve pressure in Paradise Cut and reduce flood risk to the District.	$ 1,000,000	$ 1,000,000	Systemwide - Routine maintenance	Operation and Maintenance
279	RFMP	Reclamation District 2089	Reclamation District 2089 Seepage and Slope Stability Repairs	Critical seepage sites have been identified by the FSRP along Old River and Salmon Slough. These sites are in need of repair. Critical slope stability concerns were identified by the FSRP throughout RD 2089 levees along Old River and Salmon Slough. These sites are in need of repair.	$ 29,400,000	$ -	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
280	RFMP	Reclamation District 2094	Reclamation District 2094 Geometry Improvements	The existing levee needs a larger cross section. The land-side slope of the levee along the San Joaquin River is currently steeper than 3:1. Levee geometry improvements would increase the stability of the levee, and bring it up to current standards.	$ 9,188,000	$ 9,188,000	Rural - Levee repair and infrastructure improvements	Flood Infrastructure
281	RFMP	Reclamation District 2094	Reclamation District 2094 Improve Dryland Levees	The dryland Levee located on the south boundary of RD 2094 is lower and less reliable than the levees along the San Joaquin River and was overtopped in 1997 when RD 2075 flooded. This levee was originally constructed to protect RD 2075 in the event of a failure of a levee downstream (north) on the San Joaquin River. Furthermore, this cross levee is one of only two means of egress during a flood event. This project would improve this levee to protect RD 2094 from flooding in RD 2075, and would improve public safety.	$ 13,781,000	$ 13,781,000	Rural - Levee repair and infrastructure improvements	Flood Infrastructure
282	RFMP	Reclamation District 2094	Reclamation District 2094 Restore Design Capacity to San Joaquin River	RD 2075 needs this silt buildup in the San Joaquin River to be removed to restore the design capacity and reduce the hydraulic load on its levees. This is a regional project that would benefit several Rds.	$ -	$ -	Systemwide - Routine maintenance	Operation and Maintenance
283	RFMP	Reclamation District 2094	Reclamation District 2094 Slope Stability Repairs, and Seepage Repairs	A slope stability repair site has been identified by the FSRP on the western side of the District along the San Joaquin River. Identified stability concern sites are in need of repair. The levee along the San Joaquin River is shown to have a moderate likelihood of failure due to seepage. A study should be conducted along this levee to determine the most appropriate seepage repair method, followed by implementation of the recommended action.	$ 11,456,000	$ -	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
284	RFMP	Reclamation District 2095	Reclamation District 2095 Erosion Protection	Serious erosion protection sites have been identified by the FSRP along the San Joaquin River on the eastern side of the District. The following erosion sites are in need of repair: • Unit 1 LM 0.73-0.74 • Unit 1 LM 0.86-0.86 • Unit 2 LM 1.77-1.80 • Unit 2 LM 1.85-1.89 All are on the DWR Erosion Survey and are Minimally Acceptable in the DWR Spring 2014 Levee Inspection. The District would like to repair these sites before they become Unacceptable for flood protection.	$ 450,000	$ -	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
285	RFMP	Reclamation District 2095	Reclamation District 2095 Seepage and Slope Stability Repairs	Serious seepage repair sites have been identified by the FSRP along the San Joaquin River on the eastern side of the District. Identified seepage sites are in need of repair. Decisions on fixing additional smaller sites along Paradise Cut may be influenced by the timing and/or results of the investigation for expansion of Paradise Cut.	$ 22,812,000	$ -	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
286	RFMP	Reclamation District 2096	Reclamation District 2096 Geotechnical Assessment	The RFMP Team recommends a geotechnical assessment be done for the levees around this District.	$ 50,000	$ 50,000	Urban - Studies and analysis	Watershed and Floodplain Management

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287	RFMP	Reclamation District 2096	Reclamation District 2096 Raise/Flood Proof Homes & Protect Utilities	Discussions with District representatives indicate that they would be interested in raising/flood proofing about 60 permanent homes above flood level. The remainder of residences are mobile homes. District representatives indicate that the mobile homes could be moved when flood threat increases.	$ 7,000,000	$ 7,000,000	Urban - Risk awareness, floodproofing and land use planning	Watershed and Floodplain Management
288	RFMP	Reclamation District 2096	Reclamation District 2096 Restore Channel Capacity	Walthall Slough leading to the pump station has lost capacity due to sedimentation and bank sloughing. A project is needed to remove the sediment.	$ 400,000	$ -	Systemwide - Routine maintenance	Operation and Maintenance
289	RFMP	Reclamation District 2096	Reclamation District 2096 Upgrade Pump Station Electrical	The pump station electrical components are antiquated and in need of an upgrade.	$ 200,000	$ 200,000	Urban - Other infrastructure and multi-benefit improvements	Operation and Maintenance
290	RFMP	Reclamation District 2107	Reclamation District 2107 PL84-99 Improvements	The District has no plans for projects in the near future. However, levee improvements to the PL 84-99 standard will eventually be completed.	$ 2,800,000	$ 2,800,000	Rural - Levee repair and infrastructure improvements	Flood Infrastructure
291	RFMP	Reclamation District 2115	Reclamation District 2115 Address PL84-99 Deficiencies	Once all levees meet or exceed HMP criteria, the District will bring any segments that do not meet the PL 84-99 Standard up to six inches above the PL84-99 Standard.	$ 3,400,000	$ 3,400,000	Rural - Levee repair and infrastructure improvements	Flood Infrastructure
292	RFMP	Reclamation District 2115	Reclamation District 2115 Erosion Protection	Water skiing in Mosher Slough and Fourteen Mile Slough causes wave action, which causes significant erosion on these levees. Adding rock slope protection over existing riprap to portions of the waterside slope of the levee will mitigate these erosive forces. Additionally, existing broken concrete along the western boundary of the District needs to be removed and replaced with riprap.	$ 1,300,000	$ 1,300,000	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
293	RFMP	Reclamation District 2115	Reclamation District 2115 ULDC Analysis		$ 1,500,000	$ 1,500,000	Rural - Studies and analysis	Watershed and Floodplain Management
294	RFMP	Reclamation District 2119	Reclamation District 2119 Address PL84-99 Deficiencies	The District will upgrade its levees to meet the PL 84-99 standard.	$ 2,000,000	$ 2,000,000	Rural - Levee repair and infrastructure improvements	Flood Infrastructure
295	RFMP	Reclamation District 2119	Reclamation District 2119 Protection of City Sewer Lift Station and Transmission Lines	A sewer pump station is located at the northeast corner of the District, and a transmission line traverses the east boundary of the RD 2119. It is important to the District these facilities are adequately protected during a flood. To ensure this, an all-weather road needs to be added to this levee.	$ -	$ -	Systemwide - Emergency management	Emergency Management
296	RFMP	Reclamation District 2119	Reclamation District 2119 Protection of Habitat Mitigation Areas	The District contains a habitat mitigation area for RD 2074. The District intends to maintain this area. This may become a mitigation area for other areas in the Regions.	$ -	$ -	Rural - Habitat restoration/reconnection	Natural Floodplain and Ecosystem Functions
297	RFMP	Reclamation District 2119	Reclamation District 2119 Seepage Repair	Repair areas of levee seepage.	$ 4,562,500	$ 4,562,500	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
298	RFMP	San Joaquin County, Reclamation District 2126	Reclamation District 2126 Permanent Power Source for Pump	The interior drainage pump station within RD 2126 does not currently have a permanent power source. The District would like to provide a permanent power source for an upgraded pump station if development on this District ever occurs.	$ 1,000,000	$ 1,000,000	Rural - Levee repair and infrastructure improvements	Flood Infrastructure

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299	RFMP	Reclamation District 2126	Reclamation District 2126 Urban Levee Design Criteria (ULDC) Analysis	RD 2126 is conducting a ULDC analysis of the levee to determine areas that need further work to bring the District up to 200-year ULOP.	$ 1,000,000	$ 1,000,000	Rural - Studies and analysis	Watershed and Floodplain Management
300	RFMP	Reclamation District 404	Reclamation District 404 Interior Drainage and Pump Station Improvements	An interior drainage analysis was performed in May 2010 for RD 404 to determine if the existing capacities of the pump stations, together with temporary detention storage within streets, ditches, and ponds, are sufficient to manage the expected runoff from a 24-hour, 100-year storm.	$ 2,700,000	$ 2,700,000	Urban - Other infrastructure and multi-benefit improvements	Flood Infrastructure
301	RFMP	Reclamation District 524	Reclamation District 524 Address Penetration Problems	Levee penetrations along the San Joaquin River need to be resolved. These are in the area of the Stockton WWTP facilities.	$ 5,000,000	$ -	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
302	RFMP	Reclamation District 524	Reclamation District 524 Address PL84-99 Deficiencies		$ 860,000	$ 860,000	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
303	RFMP	Reclamation District 524	Reclamation District 524 Erosion Protection	The District needs rip rap placement along the west bank of San Joaquin River. A serious erosion site adjacent to the WWTP ponds has been identified by DWR in the FSRP. These areas all need placement of erosion protection to ensure these levees continue to protect the District.	$ 3,700,000	$ -	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
304	RFMP	Reclamation District 524	Reclamation District 524 Seepage Repairs	A critical seepage site has been identified by the FSRP on the north-eastern side of the District adjacent to the WWTP ponds. Identified seepage sites are in need of repair.	$ 5,000,000	$ -	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
305	RFMP	Reclamation District 544	Reclamation District 544 Address Encroachments	The District identified encroachments along the west bank of the San Joaquin River. The District would like to identify all encroachments and address those that are not properly permitted.	$ 5,000,000	$ -	Systemwide - Routine maintenance	Operation and Maintenance
306	RFMP	Reclamation District 544	Reclamation District 544 Address PL84-99 Deficiencies	District will bring any levee segments that do not meet the PL 84-99 Standard to six inches above the PL 84-99 Standard.	$ 12,000,000	$ 12,000,000	Rural - Levee repair and infrastructure improvements	Flood Infrastructure
307	RFMP	Reclamation District 544	Reclamation District 544 Erosion Protection	The District plans to ensure the protection of the existing levee by adding rock slope protection to portions of the waterside slope of the levees requiring additional rock slope protection.	$ 1,500,000	$ 1,500,000	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
308	RFMP	Reclamation District 544	Reclamation District 544 Identify Areas that would benefit from Setback Levees	The District would like to evaluate the potential for setback levees in several areas.	$ 50,000	$ 50,000	Rural - Studies and analysis	Watershed and Floodplain Management
309	RFMP	Reclamation District 544	Reclamation District 544 Seepage Repairs - Long reaches	Levees along the San Joaquin River and Old River have experienced seepage during previous high water events. Critical seepage sites have also been identified by the FSRP. The District would like to implement the necessary improvements to mitigate seepage deficiencies. Identified seepage concern sites are in need of repair.	$ 55,100,000	$ -	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
310	RFMP	Reclamation District 544	Reclamation District 544 Seepage Repairs - Short critical reaches	Levees along the San Joaquin River and Old River have experienced seepage during previous high water events. Critical seepage sites have also been identified by the FSRP. The District would like to implement the necessary improvements to mitigate seepage deficiencies. Identified seepage concern sites are in need of repair.	$ 10,000,000	$ -	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
311	RFMP	Reclamation District 544	Reclamation District 544 Slope Stability Repairs	Critical slope stability sites have been identified by the FSRP along District levees. Identified stability concern sites are in need of repair.	$ 5,000,000	$ -	Rural - Levee repair and infrastructure improvements	Operation and Maintenance

Table B-5. San Joaquin Basin Management Actions Included within the 2017 Refined SSIA Portfolio

#	Data Set Source	Lead Agency	Project Name	Project Description	Estimated Cost - Provided by Source	Estimated Cost - Adjusted for Portfolio	Area of Interest and Management Action Category	Management Action Type
312	RFMP	Reclamation District 684	Reclamation District 684 Address PL84-99 Deficiencies	The District will bring any levee segments that do not meet the PL 84-99 Standard to six inches above the PL 84-99 Standard. One location is near the marina on Turner Cut, but other specific locations are currently unavailable.	$ 1,000,000	$ 1,000,000	Rural - Levee repair and infrastructure improvements	Flood Infrastructure
313	RFMP	Reclamation District 684	Reclamation District 684 Natali Levee Raising	A study of the Natali Levee (dryland levee) was conducted to find how much protection it offers in the event of RD 524 flooding. Raising the Natali Levee between RD 684 and RD 524 in coordination with provision for a relief cut along Burns Cutoff in RD 524 would reduce the risk of flood in RD 684 in the event of a RD 524 flood.	$ 400,000	$ 400,000	Rural - Levee repair and infrastructure improvements	Flood Infrastructure
314	RFMP	Reclamation District 684	Reclamation District 684 Seepage Repair	The levee extending from near Turner Cut to about 1 mile east along the San Joaquin River will be reconstructed as a “fish friendly” levee in the process of resolving seepage problems.	$ 2,600,000	$ 2,600,000	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
315	RFMP	Reclamation District 684	Reclamation District 684 Setback Levees	In the small group meetings with stakeholders, the District indicated the need for a setback levee along San Joaquin River/Turner Cut. Smaller setback levees are needed for access around two houses that sit near the levee crown.	$ 2,600,000	$ 2,600,000	Rural - Small-scale levee setbacks and floodplain storage	Flood Infrastructure
316	RFMP	Reclamation District 773	Reclamation District 773 Address PL84-99 Deficiencies	A small length of levees along Grant Line Canal do not currently meet PL 84-99 standards. The District will bring these portions of levee to six inches above the PL 84-99 Standard.	$ 7,900,000	$ 7,900,000	Rural - Levee repair and infrastructure improvements	Flood Infrastructure
317	RFMP	Reclamation District 773	Reclamation District 773 Erosion Protection	Levees along the south bank of Grant Line Canal and along Old River were mentioned as needing additional erosion protection. The District would like to add rock slope protection to these levee segments in order to prevent erosion and minimize future erosion repairs.	$ 10,854,000	$ 10,854,000	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
318	RFMP	Reclamation District 773	Reclamation District 773 Geometry Improvements	The reach of levee adjacent to Fabian and Bell Canal currently contains segments of over-steepened landside slopes that require flattening in order to improve overall levee stability. The levee adjacent to Grant Line Canal was also noted as having land side slopes that are too steep. Necessary levee geometry improvements will be made to these levees to meet PL84-99 project standards discussed above. Additionally, the reach of levee adjacent to Fabian and Bell Canal contains segments of over-steepened waterside slopes. The District intends to set back the levee template thereby allowing the over-steepened waterside slopes to become sacrificial over time. These geometry improvements will be more critical if the expansion of Paradise Cut occurs.	$ 42,175,000	$ 42,175,000	Rural - Levee repair and infrastructure improvements	Flood Infrastructure
319	RFMP	West Stanislaus Resource Conservation District, Potential Project Partners: Natural Resources Conservation Service, irrigation districts, Westside Coalition	Reducing Sediment Loading into the San Joaquin River from Westside Agricultural Lands	Improve irrigation technology with buried drip and sprinkler irrigation systems that allow for the capacity to irrigate a variety of crop types and effectively eliminate erosion of sediment off of farm fields when compared to traditional, flood irrigation practices. Sediment loading results in reduced capacity of and increased flooding in Westside Creeks and the San Joaquin River.	$ 65,000,000	$ -	Systemwide - Routine maintenance	Operation and Maintenance
320	RFMP	Reclamation District 2091, Chase, Reclamation District 2092, Potential Project Partners: Central Valley Flood Protection Board; landowners, California Department of Water Resources; United States Army Corp of Engineers; Stanislaus County	Regional Maintenance Technical Support Program	Development and distribution of technical information and resources to support LMA fulfillment of maintenance responsibilities within the Mid SJR Region. Will generate regional benefits; may provide a model for other regions. The project would improve flood risk management; operations and maintenance; and institutional support. DWR could provide technical assistance or information sharing but not funding.	$ 100,000	$ -	Rural - Risk awareness, floodproofing and land use planning	Watershed and Floodplain Management

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321	RFMP	Lower San Joaquin Levee District	Rehabilitation of San Joaquin River Control Structure	Settlement has occurred at the San Joaquin River Control Structure, resulting in the wing walls separating from the structure. The wing wall backfill could be excavated and voids grouted under the spread footings, or spread footings could be added or enlarged to minimize further settlement. Depending on phasing and/or timing, the design could be coordinated with the SJRRP 2B project to allow incorporation of fish passage and/or habitat restoration elements within the project footprint. However, it is also possible that any improvements to the SJR Control Structure resulting from implementation of 2B would occur as a separate project	$ 340,000	$ 340,000	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
322	RFMP	San Joaquin County, City of Stockton	Repair Mormon Slough Bank	Mormon Slough has experienced bank erosion from several past flood events. Bank erosion in the vicinity of Escalon-Bellota Road remains a problem reach. This project aims to repair this reach of Mormon Slough along with preventative measures to mitigate future bank erosion throughout the Mormon Slough.	$ 13,500,000	$ 13,500,000	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
323	RFMP	San Joaquin County, City of Stockton	Replace Bridge on Bear Cr. (1.3 mi u/s of HW 99)		$ 600,000	$ 600,000	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
324	RFMP	San Joaquin County, City of Stockton	Replace Bridge on Mormon Slough (2 mi u/s of Diverting Canal)		$ 600,000	$ 600,000	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
325	RFMP	Reclamation District 1614, Smith Tract, Reclamation District 828, Weber Tract	Replace Wisconsin Pump Station	Storm water runoff within RD 1614 is collected and conveyed via an extensive network of inlets and pipes owned and operated by the City of Stockton and San Joaquin County. It is then ultimately discharged into the Calaveras River and Smith Canal by one of eleven storm drain pump stations owned and operated by RD 1614. RD 1614 is in the process of designing and obtaining funding for the replacement of one of these pump stations – the Wisconsin Pump Station. The replacement of the Wisconsin Pump Station is necessitated by two key factors. First, the current pumping capacity is not sufficient to provide protection against runoff from a 100-year storm event. Second, the existing pump station structure is severely antiquated and in danger of detrimental collapse. The District Engineer for RD 1614, Kjeldsen, Sinnock and Neudeck, Inc. (KSN), has completed much of the preliminary planning work for this project. The environmental assessment and CEQA compliance process has begun and is nearly finalized. Surveying, mapping, and utility research has also been performed, and a 30% design level of design drawings has been prepared. RD 1614 is currently actively pursuing various funding mechanisms to assist with financing the Wisconsin Pump Station Replacement Project. RD 1614 is cooperating with Stockton East WD to apply for a Storm water Flood Management Grant with DWR through its IRWM grant program. It is expected that this grant would provide for a 50% cost share. In order to procure its 50% local share, RD 1614 is also proceeding with a Proposition 218 measure in cooperation with the SJAFCA.	$ 2,400,000	$ 2,400,000	Urban - Other infrastructure and multi-benefit improvements	Operation and Maintenance
326	RFMP	Reclamation District 404	Resolve Levee Penetration Issues	Many levee penetrations need remediation, especially in areas north of Highway 4.	$ 2,000,000	$ -	Urban - Other infrastructure and multi-benefit improvements	Operation and Maintenance
327	RFMP	San Joaquin Area Flood Control Agency, San Joaquin County	Restore Mormon Channel	This project would divert up to 1,500 cfs to Mormon Channel via a weir at the head of the Stockton Diverting Canal, thereby reducing the flood flow in the Stockton Diverting Canal and the Lower Calaveras River below the Diverting Canal. This would reduce flooding potential of these systems and provide some resiliency to accommodate future climate change.	$ 50,000,000	$ -	Rural - Levee repair and infrastructure improvements	Flood Infrastructure

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#	Data Set Source	Lead Agency	Project Name	Project Description	Estimated Cost - Provided by Source	Estimated Cost - Adjusted for Portfolio	Area of Interest and Management Action Category	Management Action Type
328	RFMP	City of Patterson, Potential Project Partners: Stanislaus County, San Joaquin River Valley Coalition, River Partners, San Joaquin River Partnership, California Department of Boating and Waterways	Riverfront Park Project	Creation of a riverfront park, recreational trail, and enhanced habitat along the western bank of the San Joaquin River between Old Las Palmas Avenue and Eucalyptus Avenue.	$ 2,500,000	$ -	Urban - Other infrastructure and multi-benefit improvements	Natural Floodplain and Ecosystem Functions
329	BWFS	California Department of Water Resources	RM 52 Setback levee	In conjunction with the RD 17 element, DWR also studied a setback levee at San Joaquin RM 52 (at the confluence of the San Joaquin and Old rivers). The confluence of San Joaquin and Old rivers is a valuable ecological area, and the inclusion of a setback levee would provide wetland, riparian and SRA habitat, including 65 acres of inundated floodplain habitat. A setback levee at this location would also be less costly than a fix-in-place improvement of the existing levee at the same location. The existing south levee would be left intact to maintain the flow split between the San Joaquin River and Old River. • 0.6 mile of setback • 130 acres riparian and marsh habitat • 40 acres of inundated floodplain habitat	$ 6,000,000	$ 12,000,000	Urban - Other infrastructure and multi-benefit improvements	Flood Infrastructure
330	BWFS	California Department of Water Resources	RM 60-65 Setback Levee	This element of the San Joaquin BWFS would include an approximately 800 acre right bank San Joaquin River setback levee to achieve 50 year LOP and to address known levee seepage, stability, and geometry problems. Land in the setback area would stay in agricultural production but would be inundated more frequently through the purchase of flowage easements. This element was included in the State Recommended Plan because it would increase the LOP from 30 year to 50 year, provide limited stage reduction, reduce levee length and associated O&M and repair costs, provide ecosystem restoration benefits, and promote agricultural stewardship for similar costs to fix-in-place levee improvements.	$ 62,000,000	$ 62,600,000	Rural - Small-scale levee setbacks and floodplain storage	Flood Infrastructure
331	Other	California Department of Water Resources	Rural Agricultural Easements - Basic	Deleted ---- To be confirmed by DWR. Assumption $10,000 per acrea and 10,000 acres in each basin. Example project from San Joaquin BWFS.	$ 300,000,000	$ -	Rural - Land acquisitions and easements	Watershed and Floodplain Management
332	Other	California Department of Water Resources	Rural Agricultural Easements - Multi-benefit	Deleted ---- To be confirmed by DWR. Assumption $10,000 per acrea and 10,000 acres in each basin. Example project from San Joaquin BWFS.	$ 100,000,000	$ -	Rural - Land acquisitions and easements	Watershed and Floodplain Management
333	RFMP	City of Patterson, Potential Project Partners: Stanislaus County	Salado Creek Flood Management Project	Widening of Salado Creek from the Delta Mendota Canal to the city limits.	$ 600,000	$ 600,000	Urban - Other infrastructure and multi-benefit improvements	Flood Infrastructure

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334	RFMP	San Joaquin River Restoration Program	Salt Slough Barrier and Mud Slough Barrier	Construct fish screens / barriers at the Salt and Mud Sloughs to prevent fish straying.	$ -	$ -	Systemwide - State operations, planning and performance tracking	Natural Floodplain and Ecosystem Functions
335	RFMP	United States Fish and Wildlife Service	San Joaquin National Wildlife Refuge Expansion	The USFWS has proposed to expand the approved acquisition boundary of the San Joaquin River NWR and acquire up to 22,156 additional acres from willing sellers within the proposed expansion area. The purposes are to: 1) protect and restore a diversity of rare and native habitats and their associated populations of fish, wildlife, invertebrate, and plant species of the San Joaquin River; 2) protect, restore, and develop a diversity of habitats for migratory birds such as Neotropical songbirds, wading birds, and shorebirds; 3) protect and restore floodplain values and benefits associated with the San Joaquin River, including improved water quality, flood storage, and increased water recharge; 4) protect, restore, and develop habitats for and otherwise support recovery of federally and State listed endangered and threatened species and help prevent the listing of candidate species and species of management concern; and 5) provide high-quality opportunities for wildlife-dependent recreation.	$ 15,000,000	$ 15,000,000	Rural - Land acquisitions and easements	Watershed and Floodplain Management
336	RFMP	City of Firebaugh	San Joaquin River Bank Stabilization at Firebaugh	Just north of 13th Street (Firebaugh Blvd.) the San Joaquin River turns due west toward downtown Firebaugh. It then makes a sharp turn to the northwest and parallels the downtown area. In recent years a bank stabilization project was constructed at this turn that included sheet piling and rock filled wire cages. About 1/4-mile downstream of this project the river makes another sharp turn to the northeast near the intersection of 9th and Q Streets. The west bank at this turn is steep, unstable, and less than 50-feet away from several residences. A second bank stabilization system improvement with a similar configuration to the first is needed at this location. This project could include recreation and environmental enhancement components.	$ 1,800,000	$ 1,800,000	Small Community - Levee repair and infrastructure improvements	Operation and Maintenance
337	RFMP		San Joaquin River Basin Sediment Status and Dynamics Study	For the entire San Joaquin River basin, 1) conduct a multi-year monitoring program, 2) develop a reach-based sediment budget and conceptual model of sediment processes, and then 3) develop one or more sediment transport models and analyze transport processes to develop sediment management recommendations at a basin-wide scale. $2.5 - 5 million for Phase 1, assuming a 5-year monitoring effort and analysis of monitoring conducted in Years 1 and 5.	$ 5,000,000	$ 5,000,000	Rural - Studies and analysis	Watershed and Floodplain Management
338	RFMP	River Partners and San Joaquin Parkway, Conservation Trust	San Joaquin River Invasive Species Management	Map, treat, and monitor populations of invasive weeds within the channel and floodplain of the San Joaquin River between Friant Dam and the Merced River confluence.	$ 2,800,000	$ 2,800,000	Rural - Risk awareness, floodproofing and land use planning	Watershed and Floodplain Management
339	RFMP	City of Firebaugh	San Joaquin River Levee at Firebaugh Rodeo Grounds	One of Firebaugh's water treatment plants is located south of the 13th Street (Firebaugh Blvd.) bridge that crosses the San Joaquin River. The City's rodeo grounds and a park area are located north of the bridge. Flood flows in the river have inundated the rodeo grounds and threatened the treatment plant in recent years. Constructing an earthen levee between the river and the facilities would protect them from future flooding. Undeveloped space along the upper flood plain of the river is available for the proposed levee. This project could include recreation and environmental enhancement components.	$ 1,450,000	$ -	Small Community - Levee repair and infrastructure improvements	Operation and Maintenance
340	RFMP	City of Firebaugh	San Joaquin River Levee at Firebaugh Waste Water Treatment Plant	The City of Firebaugh's waste water treatment plant is located near the west bank of the San Joaquin River at the south end of Firebaugh. Flood flows in the river have threatened the treatment plant in recent years. Constructing an earthen levee between the river and the treatment plant would protect it against future flooding. Undeveloped space along the upper flood plain of the river is available for the proposed levee. Untreated effluents from the City of Firebaugh's waste water treatment plant would threaten the water quality of the San Joaquin River in case of catastrophic flooding in the area. This project could include recreation and environmental enhancement components.	$ 1,280,000	$ -	Small Community - Levee repair and infrastructure improvements	Operation and Maintenance

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341	RFMP		San Joaquin River National Wildlife Refuge - Proposed Expansion	The United States Fish and Wildlife Service (USFWS) is considering expanding the San Joaquin River National Wildlife Refuge in two sections to restore and enhance habitat to benefit birds migrating along the Pacific Flyway and many other wildlife species that may be compatible or complementary with flood conveyance and transient floodwater storage on floodplains in the Mid San Joaquin River region.	$ -	$ -	Rural - Habitat restoration/reconnection	Natural Floodplain and Ecosystem Functions
342	RFMP	San Luis National Wildlife Refuge	San Luis NWR East Bear Creek Unit - Enhance existing wetland depth and configuration to provide additional habitat and flood water storage on approximately 500 acres of wetland basins	A portion of the existing restored wetlands in the East Bear Creek Unit, which currently comprise some 1000 acres, could be enhanced by deepening, expanding, and reconfiguring the current wetland acreage. This work would increase the capability of the unit for transitory floodwater storage while improving the wetlands for wildlife. This project would identify several options to achieve these objectives and fully develop and implement those options most feasible and efficient to meet the desired objectives.	$ 1,150,000	$ 1,150,000	Rural - Levee repair and infrastructure improvements	Flood Infrastructure
343	RFMP	San Luis National Wildlife Refuge	San Luis NWR East Bear Creek Unit - Install lift pumps to divert water onto 1000 acres of wetland basins during flood flows	The East Bear Creek Unit has a pumping plant on Bear Creek that is used to flood approximately 1000 acres of managed wetlands when the water level elevation of Bear Creek is between 66 feet and 83 feet. The pumping plant is equipped with four 125 horse power lift pumps and until water level elevation 83 is reached the pumping plant can divert up to 120-acre feet per day of floodwater into managed wetlands and floodplain. When water level elevation exceeds 83 feet (a common condition during flood events) the pumping plant intake alarm goes off and the pumping plant is shut down and becomes inoperable. Once water level elevation 83 is exceeded the following options could be implemented to divert water onto the unit (which is bounded by levees on all sides but does have frequent intake/discharge points). a) Install a lift pump (125 hp pump capable of diverting 30 ac/ft. per day) just northeast of the pumping plant on Bear Creek and build a short pipeline to connect with the existing two mile long pipeline utilized by the pumping plant. This would enable refuge staff to continue diversions into the East Bear Creek Unit throughout a flood event regardless of water level elevation. Electrical power is available at the site. b) Install a lift pump (125 hp pump capable of diverting 30 ac/ft. per day) at an existing but now defunct diversion point on the San Joaquin River and build a short pipeline to connect with the terminus of the existing two mile pipeline. The station could also	$ 1,260,000	$ 1,260,000	Rural - Levee repair and infrastructure improvements	Flood Infrastructure
344	RFMP	San Luis National Wildlife Refuge	San Luis NWR East Bear Creek Unit - Restore a wetland swale to divert floodwaters onto 1000 acres of wetland basins during flood flows	Utilize an existing pipe and screw-gate on the flood control levee east of the Fish and Wildlife Service (FWS) pumping station to divert floodwaters. Construct a wide swale leading from the levee to an existing refuge ditch to convey water to the restored floodplain swales and basins extending across the East Bear Creek Unit.	$ 340,000	$ 340,000	Rural - Levee repair and infrastructure improvements	Flood Infrastructure
345	RFMP	San Luis National Wildlife Refuge	San Luis NWR Freitas Unit – restore anabranches of Salt Slough	During flood events, water from the San Joaquin River backs up into and raises the level of Salt Slough. Numerous anabranches extend out of Salt Slough and have potential to spread water westward out into the Freitas floodplain. However the capacity for this is limited because most of the anabranches are silted in at their confluences with Salt Slough. Silt removal could be implemented to lower the channel grades back to level that would more readily accept high water from Salt Slough. Floodwaters would be spread out into floodplain basins and swales west of Hwy 165. The large double and triple box culvert crossings under the highway should readily accommodate any flows through the anabranch channels. Hwy 165 built before flood control levee constructed. Restoring the channel grades may protect Hwy 165 better than the existing condition because floodwaters would be conveyed west of the highway as waters were rising rather than waiting until the floodwaters overtopped the Salt Slough main channel and caused much higher water levels to advance upon the highway.	$ 50,000	$ 50,000	Rural - Levee repair and infrastructure improvements	Flood Infrastructure

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346	RFMP	San Luis National Wildlife Refuge	San Luis NWR West Bear Creek Unit - Restore wetland slough channel connectivity with the San Joaquin River to accommodate flood flows	This project seeks to enhance an existing location where a pipe and screwgate already permit the diversion of flood flows from the San Joaquin River into a water delivery canal that provides water to some 3,500 acres of wetlands. This project would enhance the size of the structures both leading into and exiting this canal at a location that would allow the diversion of water into a naturally existing floodwater basin that is currently cutoff from the San Joaquin River. This project likely would require increasing the size and armoring some four existing water control structures to accommodate the increased water capacity at these four locations.	$ 354,000	$ 354,000	Rural - Levee repair and infrastructure improvements	Flood Infrastructure
347	RFMP	Lower San Joaquin Levee District	Sand Slough Control Structure Removal	Removal of the Sand Slough Control Structure to improve fish passage and increase flow capacity.	$ 290,000	$ 290,000	Rural - Levee repair and infrastructure improvements	Flood Infrastructure
348	RFMP	River Partners, Potential Project Partners: California Department of Water Resources; Central Valley Flood Protection Board; flood management agencies relevant to the Upper SJR RFMP and Lower SJR/Delta South RFMP	Sediment Management Investigation	Complete a study that identifies sediment-induced chokepoints along the San Joaquin River in the planning area, the dynamics that create them, and potential actions to improve flood conveyance in those areas.	$ 250,000	$ 250,000	Rural - Studies and analysis	Watershed and Floodplain Management
349	RFMP	Lower San Joaquin Levee District	Sediment Removal Chowchilla Canal Bypass Control Structure	Remove sediment upstream from the Chowchilla Canal Bypass Control Structure. As part of this project, opportunities for riparian and wetland habitat enhancements will be considered.	$ 175,000	$ 175,000	Systemwide - Routine maintenance	Operation and Maintenance
350	RFMP	San Joaquin River Restoration Program	Sediment Removal in Reach 4A and Eastside Bypass	Reclamation is pursuing sand removal on the Merced National Wildlife Refuge to improve conveyance capacity in the Eastside Bypass at and downstream of El Nido Road. Permitting is underway and sand is expected to be removed by 2015.	$ -	$ -	Systemwide - Routine maintenance	Operation and Maintenance
351	BWFS	California Department of Water Resources	Sediment Removal in Subsidence Area	Sediment deposition would continue to reduce capacity in the Middle Eastside Bypass. Sediment transport analysis conducted under the SJRRP indicated that the Upper Eastside Bypass and Reach 4A contributed almost 2,000,000 and 540,000 tons in 1983 and 1997, respectively, to the upper two-thirds of the Middle Eastside Bypass. Based on sediment transport analysis, it is currently estimated that 120,000 cubic yards (89,000 tons) of sediment will be deposited in the upper two-thirds of the reach annually (assuming no future subsidence). Annual sediment removal is estimated at $0.6 million per year assuming a cost of $5 per cubic yard. Future subsidence would likely exacerbate sediment deposition in the reach, due to decreasing channel slopes, and make these costs greater. Initial grading and sediment removal costs would be covered by a potential SJRRP Reach 4B Alternative 2 project, which would be in addition to the annual sediment removal cost. DWR would consider sediment management along with levee improvements and flowage easements to address subsidence in the vicinity of the Eastside Bypass.	$ 18,000,000	$ 18,000,000	Systemwide - Routine maintenance	Operation and Maintenance
352	RFMP	Lower San Joaquin Levee District	Sediment Removal in the Eastside Bypass	Sediment removal in the Eastside Bypass to restore channel design capacity .	$ 12,850,000	$ 12,850,000	Systemwide - Routine maintenance	Operation and Maintenance

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353	RFMP	Lone Tree Mutual Water Company	Siphon Extension near Chamberlain Road	Lone Tree Mutual Water Company has an existing irrigation ditch that crosses the East Side Bypass 1/2-mile south of Chamberlain Road. There are existing culverts under the Eastside Bypass levees and an existing siphon under the pilot channel of the Bypass, but there is open ditch within the Bypass channel between the levees and the pilot channel. High flows in the Bypass are impeded by the ditch banks and the ditch must be cleaned and maintained following flood flows. Extending the siphon so it is continuous across the entire Bypass channel would improve flood operations, reduce maintenance and bring the siphon up to current flood system standards.	$ 700,000	$ 700,000	Rural - Levee repair and infrastructure improvements	Flood Infrastructure
354	RFMP	San Joaquin River Restoration Program	SJRRP Seepage Management Projects	Existing SJRRP seepage management options include actions that could benefit flood management in the region, including levee improvements, drainage improvements, conveyance improvements, and property acquisition. These actions are being evaluated throughout the San Joaquin River and Eastside Bypass. Continuing coordination with Reclamation on seepage management strategies may result in identification of potentially-compatible flood projects that can be coordinated with the USJR RFMP (such as the Firebaugh Flood Protection / Habitat Project).	$ 185,000,000	$ -	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
355	USACE	City of Stockton	Smith Canal Gate	The proposed project will construct a gate structure at the mouth of Smith Canal along the San Joaquin River/Stockton Ship Channel in Stockton. The gate structure will be operated to control back-flooding from the San Joaquin River and Delta during winter months (November 1st to April 30th) when high river flows and stages typically occur in the Smith Canal area.	$ 36,000,000	$ -	Urban - Other infrastructure and multi-benefit improvements	Flood Infrastructure
356	Other	California Department of Water Resources	State Operation in Support of 30-year Implementation	Activities and costs associated with State Operations for implementation of a 30 year program.	$ -	$ 180,000,000	Systemwide - State operations, planning and performance tracking	Policy and Regulations
357	Other	California Department of Water Resources	State Policy, Planning, and Performance Tracking	Activities and costs associated with State Policy, Planning and Performance tracking.	$ -	$ 250,000,000	Systemwide - State operations, planning and performance tracking	Policy and Regulations
358	BWFS	California Department of Water Resources	Stevinson Transitory Storage	Promoting transitory storage concept as a key opportunity for State interest in the SJ Basin strikes the right balance of acknowledging environmental interests/goals while avoiding local agency/agricultural/land owner concern over unsupported, site-specific transitory storage.	$ -	$ -	Systemwide - Reservoir and floodplain storage	Reservoir and Floodplain Storage and Operation
359	USACE	California Department of Water Resources	Stockton Levee Improvements (BWFS Option C)	Levee improvements and floodwalls would be included in the Stockton urban area for a 200 year event that accounts for future climate change and sea-level rise. Closure structures in Stockton at the mouth of Smith Canal, 14 Mile Slough, and Mosher Slough are also included to prevent Delta backwater flooding. These improvements are included in the State Recommended Plan because they are very effective at reducing flood damages and life loss for large flood events in a major urban area that has the highest flood risk in the San Joaquin River Basin. These improvements also would not induce future growth because much of Stockton already has been developed.	$ 252,000,000	$ -	Urban - Levee improvements	Flood Infrastructure
360	RFMP	Stanislaus County	Stokman Multi-benefit Floodplain Project	This property would provide wildlife habitat enhancement and restoration, improved flood management for the adjacent community of Grayson, improved groundwater recharge potential, and improved water quality in the Mid San Joaquin River. In February, 2016, River Partners received funding from the Wildlife Conservation Board (WCB) to purchase this 285-acre property within the San Joaquin River floodplain from a private seller. Acquisition is expected to be complete by the end of Summer 2016. This project is unique in that it has been specifically identified by Stanislaus County as a prime location for groundwater recharge potential. Following restoration of this property, 5-acre feet of groundwater will be returned to the San Joaquin River Watershed, as it will no longer be pumped for irrigation purposes. Additional groundwater recharge from floodwater inundation may also result from the project. Additionally, this project is located within a disadvantaged community block group and disadvantaged community tract as identified by DWR in coordination with Proposition 1 and Proposition 84. Project benefits will enhance this area ecologically, recreationally, and in terms of flood safety and groundwater recharge.	$ 2,000,000	$ 2,000,000	Small Community - Levee setbacks, land acquisitions and habitat restoration	Natural Floodplain and Ecosystem Functions

Table B-5. San Joaquin Basin Management Actions Included within the 2017 Refined SSIA Portfolio

#	Data Set Source	Lead Agency	Project Name	Project Description	Estimated Cost - Provided by Source	Estimated Cost - Adjusted for Portfolio	Area of Interest and Management Action Category	Management Action Type
361	RFMP	City of Patterson	Storm Drainage Enhancements along Salado Creek	Installation of reinforced concrete pipelines under the California Northern Railroad wooden bridge to improve storm drainage along Salado Creek.	$ 880,000	$ 880,000	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
362	USACE	San Joaquin County, City of Stockton	Study of Bear Creek aand portions of Calaveras River System, including Stockton Diverting Canal 200-year protection	The purpose of this addendum is to add a potential project that was not identified in Appendix C of the Lower San Joaquin River and Delta South Regional Flood Management Plan (LSJR-DS RFMP) dated November 2014. This addendum seeks to address an area of concern involving the Bear Creek levee system and portions of Calaveras River levee system, including Stockton Diverting Canal, which provide flood protection for the City of Stockton. Substantial time has passed since the publication of the LSJR-DS RFMP. Due to the fact that the levee systems of concern were removed from the Lower San Joaquin River Feasibility Study by the U.S. Army Corps of Engineers, for a number of Corps policy reasons, a study is necessary to determine the level of improvement needed to reach ULDC and SB5 requirements because these systems are critical to providing flood protection for the City of Stockton.	$ 400,000	$ 400,000	Urban - Studies and analysis	Watershed and Floodplain Management
363	RFMP	Lower San Joaquin River LMAs	Study Reservoir Storage Improvements	One possible measure to reduce peak flows in the lower San Joaquin River would be to increase physical storage in upstream reservoirs. This could be coupled with coordinated- and forecast-based operation of flood control reservoirs. DWR's Enhance Flood System Capacity approach in the CVFPP estimated that about 400,000 acre-feet of new flood storage would be required to effectively manage the 100-year (1% annual chance) flood. Investigations should evaluate smaller and larger storage volumes with an eye to increasing flood system resiliency to better accommodate climate change.	$ 2,000,000	$ 2,000,000	Systemwide - State operations, planning and performance tracking	Watershed and Floodplain Management
364	BWFS	California Department of Water Resources	Subsidence Area Transitory Storage/Eastside Bypass	Provides flexibility for a variety of the most cost-effective management actions to address subsidence. 0.5 ft stage reduction for 2 miles, 0.3 ft for 9 miles more (100-year event)	$ 42,000,000	$ -	Systemwide - Reservoir and floodplain storage	Reservoir and Floodplain Storage and Operation
365	RFMP	3F Group (Trout Unlimited, Ducks Unlimited, and American Rivers)	Sunrise Ranch Study	Owned and operated by Grissom Family Land & Cattle, the Ranch is situated on 1,750 acres with the East Side Canal passing through on the westerly portion. Currently, the entire property is managed for cattle grazing and waterfowl habitat, including seasonal and semi-permanent wetlands and grassland uplands. The landowner maintains a low-pressure grazing program to promote excellent grass growth in future years. Ducks Unlimited is currently working on a wetland restoration project with the landowner to restore wetland topography and hydrology. The system improvement consists of improvements to the connection of the wetlands to the adjacent waterways for the purpose of providing flood attenuation, juvenile salmonid rearing, groundwater recharge, more stable wetlands, and recreation.	$ 100,000	$ 100,000	Rural - Studies and analysis	Watershed and Floodplain Management
366	BWFS	California Department of Water Resources	Systemwide Transitory Storage (RD 2063, Bear Creek/San Luis, Owens Creek, Mariposa, Eastside Bypass, Chowchilla Bypass,)	DWR identified potential floodplain transitory storage elements to divert flood flows to adjacent offstream storage areas to evaluate floodplain transitory storage as a potential system element in the San Joaquin Basin. The objective of transitory floodplain storage is to attenuate and reduce downstream peak stages, create valuable ecosystem habitat, and/or promote flood-compatible land uses. Specific areas were evaluated based on existing land use; potential for hydraulic benefit; existing topography constraints; and proximity to major infrastructure, permanent crops, or urban areas. Approximately 120,000 acre-feet of transitory floodplain storage was formulated and evaluated at eight locations spread throughout the San Joaquin Basin. 50-year 0.9 ft stage reduction at SJR at Firebaugh 0.8 ft stage reduction at SJR at Merced River Confluence 1.4 ft stage reduction at SJR at Tuolumne Confluence 1.9 ft stage reduction at SJR at Stanislaus Confluence 100-year 0.03 ft stage increase at SJR at Firebaugh 0.8 ft stage reduction at SJR at Merced River Confluence 0.7 ft stage reduction at SJR at Tuolumne Confluence 0.8 ft stage reduction at SJR at Stanislaus Confluence (with ecosystem restoration on 60,000 acres)	$ 2,300,000,000	$ -	Systemwide - Reservoir and floodplain storage	Reservoir and Floodplain Storage and Operation

Table B-5. San Joaquin Basin Management Actions Included within the 2017 Refined SSIA Portfolio

#	Data Set Source	Lead Agency	Project Name	Project Description	Estimated Cost - Provided by Source	Estimated Cost - Adjusted for Portfolio	Area of Interest and Management Action Category	Management Action Type
367	BWFS	California Department of Water Resources	Temperance Flat Dam	< 0.4 ft stage reduction (mostly <0.2) throughout SJR and Eastside Bypass (from 50-year to 200-year+CC). Assume 100 TAF of new flood storage.	$ 200,000,000	$ -	Systemwide - Reservoir and floodplain storage	Reservoir and Floodplain Storage and Operation
368	RFMP	San Joaquin River National Wildlife Refuge Potential Project Partners: River Partners, United States Fish and Wildlife Service Anadromous Fish Restoration Program, United States Army Corp of Engineers, early project partners - USDA/Natural Resources	Three Amigos (also known as the Non-structural Alternative at the San Joaquin River National Wildlife Refuge)	Project to restore flooding and transient floodwater storage to more than 3,100 acres of historic floodplain, restore riparian habitats, and promote river physical processes of scour and deposition along 3 miles of the San Joaquin River. While the lands have been purchased, additional investment is needed to implement flood risk reduction goals consistent with the Refuge's habitat management goals. Needed efforts include planning and design of the Refuge for flood management as well as removal of levees from the federal project.	$ 5,500,000	$ -	Systemwide - Reservoir and floodplain storage	Reservoir and Floodplain Storage and Operation
369	BWFS	California Department of Water Resources	Three Amigos Transitory Storage	Project to restore flooding and transient floodwater storage to more than 3,100 acres of historic floodplain, restore riparian habitats, and promote river physical processes of scour and deposition along 3 miles of the San Joaquin River. BWFS analysis showed this does not have system-scale hydraulic effects but provides significant ecosystem restoration benefit. The levee breaching option of Three Amigos transitory storage was included in the State Recommended Plan because this element would enhance more than 2,000 acres of habitat and provide more than 150 additional acres of riparian and marsh habitat in the San Joaquin National Wildlife Refuge at low cost.	$ 5,700,000	$ 2,800,000	Systemwide - Reservoir and floodplain storage	Reservoir and Floodplain Storage and Operation
370	RFMP	3F Group (Trout Unlimited, Ducks Unlimited, and American Rivers)	Three Rivers Ranch Study	The Ranch is situated on 205 acres directly adjacent to the Eastside bypass on the west side, Owen's Creek on the north, and the East Side Canal on the other. Currently, the entire property is managed for waterfowl habitat and includes seasonal and semi-permanent wetlands, riparian habitat and grassland, and shrub/scrub uplands. Water is supplied to the wetlands either from the East Side Canal, which then must be lifted, or from a deep well that flows approximately 2,000 gallons per minute (GPM). The landowner is continually working to restore native habitats on the property and allows limited waterfowl hunting during the hunting season. The system improvement consists of improvements to the connection of the wetlands to the adjacent waterways for the purpose of providing flood attenuation, juvenile salmonid rearing, groundwater recharge, more stable wetlands, and recreation.	$ 100,000	$ 100,000	Rural - Studies and analysis	Watershed and Floodplain Management
371	RFMP	Stanislaus County, Potential Project Partners: City of Modesto; United States Army Corp of Engineers	Tuolumne River Flood Management Feasibility Study	Complete a USACE Feasibility Study, or a study similar in scope, that evaluates how the management of the Tuolumne River could be revised to improve flood control, enhance aquatic habitat, and improve water quality.	$ 3,000,000	$ 3,000,000	Rural - Studies and analysis	Watershed and Floodplain Management

Table B-5. San Joaquin Basin Management Actions Included within the 2017 Refined SSIA Portfolio

#	Data Set Source	Lead Agency	Project Name	Project Description	Estimated Cost - Provided by Source	Estimated Cost - Adjusted for Portfolio	Area of Interest and Management Action Category	Management Action Type
372	RFMP	Tuolumne River Regional Park Joint Powers Authority, Potential Project Partners: City of Modesto; City of Ceres; Stanislaus County; Tuolumne River Trust	Tuolumne River Regional Park – Carpenter Road/West Modesto Flood Management and Park Development	Help reduce flood damages in West Modesto neighborhoods while developing the adjacent Tuolumne River Regional Park.	$ 750,000	$ 750,000	Urban - Risk awareness, floodproofing and land use planning	Watershed and Floodplain Management
373	RFMP	Tuolumne River Regional Park Joint Powers Authority, Potential Project Partners: City of Modesto; City of Ceres; Stanislaus County; Tuolumne River Trust	Tuolumne River Regional Parkway	Continued development of the undeveloped areas of the Tuolumne River Regional Park including the Gateway Parcel.	$ 60,000,000	$ 60,000,000	Urban - Risk awareness, floodproofing and land use planning	Watershed and Floodplain Management
374	RFMP	Lower San Joaquin Levee District	Update San Joaquin River Flood Control Project Operations and Maintenance Manual	Update the existing San Joaquin River Flood Control Project Operations and Maintenance Manual for Levees, Irrigation and Drainage Structures, Channels, and Miscellaneous Facilities that was prepared in 1967. This update will require hydraulic modeling and will include significant USACE, Central Valley Flood Protection Board, and Department of Water Resources coordination.	$ 500,000	$ 500,000	Systemwide - Routine maintenance	Operation and Maintenance
375	RFMP	City of Merced	Update Stormwater Design Standards for the City and Region	Update the design standards for stormwater for the Merced region.	$ 80,000	$ 80,000	Systemwide - State operations, planning and performance tracking	Policy and Regulations
376	Other	California Department of Water Resources	Upper San Joaquin River - Small Community Levee O&M	Levee O&M costs were separated between urban and rural LMAs to capture the additional costs associated with urban area LMAs. Levee O&M included the following activities: vegetation maintenance, rodent control, encroachment and pipe maintenance, minor repairs (erosion, levee crown repairs etc.)	$ 873,200	$ 873,200	Systemwide - Routine maintenance	Operation and Maintenance
377	Other	California Department of Water Resources	Upper San Joaquin River - Channel RR&R - Arrundo Removal	Regional input indicated giant reed removal cost at $25,000/acre.	$ 8,820,199	$ 8,820,199	Systemwide - Routine maintenance	Operation and Maintenance
378	Other	California Department of Water Resources	Upper San Joaquin River - Channel Sediment Removal	Channel maintenance activities including sediment, vegetation, and debris removal are conducted by DWR with respect to the Sacramento River Flood Control Project and generally by LMAs in the San Joaquin Valley. Estimated costs for the Sacramento Basin were developed by using historical projects overseen by DWR, which have occurred as funding has been available, as well as input from regional experts. Estimated costs for the San Joaquin Basin were based on direct interviews with LMAs and staff.	$ 3,062,569	$ 3,062,569	Systemwide - Routine maintenance	Operation and Maintenance
379	Other	California Department of Water Resources	Upper San Joaquin River - Channel Vegetation and Debris Removal	Channel maintenance activities including sediment, vegetation, and debris removal are conducted by DWR with respect to the Sacramento River Flood Control Project and generally by LMAs in the San Joaquin Valley. Estimated costs for the Sacramento Basin were developed by using historical projects overseen by DWR, which have occurred as funding has been available, as well as input from regional experts. Estimated costs for the San Joaquin Basin were based on direct interviews with LMAs and staff.	$ 5,880,132	$ 5,880,132	Systemwide - Routine maintenance	Operation and Maintenance
380	Other	California Department of Water Resources	Upper San Joaquin River - Large Structure O&M	Major structures involve those facilities described in CWC Section 8361 and administered by DWR, and include weirs, bypass outflow control structures, outfall gate facilities, and large regional pumping plants.	$ 1,001,583	$ 1,001,583	Systemwide - Routine maintenance	Operation and Maintenance

Table B-5. San Joaquin Basin Management Actions Included within the 2017 Refined SSIA Portfolio

#	Data Set Source	Lead Agency	Project Name	Project Description	Estimated Cost - Provided by Source	Estimated Cost - Adjusted for Portfolio	Area of Interest and Management Action Category	Management Action Type
381	Other	California Department of Water Resources	Upper San Joaquin River - Large Structures RR&R	Based on discussions with DWR and LMA staff, major structures have historically been repaired and well maintained, and there is not an immediate need to repair, replace, or rehabilitate these facilities. As such, RR&R costs were not identified for this TM given major structures were assumed not to require significant repairs over the next 50 years. However, it is recommended that funding reserves be established to ensure adequate funding is available in the future to continue needed repairs or to replace aged facilities.	$ -	$ -	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
382	Other	California Department of Water Resources	Upper San Joaquin River - Non-urban Levee O&M (Rural)	Levee O&M costs were separated between urban and rural LMAs to capture the additional costs associated with urban area LMAs. Levee O&M included the following activities: vegetation maintenance, rodent control, encroachment and pipe maintenance, minor repairs (erosion, levee crown repairs etc.)	$ 236,960,516	$ 236,960,516	Systemwide - Routine maintenance	Operation and Maintenance
383	Other	California Department of Water Resources	Upper San Joaquin River - Non-urban Levee RR&R (Rural)	Levee-related RR&R costs have generally been driven by necessary flood-event repairs and known erosion or levee stability issues. The OMRR&R Work Group determined the Delta Subventions Program data set is the most robust data set for estimating RR&R cost on SPFC levees because the existence of the funding program has encouraged more regular analysis and repair of levees. Although urban levees are being improved to a higher standard to meet urban level of protection standards, the OMRR&R Work Group determined that repair and rehabilitation costs for urban and non-urban levees would not differ substantially, and the cost for ULDC compliance would be the only significant differentiating factor for RR&R of urban SPFC levees.	$ 93,348,082	$ 93,348,082	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
384	Other	California Department of Water Resources	Upper San Joaquin River - Small Community Levee RR&R	Levee-related RR&R costs have generally been driven by necessary flood-event repairs and known erosion or levee stability issues. The OMRR&R Work Group determined the Delta Subventions Program data set is the most robust data set for estimating RR&R cost on SPFC levees because the existence of the funding program has encouraged more regular analysis and repair of levees. Although urban levees are being improved to a higher standard to meet urban level of protection standards, the OMRR&R Work Group determined that repair and rehabilitation costs for urban and non-urban levees would not differ substantially, and the cost for ULDC compliance would be the only significant differentiating factor for RR&R of urban SPFC levees.	$ 343,988	$ 343,988	Small Community - Levee repair and infrastructure improvements	Operation and Maintenance
385	Other	California Department of Water Resources	Upper San Joaquin River - Small Structures O&M	Minor structures include stop log or gated closure structures, pumping plants, monitoring wells and piezometers, retaining walls and floodwalls, pipe penetrations, and encroachments. Routine O&M of these types of structures is critical, but often overlooked for budgeting purposes. As became evident in the LMA data received, LMAs typically only account for routine power costs for pumping plants and do not separately account for other activities associated with minor structures such as video inspections of pipes, lubrication and minor repairs of pipe closure valves, routine inspection and maintenance of closure structure gates or stop logs, and inspection and minor repairs of floodwalls. The OMRR&R Work Group determined that costs for minor-structure O&M are likely included in the general overhead expenses for the LMAs who have structures, and no further estimates were developed. However, it is anticipated that video inspections of pipes will be required in the future (once every 5 years) for pipes crossing SPFC levees and as such these projected costs were included in the overall estimates.	$ 2,555,898	$ 2,555,898	Systemwide - Routine maintenance	Operation and Maintenance
386	Other	California Department of Water Resources	Upper San Joaquin River - Small Structures RR&R	Small structures such as stop logs or gated closure structures, monitoring wells and piezometers, retaining walls and floodwalls, pipes, and encroachments are typically accounted for in levee RR&R costs, except for pipes. Many of these pipes were installed before or during original project construction prior to the 1950s, but no plans were implemented to assure these facilities could be replaced when they exceed their useful life. As a result, many pipes have reached their useful life with many of these structures in need of repair, replacement, or proper pipe abandonment.	$ 55,665,253	$ 55,665,253	Rural - Levee repair and infrastructure improvements	Operation and Maintenance
387	Other	California Department of Water Resources	Upper San Joaquin River - Urban Levee O&M	Levee O&M costs were separated between urban and rural LMAs to capture the additional costs associated with urban area LMAs. Levee O&M included the following activities: vegetation maintenance, rodent control, encroachment and pipe maintenance, minor repairs (erosion, levee crown repairs etc.)	$ 1,666,038	$ 1,666,038	Systemwide - Routine maintenance	Operation and Maintenance

Table B-5. San Joaquin Basin Management Actions Included within the 2017 Refined SSIA Portfolio

#	Data Set Source	Lead Agency	Project Name	Project Description	Estimated Cost - Provided by Source	Estimated Cost - Adjusted for Portfolio	Area of Interest and Management Action Category	Management Action Type
388	Other	California Department of Water Resources	Upper San Joaquin River - Urban Levee RR&R	Levee-related RR&R costs have generally been driven by necessary flood-event repairs and known erosion or levee stability issues. The OMRR&R Work Group determined the Delta Subventions Program data set is the most robust data set for estimating RR&R cost on SPFC levees because the existence of the funding program has encouraged more regular analysis and repair of levees. Although urban levees are being improved to a higher standard to meet urban level of protection standards, the OMRR&R Work Group determined that repair and rehabilitation costs for urban and non-urban levees would not differ substantially, and the cost for ULDC compliance would be the only significant differentiating factor for RR&R of urban SPFC levees.	$ 599,774	$ 599,774	Urban - Other infrastructure and multi-benefit improvements	Operation and Maintenance
389	RFMP	Lower San Joaquin Levee District	Upper San Joaquin Sediment Study	Develop a sediment study in USJR region that identifies upstream sources of sediment as well as regional mitigation efforts.	$ 100,000	$ 100,000	Rural - Studies and analysis	Watershed and Floodplain Management
390	USACE	California Department of Water Resources	Urban Levee Improvements	All urban levee improvements and associated cost estimates provided by USACE.	$ -	$ 1,000,000,000	Urban - Levee improvements	Flood Infrastructure
391	RFMP	Reclamation District 17, DWR, USACE	Walthall Levee Extension	Project will be combined with SJ_038, Levee Improvements to 200-year ULOP. This levee protects the District in the event of levee failures along the right bank of the San Joaquin River, upstream (south) of the District. The current levee is susceptible to being flanked during a flood event upstream of the District. Extending this levee easterly will help protect the District from future flood events entering from RD 2094.	$ 18,000,000	$ 18,000,000	Rural - Levee repair and infrastructure improvements	Flood Infrastructure
392	RFMP	City of Mendota	Wastewater Treatment Plant Flood Levee in City of Mendota	The City's wastewater treatment facility is located west of the Mendota Pool, separated from the waterway by a single parcel of farmland owned by another party. The plant is a series of open lagoons. Any inundation by the Mendota Pool would result not only in loss of wastewater treatment for the City of Mendota, but in flushing wastewater into the San Joaquin River. The plan itself has no outlet. Discharge is by percolation and evaporation only. The total volume of the wastewater lagoons on site is approximately 250 million gallons.	$ 10,885,000	$ 10,885,000	Urban - Levee improvements	Flood Infrastructure
393	USACE	City of Stockton	Wastewater Treatment Plant Floodwall	Included in USACE	$ 1,500,000	$ -	Urban - Levee improvements	Flood Infrastructure
394	RFMP	Red Top and Washington Ave Area Growers	Western Madera and Merced County Subsidence Solution	The Red Top Area Joint Banking project would consist of a combined banking and overdraft correction program in the Red Top/El Nido (Washington Avenue) areas east of the San Joaquin River in an effort to reduce pumping groundwater from below the Corcoran Clay. Significant subsidence has been observed lately in this area. Red Top area growers are planning to develop 720 acres of recharge ponds, 30 new shallow water wells, and surface water distribution to 26,000 acres of lands currently irrigated with well water. The recharge areas could be expanded and if flood flows occur before vine or tree budding, larger cropped areas could be flooded. Based on current projections the 720 acres of ponds can provide capacity to absorb about 180 cfs off the flood system. Over three months that adds up to 32,400 AF. Potential rehabilitation of existing and construction of new turnouts from the San Joaquin River flood system will be considered along with direct pipelines to the recharge sites. The water source could be from the Fresno and Chowchilla River systems, SJR flood flows, Kings River flood flows, which are limited to a few months in wet years. Also, the SJRECWA and/or Friant. Contractors could sell water to the growers directly. For the El Nido/Washington Ave. area, the projects would consist of detention reservoirs scattered throughout the area north of Highway 152 to enable transitory storage, thereby extending the availability of surface water by a month for use by growers. This reduces groundwater pumping which will help reduce subsidence. Additional turnouts from the Eastside By-pass and potential extensions of local irrigation systems to the area are under evaluation. Adding tile drains to the reservoirs with connections to the aquifer below the Corcoran clay would also be evaluated	$ 19,600,000	$ 19,600,000	Rural - Levee repair and infrastructure improvements	Flood Infrastructure

Table B-5. San Joaquin Basin Management Actions Included within the 2017 Refined SSIA Portfolio

#	Data Set Source	Lead Agency	Project Name	Project Description	Estimated Cost - Provided by Source	Estimated Cost - Adjusted for Portfolio	Area of Interest and Management Action Category	Management Action Type
395	BWFS	California Department of Water Resources	Western Madera and Merced County Subsidence Solution	This element of the San Joaquin BWFS includes a groundwater banking project in the Red Top/El Nido areas east of the San Joaquin River and along the Eastside Bypass. This element would reduce groundwater overdraft, and help reduce subsidence in the region by developing 720 acres of recharge ponds that could absorb about 180 cfs of flows diverted from the flood system. Potential rehabilitation of existing turnouts from the San Joaquin River flood system would be considered along with direct pipelines to the recharge ponds. Flood flow diversions could potentially be from existing local river systems, and other sources could be San Joaquin and Kings rivers flood flows in wet years. The project could include the acquisition of additional surface water supplies to reduce the imbalance between supplies and demands in the region. Diverted surface water could be made directly available to growers as an alternative to pumping groundwater, which would in turn help reduce subsidence through in-lieu recharge (i.e., the use of surface water instead of groundwater ensures that less groundwater is pumped from the aquifer and promotes a healthier groundwater system).	$ 19,700,000	$ 20,000,000	Systemwide - Reservoir and floodplain storage	Reservoir and Floodplain Storage and Operation
396	RFMP	Audubon California, Potential Project Partners: West Stanislaus Resource Conservation District; irrigation districts; Natural Resources Conservation Service; United States Fish and Wildlife Service; California Wildlife Conservation Board	Westside Creeks On-Farm Multi-Benefit Program	Provide outreach and technical assistance to landowners in the Stanislaus County Westside Creek watersheds for multi-benefit flood risk reduction projects.	$ 75,000	$ 75,000	Rural - Risk awareness, floodproofing and land use planning	Watershed and Floodplain Management
397	RFMP	Merquin County Water District	Windmill Ditch Drainage	Installation of approximately 4,500 feet of pipeline to transport drainage waters to an existing ditch that discharges to the San Joaquin River. The existing Windmill Ditch intercepts flood water upstream of the community in the northeast area. This installation would allow the flood waters to be moved around the community.	$ 1,900,000	$ 1,900,000	Rural - Levee repair and infrastructure improvements	Flood Infrastructure
398	RFMP	West Stanislaus Irrigation District, Potential Project Partners: Department of Fish and Wildlife; National Marine Fisheries Service; United States Fish and Wildlife Service; United States Bureau of Reclamation	WSID Fish Screen Project	This project will help support the West Stanislaus Irrigation District (WSID) Fish Screen Project, which will significantly improve site-specific and regional flood management resilience as well as ecosystem enhancement. Funding would contribute to the required 50% non-federal cost-share for construction of WSID's preferred alternative fish screen project. Completion of this proposed Project, in conjunction with several proposed non-structural flood control projects, would reduce operations and maintenance costs and improve efficiency in flood management/maintenance activities would occur over the short- and long-term in this central portion of the Region. Successful planning, permitting, and construction of this proposed Project would also increase institutional and local support for several non-structural flood control projects proposed by the USFWS and River Partners in this central portion of river within the Mid-SJR RFMP planning area. The project would improve flood risk management by providing connectivity between the tracts. The project would improve water supply reliability, making it a multi-benefit project, and protect fish from entrainment, which would support ecosystem function.	$ 38,000,000	$ 18,000,000	Systemwide - State operations, planning and performance tracking	Natural Floodplain and Ecosystem Functions

Appendix C: State Flood Insurance Program

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Appendix C: State Flood Insurance Program

California and other states (e.g., Louisiana and New York) have considered establishing their own flood insurance programs that could replace or augment the National Flood Insurance Program (NFIP). If a cost savings could be achieved by a State-sponsored program, the State could then use a portion of what it now pays in premiums to purchase private insurance and another portion of insurance premiums to implement risk reduction measures. These risk reduction measures could decrease damage in the event of a flood and could reduce the amount of mitigation funding needed from other sources. However, implementing a State flood insurance program would require the State to take on significant risk, as more than 7 million Californians live in floodplains and more than $580 billion in assets are situated within floodplains.

C.1 Flood Insurance Models

Before evaluating the potential of establishing or implementing a State-sponsored flood insurance program, it is necessary to understand the types of flood insurance programs currently in use in other countries. Most of these flood insurance programs fall into one of four categories, defined by whether the program is privately-backed vs. government-backed, and whether the flood insurance is bundled vs. offered as an add-on. Each of these programs has its own pros and cons, and typically only one program exists in any particular country (Maddox, 2014).

The United Kingdom's (UK's) flood insurance program is backed by private financial markets and is mandatory; it is bundled into a property owner's insurance policy whether the property-owner wants it or not. Since all property owners are covered, this allows for the insurance providers to spread the risk over a larger pool, which makes the premiums more affordable. This system, which is also used in China and Hungary, safeguards the insurance industry by improving its solvency and profitability.

Germany's flood insurance model is also backed by private financial markets; however, it is optional for property owners. Since the decision to purchase flood insurance rests with a property owner, the markets are characterized by concentration of high-risk properties, which results in high premiums. In the insurance business this is known as adverse selection. Only those facing the highest risk tend to buy insurance, and moderate- or low-risk properties are priced out of the market. The underlying philosophy in countries who have adopted this model (which includes Austria, Japan and South Africa) is that the cost of insuring against flood damage should only be borne by property owners at risk; therefore the program should focus on high-risk properties that pay high premiums.

Flood insurance models backed by national governments fall into two categories: bundled and add-on. The French and Spanish models are both backed by the government and are bundled into property insurance that also covers other natural hazards. Policies are still written by private insurers, but the state ensures the solvency of the insurance industry by retaining a portion of the premiums, which it uses to underwrite claims. Since the state is responsible for any claims, it has an interest in minimizing flood risk by either regulating development in floodplains or by funding/implementing flood risk reduction projects.

The NFIP is an example of an optional flood insurance model backed by the United States (U.S.) government. This model is similar to the German model (i.e., optional but privately-backed) with a high concentration of policies in high-risk areas. However, unlike the German model, the NFIP is subject to political pressure to keep premiums lower than the flood risk involved would indicate. This has resulted in the NFIP using federal tax revenues to make up the shortfall in funding, as the premiums paid into the system have not been able to keep up with payouts. The optional nature of the program results in only 1 percent of properties outside designated high-risk areas purchasing flood insurance, even though about half of all flood damages occur in these properties (Lamond and Penning-Rowsell, 2014).

C.2 History of NFIP

Congress established the NFIP with the passage of the National Flood Insurance Act of 1968. NFIP enables property owners in participating communities to purchase insurance as a protection against flood losses in exchange for State and community floodplain management regulations that reduce future flood damages. Participation in the NFIP is based on agreements between communities and the federal government. For example, if a community adopts and enforces a floodplain management ordinance to reduce future flood risk to new construction in floodplains, the federal government will make flood insurance available in the community as a financial protection against flood losses. This insurance is designed as an alternative to disaster assistance, and is designed to reduce the escalating costs of repairing flood damage (NFIP, 2002).

On April 1, 1979, President Jimmy Carter signed the executive order that created the Federal Emergency Management Agency (FEMA). FEMA is responsible for coordinating federal response to floods, earthquakes, hurricanes, and other natural or man-made disasters. FEMA provides disaster assistance to states, communities, and individuals. The Federal Insurance and Mitigation Administration within FEMA is responsible for administering the NFIP.

When the long-term average payouts from the NFIP matched the long-term average revenues generated from premiums, the NFIP was financially sound (i.e., self-funding). Additionally, the NFIP was set up so it could borrow up to $1.5 billion from the U.S. Department of the Treasury (Treasury) to help it meet claims in years when claim payouts exceeded revenues generated from premiums. These borrowed funds were to be paid back with interest. Up until 2001, the NFIP was able to pay back any funds it borrowed from the Treasury. In June 2001, the NFIP paid off its debt to the Treasury from a high of $922 million in 1999 (NFIP, 2002). Unfortunately for the NFIP, FEMA had to borrow money later that year to address more than 30,000 claims related to flooding from Tropical Storm Allison. Since then, there have been several severe hurricanes and

tropical storms that together have generated losses in the billions of dollars. As a result, NFIP is no longer financially sound.

U.S. Government Accountability Office (GAO) 2015 report titled Report to the Congressional Committees: High Risk Series—An Update identified the NFIP as being at high risk for "not generating sufficient revenues to repay the billions of dollars borrowed from Treasury to cover claims from the 2005 and 2012 hurricanes or potential claims related to future catastrophic losses" (GAO, 2015). The report further states that, despite how the NFIP was set up (i.e., to be funded through premiums and not tax dollars), the NFIP has never been financially sound. To help strengthen the NFIP's financial solvency, the Biggert-Waters Flood Insurance Reform Act (BW12) was passed in July 2012.

C.2.1 Biggert-Waters Insurance Reform Act of 2012

BW12 extended the NFIP for 5 years beginning in 2013, while requiring significant reform. These requirements included changes to major components of the program, including flood insurance, flood hazard mapping, grants, and floodplain management. In addition to making the NFIP more financially stable, changes required under BW12 were designed to ensure that flood insurance rates more accurately reflect the real risk of flooding (BW12, 2013).

Provisions of BW12 require the NFIP to raise insurance rates for some older properties in high-risk areas to reflect true flood risk. The affected properties are among those built before their communities joined the NFIP and adopted their first flood insurance rate map (FIRM). Communities began joining the NFIP in the late 1960s. Many of the pre-FIRM properties in high-risk areas do not meet current standards for construction and elevation, and they have received subsidized rates that do not reflect their actual risk. Approximately 20 percent of NFIP policyholders are pre-FIRM; these policyholders qualified for and received subsidized rates prior to BW12 (BW12, 2013).

The proposed changes to discounted premiums for pre-FIRM properties were to be phased over time beginning January 1, 2013, for "homeowners with subsidized insurance rates on non-primary residences and pre-FIRM structures that had not been substantially damaged or improved" (BW12, 2013). For other discounted premium recipients, such as owners of business or residential properties that had either experienced repetitive losses or whose cumulative flood-related damage claims exceeded the fair market value of their properties, the change would go into effect on October 1, 2013. The rates for these discounted premiums were scheduled to increase by 25 percent each year until premiums reflected full-risk rates. Full-risk rates would apply to owners of property who were not insured as of BW12 enactment, those who had lapsed NFIP policies, and those who purchased after the date BW12 enactment (BW12, 2013).

Although FEMA started to implement changes required by BW12, there was an immediate public outcry about the affordability of the new flood insurance premiums. Multiple newspapers reported stories of homeowners who wanted to rebuild following Hurricane Sandy (or who had rebuilt after Hurricane Katrina) but could no longer afford the new premiums and were contemplating walking away from their homes. Some of the outcry was from homeowners who lost their subsidized premiums under BW12 because of the new base flood elevation (BFE) requirements. The new BFE requirements particularly affected homeowners who had already reconstructed after Hurricane Katrina and who had followed the existing flood maps for their

areas (Alvarez and Robertson, 2013). Homeowners in New York City who were rebuilding after Hurricane Sandy also faced hurdles with the new BFE requirements because many older buildings are connected to other buildings (Anderson, 2013).

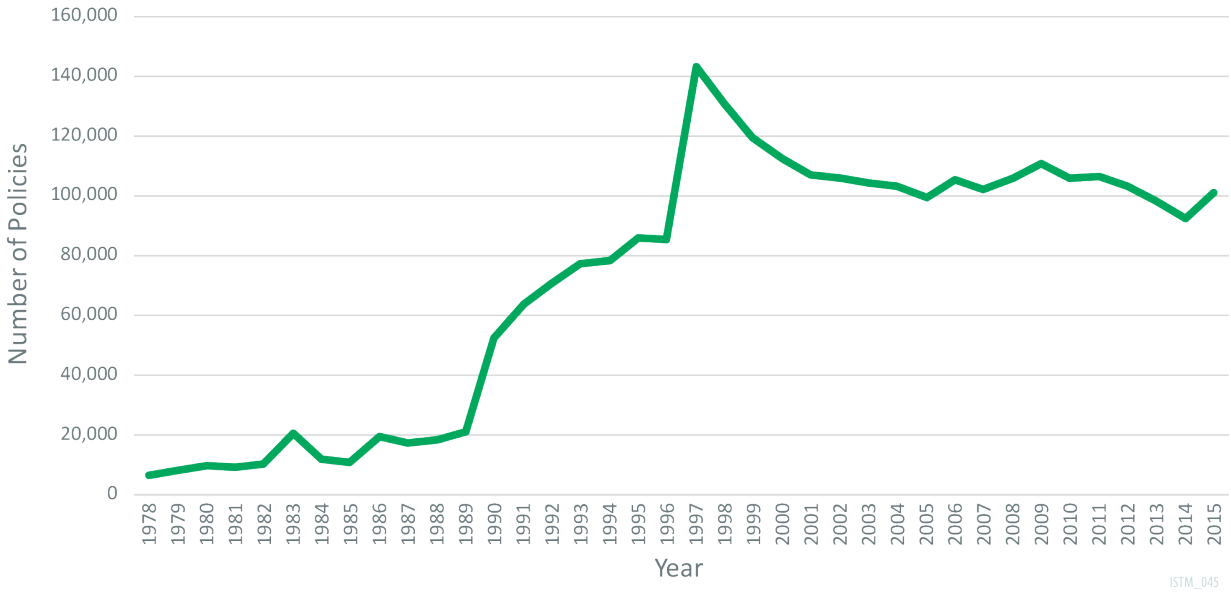
C.2.2 Homeowner Flood Insurance Affordability Act of 2014

In response to this public outcry, Congress enacted the Homeowner Flood Insurance Affordability Act of 2014 (HFIAA). HFIAA "reinstated certain premium subsidies and slowed down certain premium rate increases that had been included in the Biggert-Waters Act" (GAO, 2015). Premium subsidies were reinstated for properties purchased after July 6, 2016 (the date of HFIAA enactment) and properties whose NFIP insurance had lapsed as of that date (GAO, 2016).

C.3 NFIP Policies

Figure C-1 shows the total NFIP flood insurance policies between 1978 and 2015 relevant to the State Plan of Flood Control (SPFC) Planning Area (geographic and hydrologic scope of the CVFPP). This figure demonstrates that policy purchasing follows individuals' perceptions of their risk, which typically rises following a major flood and declines over time as the flood event recedes from memory. The number of purchased NFIP policies rose steadily from about 6,500 in 1978 to a peak of about 148,000 in 1997 before declining following a number of significant floods in California. Between 1998 and 2004, the number of policies declined by about a quarter with most (about 90 percent) of the observed decline in policies occurring in the counties of Sacramento, San Joaquin, and Sutter. In Sacramento County, the drop in purchased policies was about 50 percent; in San Joaquin and Sutter counties, the drop was about 20 percent in each county.

Figure C-1. Annual NFIP Policies, SPFC Planning Area, 1978-2015



Source: NFIP, 2016a

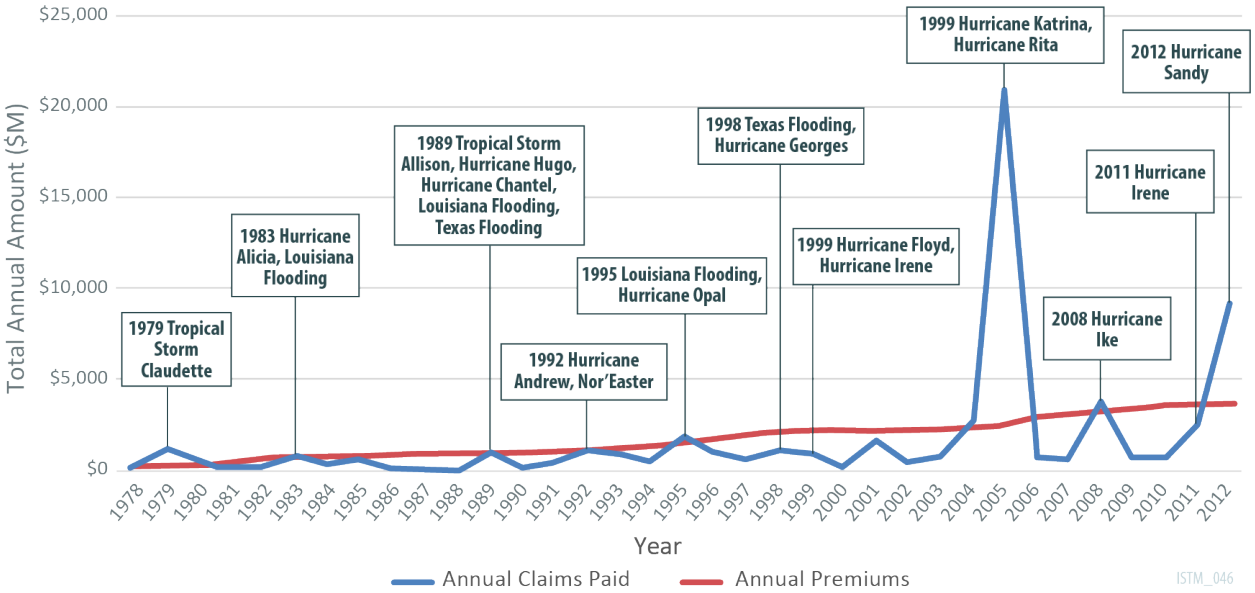
C.4 NFIP Expenditures

FEMA maintains an NFIP database that includes information about annual claims and annual premiums organized by state and by counties within states. Figure C-2 shows the total premiums collected and total claims paid out by the NFIP between 1978 and 2012. Prior to 2005, the NFIP was financially sound, with annual premiums collected exceeding annual claims paid. Hurricane Katrina in 2005 overwhelmed the NFIP's ability to repay the Treasury, and since that time premiums have not kept up with the claims paid out.

Figure C-2 also shows that a few states have consistently been among the top recipients of NFIP payouts. Between 1978 and 1989, Louisiana and Texas were the top recipients of annual NFIP payouts. Payouts to these two states combined accounted for 63 percent and 65 percent of total NFIP payouts in 1980 and 1983, respectively. From 1990 through 1999, Florida was the top recipient of NFIP payouts. Florida and Louisiana received approximately 80 percent of all NFIP payouts in 1995. Texas alone received about 79 percent of all payouts in 2001, while more than 90 percent of the 2005 payouts went to Louisiana and Mississippi. During the period shown, California was the leading recipient of NFIP payouts only once—in 1986 when the payout accounted for approximately 29 percent of all payouts that year.

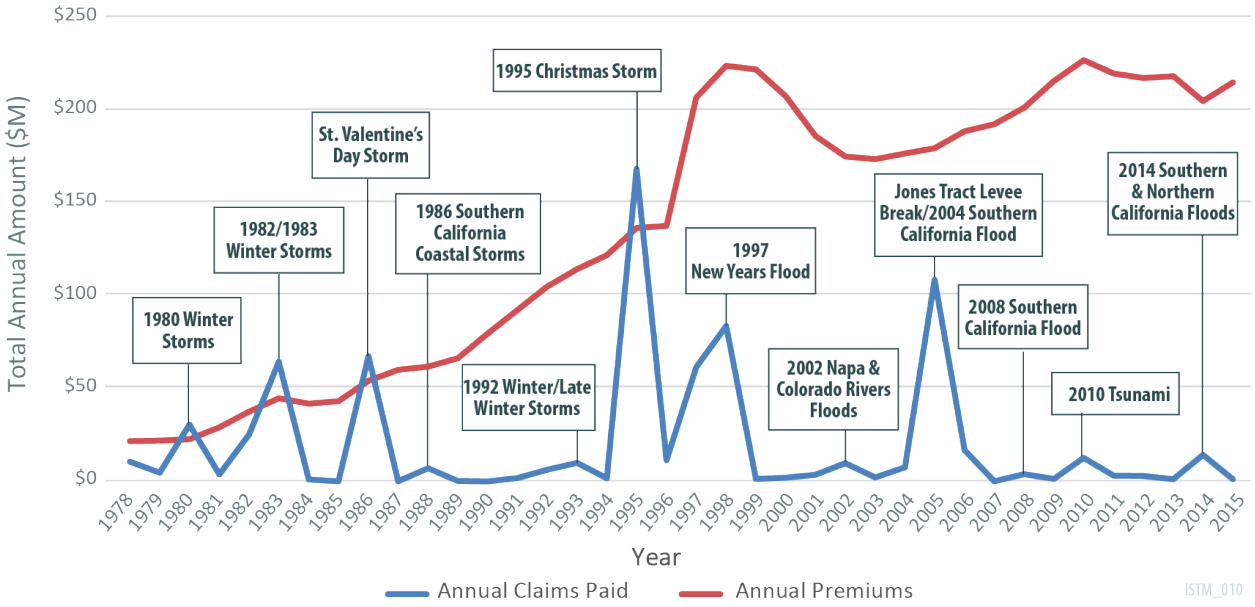
Analysis of NFIP data (from 1978 to 2008) by the Wharton Center for Risk Management and Decision Processes (WCRMDP) showed that premiums paid over time by California policy holders totaled five times more than the payouts (WCRMDP, 2011). Figure C-3 shows the total annual premiums and total annual payouts between 1978 and 2015 in California (in 2015 dollars). This figure shows that the State of California has paid more into NFIP in the form of premiums than it has received as payout from the program in all years except in 1983, 1986 and 1995. The 1983 payouts correspond to the floods following the 1982-83 winter storms in Northern California while the 1986 and 1995 figures correspond to the St. Valentine/Winter storm in 1986 and the major floods across the state in January and March 1995, respectively.

Figure C-2. Total Annual Premiums and Payouts, NFIP, Nationwide, 1978-2012



Source: NFIP, 2014

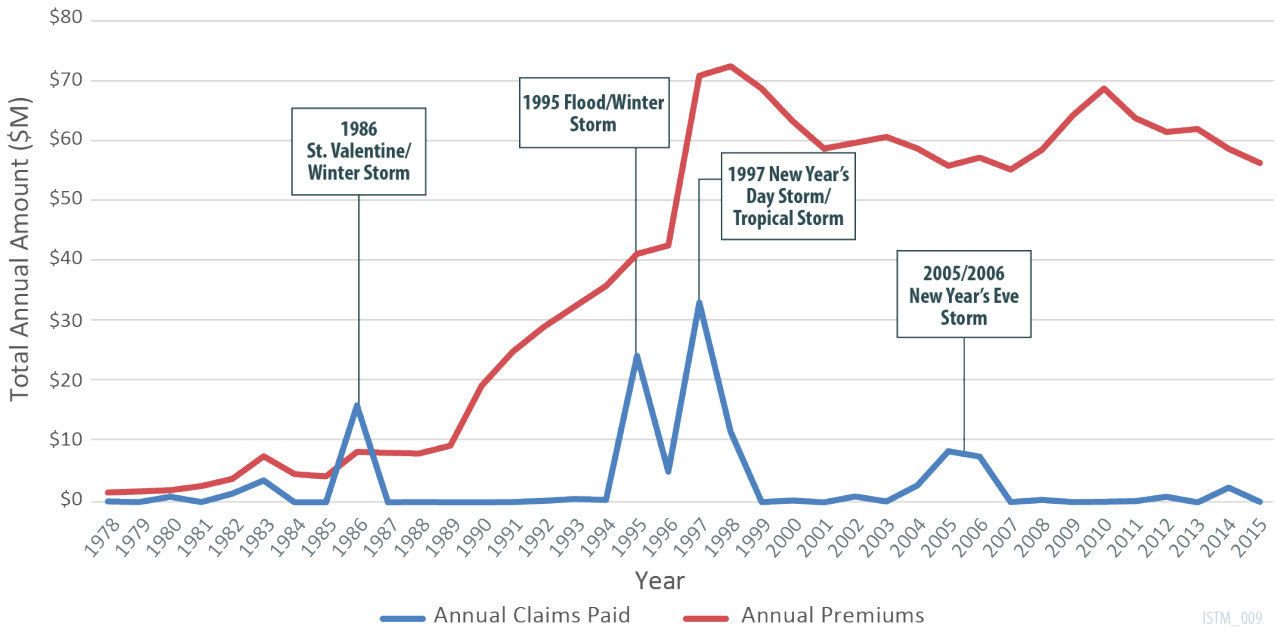
Figure C-3. Annual Premiums and Claims, NFIP, California, 1978-2015



Source: NFIP, 2016a

Figure C-4 shows the total annual premiums and total annual claims paid between 1978 and 2015 relevant to the SPFC Planning Area (in 2015 dollars). The trend in the SPFC Planning Area mirrors that seen in the State, with annual premiums exceeding annual claims paid in most years except in 1986 following the floods associated with the St. Valentine/Winter storms in February of that year. Figure C-4 also the shows that annual claims paid were relatively higher in 1986, 1995, 1997, 2005 and 2006, corresponding to flood events in those years. The largest claims paid during these years were to recipients in Sacramento County ($2.7 million in 1986, $8.3 million in 1995, and $5.8 million in 1997) and Solano County ($3.7 million in 2005). All payments are in 2015 dollars.

Figure C-4. Annual Premiums and Claims, NFIP, SPFC Planning Area, 1978-2015



Source: NFIP, 2016a

C.5 NFIP Coverage

Flood insurance through the NFIP is available to homeowners, renters, condo owners/renters and commercial owners/renters. In addition to residential and commercial properties, insurance offered through the NFIP also covers public property. Flood insurance is specifically required for all buildings in mapped Special Flood Hazard Areas (SFHAs) shown on FEMA's maps if they are financed by federally-backed loans or mortgages (FEMA, 2015). FEMA also encourages owners of homes and businesses in moderate- to low-risk areas and those whose properties have previously been flooded to purchase insurance even if their mortgage company doesn't require it. Homeowners outside the SFHAs may be eligible for a lower-risk policy called a Preferred Risk Policy (PRP). Properties that have been newly mapped into a high-risk flood zone may also qualify for an equivalent PRP rate.

Flood insurance costs vary depending on how much insurance is purchased, what it covers and the property's flood risk. Coverage is available for buildings and contents, though coverage for contents is optional. Coverage of property is limited to specific parts of the property (e.g., building and foundation, electrical and plumbing systems, HVAC, built-in appliances, permanently installed parts such as bookcases and cabinets). A separate property policy is required for detached structures other than detached garages. Coverage of contents excludes certain valuables (e.g., currency, precious metals, stock certificates, etc.) and financial losses resulting from business closures or from the loss of the use of insured property.

For communities participating in the NFIP Regular Program[1] or Emergency Program[2] the dwelling policy under the Standard Flood Insurance Policy (SFIP[3]) provides building and/or contents coverage. Coverage offered in the Dwelling Form[4] includes the building property up to $250,000, and personal property (or contents) up to $100,000. The personal property coverage applies to both homeowners and renters. The General Property Policy Form is issued to owners or lessees of non-residential buildings or units, or residential condominium buildings insurable under the Residential Condominium Building Association (RCBAP). Non-residential property owners can insure a building and its contents for up to $0.5 million each (FEMA, 2015).

Nationally, as of April 2016, the maximum annual premium (including a basement/enclosure) was $474 under the residential PRP (FloodSmart, 2017a). Based on the 1978 through 2015 NFIP data on premiums, the average flood insurance premium in California was about $600 (in 2015 dollars). This figure includes both PRP and non-PRP rates. The average flood insurance premium relevant to the SPFC Planning Area during this period (i.e., from 1978 through 2015) was about $480 per year (in 2015 dollars), and includes both PRP and non-PRP rates. Following Hurricane Katrina in 2005, average flood insurance premiums have been trending upward for the State and in the SPFC Planning Area.

Based on 2006 through 2015 NFIP premiums, the average cost of flood insurance in California was $820 per year (in 2015 dollars). Relevant to the SPFC Planning Area, and during the same time period, the average flood insurance premium was about $590 per year (in 2015 dollars). These averages are higher than the average pre-Hurricane Katrina flood insurance premiums (i.e., from 1978 through 2005). Average cost in the state was about $520, and in the SPFC Planning Area the cost was about $440 (both in 2015 dollars).

[1] The NFIP Regular Program is the final phase of a community's participation in the NFIP when a FIRM is in effect and full limits of coverage are available.
[2] The NFIP Emergency Program applies during the initial phase of a community's participation in the NFIP, when only limited amounts are available.
[3] The Standard Flood Insurance Policy (SFIP) consists of the Dwelling Form, the General Property Policy Form, and the Residential Condominium Building Association Policy (RCBAP) Form.
[4] The SFIP Dwelling Policy Form is used to insure homeowners, rental renters and condominium unit-owners and owners of residential buildings containing two to four units.

C.6 Possible State Flood Insurance Program

C.6.1 Alternatives to NFIP

With passage of HFIAA in 2014, NFIP is even more at risk for financial insolvency. As a result, several states, including Louisiana and New York, are considering opting out of NFIP and establishing a state insurance program funded through premiums paid by state residents. Their rationale is that these state-run programs would more readily meet the needs of the individual state's residents. The state program proposed by Louisiana, which was put forth before HFIAA was enacted, would require property owners to purchase an additional state insurance policy. This state program would be run by companies set up similar to corporations that handle property insurance and worker's compensation coverage for those who cannot get it in on the private market (Deslatte, 2013). However, some in Louisiana government, including the Governor, felt the proposed program would not succeed, because property owners would not be willing to pay for two programs (i.e., the new state program and the NFIP). Additionally, opponents pointed out that underwriters who are part of the proposed state corporation would expect the state to act as a backstop. Thus, costs currently born by the NFIP, and by extension all federal taxpayers, would shift to state taxpayers.

New York State is also considering a proposal to establish a state-run flood insurance program. According to the proposal, the state program, called the New York Flood Insurance Association, would provide an alternative to the rising NFIP premiums to New York residents living in flood-prone areas who may not have access to affordable flood insurance. However, similar to the Louisiana proposal, the proposed New York program may not be attractive enough to insurance companies due to the state's lack of financial clout in ensuring that insurers are protected from financial liability through limits on their financial exposure (Vagus, 2015).

The State of Florida also had looked into establishing a program run by private insurance companies (Klas, 2013) after passage of BW12 but prior to the enactment of HFIAA in 2014. However, the program was not initiated because the state could not meet the private insurers' requirement for "extraordinary regulatory flexibility." Private insurers requested extraordinary regulatory flexibility because NFIP could not give them adequate data to assess risks and hence, determine rates.

Several states are also looking to reduce the risk on their state budgets from "repeated flood insurance claims, emergency response, seawall repair, and other public expenses" that are associated with coastal properties (Pillion 2015). For example, both New York and New Jersey have implemented state programs to buy distressed properties in the aftermath of Hurricane Sandy (Kaplan, 2013; Nutt, 2013). In Massachusetts, the legislature set aside $20 million in a bond bill for a voluntary buyout program for repeatedly damaged coastal homes (Daley and Wang, 2015). The purchased land would be converted to recreational or wildlife refuges. Of particular concern to the Massachusetts legislature is the coastal town of Scituate, which accounts for nearly 40 percent of Massachusetts' "severe repetitive loss" properties. These properties have received at least four payments from NFIP in the past (Daley and Wang, 2015). The rationale for these programs is that a buyout is cheaper for state and federal taxpayers in the long run than paying for repeated flood damage claims.

C.6.2 State Flood Insurance Program

As stated earlier, prior to Hurricane Katrina, the NFIP was financially sound and able to pay back any money it borrowed from the U.S. Treasury. However, since Hurricane Katrina, the program has not been financially sound. Additionally, attempts by the federal government to restructure the program to make it more financially sound have not been successful (see Sections C.2.1 and C.2.2). California, as a net contributor to the NFIP program (with premiums exceeding claims over time), has a better chance of success with a state flood insurance program compared to some other states considering opting out of the NFIP (e.g., Louisiana and Florida). Nonetheless, a state flood insurance program will likely to face the same financial constraints as the NFIP unless certain issues are addressed. Some of these issues are related to the following:

- Accuracy of flood maps
- Public awareness about the flood risk
- Voluntary nature of flood insurance
- Linkage of flood insurance to federally-backed mortgages
- Treatment of repetitive loss property
- Affordability
- Financial solvency (i.e., spreading risk over the financial markets)

Accuracy of Flood Maps

Whether the flood insurance is provided through a state-backed program or a private one, there must be an understanding of the level of risk associated with insuring properties in a floodplain. Under the current FEMA mapping system, areas with moderate to low flood risk are included in the Non-Special Flood Hazard Area (NSFHA), which includes flood zones B, C, X, Pre-, and Post-FIRM, as designated by FEMA. Unlike properties in the SFHA that are required to purchase flood insurance if they are financed by federally-backed loans or mortgages, properties in the NSFHA are not required to purchase flood insurance. This is despite the fact that "more than 20 percent of all flood insurance claims" are from properties in the NSFHA areas (FloodSmart, 2017b).

To avoid having a mismatch between flood insurance coverage and flood insurance claims (and/or damages), the State would have to ensure that flood maps used to support the State flood insurance program properly account for actuarial risk. That is, the State would have to ensure that the maps are based on structure-specific flood elevation and frequency determinations, and that they take into account future flood risks associated with climate change. In addition to showing the risks associated with flood, the maps would also need to show existing land uses in the area. These maps would need to be updated frequently to capture any changes in an area's flood risk following land use changes or implementation of flood risk reduction projects.

Public Awareness about Flood Risk

Funding a state insurance program would require that property owners living within the floodplain purchase insurance annually. However, property owners tend to underrate their risk and drop their flood insurance within a few years of buying. An analysis of policy tenure under the NFIP showed that 73 percent of new policies entering the NFIP in 2001 renewed their policy in 2002 (Michel-Kerjan et al., 2012). After 2 years, renewal rates declined to 49.5 percent of the original policies, and by 2009 (8 years later), only 19.6 percent of the policies were still in place.

This trend was also observed for policies that went into effect in 2002, 2003, and 2004. The study found the median tenure of policies to be 2 years. However, following FEMA's FloodSmart public awareness campaign, the average tenure of policies issued between 2003 and 2006 increased to 4 years. This study also showed that that policy holders in California had shorter tenure than residents of a group of states in the northeastern U.S. (Michel-Kerjan et al., 2012).

The purchasing and renewal of insurance policies are based on a number of factors, including economic and financial conditions, perceptions of risk, and personal experiences with a disaster, though this has been shown to not always be the case. In 2014, the Wharton Center for Risk Management and Decision Processes published the results of a survey of New York City homeowners who owned a home with a ground flood in a flood-prone area. The purpose of the study was to understand individual flood risk perceptions. The survey was conducted 6 months after Hurricane Sandy and showed that, of the over 1,000 survey participants, only 44 percent purchased flood insurance because it was mandatory while 21 percent bought flood insurance voluntarily and another 33 percent did not have coverage at all. About 2 percent did not know whether they had flood insurance coverage (WCRMDP, 2014). The study also found that most of the respondents (86 percent) believed that they lived in a flood-prone area. The fact that most of the homeowners without flood insurance were nevertheless aware of the flood risk, survey results show the need for improved public understanding of the potential for flood damage and the role of flood insurance.

Outreach and education about flood risks and the potential for flood damage must be an important component of any state flood insurance program. California could model its outreach program on FEMA's FloodSmart program as a start. Flood maps used to communicate flood risks need to include information about potential damage. Additionally, the state can ensure that information about flood risk is expressed in a form that is easily understandable to residents (for example, by communicating the chance for a flood as greater than 20 percent in the next 25 years instead of the typical 1-in-100). The California program must also emphasize that large storm events are mostly independent; for example, the fact that Hurricane Sandy struck recently does not mean that the affected area is safe for the next 50 or 100 years.

Voluntary Nature of Flood Insurance Requirement

Flood insurance is mandatory only in properties located in SFHAs that are financed by federally-backed loans or mortgages. Properties outside the SFHA, such as those in the NSFHA are not required to have flood insurance but, as previously stated, about half of all flood damages occur on these properties nationally (Lamond and Penning-Rowsell, 2014). One way to ensure that all property in flood-prone areas are covered by flood insurance is to make flood insurance mandatory on all these properties. The only exception would be properties shown to be higher than the base flood elevation for the area.

When setting up a state flood insurance program, California could ensure compliance with its mandatory flood insurance program by requiring that banks and mortgage lenders require flood insurance policies for all property in flood-prone areas. Another option to ensure compliance would be to link flood insurance premiums to annual property tax bills. A third option would be to offer multi-year contracts through the state flood insurance program and write-your-own programs (WYO) offered through private insurers. These multi-year contracts could stay with

the property even if the property changes hands, thus ensuring coverage for properties at risk. Incorporating these types of safeguards may ensure the success of California's program.

Linkage of Flood Insurance to Federally-backed Mortgages

By establishing its own flood insurance program, California would be losing the safeguards provided by NFIP's requirement that properties financed by federally-backed loans or mortgages in SFHAs have flood insurance. To avoid this, the State would need to pass legislation requiring lending institutions doing business in California require flood insurance as a condition of a loan on a property located in areas identified by the State flood map as a flood-prone area.

Treatment of Repetitive Loss Properties

Before the passage of the Bunning-Bereuter-Blumenauer Flood Insurance Reform Act in 2004, the NFIP was paying out multiple flood insurance claims for damages to the same properties in some areas. The cumulative payouts on some of these properties exceeded their fair market value. The 2004 act amended Section 1323 of the National Flood Insurance Act of 1968 to provide funding to reduce or eliminate the long-term risk of flood damage to structures insured under NFIP for properties that had one or more claim payment(s) for flood damages.

The State should identify repetitive loss properties and institute a voluntary buyout program that would eliminate the risks that these properties pose to a State flood insurance program. The legislature could set up a program that funds this buyout program, or a bond measure could provide the required capital. The purchased at-risk property could be converted to open spaces and flood buffer zones and, where applicable, to recreational or wildlife refuges. A State flood insurance program could ensure participation in the voluntary buyout program by stipulating that these properties would no longer be eligible for flood protection through the program.

Affordability of Flood Insurance

Affordability of flood insurance was one of the main reasons Congress passed the HFIAA in 2014. It essentially rolled back the BW12 provision requiring the NFIP to raise insurance rates for some older pre-FIRM properties. The subsidized rates offered to these pre-FIRM properties did not reflect the true cost of their actual flood risk. A California flood insurance program is likely to face the same pressures currently faced by NFIP: keeping flood insurance rates affordable. One way the State could avoid these is to link the subsidy to the policyholder and not the property. The State would need to establish the appropriate level of the subsidy and the form that the subsidy could take. It would also need to set up guidelines about how eligibility for the subsidies would be determined; for example, it could be based on income or housing costs in relation to income (WCRMDP, 2016). The subsidy program would also need to determine the form of the subsidy (i.e., vouchers, low-interest loans, mitigation grants, or tax credits). A surcharge on non-income based flood insurance premiums could be used to offset the subsidies.

Basing the subsidy level on income is one of the options that the GAO (2016) proposed as a means to make the NFIP more solvent. The GAO proposal called for institution of a means-tested assistance program that targets assistance on the basis of individual policyholders' financial need or the financial characteristics of a local geographic area. The subsidy could also be linked to the cost of mitigating the risk.

Currently, NFIP flood insurance rates for properties on agricultural lands are the same as those for commercial properties. This rate assumes that floodplains and the associated flood risk in these floodplains are the same across the country. It also assumes that farming practices are similar across the country. But there are major differences in the type of floodplain and types of farming practices on floodplains in California and particularly within the Central Valley. In other parts of the country, designation of land as an SFHA would typically render such land inappropriate for agriculture; in California, deeper floodplains are particularly well-suited for agriculture.

FEMA's proposed updates to the NFIP floodplain maps in the Central Valley has resulted in agricultural lands being inside newly designated SFHAs. Once in the SFHA, all agricultural property is subject to NFIP flood insurance requirements, especially if the property is financed with a federally-backed loan or mortgage. Because these flood insurance requirements have the potential to affect the sustainability of agriculture in the Sacramento Valley, the State convened the Agricultural Floodplain Ordinance Task Force (AFOTF) in 2015 to identify and recommend changes that FEMA could administratively implement. The AFOTF developed a number of recommendations that would modify FEMA's rules on elevation and floodproofing (by either reducing them or removing them) and reduce the cost of flood insurance for agricultural structures (AFOTF, 2016). These recommendations could be incorporated into a State flood insurance program.

Financial Solvency

While the State currently pays more in premiums than it receives in claims from the NFIP, implementing this type of program at the State level would shift the risk of keeping the flood insurance program solvent from the federal government (and by extension all federal taxpayers) to the State government (and by extension all State taxpayers). It would also shift the responsibility for disaster payments to the State.

One way to shift some of this risk would be to couple the State flood insurance program with traditional reinsurance backed by the State. However, this would still expose the State to financial risks that it could avoid if it modeled the State flood insurance program on the UK program (i.e., a government-mandated private insurance program). The UK's program, which has a 95 percent flood insurance penetration, bundles flood insurance with other property insurance. The UK government does not subsidize premiums; nor does it offer a state-backed reinsurance program. However, it does partner with private insurers to guarantee the provision of insurance to high-risk households, conditional on the government implementing a 5-year plan to reduce flood vulnerability. The insurers transfer risk to the international reinsurance market (White, 2011).

Another way to shift or spread this risk would be to couple the State flood insurance program with private investments in the form of resilience bonds. Resilience bonds are a type of catastrophe bond. Catastrophe bonds (or cat bonds) are high-yield debt instruments that are usually insurance-linked and designed to help manage the financial risks associated with natural disasters. They were first created in the mid-1990s, in the aftermath of Hurricane Andrew and the Northridge earthquake in Southern California. Since then, the market share of cat bonds has continued to grow. Over the last decade, the cat bond market has grown 25 percent per year while the rest of the insurance sector has grown by 10 percent. In the first quarter of 2015, the cat

bond market was worth approximately $25 billion (Vajjhala and Rhodes, 2015). The growth in the cat bond market can partially be explained by its structure. If a disaster (also called a triggering event) covered by the cat bond occurs during the term of the bond (i.e., usually 3 to 5 years), the bond sponsors (or insurance purchaser) keeps a portion of the bond value to pay off losses, and investors lose some (or sometimes all) of their principal invested. However, if the triggering event does not occur, the bond investors keep all of the bond value. Common types of triggers are loss-and-damage based triggers. Cat bonds allow insurers to transfer risk outside the reinsurance market. The California Earthquake Insurance Program is an example of a program based on cat bonds.

Resilience bonds have three building blocks: insurance, resilience projects and rebates. Not only do the sponsors of resilience bonds purchase insurance, they actually have an interest in reducing physical damages from disasters. Resilience bond sponsors are only responsible for premium payments, and they benefit in the form of resilience rebates realized from the insurance value created by the resilience project. A resilience bond can have multiple sponsors who have a shared interest, and can be tailored to complement existing insurance and risk management programs (Vajjhala and Rhodes, 2015). Similar to cat bonds, resilience bonds have a fixed timeline; however, unlike cat bonds, resilience bonds identify and are linked to specific resilience projects.

C.6.3 Steps to Creating State Flood Insurance Program

The State legislature would have to pass a law creating a State flood insurance program that would specify how it would be implemented and funded. As shown above, NFIP policy holders in California have, on average, paid more in premiums into the NFIP than they have received as payouts. However, this has not always been the case in every year. Following the 1980, 1983, 1985 and 1995 floods, California policy holders received more in payouts than they paid as premiums. The NFIP had access to funds from the U.S. Treasury during years when it took in less in premiums than it had to pay out. A State flood insurance program would need to access a source of funding if premiums could not cover payouts over some period of time. In particular, the State would need to develop a source of funds to cover emergencies. Opting out of the NFIP may mean that California loses access to other funds available from FEMA, especially funding typically made available upon a presidential declaration of emergency.

C.6.4 State Flood Insurance Program – Example Templates

Possible templates for how a State flood insurance program might be established include the State's Division of Workers' Compensation insurance program and the Earthquake Insurance Program. Additionally, the State could establish a private flood insurance program similar to the UK program.

- **State Division of Workers' Compensation Insurance Program:** In California, all employers are required to participate in the State workers' compensation insurance program. The program, through its Workers' Compensation Rating Bureau, establishes insurance premiums on the basis of risk, number of workers, occupations, wages, and claims history. Risk is determined by occupations represented in the employer's staff (e.g., a roofer's insurance cost is higher than that of an office worker). Some of the risk levels associated with particular occupations have been developed over 100 years (Clark, 2013). Assessments on

insurance companies fund the State Administrative Court, which is charged with resolving disputes that arise as a result of claims. Insurance for the program is provided in one of three ways: 1) employer self-insurance whereby employers underwrite their own insurance; 2) general liability insurance typically purchased through any insurance underwriter; and 3) through the State Compensation Insurance Fund. Of these three, the State Compensation Insurance Fund is the insurer of last resort (Clark, 2013).

- **Earthquake Insurance Program:** A state flood insurance program could also be modeled on the existing earthquake insurance program managed by the California Earthquake Authority (CEA). The CEA, created in 1996, is a not-for-profit, publicly managed, privately funded provider of catastrophic residential earthquake insurance. Insurance companies, through the CEA or directly, are mandated to offer minimum levels of earthquake coverage and must make a contribution upon joining the CEA. The State imposed three requirements on the CEA: 70 percent of insurers in the state had to participate, the CEA must be exempt from federal income taxes, and reinsurance must be purchased at twice the level of contributions from insurance companies. By law, the CEA cannot access State general funds to meet claims. In the event of a catastrophic event, payments are first made from CEA capital followed by reinsurance; if both of these are inadequate, the CEA can issue bonds to raise the necessary funds. If additional funds from bonds are inadequate to meet claims, the CEA can assess insurers up to $2.8 billion (Kousky, 2010). Instead of issuing bonds to meet shortfalls, additional funding could be generated by imposing a surcharge/assessment on all property insurance premiums in California. This method is used by North Carolina and Georgia in their Fair Access to Insurance Requirements programs.

C.6.5 Revenue Generating Potential

Between 1978 and 2015, the number of annual NFIP policies in effect in the State and relevant to the SPFC Planning Area averaged about 210,000 and 72,000, respectively. Assuming the number of policies remain at the same average annual levels they have been since 2006 (i.e., about 254,000 in the State and about 103,000 in the SPFC Planning Area), and assuming all of these policy holders are charged at the average state rate ($820 per year), the State would realize about $208 million annually from premiums to fund a State flood insurance program. Assuming that only 10 percent of these funds are available for flood risk reduction projects, the State flood insurance program could provide about $20 million per year for these projects. Using the relevant SPFC Planning Area average annual rate of $590 per year, and average annual policies of 103,000, the SPFC Planning Area would generate about $60 million annually for the State flood insurance program, and could provide about $6 million (assuming 10 percent) annually in funding for flood risk reduction projects in the SPFC Planning Area. These estimates are based on the assumption that the number of policies and the premiums remain at the average annual levels for the period 2006 through 2015. The average annual premium amounts used in estimating revenue generating potential include both PRP and non-PRP rates.

Using the average number of policies for the post-Katrina period does not adequately capture the potential funding for a State flood insurance program; using the higher number of policies from the historical NFIP database does. The NFIP data show that there were about 374,000 policies in California in 1998, the highest number of flood insurance policies purchased in the years between 1978 and 2015. Assuming that State flood insurance is a mandatory program and that its

implementation results in annual state flood insurance policies of 374,000 to 400,000 (an increase of only 7 percent from the high in 1998), the State could potentially realize between $307 million and $328 million annually in premiums (in 2015 dollars). This is based on the average annual state-level premium of $820 per year. Assuming that only 10 percent of these funds are available for flood risk reduction projects, the State flood insurance program could provide $30 to $33 million annually in funding for flood risk reduction projects.

The implementation of a mandatory flood insurance program would result in increased participation in the flood insurance program and could lead to lower premium rates. Assuming annual premiums of $400 (in 2015 dollars) instead of the 2006 through 2015 average of $820, and assuming the number of policies (374,000 to 400,000) remains the same, the State flood insurance program could generate between $150 and $160 million annually, and would provide between $15 and $16 million annually in funding for flood risk reduction projects.

C.6.6 Forming an Evaluation Committee

Before opting out of the NFIP and establishing its own program, the State would need to assess the benefits and costs of participating in the NFIP. The assessment should evaluate potential options and the cost effectiveness of a State flood insurance program in comparison to the NFIP. The comparison should also include an assessment of the relative ability to mitigate losses associated with flooding through flood insurance. That is, the up front investment in mitigation can reduce costs associated with future damages from floods, and result in a net savings overall. This initial assessment should also include an evaluation of changing risks and damages due to climate change, population growth, and economic growth.

An evaluation committee should work with the AFOTF and incorporate recommendations from the AFOTF on policies and actions that minimize impacts and preserve agriculture while facilitating wise use of floodplains. Another important consideration is whether and how withdrawal from the NFIP could affect the State's access and participation in other FEMA programs, including those that support flood mitigation programs.

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Appendix D: Additional Cost Estimation Support

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Appendix D: Additional Cost Estimation Support

UNDER DEVELOPMENT

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Appendix E: Ability to Pay Analysis

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DAVID TAUSSIG & ASSOCIATES
Public Finance and Urban Economics
5000 Birch Street, Ste. 6000, Newport Beach, CA 92660
Phone: 949.955.1500 / Fax: 949.955.1590

M E M O R A N D U M

To: Allan Highstreet

From: Andrea Roess and Nehal Thumar

Re: CVFPP Ability to Pay Analysis – California Department of Water Resources

Date: February 15, 2017

For your review is a preliminary ability to pay analysis for a proposed integrated water management ("IWM") bond for the Central Valley Flood Protection Plan ("CVFPP") for the California Department of Water Resources. The CVFPP encompasses the counties of Butte, Colusa, Glenn, Fresno, Madera, Merced, Sacramento, San Joaquin, Solano, Stanislaus, Sutter, Tehama, Yolo, and Yuba.

The primary objectives of this analysis are to: (i) estimate the amount of ad valorem or parcel taxes that may be generated to finance the proposed bond or bonds, (ii) project the total effective tax rates with the proposed integrated water management tax for the fourteen counties within the CVFPP, and (iii) discuss factors impacting property owners' ability and willingness to pay the proposed integrated water management tax.

The data sources utilized in this analysis include: fiscal year 2015-2016 property tax data tables compiled by the California State Board of Equalization; and fiscal year 2015-2016 final assessment rolls and extended rolls for each county.

I. Potential Tax Revenues and Bonding Capacity Analysis

Assumptions

As part of an effort to explore new funding mechanisms for integrated water management, we have prepared the foregoing analysis of various taxing scenarios to estimate potential tax revenue, and by extension, bonding capacity. For purposes of the analysis, we have assumed that all California Proposition 218 nexus and voting requirements can be met. Tax revenues and bonding capacity will vary based on the actual funding mechanism(s) selected and other factors.

We have prepared two scenarios, both of which assume that taxes are generated from all taxable property in the CVFPP. The first scenario is based on a proposed ad valorem tax rate of $0.01 per $100 of net assessed value. For comparison, ad valorem taxes levied to repay general obligation bonds issued for school facilities under California Proposition 39 cannot exceed $0.06 per $100 of net assessed value for unified school districts. The second scenario is based on a proposed flat amount of $10 per parcel. Bonding capacity was calculated assuming a 4.50% average coupon on a 30-year bond, and construction proceeds were

calculated assuming 3.00% costs of issuance/underwriter's discount and 10.00% reserve fund. For each scenario, results are shown by County and by Regional Flood Management Plan ("RFMP") areas, as provided by CH2M Hill. The counties within each RFMP are shown in Table 1, below.

Table 1
RFMP Regions

RFMP Region	Counties in the CVFPP	Other Counties Not in CVFPP
Feather River	Butte, Sutter, Yolo, and Yuba	Placer and Plumas
Lower Sacramento/Delta North	Sacramento, San Joaquin, Solano, Sutter, and Yolo	None
Lower San Joaquin River/Delta South	Stanislaus and San Joaquin	Contra Costa
Mid San Joaquin River	Merced, San Joaquin, and Stanislaus	None
Upper Sacramento/Mid Sacramento River	Buttte, Colusa, Glenn, Sutter, Tehama, and Yolo	Lake
Upper San Joaquin River	Fresno, Madera, and Merced	None

The fourteen counties are distributed among several Strategic River Basin Areas ("SRBAs") and Hydrologic Regions ("HRs") that also contain counties that are not in the CVFPP, as identified in Tables 2 and 3 below. Based on our review of the counties, a significant portion of the SRBAs and HRs are not included in the CVFPP, and therefore, for purposes of this analysis, we have not included an analysis of the SRBAs and HRs.

Table 2
SRBA Regions

SRBA Region	Counties in the CVFPP	Other Counties Not in CVFPP
Eel	Colusa, Glenn, and Tehama	Humboldt, Lake, Mendocino, and Trinity
Klamath	Tehama	Del Norte, Humboldt, Modoc, Shasta, Siskiyou, and Trinity
North Bay	Sacramento and Solano	Alameda, Contra Costa, Marin, Napa, San Francisco, and Sonoma
Owens	Fresno and Madera	Inyo, Kern, Mono, San Bernardino, and Tulare
Pajaro	Stanislaus, Merced, and Fresno	Monterey, San Benito, Santa Clara, and Santa Cruz
Sacramento	Butte, Colusa, Glenn, Sutter, Tehama, Yolo, Yuba, Sacramento, and Solano	Alpine, Amador, El Dorado, Lake, Lassen, Mendocino, Modoc, Napa, Nevada, Placer, Plumas, Shasta, Sierra, Siskiyou, Sonoma, and Trinity
Salinas	Fresno	Kern, Kings, Monterey, San Benito, San Luis Obispo, and Santa Barbara
San Joaquin	Sacramento, San Joaquin, Stanislaus, Merced, Fresno, Madera	Alameda, Alpine, Amador, Calaveras, Contra Costa, El Dorado, Inyo, Mariposa, Mono, San Benito, Santa Clara, and Tuolumne
South Bay	Sacramento, Solano, San Joaquin, and Stanislaus	Alameda, Contra Costa, San Francisco, San Mateo, Santa Clara, and Santa Cruz
Tulare	Fresno	Inyo, Kern, Kings, Monterey, San Benito, San Luis Obispo, and Tulare

Table 3
HR Regions

HR Region	Counties in the CVFPP	Other Counties Not in CVFPP
North Coast	Colusa, Glenn, and Tehama	Del Norte, Humboldt, Lake, Marin, Mendocino, Modoc, Napa, Shasta, Siskiyou, Sonoma, and Trinity
San Francisco Bay	Sacramento, Solano, San Joaquin, and Stanislaus	Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, Santa Cruz, and Sonoma
San Joaquin River	Sacramento, San Joaquin, Stanislaus, Merced, Fresno, Madera	Alameda, Alpine, Amador, Calaveras, Contra Costa, El Dorado, Inyo, Mono, San Benito, Santa Clara, and Tuolumne
Central Coast	Stanislaus, Merced, and Fresno	Kern, Kings, Monterey, San Benito, San Luis Obispo, San Mateo, Santa Barbara, Santa Clara, Santa Cruz, and Ventura
Tulare Lake	Fresno and Madera	Inyo, Kern, Kings, Los Angeles, Monterey, San Benito, San Luis Obispo, Tulare, and Ventura
Sacramento River	Butte, Colusa, Glenn, Sutter, Tehama, Yolo, Yuba, Sacramento, and Solano	Alpine, Amador, Contra Costa, El Dorado, Lake, Lassen, Mendocino, Modoc, Napa, Nevada, Placer, Plumas, Shasta, Sierra, Siskiyou, Sonoma, and Trinity
South Lahontan	Fresno	Inyo, Kern, Los Angeles, Mono, San Bernardino, Tulare, and Tuolumne

A summary of the potential tax revenues, estimated bonding capacity, and estimated construction proceeds generated under each scenario in aggregate is shown in Chart 1 and Table 4 below.

Chart 1
Scenarios 1 and 2
Potential Annual Tax Revenues and Bonding Capacity

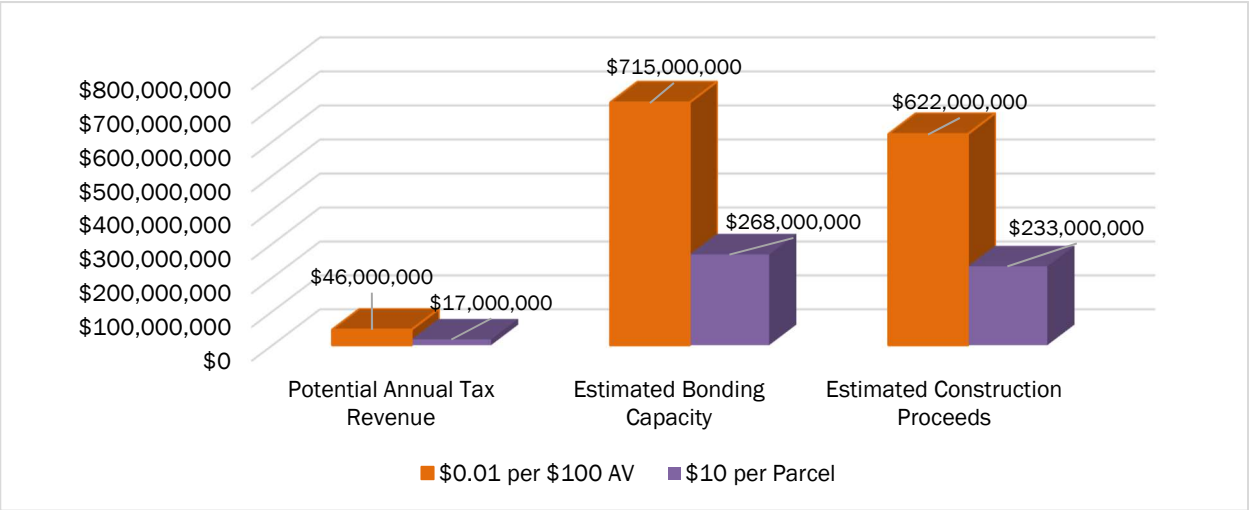


Table 4
Scenarios 1 and 2
Potential Annual Tax Revenues and Bonding Capacity

Scenario	Potential Annual Tax Revenue	Estimated Bonding Capacity	Estimated Construction Proceeds
1: $0.01 per $100 AV	$46,000,000	$715,000,000	$622,000,000
2: $10 per Parcel	$17,000,000	$268,000,000	$233,000,000

Scenario 1: Tax at $0.01 per $100 AV

For Scenario 1, DTA obtained the fiscal year 2015-2016 secured local roll net assessed values for the fourteen counties in the CVFPP from the State Board of Equalization.

The total fiscal year 2015-2016 secured local roll net assessed value for the fourteen counties is approximately $461 billion. Total bonding capacity for the CVFPP area from an ad valorem tax rate of $0.01 per $100 of net assessed value is approximately $715 million. Potential tax revenues and bonding capacity by County are shown in **Charts 2-3** below. Numerical data is shown in **Exhibit A**.

As shown in **Charts 2-3** below and **Exhibit A**, the County with the highest revenue generating potential by far is Sacramento ($13.6 million), followed by Fresno ($7.1 million).

Chart 2
Scenario 1: Tax at $0.01 per $100 AV
Potential Tax Revenues Generated by County

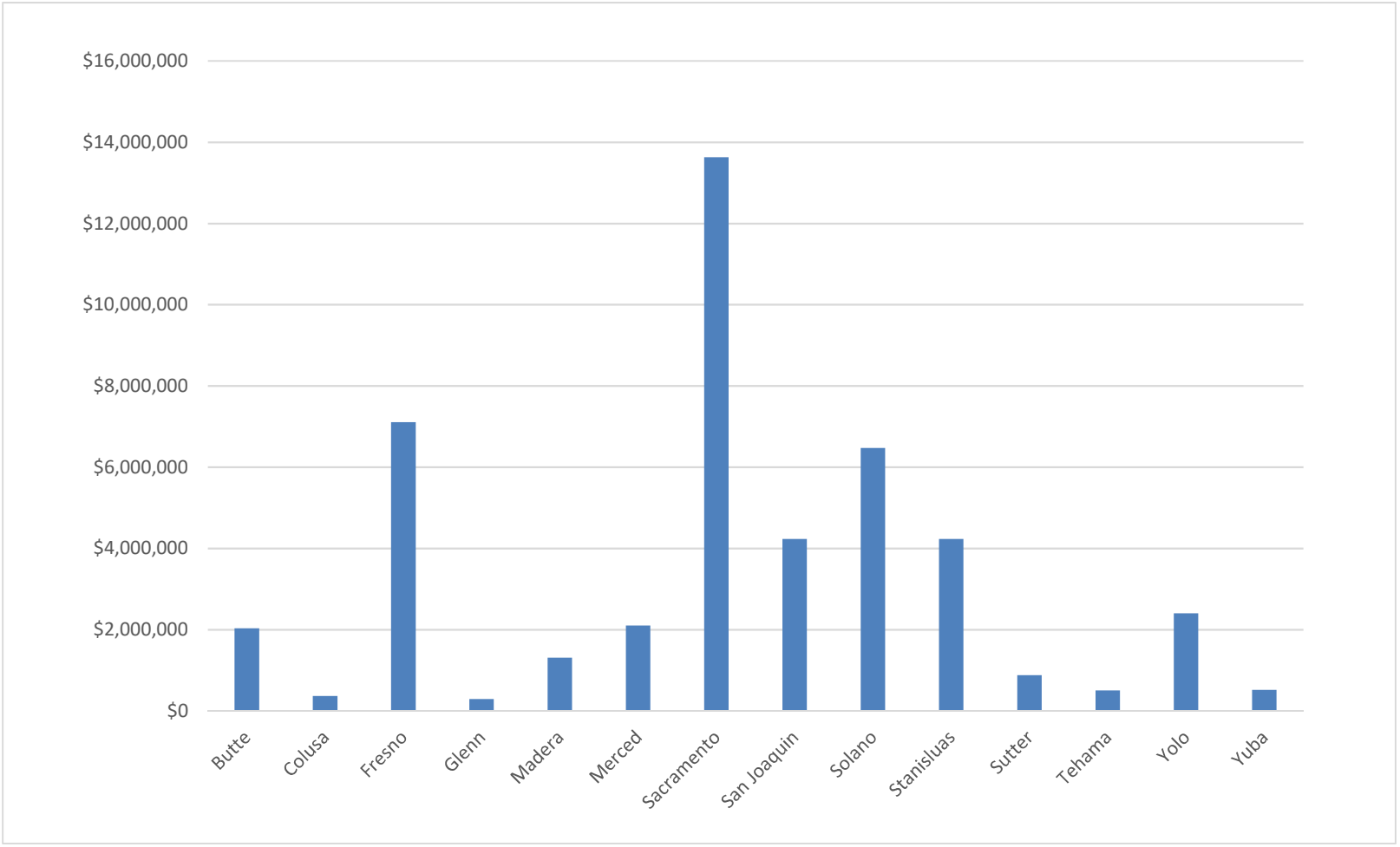
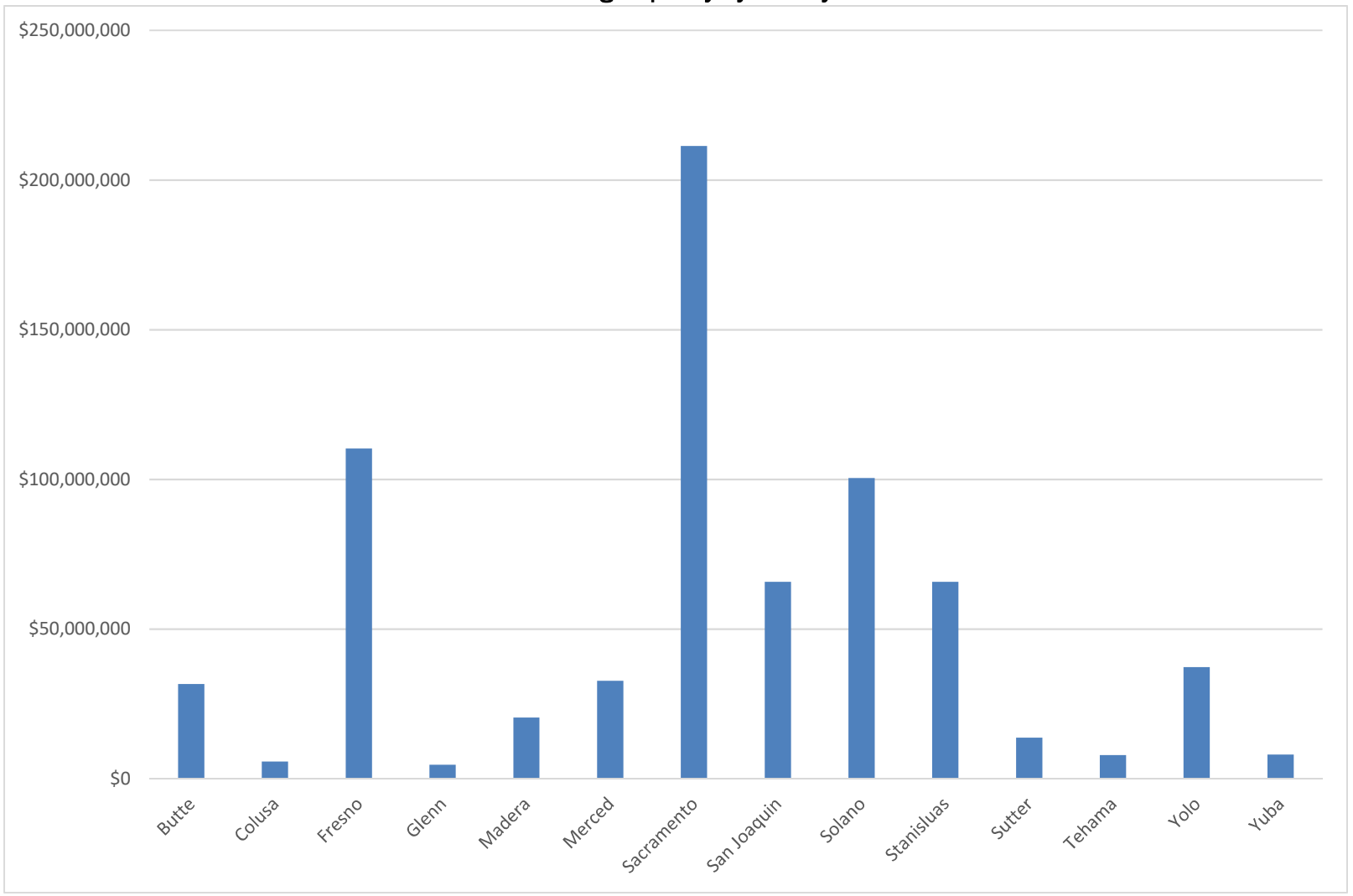


Chart 3
Scenario 1: Tax at $0.01 per $100 AV
Bonding Capacity by County



Potential tax revenues and bonding capacity by RFMP are shown in **Charts 4-5** below. Numerical data is shown in **Exhibit A**. DTA calculated the net assessed value of each RFMP by applying the percent of each CVFPP county's acreage in each RFMP (provided by CH2M Hill) to the county's net assessed value, and summing across the RFMP. For example, approximately 1.8% of Fresno County, 9.4% of Madera County, and 17.8% of Merced County, are within the Upper San Joaquin River RFMP; therefore, for purposes of this analysis, the net assessed value for the Upper San Joaquin River RFMP is the sum of approximately 1.8% of Fresno County's net assessed value, 9.4% of Madera County's net assessed value, and 17.8% of Merced County's net assessed value. The actual share of assessed value of each County within the RFMP region will vary based on the actual parcels in the RFMP.

As shown in **Charts 4-5** below and **Exhibit A**, the RFMP (for CVFPP Counties only) with the highest revenue generating potential is Lower Sacramento/Delta North ($5.3 million), followed by Lower San Joaquin River/Delta South ($772 thousand).

Chart 4
Scenario 1: Tax at $0.01 per $100 AV
Potential Tax Revenues Generated by CVFPP Counties in RFMP

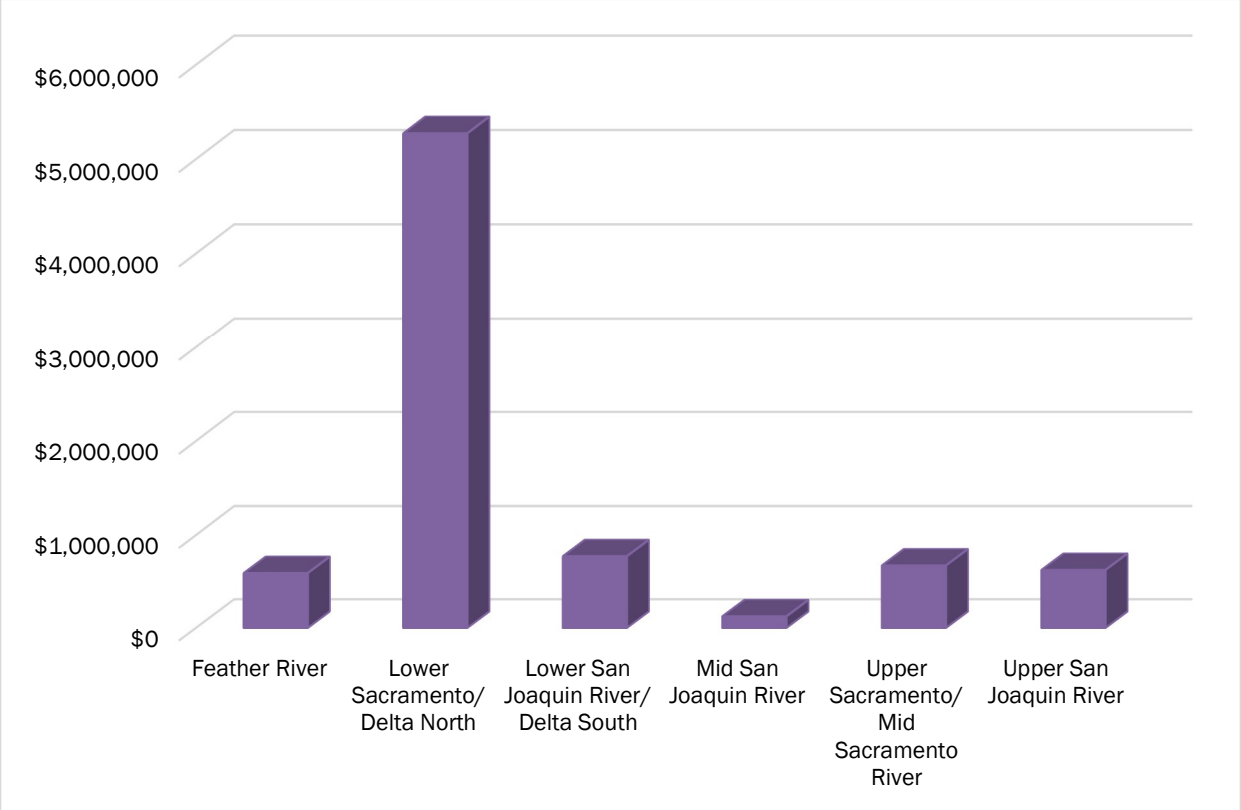
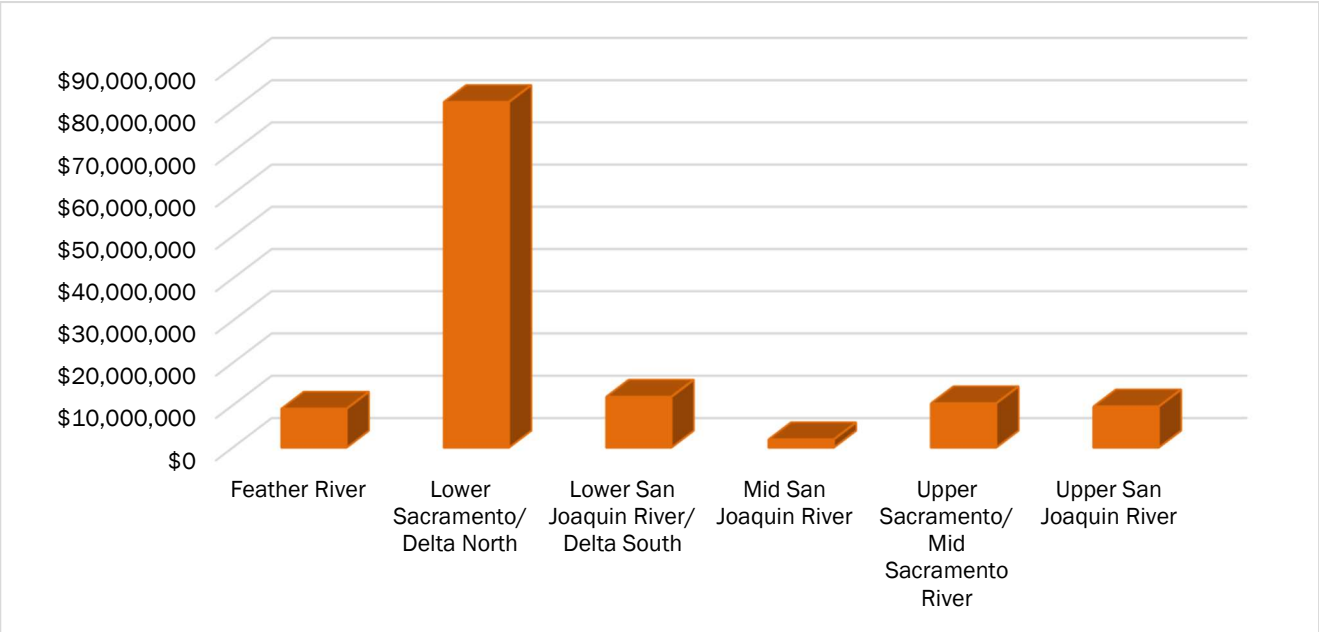


Chart 5
Scenario 1: Tax at $0.01 per $100 AV
Bonding Capacity by CVFPP Counties in RFMP



Scenario 2: Tax at $10 per Parcel

For Scenario 2, DTA estimated the fiscal year 2015-2016 number of taxable parcels in each county by determining the number of parcels in each county's extended roll with non-zero net assessed value.

The estimated total fiscal year 2015-2016 number of taxable parcels in the fourteen counties is approximately 1.73 million. Total bonding capacity for the CVFPP from a flat amount of $10 per parcel is approximately $268 million. Potential tax revenues and bonding capacity by County are shown in **Charts 6-7** below. Numerical data is shown in **Exhibit B**.

As shown in **Charts 6-7** below and **Exhibit B**, the County with the highest revenue generating potential by far is Sacramento ($4.67 million), followed by Fresno ($2.87 million).

Chart 6
Scenario 2: Tax at $10 per Parcel
Potential Tax Revenues Generated by County

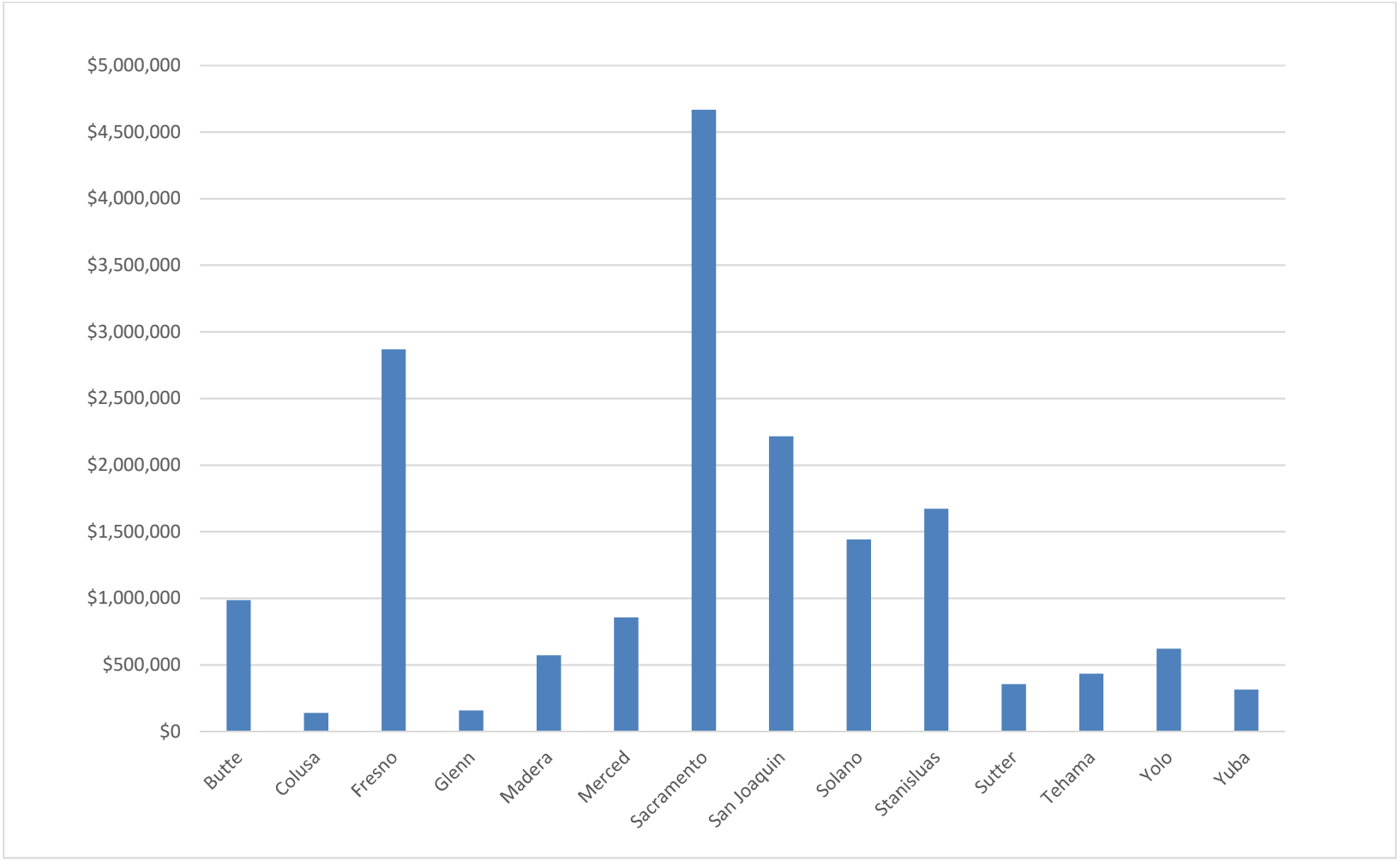
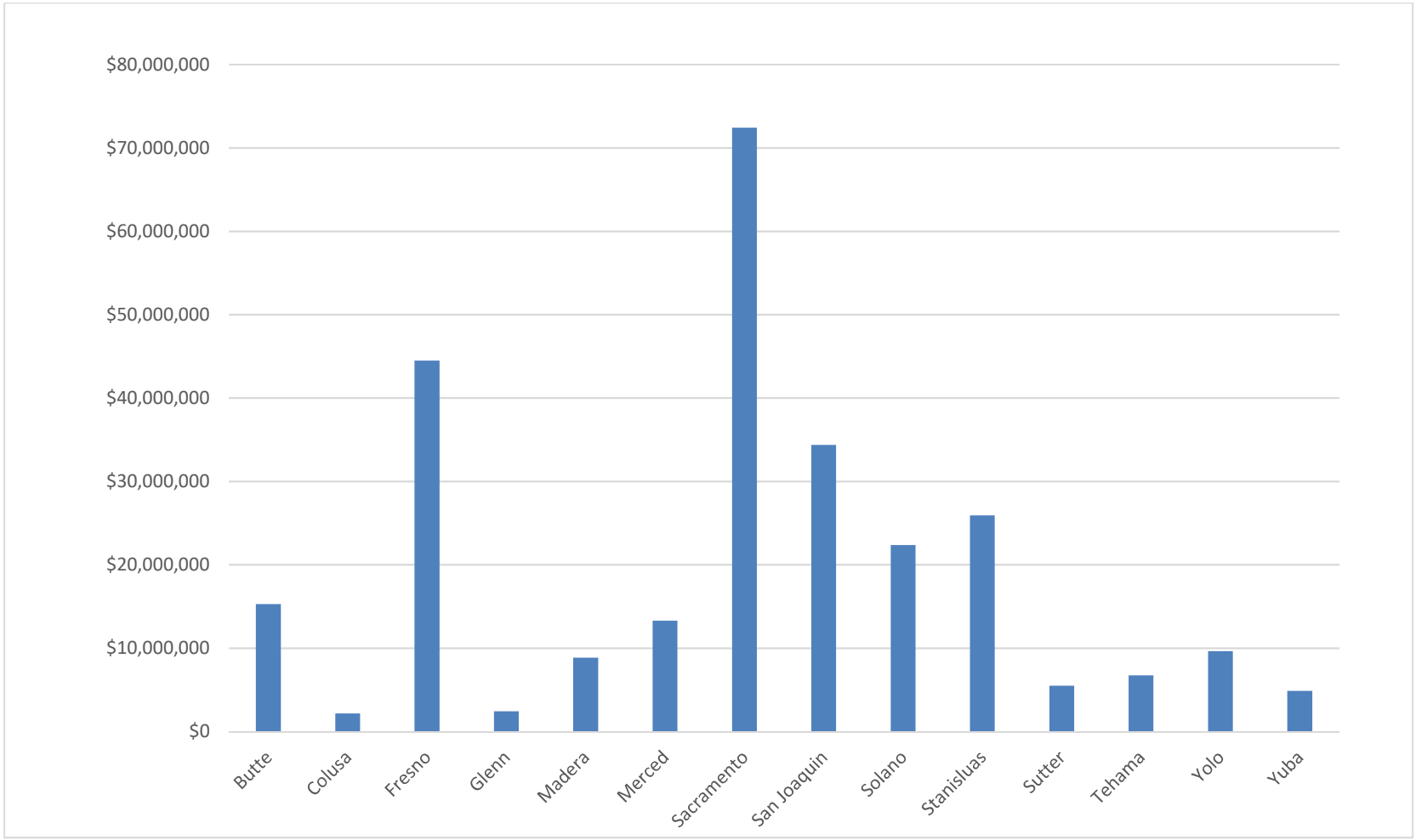


Chart 7
Scenario 2: Tax at $10 per Parcel
Bonding Capacity by County



Potential tax revenues and bonding capacity by RFMP are shown in **Charts 8-9** below. Numerical data is shown in **Exhibit B.**

As shown in **Charts 8-9** below and **Exhibit B**, the RFMP (for CVFPP counties only) with the highest revenue generating potential is Lower Sacramento/ Delta North ($1.6 million), followed by Lower San Joaquin River/ Delta South ($404 thousand).

Chart 8
Scenario 2: Tax at $10 per Parcel
Potential Tax Revenues Generated by CVFPP Counties in RFMP

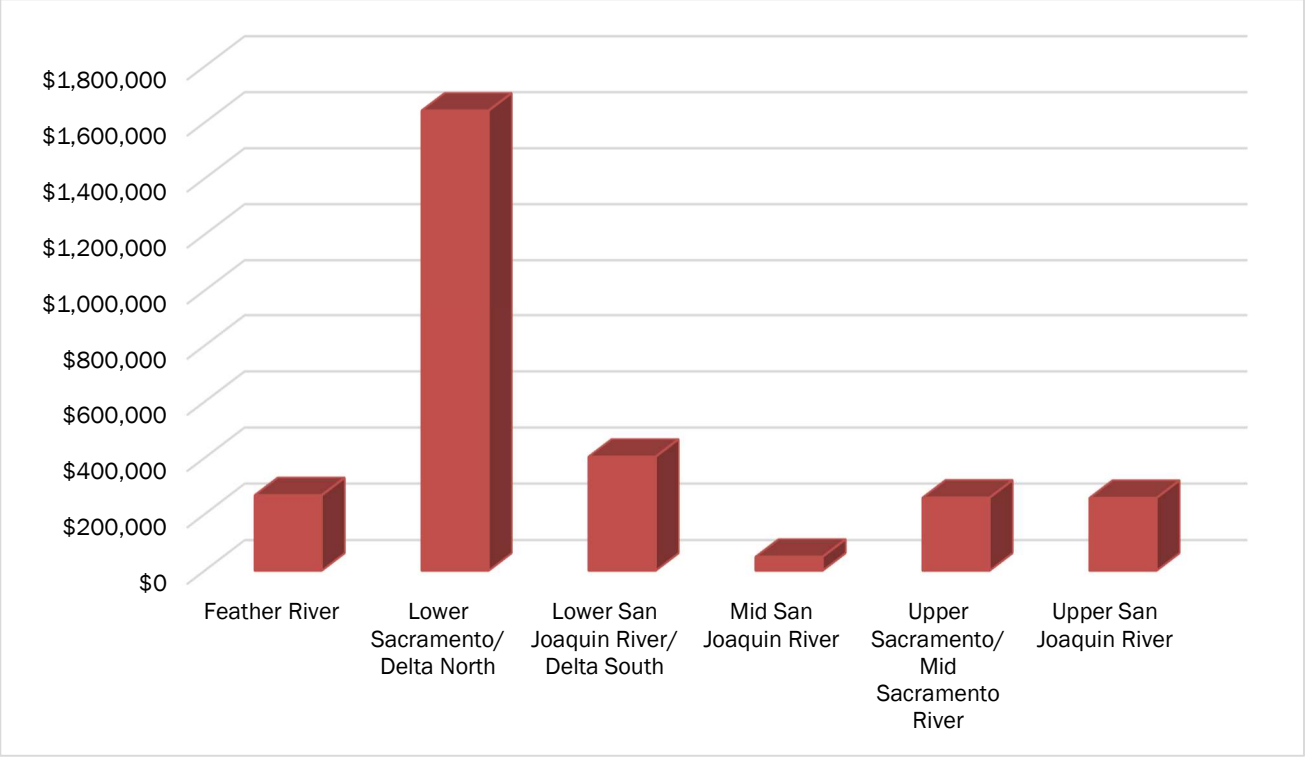
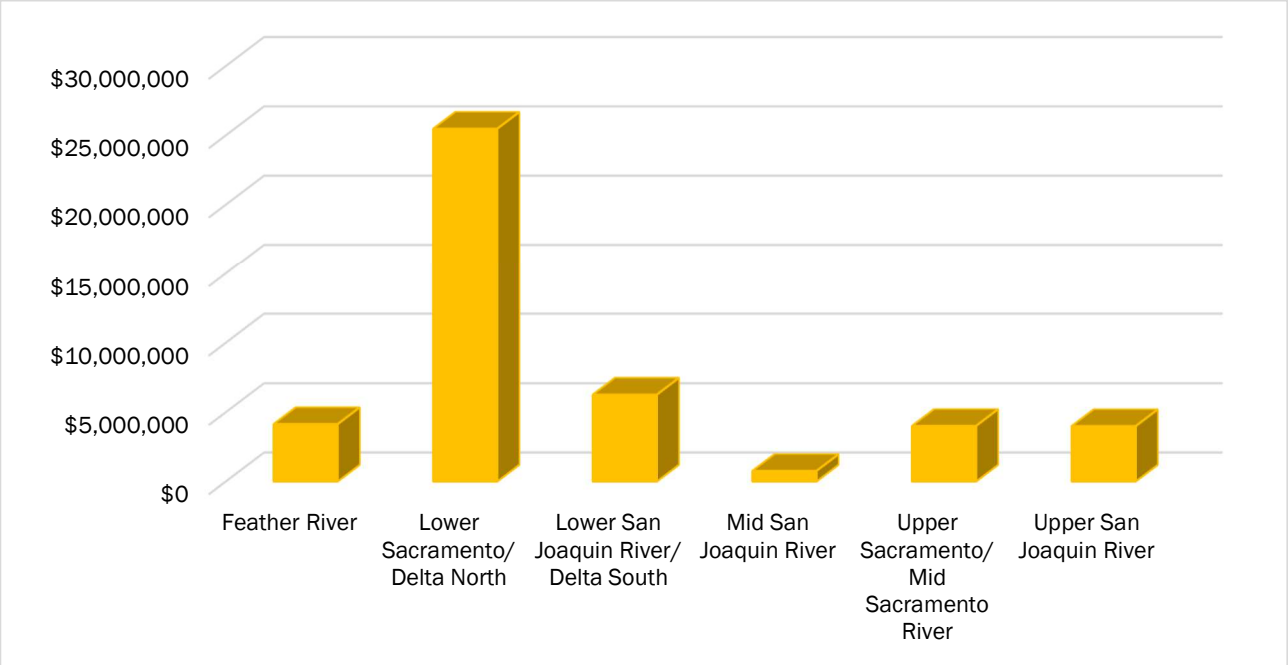


Chart 9
Scenario 2: Tax at $10 per Parcel
Bonding Capacity by CVFPP Counties in RFMP



Comparison of Scenarios 1 and 2

In aggregate, the potential annual tax revenues, bonding capacity, and construction proceeds are greater in Scenario 1 than in Scenario 2. Total potential annual tax revenues in Scenario 1 are approximately $46.1 million compared to $17.3 million in Scenario 2; total bonding capacity in Scenario 1 is approximately $715 million compared to $268 million in Scenario 2. In order to generate total tax revenues and bonding capacity equivalent to those of the ad valorem rate, the per parcel charge would need to be increased to approximately $26.59. On an individual county basis, a minority of counties – Yolo, Sacramento, and Solano- would generate more funds via the ad valorem rate than via the per parcel charge of $26.59. The majority of counties – Butte, Colusa, San Joaquin, Merced, and Fresno, among others – would generate more funds via the per parcel charge of $26.59.

For the total RFMP, the potential annual tax revenues, bonding capacity, and construction proceeds are greater in Scenario 1 than in Scenario 2. Total potential annual tax revenues in Scenario 1 are approximately $8.1 million compared to $2.9 million in Scenario 2; total bonding capacity in Scenario 1 is approximately $125 million compared to $45 million in Scenario 2. In order to generate total tax revenues and bonding capacity equivalent to those of the ad valorem rate, the per parcel charge would need to be increased to approximately $27.99.

On a county or RFMP level, the ratio of potential tax revenues (and consequently, estimated annual debt service, bonding capacity, and construction proceeds) in Scenario 1 to those in Scenario 2 is positively correlated with the net assessed value per parcel. In other words, the

higher the net assessed value per parcel, the higher the potential revenues in Scenario 1 relative to Scenario 2.

The Scenario 2 $10 per parcel charge, as a regressive tax, would shift some of the burden of bond repayment away from high income/high value areas to low and middle income/value areas. As expected and shown further in the Effective Tax Rate Analysis, the Scenario 2 $10 per parcel charge would also result in lower overall taxes and tax rates for the vast majority of parcels, as compared to the Scenario 1 $0.01 per $100 AV. While the lower charge may be more palatable to property owners, a regressive tax may bring up fairness considerations: property owners of parcels with low net assessed values would pay a higher percent of their net assessed values than property owners of parcels with high net assessed values.

II. Effective Tax Rate Analysis

The estimated tax revenues from Section I are largely theoretical; the tax revenues that will actually be generated via a new tax ultimately depends on a variety of factors, including the willingness of elected officials to propose ballot measures and the willingness of voters to approve of such measures. For this reason, we analyzed existing total effective tax rates, as well as the resulting total effective tax rates assuming a proposed IWM tax. The analysis shows the existing tax burden and how the proposed IWM bonds tax would impact the existing tax burden, which may suggest some level of tolerance for additional taxes.

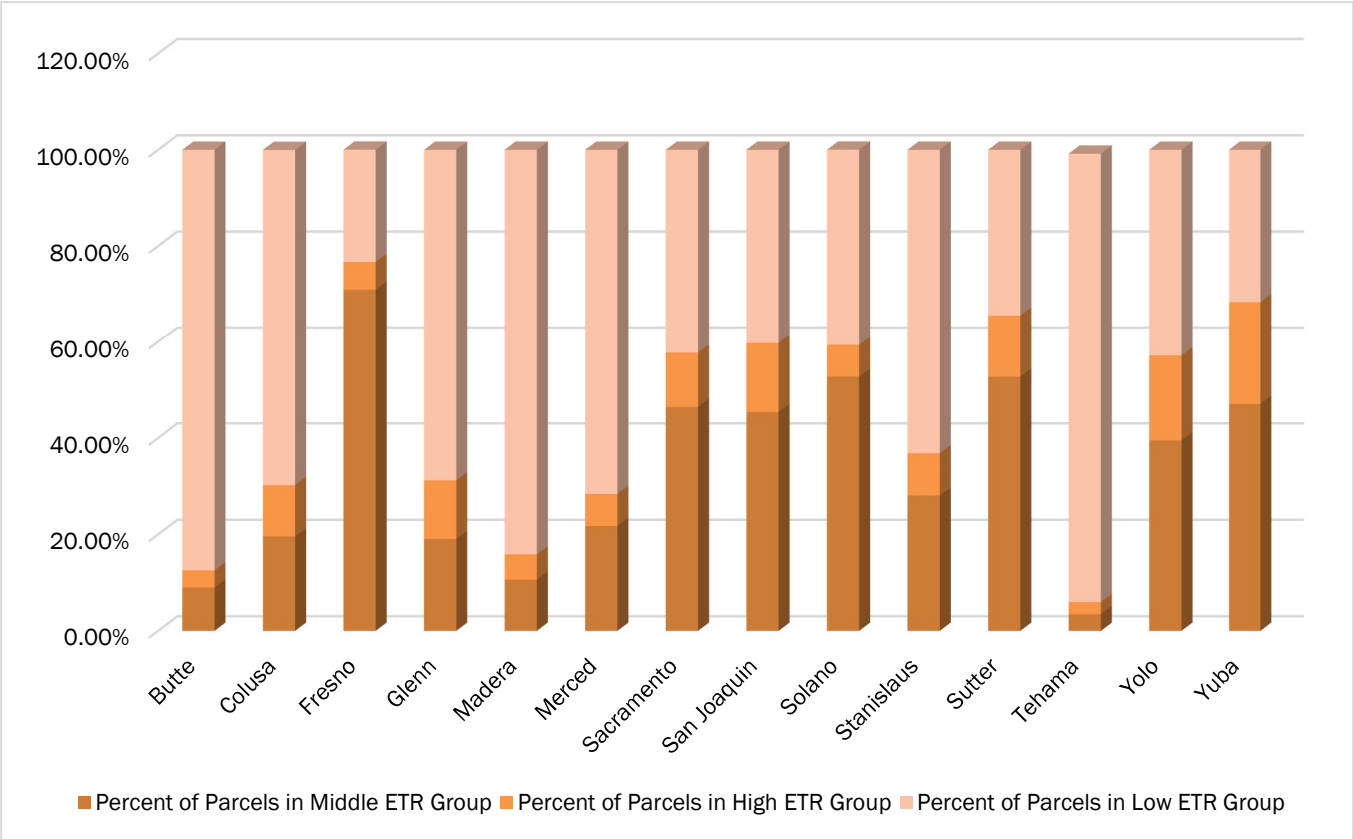
Using fiscal year 2015-2016 extended roll data, we have estimated the average effective tax rates (ETRs) for parcels in the fourteen counties in the CVFPP area. We calculate the ETR by dividing the current assessed value by the total tax amount due, with both values pulled from the extended assessor rolls. We extracted parcels with non-zero net assessed values, and divided them into three groups based on existing (pre-IWM bonds tax) tax rates:

- Low ETR (less than 1.20%);
- Middle ETR (1.20%-1.60%); and
- High ETR (greater than 1.60%).

We then calculated the proposed IWM bonds tax under the two scenarios discussed in Section I using the average net assessed value for each group, and derived the average new (post-IWM bonds tax) effective tax rates for each group. The results of our analysis are shown in **Exhibit C**.

In all counties, most parcels have existing effective tax rates under 1.50%. In the counties of Sutter, Sacramento, Solano, and Fresno, the majority of parcels are in the middle ETR group. In the remaining counties, the majority of parcels are in the low ETR group. Only the county of Yuba has more than 20% of parcels in the high ETR group. The percent of parcels in each ETR group by County is shown in **Chart 10** below.

Chart 10
Percent of Parcels in Each ETR Group by County (Pre-IWM Bonds Tax)



The median or typical taxpayer in each County has an existing effective tax rate between 1.02% (Tehama) and 1.28% (San Joaquin). In Tehama, this translates to approximately $1,100 in taxes on net assessed value of approximately $109,000; in San Joaquin, this equates to approximately $3,600 in taxes on net assessed value of approximately $285,000. The median existing effective tax rates and property tax amounts are shown in **Charts 11-12** below.

Chart 11
Effective Tax Rates, Median Taxpayer (Existing Taxes)

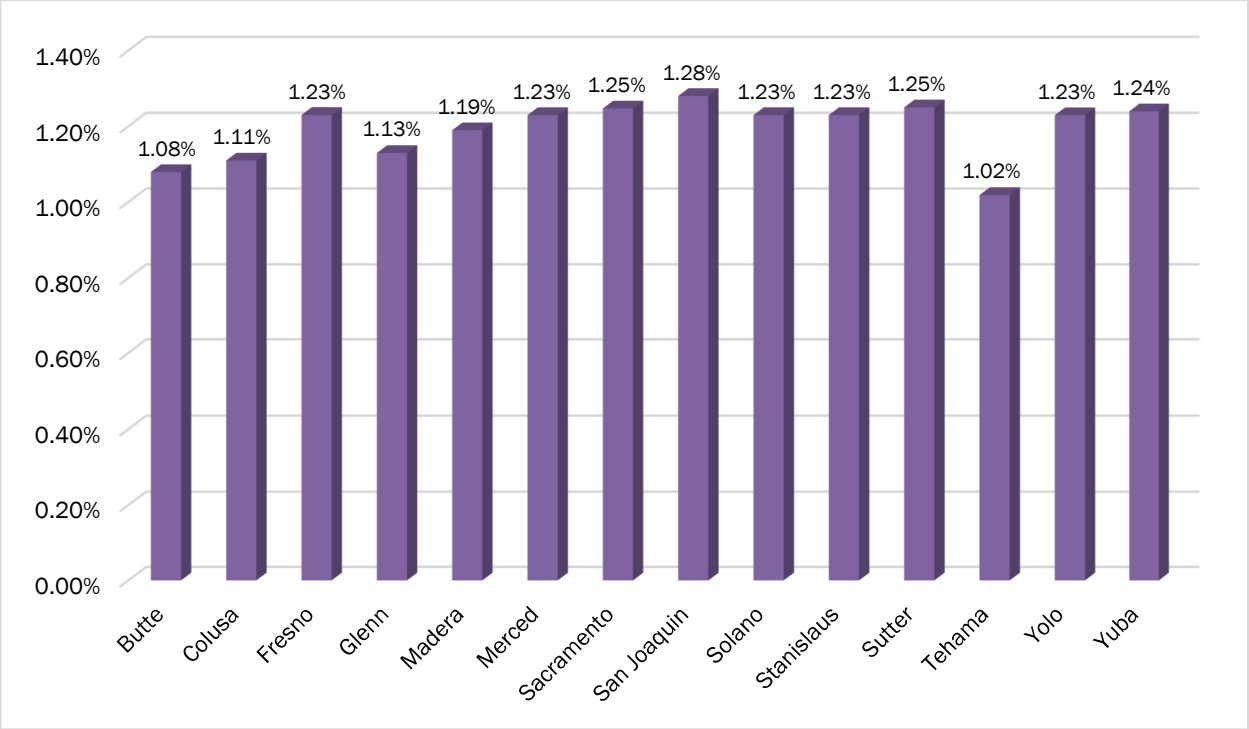
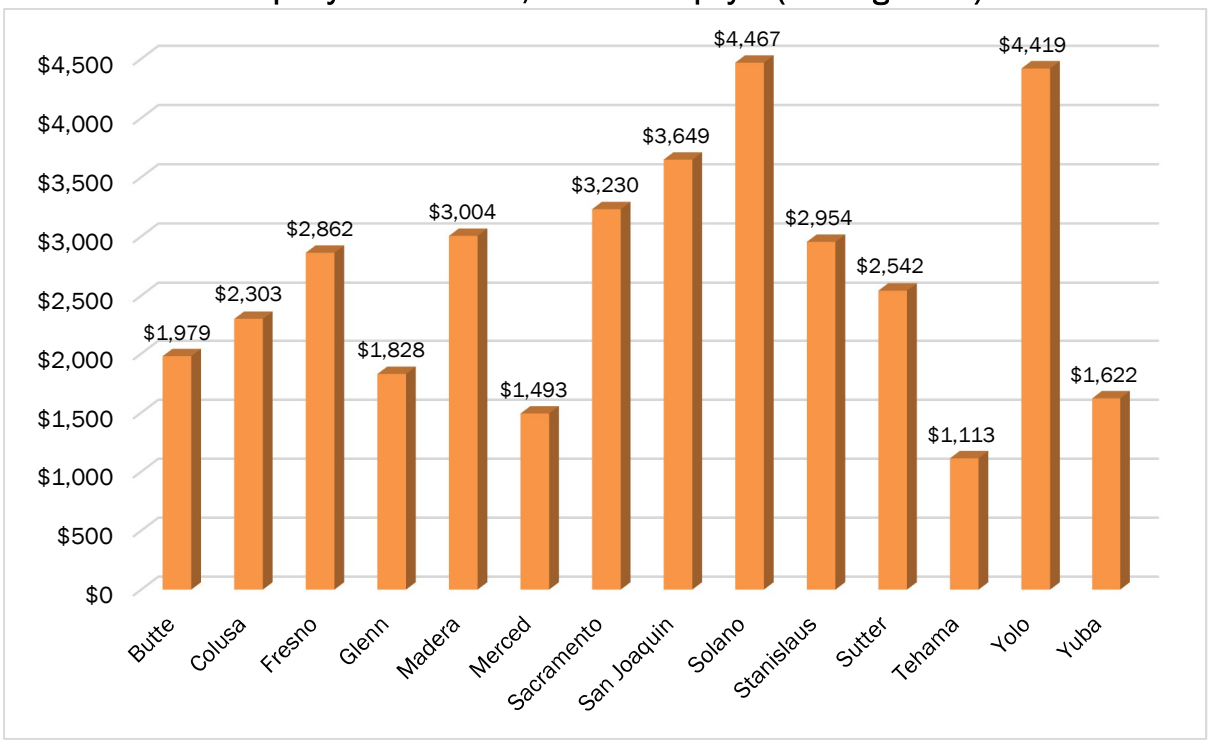


Chart 12
Property Tax Amounts, Median Taxpayer (Existing Taxes)



With the addition of the IWM bonds tax, the effective tax rate for the middle ETR group ranges from 1.27% to 1.37%, and the property tax amount for the middle ETR group ranges from $1,024 to $4,845 under Scenario 1. The effective tax rate for the middle ETR group ranges from 1.26% to 1.37%, and the property tax amount for the middle ETR group ranges from $1,026 to $4,817 under Scenario 2. The post-IWM bonds tax effective tax rates and property tax amounts under each Scenario are shown in **Charts 13-14** below. The difference between the post-IWM bonds effective tax rate for all 14 counties under Scenario 1 and Scenario 2 ranges from 0.0006% and 0.0074%, as shown in **Chart 13**, below.

Chart 13
Scenarios 1 and 2
ETRs (Existing and Post-IWM Bonds Tax), Middle ETR Group

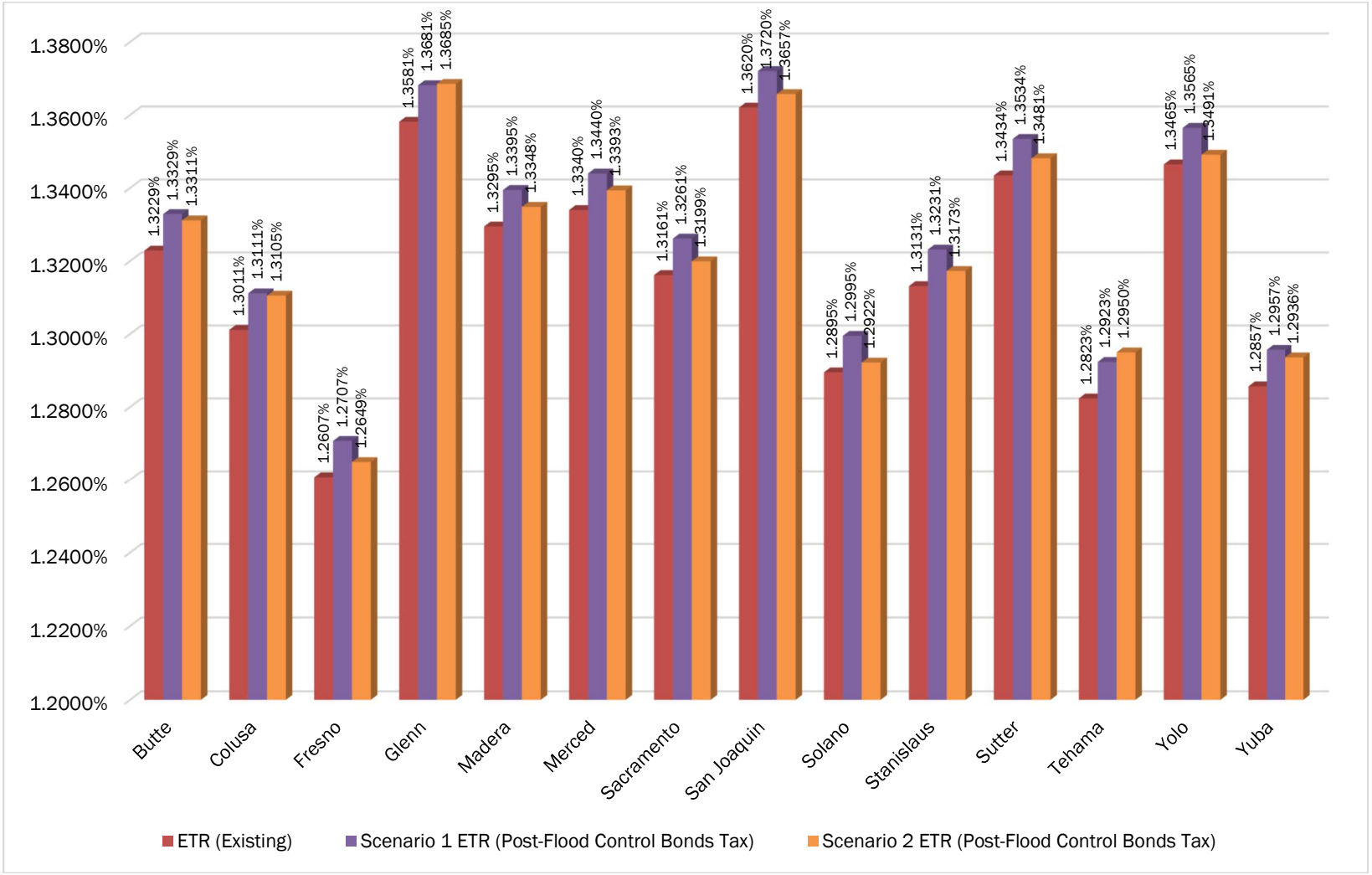
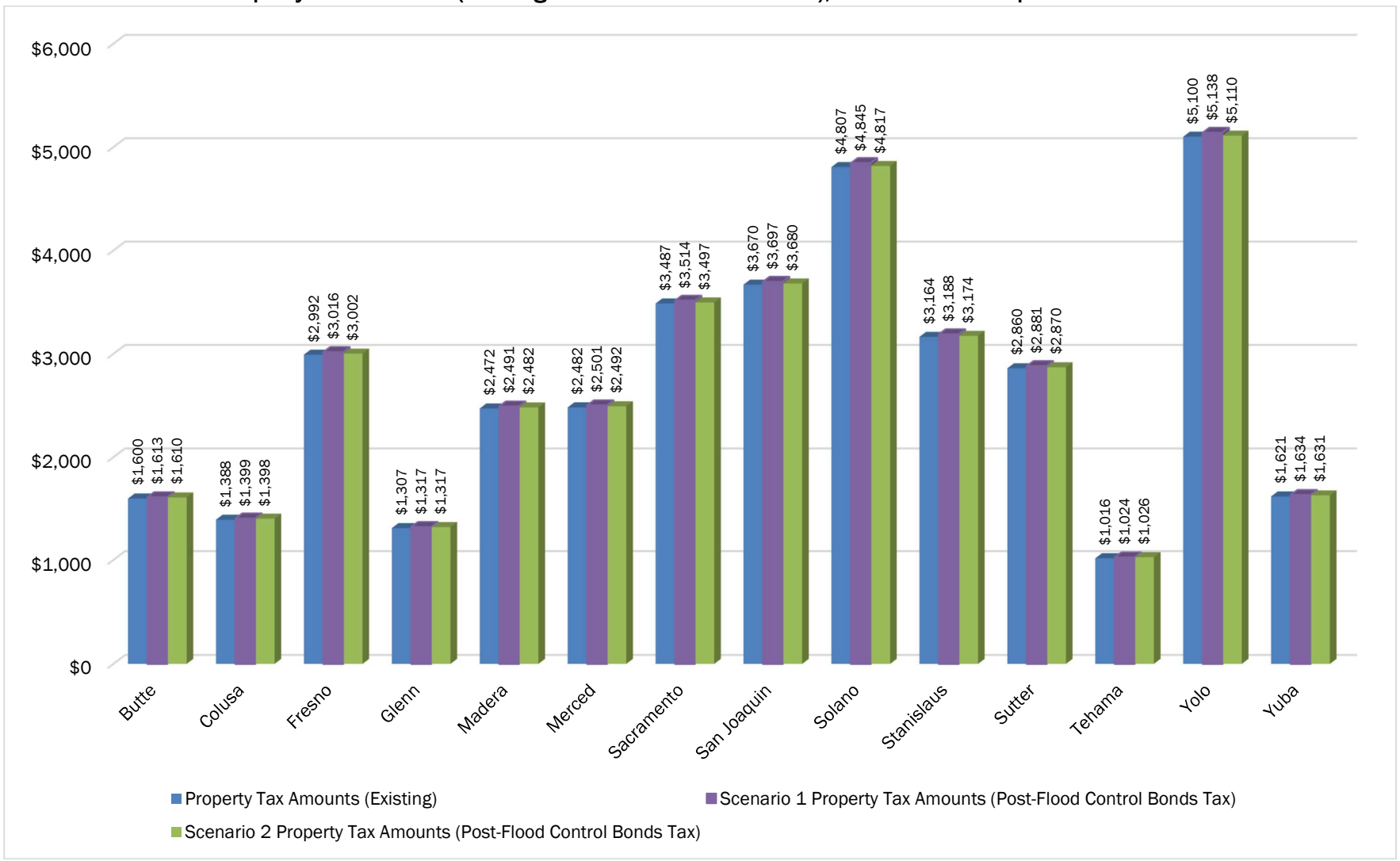


Chart 14
Scenarios 1 and 2
Property Tax Amounts (Existing and Post-IWM Bonds Tax), Middle ETR Group



III. County Analysis

The fourteen counties in the CVFPP can be broken into two groups: (1) Counties where the majority of parcels are in the low ETR group and (2) Counties where the majority of parcels are in the middle ETR group. For each county, we calculated the average existing tax rate for the primary ETR group. In addition, we determined the most prevalent land uses for each primary ETR group for each county, as shown in **Table 5** below.

Table 5
Primary ETR Groups by County

County	Primary ETR Group [1]	Percent of Parcels in Primary ETR Group	Average Net Assessed Value [2,3]	Average Existing Tax Rate [2,4]	Tax Rate Post IWM Bonds: Scenario 1 [2]	Tax Rate Post IWM Bonds: Scenario 2 [2]	Primary Land Use [2]
Butte	Low (1.00%-1.20%)	87%	$211,807	1.08%	1.09%	1.09%	Rural Residences
Colusa	Low (1.00%-1.20%)	70%	$308,751	1.07%	1.09%	1.08%	Single Family Residential
Fresno	Middle (1.20%-1.60%)	71%	$237,351	1.26%	1.27%	1.26%	N/A
Glenn	Low (1.00%-1.20%)	69%	$239,498	1.08%	1.09%	1.09%	Single Family Residential
Madera	Low (1.00%-1.20%)	84 %	$239,276	1.11%	1.12%	1.12%	Single Family Residential
Merced	Low (1.00%-1.20%)	72%	$253,916	1.11%	1.12%	1.11%	Single Family Residential
Sacramento	Middle (1.20%-1.60%)	46%	$264,970	1.32%	1.33%	1.32%	Single Family Residential
San Joaquin	Middle (1.20%-1.60%)	45%	$269,451	1.36%	1.37%	1.37%	Single Family Residential
Solano	Middle (1.20%-1.60%)	53%	$372,810	1.29%	1.30%	1.29%	N/A
Stanislaus	Low (1.00%-1.20%)	63%	$261,427	1.11%	1.12%	1.11%	Single Family Residential
Sutter	Middle (1.20%-1.60%)	53%	$212,883	1.34%	1.35%	1.35%	Vacant or Improved
Tehama	Low (1.00%-1.20%)	93%	$124,808	1.02%	1.03%	1.03%	Rural Residences
Yolo	Low (1.00%-1.20%)	43%	$431,987	1.11%	1.12%	1.11%	Single Family Residential
Yuba	Middle (1.20%-1.60%)	47%	$126,078	1.29%	1.30%	1.29%	Single Family-Urban

[1] ETR group with the highest percentage of parcels for each county.
[2] For primary ETR group for that county. Based on information provided by the Assessor for each county as of January 1, 2015.
[3] Average Net Assessed Value is calculated by dividing the net assessed value by the number of parcels with a net assessed value greater than zero.
[4] Average Existing Tax Rate is calculated by dividing the average net assessed value by the average fiscal year 2015-2016 property tax amount.

In addition, each county has parcels spread among the three ETR groups (low, middle, and high), as shown in **Table 6** below.

Table 6
Portion in ETR Groups
By County

County	Percent of Parcels in Low Group (1.00%-1.20%)	Percent of Parcels in Middle Group (1.20%-1.60%)	Percent of Parcels in High Group (>1.60%)	Total
Butte	**87%**	9%	4%	100%
Colusa	**70%**	20%	11%	100%
Fresno	23%	**71%**	6%	100%
Glenn	**69%**	19%	12%	100%
Madera	**84%**	11%	5%	100%
Merced	**72%**	22%	7%	100%
Sacramento	42%	**46%**	11%	100%
San Joaquin	40%	**45%**	14%	100%
Solano	41%	**53%**	7%	100%
Stanislaus	**63%**	28%	9%	100%
Sutter	34%	**53%**	13%	100%
Tehama	**93%**	3%	4%	100%
Yolo	**43%**	39%	18%	100%
Yuba	32%	**47%**	21%	100%

Low ETR Group (1.00%-1.20%)

Eight of the 14 counties in the CVFPP (Butte, Colusa, Glenn, Madera, Merced, Stanislaus, Tehama, and Yolo) have a majority of their parcels in the low ETR group, as shown in **Tables 5** and **6**, above.

Of these eight counties, six of them (Butte, Colusa, Glenn, Madera, Merced, and Tehama) have over 65% of their parcels in the low ETR group, while the other two counties (Stanislaus and Yolo) have only 63% and 43% of their parcels in the low ETR group, respectively. Therefore, the six counties may be more willing to accept additional taxes than the other two counties since they have more room to go up. Based on Assessors' land use codes, residential parcels – single family residences and rural residences - make up the bulk of this ETR group for these six counties. In addition, these six counties have the largest proportion of parcels in the low ETR group (70%-93%) of all 14 counties. The average ETR for the parcels in the low ETR group for these six counties ranges from 1.02% to 1.11%, suggesting that there is a low amount of ad valorem taxes or fixed charges in excess of the 1.00% base rate. Under Scenarios 1 and 2, post-IWM bonds taxes would range from 1.03% to 1.12% for these six counties. As a result, these six counties may have a much higher tolerance for additional taxes based on ETR measures alone.

Conversely, Stanislaus and Yolo counties have less than 65% of parcels in the low ETR group, with only 63% and 43% of parcels in the low ETR group, respectively. For both counties, a minority of parcels are in the middle ETR group (28% for Stanislaus and 39% for Yolo). The parcels within the middle ETR group for Stanislaus and Yolo have moderate average tax rates, 1.31% and 1.35%, respectively, showing these two counties may still have a relatively moderate to high ability to accept more taxes. Additionally, Yolo County has 18% of their parcels in the high ETR group. Based on Assessors' land use codes, residential parcels – single family residences and single family condominiums - make up the bulk of this ETR group. Under Scenarios 1 and 2, post-IWM bonds taxes would range from 1.11% to 1.12% for these two counties. While Butte, Colusa, Glenn, Madera, Merced, and Tehama counties clearly have the strongest capacity for increased taxes, Stanislaus and Yolo counties may also have significant room for increased taxes.

All eight of these counties appear to have a negative correlation between ETR and assessed value, with lower value parcels paying a higher percentage of their value in taxes. For all eight counties, all three ETR groups would pay a lower amount with the 1.00% ad valorem or $10 per parcel charge, than the $26.59 per parcel charge.

Middle ETR Group (1.20%-1.60%)

Six of the 14 counties in the CVFPP (Fresno, Sacramento, San Joaquin, Solano, Sutter, and Yuba) have a majority of their parcels in the middle ETR group, as shown in **Tables 5** and **6**, above, ranging from 46% to 71%.

The average existing tax rate for the parcels in the middle ETR group ranges from 1.26% to 1.36%, suggesting that there is a low to moderate amount of ad valorem taxes or fixed charges in excess of the 1.00% base rate. These six counties may have moderate to high additional taxing capacity, with varying degrees.

Four of the six counties, Sutter, Sacramento, Solano, and San Joaquin may have a high to moderate willingness to accept additional taxes, with only a slightly higher percentage of parcels in the middle ETR group than the low ETR group. Based on Assessor's land use codes, Sacramento and San Joaquin counties are primarily made up of single family residences for this group, while Sutter County is primarily made up of vacant or improved land. At this time, DTA does not have access to land usage data for Solano County, but can do further research if necessary The average tax rate for the middle ETR groups for Sutter, Sacramento, Solano, and San Joaquin ranges from 1.29% to 1.36%, and the average tax rates for the low ETR groups ranging from 1.11% to 1.15%. Under Scenarios 1 and 2, post-IWM bonds taxes would range from 1.29% to 1.136% for the middle ETR group. Therefore, these four counties may have moderate to high ability to accept more taxes

Yuba County has 47% of its parcels in the middle ETR group, with an average tax rate of 1.29%. Yuba County also has the highest portion of parcels of all 14 counties in the high ETR group, at over 20%. Based on Assessors' land use codes, residential parcels – urban single family residences and vacant single family residences - make up the bulk of the high ETR group. Therefore, Yuba County may have the lowest capacity for increased taxes within this group.

Conversely, Fresno County may have the highest capacity for increased taxes of the counties in this group, with 71% of parcels in the middle ETR group with a relatively low average tax rate of 1.26%, only 0.06% greater than the maximum of the low ETR range. Under Scenarios 1 and 2, post-IWM bonds taxes would increase to a range of 1.26% to 1.27% for the middle ETR group

Similarly to the low ETR group, five of the six counties appear to have a negative correlation between ETR and assessed value, with lower value parcels paying a higher percentage of their value in taxes. Solano County is the only county in the CVFPP that does not appear to have a negative correlation between ETR and assessed value. For all eight counties, all three ETR groups would pay a lower amount with the 1.00% ad valorem or $10 per parcel charge, than the $26.59 per parcel charge.

IV. Ability & Willingness to Pay

As outlined in a 2011 California Debt Investment Advisory Commission (CDIAC) report, *Debt Burdens of California State and Local Governments: Past, Present and Future*, one approach to evaluating the feasibility and reasonableness of a proposed tax measure is to assess its affordability, that is, whether individuals and governments can afford the tax (and its associated debt) and everything else they want to purchase. From the perspective of individuals, the issue is the amount of taxes they are willing to pay to finance government debt. A number of factors may affect individuals' willingness to pay, among them: their existing total effective tax rate, their income, the local unemployment rate, the amount/nature/purpose of the tax itself, and public opinion. In addition, the factors may affect different classes to different extents: Owners of residential property may be more influenced by the existing total effective tax rate, while owners of non-residential property may be more influenced by the purpose of the tax or public opinion. It is important, therefore, to consider the type of funding mechanism and who is voting, in properly assessing willingness

to pay and the ultimate success of the funding mechanism. If, for example, we consider a property owner election, both residential and non-residential owners will vote, but those who rent property will not vote. If a registered voter election, residential property owners and renters will vote, but non-residential owners will not vote.

Effective Tax Rate Considerations

The total effective tax rate on a home is equal to the total taxes on the home divided by the assessed value of the home. The taxes consist of ad valorem taxes and fixed charges. Ad valorem taxes are percentage taxes applied to the net assessed value of the home. Under California Proposition 13 passed in 1978, general ad valorem taxes are capped at 1.00% of net assessed value, and go toward county, city, and school funds. Ad valorem taxes above 1.00% include any voter-approved general obligation debt issued by public entities, such as cities, school districts, community college districts, and water districts. In contrast, fixed charges and assessments are not impacted by the value of the home. These charges, among them Mello-Roos special taxes, and special assessments, finance a variety of public facilities and services, including city and school facilities, street and storm drain maintenance, and park maintenance. Because fixed charges are not impacted by changing values, homes with high fixed charges will see their tax rates increase as their assessed value decreases.

In a 1991 report, CDIAC established total effective tax rate guidelines, which have since become the industry standard: New parcel taxes should be calculated such that "the total tax burden on residential property [does not] exceed 2.00% of the anticipated fair market value of each improved parcel upon completion of all public and private improvements." The purpose of the 2.00% "cap" is to prevent public agencies from overburdening properties with property taxes. At some point, a high tax burden may have an impact on property marketability and attractiveness, residential population, residential spending habits, and ultimately local tax revenues.

In addition, low existing total effective tax rates may be positively correlated with tax election successes. A Rand Foundation study, *Schools, Taxes, and Voter Behavior: An Analysis of School District Property Tax Elections* (1974) looked at 1600 school district property tax elections held in California from the mid-1950's to 1972, and found that the existing taxes, the proposed taxes, and the change in taxes were all smaller in the successful elections than in the failing elections.

It should be noted that Proposition 13 also restricted annual increases of assessed value to an inflation factor not to exceed 2.00% per year, and limited reassessment to cases of (1) change in ownership, or (2) completion of new construction. Low assessed value, therefore, may not necessarily be indicative of a home's condition or property owner income. In areas where home assessed values are, on average, lower than market value, property owners may not consider a high effective tax rate a burden.

Demographic Considerations

Demographics may also impact individuals' ability and willingness to pay new taxes. For example, property owners in more affluent areas may have more disposable income and be more amenable to diverting a portion of their income to public facilities and services. Similarly,

property owners in areas with low unemployment are more likely to be employed, and thus have regular income, and may be better able to afford new taxes. Areas that are composed largely of Democrats may be more favorable to increased government spending. Areas with higher proportions of senior citizens may be disinclined to vote for long-term debt for which they may not see benefit.

Although literature on the effect of various demographics on voter behavior in parcel tax elections in California is somewhat limited, the existing literature seems to bear out the positive correlation between income and success of a tax measure. *Schools, Taxes, and Voter Behavior* found that high family incomes were associated with successful elections, and low family incomes with failing elections. In addition, the proportion of families with income greater than $25,000 (1974 dollars) was an important variable in the outcomes of the elections. Similarly, an EdSource Study titled *Raising Revenues Locally: Parcel Taxes in California School Districts 1983-2012* (2013) found that parcel taxes were approved in school districts that tended to be smaller, more affluent, and with a higher percentage of white and Asian students. More than 50% of school districts that approved a parcel tax had less than 25% of their students qualify for free and reduced-price meals, and more than 33% were "basic aid" school districts, among the wealthiest in the state.

Other Considerations

One final consideration is the importance of ensuring property owners or registered voters see return on their investment, that is, that they can point to tangible benefits in their day-to-day lives from increased flood protection facilities. One benefit may be lower home and auto insurance rates in areas with frequent flooding. In addition, external factors may affect individuals' need or perceived need for flood protection facilities. For example, during or immediately following storms, individuals may perceive more benefit from the flood protection facilities, and be more willing to pay for them.

There is no formula for a successful parcel tax measure; a wide array of factors, to varying extents, influence the outcomes of property tax elections. We look forward to discussing our analyses and research with you in further detail.

EXHIBIT A

Potential Tax Revenues and Bonding Capacity Analysis
Scenario 1: $0.01 per $100 AV

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Scenario 1: Tax at $0.01 per $100 AV by County

County	FY 2015-2016 Secured Local Roll Net Assessed Valuation	Potential Tax Revenue	Estimated Bonding Capacity	Estimated Construction Proceeds
Butte	$20,378,712,000	$2,037,871	$31,610,000	$27,500,700
Colusa	$3,673,998,000	$367,400	$5,695,000	$4,954,650
Fresno	$71,088,391,000	$7,108,839	$110,280,000	$95,943,600
Glenn	$2,957,463,000	$295,746	$4,585,000	$3,988,950
Madera	$13,115,003,000	$1,311,500	$20,345,000	$17,700,150
Merced	$21,026,330,000	$2,102,633	$32,615,000	$28,375,050
Sacramento	$136,265,062,000	$13,626,506	$211,390,000	$183,909,300
San Joaquin	$42,354,843,000	$4,235,484	$65,705,000	$57,163,350
Solano	$64,712,343,000	$6,471,234	$100,385,000	$87,334,950
Stanisluas	$42,354,843,000	$4,235,484	$65,705,000	$57,163,350
Sutter	$8,834,229,000	$883,423	$13,700,000	$11,919,000
Tehama	$5,074,988,000	$507,499	$7,870,000	$6,846,900
Yolo	$24,015,579,000	$2,401,558	$37,255,000	$32,411,850
Yuba	$5,193,638,000	$519,364	$8,055,000	$7,007,850
Total	**$461,045,422,000**	**$46,104,542**	**$715,195,000**	**$622,219,650**

Scenario 1: Tax at $0.01 per $100 AV by RFMP

Regional Flood Management Plan (RFMP)	FY 2015-2016 Secured Local Roll Net Assessed Valuation	Potential Tax Revenue	Estimated Bonding Capacity	Estimated Construction Proceeds
Feather River	$5,907,536,506	$590,754	$9,160,000	$7,969,200
Lower Sacramento/ Delta North	$52,723,575,003	$5,272,358	$81,790,000	$71,157,300
Lower San Joaquin River/ Delta South	$7,721,379,954	$772,138	$11,975,000	$10,418,250
Mid San Joaquin River	$1,234,812,762	$123,481	$1,915,000	$1,666,050
Upper Sacramento/ Mid Sacramento River	$6,725,831,230	$672,583	$10,430,000	$9,074,100
Upper San Joaquin River	$6,241,887,130	$624,189	$9,680,000	$8,421,600
Total	**$80,555,022,585**	**$8,055,502**	**$124,950,000**	**$108,706,500**

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EXHIBIT B

Potential Tax Revenues and Bonding Capacity Analysis
Scenario 2: $10 per Parcel

		Scenario 2: Tax at $10 per Parcel by County		
County	**FY 2015-2016 Number of Taxable Parcels**	**Potential Tax Revenue**	**Estimated Bonding Capacity**	**Estimated Construction Proceeds**
Butte	98,579	$985,790	$15,290,000	$13,302,300
Colusa	14,006	$140,060	$2,170,000	$1,887,900
Fresno	286,850	$2,868,500	$44,495,000	$38,710,650
Glenn	15,723	$157,230	$2,435,000	$2,118,450
Madera	57,199	$571,990	$8,870,000	$7,716,900
Merced	85,637	$856,370	$13,285,000	$11,557,950
Sacramento	466,702	$4,667,020	$72,400,000	$62,988,000
San Joaquin	221,581	$2,215,810	$34,370,000	$29,901,900
Solano	144,203	$1,442,030	$22,370,000	$19,461,900
Stanisluas	167,122	$1,671,220	$25,925,000	$22,554,750
Sutter	35,523	$355,230	$5,510,000	$4,793,700
Tehama	43,434	$434,340	$6,735,000	$5,859,450
Yolo	62,179	$621,790	$9,645,000	$8,391,150
Yuba	31,407	$314,070	$4,870,000	$4,236,900
Total	**1,730,145**	**$17,301,450**	**$268,370,000**	**$233,481,900**

		Scenario 2: Tax at $10 per Parcel by RFMP		
Regional Flood Management Plan (RFMP)	**FY 2015-2016 Number of Taxable Parcels**	**Potential Tax Revenue**	**Estimated Bonding Capacity**	**Estimated Construction Proceeds**
Feather River	26,682	$266,820	$4,135,000	$3,597,450
Lower Sacramento/ Delta North	164,243	$1,642,430	$25,475,000	$22,163,250
Lower San Joaquin River/ Delta South	40,394	$403,940	$6,265,000	$5,450,550
Mid San Joaquin River	4,875	$48,750	$755,000	$656,850
Upper Sacramento/ Mid Sacramento River	25,830	$258,300	$4,005,000	$3,484,350
Upper San Joaquin River	25,731	$257,310	$3,990,000	$3,471,300
Total	**287,755**	**$2,877,550**	**$44,625,000**	**$38,823,750**

EXHIBIT C

Estimated Effective Tax Rates

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	Butte			Colusa			Glenn			Sutter		
	Existing	**Scenario 1**	**Scenario 2**	**Existing**	**Scenario 1**	**Scenario 2**	**Existing**	**Scenario 1**	**Scenario 2**	**Existing**	**Scenario 1**	**Scenario 2**
Average Effective Tax Rate Group (1.20% - 1.60%)												
Percent of Parcels in Average Range (Existing) [1]	8.99%	NA	NA	19.58%	NA	NA	19.04%	NA	NA	52.69%	NA	NA
Average Net Assessed Value [1]	$120,983.40	$120,983.40	$120,983.40	$106,690.64	$106,690.64	$106,690.64	$96,253.11	$96,253.11	$96,253.11	$212,883.19	$212,883.19	$212,883.19
Average Existing FY 2015-2016 Property Taxes [1]	$1,600.43	$1,600.43	$1,600.43	$1,388.19	$1,388.19	$1,388.19	$1,307.25	$1,307.25	$1,307.25	$2,859.96	$2,859.96	$2,859.96
Proposed Flood Control Bonds Tax	$0.00	$12.10	$10.00	$0.00	$10.67	$10.00	$0.00	$9.63	$10.00	$0.00	$21.29	$10.00
Total Estimated Property Taxes	$1,600.43	$1,612.53	$1,610.43	$1,388.19	$1,398.86	$1,398.19	$1,307.25	$1,316.88	$1,317.25	$2,859.96	$2,881.25	$2,869.96
Total Effective Tax Rate	***1.3229%***	***1.3329%***	***1.3311%***	***1.3011%***	***1.3111%***	***1.3105%***	***1.3581%***	***1.3681%***	***1.3685%***	***1.3434%***	***1.3534%***	***1.3481%***
High Effective Tax Rate Group (> 1.60%)												
Percent of Parcels in High Range (Existing) [1]	3.56%	NA	NA	10.63%	NA	NA	12.17%	NA	NA	12.83%	NA	NA
Average Net Assessed Value [1]	$75,861.53	$75,861.53	$75,861.53	$53,653.81	$53,653.81	$53,653.81	$63,971.13	$63,971.13	$63,971.13	$181,973.77	$181,973.77	$181,973.77
Average Existing FY 2015-2016 Property Taxes [1]	$1,677.02	$1,677.02	$1,677.02	$1,090.82	$1,090.82	$1,090.82	$1,391.69	$1,391.69	$1,391.69	$3,357.83	$3,357.83	$3,357.83
Proposed Flood Control Bonds Tax	$0.00	$7.59	$10.00	$0.00	$5.37	$10.00	$0.00	$6.40	$10.00	$0.00	$18.20	$10.00
Total Estimated Property Taxes	$1,677.02	$1,684.61	$1,687.02	$1,090.82	$1,096.19	$1,100.82	$1,391.69	$1,398.09	$1,401.69	$3,357.83	$3,376.03	$3,367.83
Total Effective Tax Rate	***2.2106%***	***2.2206%***	***2.2238%***	***2.0331%***	***2.0431%***	***2.0517%***	***2.1755%***	***2.1855%***	***2.1911%***	***1.8452%***	***1.8552%***	***1.8507%***
Low Effective Tax Rate Group (1.00% - 1.20%)												
Percent of Parcels in Low Range (Existing) [1]	87.45%	NA	NA	69.76%	NA	NA	68.78%	NA	NA	34.48%	NA	NA
Average Net Assessed Value [1]	$211,806.80	$211,806.80	$211,806.80	$308,751.13	$308,751.13	$308,751.13	$239,498.38	$239,498.38	$239,498.38	$305,082.61	$305,082.61	$305,082.61
Average Existing FY 2015-2016 Property Taxes [1]	$2,292.35	$2,292.35	$2,292.35	$3,319.90	$3,319.90	$3,319.90	$2,590.01	$2,590.01	$2,590.01	$3,449.04	$3,449.04	$3,449.04
Proposed Flood Control Bonds Tax	$0.00	$21.18	$10.00	$0.00	$30.88	$10.00	$0.00	$23.95	$10.00	$0.00	$30.51	$10.00
Total Estimated Property Taxes	$2,292.35	$2,313.53	$2,302.35	$3,319.90	$3,350.78	$3,329.90	$2,590.01	$2,613.96	$2,600.01	$3,449.04	$3,479.55	$3,459.04
Total Effective Tax Rate	***1.0823%***	***1.0923%***	***1.0870%***	***1.0753%***	***1.0853%***	***1.0785%***	***1.0814%***	***1.0914%***	***1.0856%***	***1.1305%***	***1.1405%***	***1.1338%***
Actual Average Effective Tax Rate												
Total Number of Taxable Parcels [1]	98,579	98,579	98,579	14,006	14,006	14,006	15,723	15,723	15,723	35,523	35,523	35,523
Average Net Assessed Value [1]	$198,801.91	$198,801.91	$198,801.91	$242,014.73	$242,014.73	$242,014.73	$190,854.53	$190,854.53	$190,854.53	$240,710.50	$240,710.50	$240,710.50
Average Existing FY 2015-2016 Property Taxes [1]	$2,208.25	$2,208.25	$2,208.25	$2,704.05	$2,704.05	$2,704.05	$2,199.88	$2,199.88	$2,199.88	$3,126.97	$3,126.97	$3,126.97
Proposed Flood Control Bonds Tax	$0.00	$19.88	$10.00	$0.00	$24.20	$10.00	$0.00	$19.09	$10.00	$0.00	$24.07	$10.00
Total Estimated Property Taxes	$2,208.25	$2,228.13	$2,218.25	$2,704.05	$2,728.25	$2,714.05	$2,199.88	$2,218.97	$2,209.88	$3,126.97	$3,151.04	$3,136.97
Total Effective Tax Rate	***1.1108%***	***1.1208%***	***1.1158%***	***1.1173%***	***1.1273%***	***1.1214%***	***1.1526%***	***1.1626%***	***1.1579%***	***1.2991%***	***1.3091%***	***1.3032%***
Actual Median Effective Tax Rate												
Total Number of Taxable Parcels [1]	98,579	98,579	98,579	14,006	14,006	14,006	15,723	15,723	15,723	35,523	35,523	35,523
Average Net Assessed Value [1]	$183,337.85	$183,337.85	$183,337.85	$207,529.84	$207,529.84	$207,529.84	$161,800.80	$161,800.80	$161,800.80	$203,373.88	$203,373.88	$203,373.88
Average Existing FY 2015-2016 Property Taxes [1]	$1,978.92	$1,978.92	$1,978.92	$2,303.10	$2,303.10	$2,303.10	$1,827.78	$1,827.78	$1,827.78	$2,542.00	$2,542.00	$2,542.00
Proposed Flood Control Bonds Tax	$0.00	$18.33	$10.00	$0.00	$20.75	$10.00	$0.00	$16.18	$10.00	$0.00	$20.34	$10.00
Total Estimated Property Taxes	$1,978.92	$1,997.25	$1,988.92	$2,303.10	$2,323.85	$2,313.10	$1,827.78	$1,843.96	$1,837.78	$2,542.00	$2,562.34	$2,552.00
Total Effective Tax Rate	***1.0794%***	***1.0894%***	***1.0848%***	***1.1098%***	***1.1198%***	***1.1146%***	***1.1296%***	***1.1396%***	***1.1358%***	***1.2499%***	***1.2599%***	***1.2548%***

[1] Includes parcels with fiscal year 2015-2016 net assessed value greater than $0 on the fiscal year 2015-2016 extended roll. For all counties, net assessed value and existing property tax data from the fiscal year 2015-2016 extended roll.

	Tehama			Yolo			Yuba			Sacramento	
	Existing	**Scenario 1**	**Scenario 2**	**Existing**	**Scenario 1**	**Scenario 2**	**Existing**	**Scenario 1**	**Scenario 2**	**Existing**	**Scenario 1**
Average Effective Tax Rate Group (1.20% - 1.60%)											
Percent of Parcels in Average Range (Existing) [1]	3.45%	NA	NA	39.48%	NA	NA	47.04%	NA	NA	46.42%	NA
Average Net Assessed Value [1]	$79,243.93	$79,243.93	$79,243.93	$378,803.62	$378,803.62	$378,803.62	$126,077.69	$126,077.69	$126,077.69	$264,969.86	$264,969.86
Average Existing FY 2015-2016 Property Taxes [1]	$1,016.18	$1,016.18	$1,016.18	$5,100.46	$5,100.46	$5,100.46	$1,620.92	$1,620.92	$1,620.92	$3,487.38	$3,487.38
Proposed Flood Control Bonds Tax	$0.00	$7.92	$10.00	$0.00	$37.88	$10.00	$0.00	$12.61	$10.00	$0.00	$26.50
Total Estimated Property Taxes	$1,016.18	$1,024.10	$1,026.18	$5,100.46	$5,138.34	$5,110.46	$1,620.92	$1,633.53	$1,630.92	$3,487.38	$3,513.88
Total Effective Tax Rate	***1.2823%***	***1.2923%***	***1.2950%***	***1.3465%***	***1.3565%***	***1.3491%***	***1.2857%***	***1.2957%***	***1.2936%***	***1.3161%***	***1.3261%***
High Effective Tax Rate Group (> 1.60%)											
Percent of Parcels in High Range (Existing) [1]	2.52%	NA	NA	17.64%	NA	NA	21.29%	NA	NA	11.30%	NA
Average Net Assessed Value [1]	$15,760.17	$15,760.17	$15,760.17	$286,260.03	$286,260.03	$286,260.03	$124,713.55	$124,713.55	$124,713.55	$206,883.25	$206,883.25
Average Existing FY 2015-2016 Property Taxes [1]	$429.47	$429.47	$429.47	$5,777.49	$5,777.49	$5,777.49	$2,591.08	$2,591.08	$2,591.08	$4,551.75	$4,551.75
Proposed Flood Control Bonds Tax	$0.00	$1.58	$10.00	$0.00	$28.63	$10.00	$0.00	$12.47	$10.00	$0.00	$20.69
Total Estimated Property Taxes	$429.47	$431.05	$439.47	$5,777.49	$5,806.12	$5,787.49	$2,591.08	$2,603.55	$2,601.08	$4,551.75	$4,572.44
Total Effective Tax Rate	***2.7250%***	***2.7350%***	***2.7885%***	***2.0183%***	***2.0283%***	***2.0218%***	***2.0776%***	***2.0876%***	***2.0856%***	***2.2002%***	***2.2102%***
Low Effective Tax Rate Group (1.00% - 1.20%)											
Percent of Parcels in Low Range (Existing) [1]	93.23%	NA	NA	42.88%	NA	NA	31.67%	NA	NA	42.27%	NA
Average Net Assessed Value [1]	$124,807.79	$124,807.79	$124,807.79	$431,987.45	$431,987.45	$431,987.45	$265,291.22	$265,291.22	$265,291.22	$336,319.81	$336,319.81
Average Existing FY 2015-2016 Property Taxes [1]	$1,273.46	$1,273.46	$1,273.46	$4,781.90	$4,781.90	$4,781.90	$2,992.61	$2,992.61	$2,992.61	$3,852.22	$3,852.22
Proposed Flood Control Bonds Tax	$0.00	$12.48	$10.00	$0.00	$43.20	$10.00	$0.00	$26.53	$10.00	$0.00	$33.63
Total Estimated Property Taxes	$1,273.46	$1,285.94	$1,283.46	$4,781.90	$4,825.10	$4,791.90	$2,992.61	$3,019.14	$3,002.61	$3,852.22	$3,885.85
Total Effective Tax Rate	***1.0203%***	***1.0303%***	***1.0283%***	***1.1070%***	***1.1170%***	***1.1093%***	***1.1280%***	***1.1380%***	***1.1318%***	***1.1454%***	***1.1554%***
Actual Average Effective Tax Rate											
Total Number of Taxable Parcels [1]	43,434	43,434	43,434	62,179	62,179	62,179	31,407	31,407	31,407	466,702	466,702
Average Net Assessed Value [1]	$119,488.94	$119,488.94	$119,488.94	$385,282.28	$436,018.70	$436,018.70	$169,875.36	$169,875.36	$169,875.36	$288,565.45	$288,565.45
Average Existing FY 2015-2016 Property Taxes [1]	$1,243.33	$1,243.33	$1,243.33	$5,083.19	$6,058.55	$6,058.55	$2,261.97	$2,261.97	$2,261.97	$3,761.93	$3,761.93
Proposed Flood Control Bonds Tax	$0.00	$11.95	$10.00	$0.00	$43.60	$10.00	$0.00	$16.99	$10.00	$0.00	$28.86
Total Estimated Property Taxes	$1,243.33	$1,255.28	$1,253.33	$5,083.19	$6,102.15	$6,068.55	$2,261.97	$2,278.96	$2,271.97	$3,761.93	$3,790.79
Total Effective Tax Rate	***1.0405%***	***1.0505%***	***1.0489%***	***1.3193%***	***1.3995%***	***1.3918%***	***1.3315%***	***1.3415%***	***1.3374%***	***1.3037%***	***1.3137%***
Actual Median Effective Tax Rate											
Total Number of Taxable Parcels [1]	43,434	43,434	43,434	62,179	62,179	62,179	31,407	31,407	31,407	466,702	466,702
Average Net Assessed Value [1]	$109,260.02	$109,260.02	$109,260.02	$359,434.67	$359,434.67	$359,434.67	$130,820.23	$130,820.23	$130,820.23	$262,629.75	$262,629.75
Average Existing FY 2015-2016 Property Taxes [1]	$1,112.97	$1,112.97	$1,112.97	$4,418.96	$4,418.96	$4,418.96	$1,621.53	$1,621.53	$1,621.53	$3,229.84	$3,229.84
Proposed Flood Control Bonds Tax	$0.00	$10.93	$10.00	$0.00	$35.94	$10.00	$0.00	$13.08	$10.00	$0.00	$26.26
Total Estimated Property Taxes	$1,112.97	$1,123.90	$1,122.97	$4,418.96	$4,454.90	$4,428.96	$1,621.53	$1,634.61	$1,631.53	$3,229.84	$3,256.10
Total Effective Tax Rate	***1.0186%***	***1.0286%***	***1.0278%***	***1.2294%***	***1.2394%***	***1.2322%***	***1.2395%***	***1.2495%***	***1.2472%***	***1.2298%***	***1.2398%***

[1] Includes parcels with fiscal year 2015-2016 net assessed value greater than $0 on the fiscal year 2015-2016 extended roll. For all counties, net assessed value and existing property tax data from the fiscal year 2015-2016 extended roll.

	Solano				San Joaquin			Stanislaus			
	Scenario 2	Existing	Scenario 1	Scenario 2	Existing	Scenario 1	Scenario 2	Existing	Scenario 1	Scenario 2	Existing
Average Effective Tax Rate Group (1.20% - 1.60%)											
Percent of Parcels in Average Range (Existing) [1]	NA	52.73%	NA	NA	45.34%	NA	NA	28.06%	NA	NA	21.73%
Average Net Assessed Value [1]	$264,969.86	$372,810.18	$372,810.18	$372,810.18	$269,451.32	$269,451.32	$269,451.32	$240,967.41	$240,967.41	$240,967.41	$186,084.11
Average Existing FY 2015-2016 Property Taxes [1]	$3,487.38	$4,807.38	$4,807.38	$4,807.38	$3,670.00	$3,670.00	$3,670.00	$3,164.20	$3,164.20	$3,164.20	$2,482.30
Proposed Flood Control Bonds Tax	$10.00	$0.00	$37.28	$10.00	$0.00	$26.95	$10.00	$0.00	$24.10	$10.00	$0.00
Total Estimated Property Taxes	$3,497.38	$4,807.38	$4,844.66	$4,817.38	$3,670.00	$3,696.95	$3,680.00	$3,164.20	$3,188.30	$3,174.20	$2,482.30
Total Effective Tax Rate	***1.3199%***	***1.2895%***	***1.2995%***	***1.2922%***	***1.3620%***	***1.3720%***	***1.3657%***	***1.3131%***	***1.3231%***	***1.3173%***	***1.3340%***
High Effective Tax Rate Group (> 1.60%)											
Percent of Parcels in High Range (Existing) [1]	NA	6.61%	NA	NA	14.38%	NA	NA	8.76%	NA	NA	6.65%
Average Net Assessed Value [1]	$206,883.25	$243,940.99	$243,940.99	$243,940.99	$205,693.26	$205,693.26	$205,693.26	$159,069.51	$159,069.51	$159,069.51	$77,768.75
Average Existing FY 2015-2016 Property Taxes [1]	$4,551.75	$5,325.65	$5,325.65	$5,325.65	$4,517.25	$4,517.25	$4,517.25	$3,570.10	$3,570.10	$3,570.10	$1,757.19
Proposed Flood Control Bonds Tax	$10.00	$0.00	$24.39	$10.00	$0.00	$20.57	$10.00	$0.00	$15.91	$10.00	$0.00
Total Estimated Property Taxes	$4,561.75	$5,325.65	$5,350.04	$5,335.65	$4,517.25	$4,537.82	$4,527.25	$3,570.10	$3,586.01	$3,580.10	$1,757.19
Total Effective Tax Rate	***2.2050%***	***2.1832%***	***2.1932%***	***2.1873%***	***2.1961%***	***2.2061%***	***2.2010%***	***2.2444%***	***2.2544%***	***2.2507%***	***2.2595%***
Low Effective Tax Rate Group (1.00% - 1.20%)											
Percent of Parcels in Low Range (Existing) [1]	NA	40.67%	NA	NA	40.28%	NA	NA	63.18%	NA	NA	71.62%
Average Net Assessed Value [1]	$336,319.81	$280,976.35	$280,976.35	$280,976.35	$324,342.42	$324,342.42	$324,342.42	$261,426.90	$261,426.90	$261,426.90	$253,915.78
Average Existing FY 2015-2016 Property Taxes [1]	$3,852.22	$3,188.58	$3,188.58	$3,188.58	$3,600.56	$3,600.56	$3,600.56	$2,904.28	$2,904.28	$2,904.28	$2,808.02
Proposed Flood Control Bonds Tax	$10.00	$0.00	$28.10	$10.00	$0.00	$32.43	$10.00	$0.00	$26.14	$10.00	$0.00
Total Estimated Property Taxes	$3,862.22	$3,188.58	$3,216.68	$3,198.58	$3,600.56	$3,632.99	$3,610.56	$2,904.28	$2,930.42	$2,914.28	$2,808.02
Total Effective Tax Rate	***1.1484%***	***1.1348%***	***1.1448%***	***1.1384%***	***1.1101%***	***1.1201%***	***1.1132%***	***1.1109%***	***1.1209%***	***1.1148%***	***1.1059%***
Actual Average Effective Tax Rate											
Total Number of Taxable Parcels [1]	466,702	144,203	144,203	144,203	221,581	221,581	221,581	167,122	167,122	167,122	85,637
Average Net Assessed Value [1]	$288,565.45	$326,948.82	$326,948.82	$326,948.82	$282,395.47	$282,395.47	$282,395.47	$246,720.37	$246,720.37	$246,720.37	$227,458.51
Average Existing FY 2015-2016 Property Taxes [1]	$3,761.93	$4,183.32	$4,183.32	$4,183.32	$3,763.84	$3,763.84	$3,763.84	$3,035.54	$3,035.54	$3,035.54	$2,667.33
Proposed Flood Control Bonds Tax	$10.00	$0.00	$32.69	$10.00	$0.00	$28.24	$10.00	$0.00	$24.67	$10.00	$0.00
Total Estimated Property Taxes	$3,771.93	$4,183.32	$4,216.01	$4,193.32	$3,763.84	$3,792.08	$3,773.84	$3,035.54	$3,060.21	$3,045.54	$2,667.33
Total Effective Tax Rate	***1.3071%***	***1.2795%***	***1.2895%***	***1.2826%***	***1.3328%***	***1.3428%***	***1.3364%***	***1.2304%***	***1.2404%***	***1.2344%***	***1.1727%***
Actual Median Effective Tax Rate											
Total Number of Taxable Parcels [1]	466,702	144,203	144,203	144,203	221,581	221,581	221,581	167,122	167,122	167,122	85,637
Average Net Assessed Value [1]	$262,629.75	$363,291.89	$363,291.89	$363,291.89	$285,049.42	$285,049.42	$285,049.42	$240,169.91	$240,169.91	$240,169.91	$121,416.90
Average Existing FY 2015-2016 Property Taxes [1]	$3,229.84	$4,467.37	$4,467.37	$4,467.37	$3,648.57	$3,648.57	$3,648.57	$2,953.74	$2,953.74	$2,953.74	$1,493.01
Proposed Flood Control Bonds Tax	$10.00	$0.00	$36.33	$10.00	$0.00	$28.50	$10.00	$0.00	$24.02	$10.00	$0.00
Total Estimated Property Taxes	$3,239.84	$4,467.37	$4,503.70	$4,477.37	$3,648.57	$3,677.07	$3,658.57	$2,953.74	$2,977.76	$2,963.74	$1,493.01
Total Effective Tax Rate	***1.2336%***	***1.2297%***	***1.2397%***	***1.2324%***	***1.2800%***	***1.2900%***	***1.2835%***	***1.2299%***	***1.2399%***	***1.2340%***	***1.2297%***

[1] Includes parcels with fiscal year 2015-2016 net assessed value greater than $0 on the fiscal year 2015-2016 extended roll. For all counties, net assessed value and existing property tax data from the fiscal year 2015-2016 extended roll.

	Merced		Fresno			Madera		
	Scenario 1	Scenario 2	Existing	Scenario 1	Scenario 2	Existing	Scenario 1	Scenario 2
Average Effective Tax Rate Group (1.20% - 1.60%)								
Percent of Parcels in Average Range (Existing) [1]	NA	NA	70.93%	NA	NA	10.60%	NA	NA
Average Net Assessed Value [1]	$186,084.11	$186,084.11	$237,350.55	$237,350.55	$237,350.55	$185,936.90	$185,936.90	$185,936.90
Average Existing FY 2015-2016 Property Taxes [1]	$2,482.30	$2,482.30	$2,992.29	$2,992.29	$2,992.29	$2,471.94	$2,471.94	$2,471.94
Proposed Flood Control Bonds Tax	$18.61	$10.00	$0.00	$23.74	$10.00	$0.00	$18.59	$10.00
Total Estimated Property Taxes	$2,500.91	$2,492.30	$2,992.29	$3,016.03	$3,002.29	$2,471.94	$2,490.53	$2,481.94
Total Effective Tax Rate	***1.3440%***	***1.3393%***	***1.2607%***	***1.2707%***	***1.2649%***	***1.3295%***	***1.3395%***	***1.3348%***
High Effective Tax Rate Group (> 1.60%)								
Percent of Parcels in High Range (Existing) [1]	NA	NA	5.77%	NA	NA	5.28%	NA	NA
Average Net Assessed Value [1]	$77,768.75	$77,768.75	$114,200.35	$114,200.35	$114,200.35	$82,377.96	$82,377.96	$82,377.96
Average Existing FY 2015-2016 Property Taxes [1]	$1,757.19	$1,757.19	$2,409.51	$2,409.51	$2,409.51	$1,937.67	$1,937.67	$1,937.67
Proposed Flood Control Bonds Tax	$7.78	$10.00	$0.00	$11.42	$10.00	$0.00	$8.24	$10.00
Total Estimated Property Taxes	$1,764.97	$1,767.19	$2,409.51	$2,420.93	$2,419.51	$1,937.67	$1,945.91	$1,947.67
Total Effective Tax Rate	***2.2695%***	***2.2724%***	***2.1099%***	***2.1199%***	***2.1187%***	***2.3522%***	***2.3622%***	***2.3643%***
Low Effective Tax Rate Group (1.00% - 1.20%)								
Percent of Parcels in Low Range (Existing) [1]	NA	NA	23.31%	NA	NA	84.12%	NA	NA
Average Net Assessed Value [1]	$253,915.78	$253,915.78	$276,460.84	$276,460.84	$276,460.84	$239,276.02	$239,276.02	$239,276.02
Average Existing FY 2015-2016 Property Taxes [1]	$2,808.02	$2,808.02	$3,127.53	$3,127.53	$3,127.53	$2,664.33	$2,664.33	$2,664.33
Proposed Flood Control Bonds Tax	$25.39	$10.00	$0.00	$27.65	$10.00	$0.00	$23.93	$10.00
Total Estimated Property Taxes	$2,833.41	$2,818.02	$3,127.53	$3,155.18	$3,137.53	$2,664.33	$2,688.26	$2,674.33
Total Effective Tax Rate	***1.1159%***	***1.1098%***	***1.1313%***	***1.1413%***	***1.1349%***	***1.1135%***	***1.1235%***	***1.1177%***
Actual Average Effective Tax Rate								
Total Number of Taxable Parcels [1]	85,637	85,637	286,850	286,850	286,850	57,199	57,199	57,199
Average Net Assessed Value [1]	$227,458.51	$227,458.51	$239,361.42	$239,361.42	$239,361.42	$225,337.22	$225,337.22	$225,337.22
Average Existing FY 2015-2016 Property Taxes [1]	$2,667.33	$2,667.33	$2,990.19	$2,990.19	$2,990.19	$2,605.56	$2,605.56	$2,605.56
Proposed Flood Control Bonds Tax	$22.75	$10.00	$0.00	$23.94	$10.00	$0.00	$22.53	$10.00
Total Estimated Property Taxes	$2,690.08	$2,677.33	$2,990.19	$3,014.13	$3,000.19	$2,605.56	$2,628.09	$2,615.56
Total Effective Tax Rate	***1.1827%***	***1.1771%***	***1.2492%***	***1.2592%***	***1.2534%***	***1.1563%***	***1.1663%***	***1.1607%***
Actual Median Effective Tax Rate								
Total Number of Taxable Parcels [1]	85,637	85,637	286,850	286,850	286,850	57,199	57,199	57,199
Average Net Assessed Value [1]	$121,416.90	$121,416.90	$232,678.09	$232,678.09	$232,678.09	$252,508.64	$252,508.64	$252,508.64
Average Existing FY 2015-2016 Property Taxes [1]	$1,493.01	$1,493.01	$2,861.95	$2,861.95	$2,861.95	$3,004.07	$3,004.07	$3,004.07
Proposed Flood Control Bonds Tax	$12.14	$10.00	$0.00	$23.27	$10.00	$0.00	$25.25	$10.00
Total Estimated Property Taxes	$1,505.15	$1,503.01	$2,861.95	$2,885.22	$2,871.95	$3,004.07	$3,029.32	$3,014.07
Total Effective Tax Rate	***1.2397%***	***1.2379%***	***1.2300%***	***1.2400%***	***1.2343%***	***1.1897%***	***1.1997%***	***1.1937%***

[1] Includes parcels with fiscal year 2015-2016 net assessed value greater than $0 on the fiscal year 2015-2016 extended roll. For all counties, net assessed value and existing property tax data from the fiscal year 2015-2016 extended roll.

Appendix F: Funding Scenario Support

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Appendix F: Funding Scenario Support

Table F-1. Scenario 1 Capital Investment by Phase

Management Action Category and Area of Interest	Years 1-10	Years 11-20	Years 21-30
Systemwide			
Yolo Bypass multi-benefit improvements	State GO Bonds: $522 USACE: $61 Local: $31	State GO Bonds: $522 USACE: $61 Local: $31	State GO Bonds: $522 USACE: $61 Local: $31
Feather River-Sutter Bypass multi-benefit improvements			
Paradise Cut multi-benefit improvements	State GO Bonds: $23 USACE: $6 Local: $2	State GO Bonds: $104 USACE: $28 Local: $7	State GO Bonds: $104 USACE: $28 Local: $7
Reservoir and floodplain storage	State GO Bonds: $92 USACE: $77 Local: $15	State GO Bonds: $92 USACE: $77 Local: $15	State GO Bonds: $81 USACE: $87 Local: $15
Urban			
Levee improvements	State GO Bonds: $177 USACE: $574 Local: $132	State GO Bonds: $177 USACE: $574 Local: $132	State GO Bonds: $59 USACE: $558 Local: $242
Other Infrastructure and multi-benefit improvements	State GO Bonds: $22 USACE: $56 Local: $9	State GO Bonds: $12 USACE: $56 Local: $18	State GO Bonds: $11 USACE: $56 Local: $20
Rural			
Levee repair and infrastructure improvements	State GO Bonds: $134 Local: $51	State GO Bonds: $139 Local: $59	State GO Bonds: $134 Local: $57
Small-scale levee setbacks and floodplain storage	State GO Bonds: $40 USACE: $8 Local: $3	State GO Bonds: $43 USACE: $5 Local: $3	State GO Bonds: $40 USACE: $8 Local: $3
Land acquisitions and easements	State GO Bonds: $153 FEMA: $9 Local: $9	State GO Bonds: $153 FEMA: $2 Local: $15	State GO Bonds: $153 FEMA: $2 Local: $15
Habitat restoration/ reconnection	State GO Bonds: $62 USACE: $7	State GO Bonds: $62 USACE: $7	State GO Bonds: $62 USACE: $7
Small Community			
Levee repair and infrastructure improvements	State GO Bonds: $200 USACE: $14	State GO Bonds: $203 USACE: $11	State GO Bonds: $199 USACE: $15
Levee setbacks, land acquisitions and habitat restoration	State GO Bonds: $71 USACE: $14	State GO Bonds: $77 USACE: $8	State GO Bonds: $71 USACE: $14
Total Capital Investment	State GO Bonds: $1494 USACE: $817 FEMA: $9 Local: $250 **Total: $2570**	State GO Bonds: $1583 USACE: $827 FEMA: $2 Local: $279 **Total: $2692**	State GO Bonds: $1436 USACE: $835 FEMA: $2 Local: $388 **Total: $2661**

Table F-2. Scenario 1 Ongoing Investment by Phase

Management Action Category and Area of Interest	Years 1-10	Years 11-20	Years 21-30
Systemwide			
State operations, planning, and performance tracking	State GF: $13.1	State GF: $13.1	State GF: $13.1
Emergency management	State GF: $17 Local: $2.5	State GF: $16.5 Local: $3.5	State GF: $17.5 Local: $2.5
Reservoir operations	State GF: $3.9 USACE: $0.4	State GF: $5.7	State GF: $5.7
Routine maintenance	State GF: $26.1 Local: $6.5	State GF: $28.3 Local: $7.1	State GF: $28.3 Local: $7.1
Urban			
Risk awareness, floodproofing and land use planning	State GF: $0.7 USACE: $1.5 Local: $0.9	State GF: $1 USACE: $1.9 FEMA: $0.3 Local: $1.2	State GF: $1 USACE: $2.2 Local: $1.2
Studies and analysis	State GO Bonds: $0.1 USACE: $0.2 Local: $0.1	USACE: $0.2 Local: $0.2	USACE: $0.3 Local: $0.3
Rural			
Risk awareness, floodproofing and land use planning	State GF: $0.2 USACE: $0.6 FEMA: $0.3 Local: $0.1	State GF: $0.3 USACE: $0.2 FEMA: $0.7 Local: $0.1	State GF: $0.4 USACE: $0.9 FEMA: $0.3 Local: $0.1
Studies and analysis	State GF: $0 FEMA: $0 Local: $0	State GF: $0.1 FEMA: $0.1 Local: $0	State GF: $0.1 FEMA: $0.1 Local: $0
Small Community			
Risk awareness, floodproofing and land use planning	State GO Bonds: $0.6 FEMA: $1.7	State GF: $0.8 FEMA: $2.3	State GF: $0.8 FEMA: $2.3
Studies and analysis	State GF: $1 USACE: $0.6 FEMA: $0.4	State GF: $1.4 FEMA: $1.4	State GF: $1.9 USACE: $1.8 FEMA: $0
Total Ongoing Investment	State GF: $62 State GO Bonds: $1 USACE: $3 FEMA: $2 Local: $10 **Total: $78**	State GF: $67 USACE: $2 FEMA: $5 Local: $12 **Total: $86**	State GF: $69 USACE: $5 FEMA: $3 Local: $11 **Total: $88**

Table F-3. Scenario 2A Ongoing Investment by Phase

Management Action Category and Area of Interest	Years 1-10	Years 11-20	Years 21-30
Systemwide			
State operations, planning, and performance tracking	State GF: $21.4	State GF: $34	State GF: $45.6
Emergency management	State GF: $21.6 Local: $5.4	State GF: $28.9 Local: $7.2	State GF: $28.9 Local: $7.2
Reservoir operations	State GF: $7.5 USACE: $1.1 Local: $2.1	State GF: $10.1 USACE: $1.3 Local: $2.9	State GF: $10 USACE: $1.4 Local: $2.9
Routine maintenance	State GF: $38 Local: $34.6	State GF: $74.7 Local: $26.2	State GF: $80.3 Local: $29.9
Urban			
Risk awareness, floodproofing and land use planning	USACE: $2.3 Local: $5.3	USACE: $3.2 Local: $7.5	USACE: $4.8 Local: $8.1
Studies and analysis	USACE: $0.5 Local: $0.5	USACE: $0.8 Local: $0.8	USACE: $1.1 Local: $1.1
Rural			
Risk awareness, floodproofing and land use planning	State GF: $0 FEMA: $1.1 Local: $1.1	State GF: $0 FEMA: $1.8 Local: $1.7	State GF: $1.8 FEMA: $2.4 Local: $0.6
Studies and analysis	FEMA: $0.1 Local: $0.1	State GF: $0.1 FEMA: $0.3 Local: $0.2	State GF: $0.2 FEMA: $0.6 Local: $0.3
Small Community			
Risk awareness, floodproofing and land use planning	State GF: $1.4 FEMA: $2.9 Local: $1.4	State GF: $2.2 FEMA: $4.4 Local: $2.2	State GF: $2.8 FEMA: $5.7 Local: $2.8
Studies and analysis	State GF: $0 USACE: $2.6 Local: $2.6	State GF: $0.1 USACE: $4 Local: $3.9	State GF: $5.2 USACE: $5.3 Local: $0.1
Total Ongoing Investment	State GF: $90 USACE: $6 FEMA: $4 Local: $53 **Total: $154**	State GF: $150 USACE: $9 FEMA: $6 Local: $53 **Total: $218**	State GF: $175 USACE: $13 FEMA: $9 Local: $53 **Total: $249**

Table F-4. Scenario 2B Ongoing Investment by Phase

Management Action Category and Area of Interest	Years 1-10	Years 11-20	Years 21-30
Systemwide			
State operations, planning, and performance tracking	State GF: $21.4	State GF: $34	State GF: $45.6
Emergency management	State GF: $21.6 Local: $5.4	State GF: $18.1 State River Basin Assess: $10.7 Local: $7.2	State GF: $20.4 State River Basin Assess: $8.5 Local: $7.2
Reservoir operations	State GF: $7.5 USACE: $1.1 Local: $2.1	State River Basin Assess: $14.3	State River Basin Assess: $14.3
Routine maintenance	State GF: $38 Local: $19.6 Sac/SJ Drainage District: $15	State GF: $78.7 Sac/SJ Drainage District: $22.2	State GF: $88.2 Sac/SJ Drainage District: $22
Urban			
Risk awareness, floodproofing and land use planning	USACE: $2.3 Local: $5.3	USACE: $3.2 Local: $7.5	USACE: $6.4 Local: $6.4
Studies and analysis	USACE: $0.5 Local: $0.5	USACE: $0.8 Local: $0.8	USACE: $1.1 Local: $0.8 Sac/SJ Drainage District: $0.2
Rural			
Risk awareness, floodproofing and land use planning	FEMA: $1.1 Local: $1.1	State Insurance Program: $1.9 FEMA: $1.5 Local: $0.2	State GF: $0 State Insurance Program: $1.9 State River Basin Assess: $0.6 FEMA: $2.1 Local: $0.2
Studies and analysis	State GF: $0.1 FEMA: $0.1 Local: $0	State GF: $0.2 FEMA: $0.3 Local: $0.1	State GF: $0.4 FEMA: $0.6 Local: $0.1 Sac/SJ Drainage District: $0.1
Small Community			
Risk awareness, floodproofing and land use planning	State GF: $1.4 FEMA: $2.9 Local: $1.4	State Insurance Program: $4.4 FEMA: $4.4	State Insurance Program: $4.2 State River Basin Assess: $1.5 FEMA: $5.7
Studies and analysis	USACE: $2.6 Local: $2.6	State GF: $4 USACE: $4	State GF: $5.3 USACE: $5.3
Total Ongoing Investment	State GF: $90 USACE: $6 FEMA: $4 Local: $38 Sac/SJ Drainage District: $15 **Total: $154**	State GF: $135 State Insurance Program: $6 State River Basin Assess: $25 USACE: $8 FEMA: $6 Local: $16 Sac/SJ Drainage District: $22 **Total: $218**	State GF: $160 State Insurance Program: $6 State River Basin Assess: $25 USACE: $13 FEMA: $8 Local: $15 Sac/SJ Drainage District: $22 **Total: $249**

Table F-5. Scenario 3A Capital Investment by Phase

Management Action Category and Area of Interest	Years 1-10	Years 11-20	Years 21-30
Systemwide			
Yolo Bypass multi-benefit improvements	State GO Bonds: $714 USACE: $257 Local: $0 Sac/SJ Drainage District: $51	State GO Bonds: $805 USACE: $167 Sac/SJ Drainage District: $51	State GO Bonds: $102 USACE: $114 Sac/SJ Drainage District: $11
Feather River-Sutter Bypass multi-benefit improvements			
Paradise Cut multi-benefit improvements	State GO Bonds: $14 USACE: $15 Sac/SJ Drainage District: $2	State GO Bonds: $125 USACE: $139 Sac/SJ Drainage District: $14	
Reservoir and floodplain storage	State GO Bonds: $81 USACE: $87 Local: $12 Sac/SJ Drainage District: $2	State GO Bonds: $31 USACE: $138 Sac/SJ Drainage District: $15	State GO Bonds: $31 USACE: $138 Sac/SJ Drainage District: $15
Urban			
Levee improvements	State GO Bonds: $137 USACE: $797 Local: $292	State GO Bonds: $222 USACE: $797 Local: $208	State GO Bonds: $152 USACE: $797 Local: $248 Sac/SJ Drainage District: $29
Other Infrastructure and multi-benefit improvements	State GO Bonds: $30 USACE: $78 Local: $12	State GO Bonds: $30 USACE: $77 Local: $12	State GO Bonds: $27 USACE: $77 Local: $9 Sac/SJ Drainage District: $5
Rural			
Levee repair and infrastructure improvements	State GO Bonds: $290 Local: $124	State GO Bonds: $222 Local: $193	State GO Bonds: $218 Local: $180 Sac/SJ Drainage District: $17
Small-scale levee setbacks and floodplain storage	State GO Bonds: $44 USACE: $12 Local: $3	State GO Bonds: $44 USACE: $12 Local: $3	State GO Bonds: $44 USACE: $12 Local: $3
Land acquisitions and easements	State GO Bonds: $179 FEMA: $10 Local: $10	State GO Bonds: $152 State Insurance Program: $27 FEMA: $10 Local: $10	State GO Bonds: $179 FEMA: $4 Local: $14 Sac/SJ Drainage District: $2
Habitat restoration/reconnection	State GO Bonds: $63 USACE: $7	State GO Bonds: $63 USACE: $7	State GO Bonds: $63 USACE: $7
Small Community			
Levee repair and infrastructure improvements	State GO Bonds: $124 USACE: $31	State GO Bonds: $205 State Insurance Program: $29 USACE: $32	State GO Bonds: $213 USACE: $53
Levee setbacks, land acquisitions and habitat restoration	State GF: $34 State GO Bonds: $3 USACE: $9	State GO Bonds: $90 State Insurance Program: $2 USACE: $23	State GO Bonds: $264 USACE: $66
Total Capital Investment	State GF: $34 State GO Bonds: $1680 USACE: $1295 FEMA: $10 Local: $454 Sac/SJ Drainage District: $55 **Total: $3528**	State GO Bonds: $1990 State Insurance Program: $58 USACE: $1392 FEMA: $10 Local: $425 Sac/SJ Drainage District: $80 **Total: $3954**	State GO Bonds: $1294 USACE: $1264 FEMA: $4 Local: $454 Sac/SJ Drainage District: $80 **Total: $3095**

Table F-6. Scenario 3A Ongoing Investment by Phase

Management Action Category and Area of Interest	Years 1-10	Years 11-20	Years 21-30
Systemwide			
State operations, planning, and performance tracking	State GF: $21.4	State GF: $34	State GF: $45.6
Emergency management	State GF: $21.6 Local: $5.4	State GF: $28.1 State River Basin Assess: $0.7 Local: $7.2	State GF: $24.9 State River Basin Assess: $4 Local: $7.2
Reservoir operations	State GF: $10.7	State River Basin Assess: $14.3	State River Basin Assess: $14.3
Routine maintenance	State GF: $58 Sac/SJ Drainage District: $14.5	State GF: $78.7 State Insurance Program: $2 Sac/SJ Drainage District: $20.2	State GF: $88.2 Sac/SJ Drainage District: $22
Urban			
Risk awareness, floodproofing and land use planning	FEMA: $3.8 Local: $3.8	State Insurance Program: $4.3 FEMA: $5.4 Local: $1.1	State Insurance Program: $5.1 USACE: $4.3 FEMA: $2.1 Local: $1.3
Studies and analysis	State GF: $0.3 USACE: $0.5 Local: $0.3	USACE: $0.8 Local: $0.8	State GF: $0.3 USACE: $1.1 Local: $0.7
Rural			
Risk awareness, floodproofing and land use planning	State GF: $0.4 FEMA: $1.6 Local: $0.1	State Insurance Program: $0.7 FEMA: $2.6 Local: $0.2	State GF: $0.2 State Insurance Program: $0.5 State River Basin Assess: $0.3 USACE: $2.6 FEMA: $1 Local: $0.2
Studies and analysis	State GF: $0.1 FEMA: $0.1 Local: $0	State GF: $0.2 FEMA: $0.3 Local: $0.1	State GF: $0.4 FEMA: $0.6 Local: $0.1
Small Community			
Risk awareness, floodproofing and land use planning	State GF: $1.4 FEMA: $4.3	State Insurance Program: $2.2 FEMA: $6.6	State Insurance Program: $1.4 State River Basin Assess: $1.4 FEMA: $8.5
Studies and analysis	State GF: $2.6 FEMA: $2.6	State GF: $4 FEMA: $4	State GF: $5.3 USACE: $5.3
Total Ongoing Investment	State GF: $117 USACE: $1 FEMA: $12 Local: $10 Sac/SJ Drainage District: $15 **Total: $154**	State GF: $145 State Insurance Program: $9 State River Basin Assess: $15 USACE: $1 FEMA: $19 Local: $9 Sac/SJ Drainage District: $20 **Total: $218**	State GF: $165 State Insurance Program: $7 State River Basin Assess: $20 USACE: $13 FEMA: $12 Local: $10 Sac/SJ Drainage District: $22 **Total: $249**

Table F-7. Scenario 3B Capital Investment by Phase

Management Action Category and Area of Interest	Years 1-10	Years 11-20	Years 21-30
Systemwide			
Yolo Bypass multi-benefit improvements	USACE: $511 Sac/SJ Drainage District: $51	State GO Bonds: $1186 USACE: $222 Sac/SJ Drainage District: $74	State GO Bonds: $182 USACE: $34 Local: $9 Sac/SJ Drainage District: $2
Feather River-Sutter Bypass multi-benefit improvements			
Paradise Cut multi-benefit improvements	State GF: $77 USACE: $21 Sac/SJ Drainage District: $5	State GO Bonds: $77 USACE: $21 Sac/SJ Drainage District: $5	State GO Bonds: $77 USACE: $21 Sac/SJ Drainage District: $5
Reservoir and floodplain storage	USACE: $206 Sac/SJ Drainage District: $22	State GO Bonds: $161 USACE: $135 Sac/SJ Drainage District: $26	State GO Bonds: $138 USACE: $116 Sac/SJ Drainage District: $22
Urban			
Levee improvements	State GF: $201 USACE: $854 Local: $276	State GO Bonds: $470 USACE: $1073 Local: $352	State GO Bonds: $275 USACE: $893 Local: $206
Other Infrastructure and multi-benefit improvements	USACE: $74 Local: $18	State GO Bonds: $93 USACE: $21 Local: $14	State GO Bonds: $36 USACE: $94 Local: $14
Rural			
Levee repair and infrastructure improvements	Local: $26	State GO Bonds: $218 State Insurance Program: $47 Local: $95	State GO Bonds: $714 Local: $306
Small-scale levee setbacks and floodplain storage	USACE: $11 Local: $3	State GO Bonds: $67 State Insurance Program: $17 USACE: $6 Local: $5	State GO Bonds: $56 USACE: $10 Local: $3
Land acquisitions and easements	State GF: $1 Local: $6	State GO Bonds: $91 State Insurance Program: $30 State River Basin Assess: $77 Local: $11	State GO Bonds: $418 FEMA: $23 Local: $23
Habitat restoration/reconnection	USACE: $7	State GO Bonds: $112 USACE: $12	State GO Bonds: $77 USACE: $9
Small Community			
Levee repair and infrastructure improvements	State GF: $76 USACE: $11 Local: $115	State GO Bonds: $225 State Insurance Program: $7 Local: $26	State GO Bonds: $365 USACE: $42
Levee setbacks, land acquisitions and habitat restoration	State GF: $83 Local: $9	State GF: $83 USACE: $2 Local: $7	State GO Bonds: $261 USACE: $46
Total Capital Investment	State GF: $438 USACE: $1695 Local: $452 Sac/SJ Drainage District: $78 **Total: $2664**	State GF: $83 State GO Bonds: $2700 State Insurance Program: $100 State River Basin Assess: $77 USACE: $1493 Local: $510 Sac/SJ Drainage District: $105 **Total: $5068**	State GO Bonds: $2598 USACE: $1264 FEMA: $23 Local: $562 Sac/SJ Drainage District: $30 **Total: $4477**

Table F-8. Scenario 3B Ongoing Investment by Phase

Management Action Category and Area of Interest	Years 1-10	Years 11-20	Years 21-30
Systemwide			
State operations, planning, and performance tracking	State GF: $21.4	State GF: $34	State GF: $45.6
Emergency management	State GF: $25.7 Local: $1.4	State GF: $34.3 Local: $1.8	State GF: $26.3 State River Basin Assess: $3.2 Local: $6.6
Reservoir operations	State GF: $10.7	State GF: $7.4 State River Basin Assess: $6.9	State River Basin Assess: $14.3
Routine maintenance	State GF: $58 Local: $7.3 Sac/SJ Drainage District: $7.2	State GF: $80.7 Local: $5.7 Sac/SJ Drainage District: $14.5	State GF: $88.2 Sac/SJ Drainage District: $22
Urban			
Risk awareness, floodproofing and land use planning	State GF: $3.8 FEMA: $3 Local: $0.8	State GF: $1.3 State Insurance Program: $4 FEMA: $4.3 Local: $1.1	State Insurance Program: $6.4 USACE: $1.6 FEMA: $3.6 Local: $1.3
Studies and analysis	State GF: $0.3 USACE: $0.5 Local: $0.2	State GF: $0.4 USACE: $0.7 Local: $0.2	State GF: $0.5 USACE: $1.1 Local: $0.5
Rural			
Risk awareness, floodproofing and land use planning	State GF: $1.3 FEMA: $0.8 Local: $0.1	State GF: $2.1 FEMA: $1.2 Local: $0.2	State GF: $0.2 State River Basin Assess: $1.3 USACE: $0.7 FEMA: $2.5 Local: $0.2
Studies and analysis	State GF: $0.1 FEMA: $0.1 Local: $0	State GF: $0.2 FEMA: $0.3 Local: $0	State GF: $0.4 FEMA: $0.6 Local: $0.1
Small Community			
Risk awareness, floodproofing and land use planning	State GF: $2.3 FEMA: $3.5	State GF: $2.3 State Insurance Program: $0.9 State River Basin Assess: $0.4 FEMA: $5.2	State Insurance Program: $1.7 State River Basin Assess: $1.2 FEMA: $8.5
Studies and analysis	State GF: $2.6 FEMA: $2.6	State GF: $4 FEMA: $4	State GF: $5.3 USACE: $5.3
Total Ongoing Investment	State GF: $126 USACE: $0 FEMA: $10 Local: $10 Sac/SJ Drainage District: $7 **Total: $154**	State GF: $167 State Insurance Program: $5 State River Basin Assess: $7 USACE: $1 FEMA: $15 Local: $9 Sac/SJ Drainage District: $14 **Total: $218**	State GF: $167 State Insurance Program: $8 State River Basin Assess: $20 USACE: $9 FEMA: $15 Local: $9 Sac/SJ Drainage District: $22 **Total: $249**

Table F-9. Scenario 3B Capital Investment by Phase

Management Action Category and Area of Interest	Years 1-10	Years 11-20	Years 21-30
Systemwide			
Yolo Bypass multi-benefit improvements	USACE: $511 Sac/SJ Drainage District: $51	State GO Bonds: $1186 USACE: $222 Sac/SJ Drainage District: $74	State GO Bonds: $182 USACE: $34 Sac/SJ Drainage District: $11
Feather River-Sutter Bypass multi-benefit improvements			
Paradise Cut multi-benefit improvements	State GF: $77 USACE: $21 Sac/SJ Drainage District: $5	State GO Bonds: $77 USACE: $21 Sac/SJ Drainage District: $5	State GO Bonds: $77 USACE: $21 Sac/SJ Drainage District: $5
Reservoir and floodplain storage	USACE: $206 Sac/SJ Drainage District: $22	State GO Bonds: $161 USACE: $135 Sac/SJ Drainage District: $26	State GO Bonds: $138 USACE: $116 Sac/SJ Drainage District: $22
Urban			
Levee improvements	State GF: $1 USACE: $1104 Local: $276	State GO Bonds: $460 USACE: $986 Local: $345	State GO Bonds: $286 USACE: $929 Local: $214
Other Infrastructure and multi-benefit improvements	USACE: $74 Local: $18	State GO Bonds: $104 USACE: $10 Local: $14	State GO Bonds: $36 USACE: $94 Local: $2 Sac/SJ Drainage District: $12
Rural			
Levee repair and infrastructure improvements	Local: $26	State GO Bonds: $324 State Insurance Program: $15 Local: $97	State GO Bonds: $660 Local: $256 Sac/SJ Drainage District: $27
Small-scale levee setbacks and floodplain storage	USACE: $11 Local: $3	State GO Bonds: $84 USACE: $6 Local: $9	State GO Bonds: $52 USACE: $10 Local: $3
Land acquisitions and easements	State GF: $1 Local: $6	State GO Bonds: $164 State Insurance Program: $30 State River Basin Assess: $4 FEMA: $11 Local: $11	State GO Bonds: $409 FEMA: $23 Local: $21 Sac/SJ Drainage District: $2
Habitat restoration/reconnection	USACE: $7	State GO Bonds: $112 USACE: $12	State GO Bonds: $77 USACE: $9
Small Community			
Levee repair and infrastructure improvements	State GF: $76 USACE: $11 Local: $115	State GO Bonds: $225 State Insurance Program: $7 Local: $26	State GO Bonds: $365 USACE: $42
Levee setbacks, land acquisitions and habitat restoration	State GF: $83 Local: $9	State GF: $49 State GO Bonds: $34 Local: $9	State GO Bonds: $261 USACE: $46
Total Capital Investment	State GF: $238 USACE: $1945 Local: $452 Sac/SJ Drainage District: $78 **Total: $2714**	State GF: $49 State GO Bonds: $2932 State Insurance Program: $52 State River Basin Assess: $4 USACE: $1393 FEMA: $11 Local: $510 Sac/SJ Drainage District: $105 **Total: $5055**	State GO Bonds: $2542 USACE: $1300 FEMA: $23 Local: $497 Sac/SJ Drainage District: $80 **Total: $4440**

Table F-10. Scenario 3B Ongoing Investment by Phase

Management Action Category and Area of Interest	Years 1-10	Years 11-20	Years 21-30
Systemwide			
State operations, planning, and performance tracking	State GF: $21.4	State GF: $34	State GF: $45.6
Emergency management	State GF: $25.7 Local: $1.4	State GF: $34.3 Local: $1.8	State GF: $29.8 State River Basin Assess: $3.2 Local: $3.2
Reservoir operations	State GF: $10.7	State River Basin Assess: $14.3	State River Basin Assess: $14.3
Routine maintenance	State GF: $58 Local: $7.3 Sac/SJ Drainage District: $7.2	State GF: $80.7 Local: $0.7 Sac/SJ Drainage District: $19.5	State GF: $88.2 Sac/SJ Drainage District: $22
Urban			
Risk awareness, floodproofing and land use planning	State GF: $3.8 FEMA: $3 Local: $0.8	State Insurance Program: $5.4 FEMA: $4.3 Local: $1.1	State Insurance Program: $6.4 USACE: $1.6 FEMA: $3.6 Local: $1.3
Studies and analysis	State GF: $0.3 USACE: $0.5 Local: $0.2	State GF: $0.4 USACE: $0.7 Local: $0.2	State GF: $0.5 USACE: $1.1 Local: $0.5
Rural			
Risk awareness, floodproofing and land use planning	State GF: $1.3 FEMA: $0.8 Local: $0.1	State GF: $2.1 FEMA: $1.2 Local: $0.2	State GF: $0.2 State River Basin Assess: $1.3 USACE: $0.7 FEMA: $2.5 Local: $0.2
Studies and analysis	State GF: $0.1 FEMA: $0.1 Local: $0	State GF: $0.2 FEMA: $0.3 Local: $0	State GF: $0.4 FEMA: $0.6 Local: $0.1
Small Community			
Risk awareness, floodproofing and land use planning	State GF: $2.3 FEMA: $3.5	State Insurance Program: $4.4 State River Basin Assess: $0.3 FEMA: $4.1	State Insurance Program: $1.7 State River Basin Assess: $1.2 FEMA: $8.5
Studies and analysis	State GF: $2.6 FEMA: $2.6	State GF: $4 FEMA: $4	State GF: $5.3 USACE: $5.3
Total Ongoing Investment	State GF: $126 USACE: $0 FEMA: $10 Local: $10 Sac/SJ Drainage District: $7 **Total: $154**	State GF: $156 State Insurance Program: $10 State River Basin Assess: $15 USACE: $1 FEMA: $14 Local: $4 Sac/SJ Drainage District: $19 **Total: $218**	State GF: $170 State Insurance Program: $8 State River Basin Assess: $20 USACE: $9 FEMA: $15 Local: $5 Sac/SJ Drainage District: $22 **Total: $249**

Table F-11. Scenario 3C Capital Investment by Phase

Management Action Category and Area of Interest	Years 1-10	Years 11-20	Years 21-30
Systemwide			
Yolo Bypass multi-benefit improvements	State GO Bonds: $460 USACE: $511 Sac/SJ Drainage District: $51	State GO Bonds: $818 USACE: $153 Sac/SJ Drainage District: $51	State GO Bonds: $182 USACE: $34 Local: $4 Sac/SJ Drainage District: $8
Feather River-Sutter Bypass multi-benefit improvements			
Paradise Cut multi-benefit improvements	State GO Bonds: $14 USACE: $15 Sac/SJ Drainage District: $2	State GO Bonds: $209 USACE: $56 Sac/SJ Drainage District: $14	
Reservoir and floodplain storage	State GO Bonds: $47 USACE: $206 Local: $18 Sac/SJ Drainage District: $4	State GO Bonds: $138 USACE: $116 Sac/SJ Drainage District: $22	State GO Bonds: $138 USACE: $116 Sac/SJ Drainage District: $22
Urban			
Levee improvements	State GO Bonds: $368 USACE: $1196 Local: $276	State GO Bonds: $368 USACE: $1196 Local: $276	State GO Bonds: $46 USACE: $598 Local: $276
Other Infrastructure and multi-benefit improvements	State GO Bonds: $87 USACE: $226 Local: $35	State GO Bonds: $5 USACE: $12 Local: $2	USACE: $59 Local: $32
Rural			
Levee repair and infrastructure improvements	State GO Bonds: $536 Local: $219	State GO Bonds: $427 Local: $222	State GO Bonds: $287 Local: $224
Small-scale levee setbacks and floodplain storage	State GO Bonds: $128 USACE: $34 Local: $9	State GO Bonds: $6 USACE: $2 Local: $0	State GO Bonds: $12 USACE: $3 Local: $1
Land acquisitions and easements	State GO Bonds: $306 FEMA: $17 Local: $17	State GO Bonds: $306 FEMA: $13 Local: $21	State GO Bonds: $153 FEMA: $1 Local: $16
Habitat restoration/reconnection	State GO Bonds: $176 USACE: $20	State GO Bonds: $18 USACE: $2	State GO Bonds: $59 USACE: $7
Small Community			
Levee repair and infrastructure improvements	State GO Bonds: $181 USACE: $45	State GO Bonds: $415 USACE: $46	State GO Bonds: $319 USACE: $36
Levee setbacks, land acquisitions and habitat restoration	State GO Bonds: $37 USACE: $9	State GO Bonds: $192 USACE: $38	State GO Bonds: $367 USACE: $63
Total Capital Investment	State GO Bonds: $2340 USACE: $2263 FEMA: $17 Local: $574 Sac/SJ Drainage District: $56 **Total: $5251**	State GO Bonds: $2901 USACE: $1621 FEMA: $13 Local: $521 Sac/SJ Drainage District: $87 **Total: $5143**	State GO Bonds: $1563 USACE: $916 FEMA: $1 Local: $553 Sac/SJ Drainage District: $30 **Total: $3062**

Table F-12. Scenario 3C Ongoing Investment by Phase

Management Action Category and Area of Interest	Years 1-10	Years 11-20	Years 21-30
Systemwide			
State operations, planning, and performance tracking	State GF: $21.4	State GF: $34	State GF: $45.6
Emergency management	State GF: $25.7 Local: $1.4	State GF: $28.1 State River Basin Assess: $0.7 Local: $7.2	State GF: $28.9 Local: $7.2
Reservoir operations	State GF: $10.7	State River Basin Assess: $14.3	State River Basin Assess: $14.3
Routine maintenance	State GF: $58 Local: $0.2 Sac/SJ Drainage District: $14.4	State GF: $80.7 Local: $3.9 Sac/SJ Drainage District: $16.3	State GF: $88.2 Sac/SJ Drainage District: $22
Urban			
Risk awareness, floodproofing and land use planning	State GF: $3 USACE: $2.8 FEMA: $1 Local: $0.8	State Insurance Program: $4.3 FEMA: $5.4 Local: $1.1	State Insurance Program: $5.1 FEMA: $6.4 Local: $1.3
Studies and analysis	State GF: $0.3 USACE: $0.5 Local: $0.2	State GF: $0.4 USACE: $0.8 Local: $0.4	State GF: $0.2 USACE: $1.1 Local: $0.9
Rural			
Risk awareness, floodproofing and land use planning	State GF: $0.4 USACE: $0.7 FEMA: $1 Local: $0.1	State GF: $0.3 State Insurance Program: $0.4 FEMA: $2.6 Local: $0.2	State GF: $0.5 State Insurance Program: $0 State River Basin Assess: $0.4 FEMA: $3.7 Local: $0.2
Studies and analysis	State GF: $0.1 FEMA: $0.1 Local: $0	State GF: $0.2 FEMA: $0.3 Local: $0.1	State GF: $0.4 FEMA: $0.6 Local: $0.1
Small Community			
Risk awareness, floodproofing and land use planning	State GF: $1.4 FEMA: $4.3	State Insurance Program: $2.2 FEMA: $6.6	State River Basin Assess: $2.8 FEMA: $8.5
Studies and analysis	State GF: $2.6 USACE: $2.6 FEMA: $0	State GF: $4 FEMA: $4	State GF: $5.3 FEMA: $5.3
Total Ongoing Investment	State GF: $124 USACE: $7 FEMA: $6 Local: $3 Sac/SJ Drainage District: $14 **Total: $154**	State GF: $148 State Insurance Program: $7 State River Basin Assess: $15 USACE: $1 FEMA: $19 Local: $13 Sac/SJ Drainage District: $16 **Total: $218**	State GF: $169 State Insurance Program: $5 State River Basin Assess: $18 USACE: $1 FEMA: $24 Local: $10 Sac/SJ Drainage District: $22 **Total: $249**

Table F-13. Scenario 4A Capital Investment by Phase

Management Action Category and Area of Interest	Years 1-10	Years 11-20	Years 21-30
Systemwide			
Yolo Bypass multi-benefit improvements	State GO Bonds: $818 USACE: $153 Local: $51	State GO Bonds: $818 USACE: $153 Local: $51	State GO Bonds: $182 USACE: $34 Local: $11
Feather River-Sutter Bypass multi-benefit improvements			State GO Bonds: $1840 USACE: $460
Paradise Cut multi-benefit improvements	State GO Bonds: $23 USACE: $6 Local: $2	State GO Bonds: $209 USACE: $56 Local: $14	
Reservoir and floodplain storage	State GO Bonds: $47 USACE: $206 Local: $22	State GO Bonds: $47 USACE: $206 Local: $22	State GO Bonds: $47 USACE: $206 Local: $22
Urban			
Levee improvements	State GO Bonds: $368 USACE: $1196 Local: $276	State GO Bonds: $356 USACE: $1196 Local: $288	State GO Bonds: $24 USACE: $598 Local: $298
Other Infrastructure and multi-benefit improvements	State GO Bonds: $87 USACE: $226 Local: $35	State GO Bonds: $5 USACE: $12 Local: $2	State GO Bonds: $23 USACE: $59 Local: $9
Rural			
Levee repair and infrastructure improvements	State GO Bonds: $536 Local: $230	State GO Bonds: $424 Local: $215	State GO Bonds: $282 Local: $229
Small-scale levee setbacks and floodplain storage	State GO Bonds: $145 USACE: $17 Local: $9	State GO Bonds: $7 USACE: $1 Local: $0	State GO Bonds: $14 USACE: $2 Local: $1
Land acquisitions and easements	State GO Bonds: $306 FEMA: $17 Local: $17	State GO Bonds: $306 FEMA: $17 Local: $17	State GO Bonds: $153 FEMA: $4 Local: $13
Habitat restoration/reconnection	State GO Bonds: $176 USACE: $20	State GO Bonds: $18 USACE: $2	State GO Bonds: $59 USACE: $7
Small Community			
Levee repair and infrastructure improvements	State GO Bonds: $204 USACE: $23	State GO Bonds: $415 USACE: $46	State GO Bonds: $319 USACE: $35
Levee setbacks, land acquisitions and habitat restoration	State GF: $2 State GO Bonds: $40 USACE: $5	State GF: $76 State GO Bonds: $131 USACE: $23	State GF: $164 State GO Bonds: $224 USACE: $43
Total Capital Investment	State GF: $2 State GO Bonds: $2750 USACE: $1852 FEMA: $17 Local: $641 **Total: $5261**	State GF: $76 State GO Bonds: $2736 USACE: $1696 FEMA: $17 Local: $609 **Total: $5133**	State GF: $164 State GO Bonds: $3167 USACE: $1445 FEMA: $4 Local: $583 **Total: $5362**

Table F-14. Scenario 4A Ongoing Investment by Phase

Management Action Category and Area of Interest	Years 1-10	Years 11-20	Years 21-30
Systemwide			
State operations, planning, and performance tracking	State GF: $21.4	State GF: $34	State GF: $45.6
Emergency management	State GF: $24.8 Local: $2.3	State GF: $28.9 Local: $7.2	State GF: $28.9 Local: $7.2
Reservoir operations	State GF: $10.7	State GF: $14.3	State GF: $14.3
Routine maintenance	State GF: $58 Local: $14.5	State GF: $80.7 Local: $20.2	State GF: $88.2 Local: $22
Urban			
Risk awareness, floodproofing and land use planning	State GF: $3 FEMA: $3.8 Local: $0.8	State GF: $4.3 USACE: $0 FEMA: $5.4 Local: $1.1	State GF: $5.1 USACE: $6.4 Local: $1.3
Studies and analysis	State GF: $0.3 USACE: $0.5 Local: $0.3	State GF: $0.4 USACE: $0.8 Local: $0.4	State GF: $0.3 USACE: $1.1 Local: $0.8
Rural			
Risk awareness, floodproofing and land use planning	State GF: $0.4 USACE: $1.6 FEMA: $0.1 Local: $0.1	State GF: $0.7 USACE: $0.9 FEMA: $1.8 Local: $0.2	State GF: $1 USACE: $2.7 FEMA: $1 Local: $0.2
Studies and analysis	State GF: $0.1 FEMA: $0.1 Local: $0	State GF: $0.2 FEMA: $0.3 Local: $0.1	State GF: $0.4 FEMA: $0.6 Local: $0.1
Small Community			
Risk awareness, floodproofing and land use planning	State GF: $1.4 FEMA: $4.3	State GF: $2.2 FEMA: $6.6	State GF: $2.8 FEMA: $8.5
Studies and analysis	State GF: $2.6 USACE: $0 FEMA: $2.6	State GF: $4 USACE: $4	State GF: $5.3 USACE: $0.1 FEMA: $5.2
Total Ongoing Investment	State GF: $123 USACE: $2 FEMA: $11 Local: $18 **Total: $154**	State GF: $170 USACE: $6 FEMA: $14 Local: $29 **Total: $218**	State GF: $192 USACE: $10 FEMA: $15 Local: $32 **Total: $249**

Table F-15. Scenario 4B Capital Investment by Phase

Management Action Category and Area of Interest	Years 1-10	Years 11-20	Years 21-30
Systemwide			
Yolo Bypass multi-benefit improvements	State GO Bonds: $818 USACE: $153 Local: $51	State GO Bonds: $818 USACE: $153 Local: $51	State GO Bonds: $182 USACE: $34 Local: $11
Feather River-Sutter Bypass multi-benefit improvements			State GO Bonds: $1840 USACE: $460
Paradise Cut multi-benefit improvements	State GO Bonds: $23 USACE: $6 Local: $2	State GO Bonds: $209 USACE: $56 Local: $14	
Reservoir and floodplain storage	State GO Bonds: $47 USACE: $206 Local: $22	State GO Bonds: $47 USACE: $206 Local: $22	State GO Bonds: $47 USACE: $206 Local: $22
Urban			
Levee improvements	State GO Bonds: $368 USACE: $1196 Local: $276	State GO Bonds: $356 USACE: $1196 Local: $288	State GO Bonds: $24 USACE: $598 Local: $298
Other Infrastructure and multi-benefit improvements	State GO Bonds: $87 USACE: $226 Local: $35	State GO Bonds: $5 USACE: $12 Local: $2	State GO Bonds: $23 USACE: $59 Local: $9
Rural			
Levee repair and infrastructure improvements	State GO Bonds: $536 Local: $230	State GO Bonds: $424 Local: $215	State GO Bonds: $282 Local: $229
Small-scale levee setbacks and floodplain storage	State GO Bonds: $145 USACE: $17 Local: $9	State GO Bonds: $7 USACE: $1 Local: $0	State GO Bonds: $14 USACE: $2 Local: $1
Land acquisitions and easements	State GO Bonds: $306 FEMA: $17 Local: $17	State GO Bonds: $306 FEMA: $17 Local: $17	State GO Bonds: $153 FEMA: $4 Local: $13
Habitat restoration/reconnection	State GO Bonds: $176 USACE: $20	State GO Bonds: $18 USACE: $2	State GO Bonds: $59 USACE: $7
Small Community			
Levee repair and infrastructure improvements	State GO Bonds: $204 USACE: $23	State GO Bonds: $415 USACE: $46	State GO Bonds: $319 USACE: $35
Levee setbacks, land acquisitions and habitat restoration	State GF: $2 State GO Bonds: $40 USACE: $5	State GF: $76 State GO Bonds: $131 USACE: $23	State GF: $164 State GO Bonds: $224 USACE: $43
Total Capital Investment	State GF: $2 State GO Bonds: $2750 USACE: $1852 FEMA: $17 Local: $641 **Total: $5261**	State GF: $76 State GO Bonds: $2736 USACE: $1696 FEMA: $17 Local: $609 **Total: $5133**	State GF: $164 State GO Bonds: $3167 USACE: $1445 FEMA: $4 Local: $583 **Total: $5362**

Table F-16. Scenario 4B Ongoing Investment by Phase

Management Action Category and Area of Interest	Years 1-10	Years 11-20	Years 21-30
Systemwide			
State operations, planning, and performance tracking	State GF: $21.4	State GF: $34	State GF: $45.6
Emergency management	State GF: $24.8 Local: $2.3	State GF: $28.9 Local: $7.2	State GF: $28.9 Local: $7.2
Reservoir operations	State GF: $10.7	State GF: $14.3	State GF: $14.3
Routine maintenance	State GF: $58 Local: $14.5	State GF: $80.7 Local: $20.2	State GF: $88.2 Local: $22
Urban			
Risk awareness, floodproofing and land use planning	State GF: $3 FEMA: $3.8 Local: $0.8	State GF: $4.3 USACE: $0 FEMA: $5.4 Local: $1.1	State GF: $5.1 USACE: $6.4 Local: $1.3
Studies and analysis	State GF: $0.3 USACE: $0.5 Local: $0.3	State GF: $0.4 USACE: $0.8 Local: $0.4	State GF: $0.3 USACE: $1.1 Local: $0.8
Rural			
Risk awareness, floodproofing and land use planning	State GF: $0.4 USACE: $1.6 FEMA: $0.1 Local: $0.1	State GF: $0.7 USACE: $0.9 FEMA: $1.8 Local: $0.2	State GF: $1 USACE: $2.7 FEMA: $1 Local: $0.2
Studies and analysis	State GF: $0.1 FEMA: $0.1 Local: $0	State GF: $0.2 FEMA: $0.3 Local: $0.1	State GF: $0.4 FEMA: $0.6 Local: $0.1
Small Community			
Risk awareness, floodproofing and land use planning	State GF: $1.4 FEMA: $4.3	State GF: $2.2 FEMA: $6.6	State GF: $2.8 FEMA: $8.5
Studies and analysis	State GF: $2.6 USACE: $0 FEMA: $2.6	State GF: $4 USACE: $4	State GF: $5.3 USACE: $0.1 FEMA: $5.2
Total Ongoing Investment	State GF: $123 USACE: $2 FEMA: $11 Local: $18 **Total: $154**	State GF: $170 USACE: $6 FEMA: $14 Local: $29 **Total: $218**	State GF: $192 USACE: $10 FEMA: $15 Local: $32 **Total: $249**

Table F-17. Scenario 4C Capital Investment by Phase

Management Action Category and Area of Interest	Years 1-10	Years 11-20	Years 21-30
Systemwide			
Yolo Bypass multi-benefit improvements	State GO Bonds: $460 USACE: $511 Sac/SJ Drainage District: $51	State GO Bonds: $460 USACE: $511 Sac/SJ Drainage District: $51	State GO Bonds: $102 USACE: $114 Local: $4 Sac/SJ Drainage District: $8
Feather River-Sutter Bypass multi-benefit improvements			State GO Bonds: $1150 USACE: $1150
Paradise Cut multi-benefit improvements	State GO Bonds: $14 USACE: $15 Sac/SJ Drainage District: $2	State GO Bonds: $125 USACE: $139 Sac/SJ Drainage District: $14	
Reservoir and floodplain storage	State GO Bonds: $47 USACE: $206 Local: $18 Sac/SJ Drainage District: $4	State GO Bonds: $47 USACE: $206 Sac/SJ Drainage District: $22	State GO Bonds: $47 USACE: $206 Sac/SJ Drainage District: $22
Urban			
Levee improvements	State GO Bonds: $368 USACE: $1196 Local: $276	State GO Bonds: $368 USACE: $1196 Local: $276	State GO Bonds: $63 USACE: $598 Local: $259
Other Infrastructure and multi-benefit improvements	State GO Bonds: $87 USACE: $226 Local: $35	State GO Bonds: $5 USACE: $12 Local: $2	State GO Bonds: $23 USACE: $59 Local: $9
Rural			
Levee repair and infrastructure improvements	State GO Bonds: $536 Local: $230	State GO Bonds: $418 Local: $220	State GO Bonds: $198 State Insurance Program: $44 Local: $269
Small-scale levee setbacks and floodplain storage	State GO Bonds: $128 USACE: $34 Local: $9	State GO Bonds: $6 USACE: $2 Local: $0	State GO Bonds: $12 USACE: $3 Local: $1
Land acquisitions and easements	State GO Bonds: $306 FEMA: $17 Local: $17	State GO Bonds: $306 FEMA: $11 Local: $23	State GO Bonds: $153 FEMA: $5 Local: $12
Habitat restoration/reconnection	State GO Bonds: $157 USACE: $39	State GO Bonds: $16 USACE: $4	State GO Bonds: $53 USACE: $13
Small Community			
Levee repair and infrastructure improvements	State GO Bonds: $181 USACE: $45	State GO Bonds: $369 USACE: $92	State GO Bonds: $255 State River Basin Assess: $29 USACE: $71
Levee setbacks, land acquisitions and habitat restoration	State GO Bonds: $37 USACE: $9	State GO Bonds: $184 USACE: $46	State GF: $130 State GO Bonds: $160 State Insurance Program: $54 USACE: $86
Total Capital Investment	State GO Bonds: $2320 USACE: $2283 FEMA: $17 Local: $584 Sac/SJ Drainage District: $56 **Total: $5261**	State GO Bonds: $2305 USACE: $2209 FEMA: $11 Local: $521 Sac/SJ Drainage District: $87 **Total: $5133**	State GF: $130 State GO Bonds: $2216 State Insurance Program: $99 State River Basin Assess: $29 USACE: $2301 FEMA: $5 Local: $553 Sac/SJ Drainage District: $30 **Total: $5362**

Table F-18. Scenario 4C Ongoing Investment by Phase

Management Action Category and Area of Interest	Years 1-10	Years 11-20	Years 21-30
Systemwide			
State operations, planning, and performance tracking	State GF: $21.4	State GF: $34	State GF: $45.6
Emergency management	State GF: $25.7 Local: $1.4	State GF: $28.1 State River Basin Assess: $0.7 Local: $7.2	State GF: $28.9 Local: $7.2
Reservoir operations	State GF: $10.7	State River Basin Assess: $14.3	State River Basin Assess: $14.3
Routine maintenance	State GF: $58 Local: $0.2 Sac/SJ Drainage District: $14.4	State GF: $80.7 Local: $3.9 Sac/SJ Drainage District: $16.3	State GF: $88.2 Sac/SJ Drainage District: $22
Urban			
Risk awareness, floodproofing and land use planning	State GF: $2.1 USACE: $3.8 Local: $1.7	State Insurance Program: $4.3 USACE: $5.4 Local: $1.1	State Insurance Program: $5.1 USACE: $6.4 Local: $1.3
Studies and analysis	State GF: $0.3 USACE: $0.5 Local: $0.3	State GF: $0.4 USACE: $0.8 Local: $0.4	State GF: $0.3 USACE: $1.1 Local: $0.8
Rural			
Risk awareness, floodproofing and land use planning	State GF: $0.7 USACE: $1.4 Local: $0.1	State GF: $0.3 State Insurance Program: $0.4 USACE: $2.6 Local: $0.2	State GF: $1 USACE: $3.7 Local: $0.2
Studies and analysis	State GF: $0.1 FEMA: $0.1 Local: $0	State GF: $0.2 FEMA: $0.3 Local: $0.1	State GF: $0.4 FEMA: $0.6 Local: $0.1
Small Community			
Risk awareness, floodproofing and land use planning	State GF: $1.4 FEMA: $4.3	State Insurance Program: $2.2 FEMA: $6.6	State River Basin Assess: $2.8 FEMA: $8.5
Studies and analysis	State GF: $2.6 USACE: $2.6	State GF: $4 USACE: $4	State GF: $5.3 USACE: $5.3
Total Ongoing Investment	State GF: $123 USACE: $8 FEMA: $4 Local: $4 Sac/SJ Drainage District: $14 **Total: $154**	State GF: $148 State Insurance Program: $7 State River Basin Assess: $15 USACE: $13 FEMA: $7 Local: $13 Sac/SJ Drainage District: $16 **Total: $218**	State GF: $170 State Insurance Program: $5 State River Basin Assess: $17 USACE: $16 FEMA: $9 Local: $10 Sac/SJ Drainage District: $22 **Total: $249**

Table F-19. Scenario 4D Capital Investment by Phase

Management Action Category and Area of Interest	Years 1-10	Years 11-20	Years 21-30
Systemwide			
Yolo Bypass multi-benefit improvements	State GO Bonds: $491 USACE: $511 Sac/SJ Drainage District: $20	State GO Bonds: $491 USACE: $511 Sac/SJ Drainage District: $20	State GO Bonds: $109 USACE: $114 Sac/SJ Drainage District: $5
Feather River-Sutter Bypass multi-benefit improvements			State GO Bonds: $1150 USACE: $1150
Paradise Cut multi-benefit improvements	State GO Bonds: $15 USACE: $15 Sac/SJ Drainage District: $1	State GO Bonds: $133 USACE: $139 Sac/SJ Drainage District: $6	
Reservoir and floodplain storage	State GO Bonds: $55 USACE: $206 Sac/SJ Drainage District: $14	State GO Bonds: $55 USACE: $206 Sac/SJ Drainage District: $14	State GO Bonds: $11 State Insurance Program: $44 USACE: $206 Sac/SJ Drainage District: $14
Urban			
Levee improvements	State GO Bonds: $415 USACE: $1196 Local: $229	State GO Bonds: $442 USACE: $1196 Local: $202	State GO Bonds: $173 USACE: $598 Local: $149
Other Infrastructure and multi-benefit improvements	State GO Bonds: $94 USACE: $226 Local: $28	State GO Bonds: $5 USACE: $12 Local: $1	State GO Bonds: $2 USACE: $59 Sac/SJ Drainage District: $30
Rural			
Levee repair and infrastructure improvements	State GO Bonds: $495 USACE: $115 Local: $77	State GO Bonds: $396 State Insurance Program: $19 USACE: $96 Local: $123	State GO Bonds: $211 USACE: $66 Local: $224 Sac/SJ Drainage District: $14
Small-scale levee setbacks and floodplain storage	State GO Bonds: $111 USACE: $51 Local: $9	State GO Bonds: $6 USACE: $3	State GO Bonds: $11 USACE: $5 Local: $1
Land acquisitions and easements	State GO Bonds: $306 FEMA: $34	State GO Bonds: $306 FEMA: $34	State GO Bonds: $94 State Insurance Program: $23 State River Basin Assess: $36 FEMA: $17
Habitat restoration/reconnection	State GO Bonds: $137 USACE: $59	State GO Bonds: $14 USACE: $6	State GO Bonds: $46 USACE: $20
Small Community			
Levee repair and infrastructure improvements	State GO Bonds: $181 USACE: $45	State GO Bonds: $362 State River Basin Assess: $7 USACE: $92	State GO Bonds: $281 State River Basin Assess: $3 USACE: $71
Levee setbacks, land acquisitions and habitat restoration	State GF: $37 USACE: $9	State GF: $94 State GO Bonds: $30 State Insurance Program: $60 USACE: $46	State GF: $186 State GO Bonds: $143 State Insurance Program: $15 USACE: $86
Total Capital Investment	State GO Bonds: $2416 USACE: $2434 FEMA: $34 Local: $342 Sac/SJ Drainage District: $35 **Total: $5261**	State GF: $94 State GO Bonds: $2240 State Insurance Program: $80 State River Basin Assess: $7 USACE: $2307 FEMA: $34 Local: $327 Sac/SJ Drainage District: $40 **Total: $5129**	State GF: $186 State GO Bonds: $2230 State Insurance Program: $82 State River Basin Assess: $39 USACE: $2375 FEMA: $17 Local: $374 Sac/SJ Drainage District: $62 **Total: $5366**

Table F-20. Scenario 4D Ongoing Investment by Phase

Management Action Category and Area of Interest	Years 1-10	Years 11-20	Years 21-30
Systemwide			
State operations, planning, and performance tracking	State GF: $21.4	State GF: $34	State GF: $45.6
Emergency management	State GF: $25.7 Local: $1.4	State GF: $28.9 Local: $7.2	State GF: $28.9 Local: $7.2
Reservoir operations	State GF: $10.7	State River Basin Assess: $14.3	State River Basin Assess: $14.3
Routine maintenance	State GF: $60.2 Local: $0.8 Sac/SJ Drainage District: $11.5	State GF: $83.8 Local: $1.1 Sac/SJ Drainage District: $16	State GF: $91.5 Sac/SJ Drainage District: $18
Urban			
Risk awareness, floodproofing and land use planning	State GF: $3.4 USACE: $3.8 Local: $0.4	State Insurance Program: $4 State River Basin Assess: $1.2 USACE: $5.4 Local: $0.5	State Insurance Program: $4 State River Basin Assess: $3.9 USACE: $6.4 Local: $0.6
Studies and analysis	State GF: $0.3 USACE: $0.7 Local: $0.1	State GF: $0.4 USACE: $1.1 Local: $0.2	State GF: $0.3 USACE: $1.4 Local: $0.4
Rural			
Risk awareness, floodproofing and land use planning	State GF: $1.3 USACE: $0.8 Local: $0.1	State GF: $0.7 USACE: $2.6 Local: $0.2	State GF: $1 USACE: $3.7 Local: $0.2
Studies and analysis	State GF: $0.1 FEMA: $0.1	State GF: $0.2 FEMA: $0.4	State GF: $0.3 FEMA: $0.7
Small Community			
Risk awareness, floodproofing and land use planning	State GF: $1.4 FEMA: $4.3	State River Basin Assess: $2.2 FEMA: $6.6	State River Basin Assess: $3.8 FEMA: $8.5
Studies and analysis	State GF: $1.8 USACE: $3.4	State GF: $2.8 USACE: $5.1	State GF: $3.7 USACE: $6.9
Total Ongoing Investment	State GF: $126 USACE: $9 FEMA: $4 Local: $3 Sac/SJ Drainage District: $12 **Total: $154**	State GF: $151 State Insurance Program: $4 State River Basin Assess: $17 USACE: $14 FEMA: $7 Local: $9 Sac/SJ Drainage District: $16 **Total: $218**	State GF: $171 State Insurance Program: $4 State River Basin Assess: $21 USACE: $18 FEMA: $9 Local: $9 Sac/SJ Drainage District: $18 **Total: $249**

Table F-21. Scenario 5 Capital Investment by Phase

Management Action Category and Area of Interest	Years 1-10	Years 11-20	Years 21-30
Systemwide			
Yolo Bypass multi-benefit improvements	State GF: $66 USACE: $73 Local: $7	State GF: $58 USACE: $64 Local: $6	State GF: $51 USACE: $57 Local: $6
Feather River-Sutter Bypass multi-benefit improvements			
Paradise Cut multi-benefit improvements	USACE: $5 Local: $1	USACE: $7 Local: $1	USACE: $9 Local: $1
Reservoir and floodplain storage	USACE: $29 Local: $3	USACE: $34 Local: $4	USACE: $32 Local: $3
Urban			
Levee improvements	USACE: $199 Local: $46	USACE: $211 Local: $49	USACE: $179 Local: $54
Other Infrastructure and multi-benefit improvements	USACE: $38 Local: $6	USACE: $42 Local: $7	USACE: $39 Local: $6
Rural			
Levee repair and infrastructure improvements	Local: $14	Local: $36	Local: $71
Small-scale levee setbacks and floodplain storage	USACE: $6 Local: $1	USACE: $9 Local: $2	USACE: $11 Local: $3
Land acquisitions and easements	FEMA: $6 Local: $3	FEMA: $10 Local: $5	FEMA: $12 Local: $6
Habitat restoration/reconnection	USACE: $3	USACE: $6	USACE: $8
Small Community			
Levee repair and infrastructure improvements	USACE: $11 Local: $13	USACE: $18 Local: $4	USACE: $23 Local: $1
Levee setbacks, land acquisitions and habitat restoration	USACE: $3	USACE: $9 Local: $5	USACE: $11 Local: $7
Total Capital Investment	State GF: $66 USACE: $368 FEMA: $6 Local: $95 **Total: $535**	State GF: $58 USACE: $399 FEMA: $10 Local: $119 **Total: $585**	State GF: $51 USACE: $367 FEMA: $12 Local: $158 **Total: $589**

Table F-22. Scenario 5 Ongoing Investment by Phase

Management Action Category and Area of Interest	Years 1-10	Years 11-20	Years 21-30
Systemwide			
State operations, planning, and performance tracking	State GF: $10.7	State GF: $13.6	State GF: $16
Emergency management	State GF: $18.8 Local: $4.7	State GF: $18.8 Local: $4.7	State GF: $18.8 Local: $4.7
Reservoir operations	State GF: $3.7 USACE: $0.5 Local: $1.1	State GF: $4 USACE: $0.6 Local: $1.1	State GF: $4 USACE: $0.6 Local: $1.1
Routine maintenance	State GF: $19.6 Local: $16.7	State GF: $21.9 Local: $18.4	State GF: $24.8 Local: $19.3
Urban			
Risk awareness, floodproofing and land use planning	USACE: $2.6 FEMA: $0 Local: $2.6	USACE: $3.2 Local: $3.2	USACE: $3.2 Local: $3.2
Studies and analysis	USACE: $0.1 Local: $0.1	USACE: $0.2 Local: $0.2	USACE: $0.2 Local: $0.2
Rural			
Risk awareness, floodproofing and land use planning	State GF: $0.1 USACE: $0.1 FEMA: $0.2 Local: $0	State GF: $0.1 USACE: $0.5 Local: $0	State GF: $0.2 USACE: $0.7 Local: $0
Studies and analysis	State GF: $0 FEMA: $0 Local: $0	State GF: $0 FEMA: $0.1 Local: $0	State GF: $0.1 FEMA: $0.1 Local: $0
Small Community			
Risk awareness, floodproofing and land use planning	FEMA: $0.9 Local: $0.3	FEMA: $1.3 Local: $0.4	FEMA: $1.7 Local: $0.6
Studies and analysis	State GF: $0.5 USACE: $0 FEMA: $0.5	State GF: $0.8 USACE: $0.8	State GF: $1.1 USACE: $1.1
Total Ongoing Investment	State GF: $53 USACE: $3 FEMA: $2 Local: $26 **Total: $84**	State GF: $59 USACE: $5 FEMA: $1 Local: $28 **Total: $94**	State GF: $65 USACE: $6 FEMA: $2 Local: $29 **Total: $102**

Appendix G: Defining the Levels of Outcome

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Appendix G: Defining the Levels of Outcome

State participation and investment in water resources management in California is driven largely by societal values for the people of California, including public health and safety, a stable economy, sustainable vital ecosystems, and opportunities for enriching experiences, in alignment with the California Water Action Plan (DWR, 2014), the California Water Plan (CNRS, 2016), and California's Flood Future (DWR, 2013). All California Department of Water Resources (DWR) water management programs—the Central Valley Flood Protection Plan (CVFPP) included—play specific roles in helping the State support these societal values. Central Valley flood management is primarily intended to contribute to these values by helping to minimize lives lost from flooding and contribute to the economic stability of local communities, the region, and the State.

Describing and justifying investments that will achieve CVFPP goals depends on applying an outcome-driven planning approach, which focuses on the outcome of an action versus the action itself. Such an approach guides the CVFPP investment strategy, and has guided the types of management actions included in the 2017 CVFPP Update and its refined SSIA portfolio.

Four levels of outcomes are defined in this outcome-driven planning approach, and they offer useful distinctions for flood management. Outcomes (both intended and actual) can be sorted into these levels based on sequential dependencies. Outcomes can take different shapes, are interdependent, and can build upon one another to contribute toward broader societal values. The higher level outcomes (i.e., Levels 3 and 4, with Level 4 being the highest level) represent outcomes that provide the most tangible value to society. They are more complex to measure and more challenging to achieve than lower level outcomes (i.e., Levels 1 and 2). However, outcomes at Levels 1 and 2 are crucial to the overall effectiveness of a flood management system because they are necessary to achieve the intended higher levels of outcome (DWR, 2016a).

The following discussion outlines the hierarchy and description of these levels of outcome for flood management. Many of the concepts and the interconnectivity of the outcomes discussed here are associated with overall prioritization of the 2017 refined SSIA portfolio, and influenced the recommended investments. The prioritization of the 2017 refined SSIA portfolio is directly discussed in Section 3 of the CVFPP Investment Strategy Technical Memorandum (TM).

- **Higher-level intended outcomes: the "why" of Central Valley flood management**
  - **Level 4: Sustainability.** Sustainability is defined here as a resilient, dynamic balance between the societal values of public health and safety, ecosystem vitality, economic stability and opportunities for enriching experiences. This balance is contributed to in part by flood-specific outcomes, but also by other resource management efforts across the State.

  - **Level 3: Flood-specific resource and societal benefits.** These outcomes are specific to flood management (such as floodplain ecosystem productivity or economic damages from flooding) that contribute to societal values. Therefore, they are referred to as flood-specific outcomes in this plan. These outcomes depend on the lower level outcomes discussed below.

- **Lower-level outcomes: the "what" and "how" of Central Valley flood management**

  - **Level 2: Physical Assets and Behaviors.** These outcomes form the "what" of Central Valley flood management. Changes to physical assets and behaviors such as floodplain land uses, flood infrastructure, or human responses to floods come about as a result of management action implementation. Therefore, these outcomes are referred to as management actions.

  - **Level 1: Enabling Conditions.** This is the "how" of flood management. Enabling conditions like funding mechanisms, programs, authorities, and other foundational features are needed to support successful CVFPP implementation and associated changes to physical assets and behaviors.

The actions that are recommended for producing the "how" and "what" of Central Valley flood management are ultimately driven by assumptions about management actions that will affect flood-specific outcomes, and by the ultimate desire to meaningfully contribute to societal values. Success is measured by the degree to which actions taken help bring about their related intended outcomes. Actual outcomes are tracked over time for the purpose of demonstrating the value and improve the effectiveness of investment with each planning cycle.

- **The why:** flood-specific outcomes that most effectively and resiliently contribute to societal values

- **The what:** changes to physical assets and behaviors through management actions that are needed to bring about those outcomes

- **The how:** establishing enabling conditions that can make those changes possible

G.1 The Why: Defining Flood-Specific Outcomes

As a DWR water management program, the CVFPP most directly contributes to flood-specific outcomes for which flood management has a unique or shared responsibility. These flood-specific outcomes represent the reason **why** management actions are needed to be implemented to improve the flood management system, and their relation to societal values is the reason **why** some degree of public funding for such management actions is justified. This is why the CVFPP investment strategy focuses on flood-specific outcomes and uses these outcomes to prioritize its investments. For example, minimizing additional lives exposed and reducing human vulnerability to floodwaters contributes to the societal value of public safety by reducing lives lost or injured from flooding. The management actions most effective at minimizing lives exposed or reducing human vulnerability, therefore, have their investments justified by contributing to public safety. All investments included in the 2017 refined SSIA portfolio were prioritized using this flood-specific outcome pattern as a basis. Section 3 of the CVFPP Investment Strategy TM expands on this prioritization process. Table G-1 defines the flood-specific outcomes associated with each societal value. CVFPP goals of course also closely relate to flood-specific outcomes and are shown for reference in Table G-1.

Table G-1. Flood-Specific Outcomes and Related CVFPP Goals

Outcomes that Contribute to Societal Values			Related CVFPP Goals
Public Health and Safety		**Minimize number of people within the floodplain.** Reduce or minimize the current and/or additional number of people who live or work within the floodplain and could be exposed to potential flooding (floodplain defined as the area that could potentially flood in a very large, but reasonably foreseeable flood event).	**Improve Flood Risk Management:** Improve public safety, preparedness, and emergency response.
		Reduce human vulnerability when flooding occurs. Reduce the extent to which people located within floodplains are harmed or are unable to evacuate in the case of a flood when faced with oncoming floodwaters.	**Improve Flood Risk Management:** Improve public safety, preparedness, and emergency response.
		Increase system performance in populous areas. Reduce the extent to which river flows from storm events and runoff are capable of or likely to cause flooding in populated areas.	**Improve Flood Risk Management:** Reduce the chance of flooding.
Ecosystem Vitality		**Reduce stressors on riverine and floodplain ecosystems.** Reduce the number of stressors to priority riverine and floodplain species and ecosystems.	Promote Ecosystem Functions
		Improve the riverine and floodplain habitats and ecosystems. Increase the amount (acreage, channel miles, etc.) and variety of available floodplain-related habitats that are wetted and/or connected at the appropriate times, are subject to more natural hydrologic and/or geomorphic processes, and are of otherwise high enough quality to meaningfully function as beneficial habitat for a variety of floodplain-dependent species.	Promote Ecosystem Functions
		Increase and maintain the abundance and diversity of floodplain dependent native species. Increase the number of native species that have access to, benefit from and can use floodplain and associated habitats, and which benefit from those habitats in ways that makes them more likely to survive.	Promote Ecosystem Functions

Table G-1. Flood-Specific Outcomes and Related CVFPP Goals

Outcomes that Contribute to Societal Values		Related CVFPP Goals
Economic Stability	**Minimize property and assets within the floodplain.** Reduce or minimize the value of assets currently within or added to the floodplain and could be exposed to potential flooding (floodplain defined as the area that could potentially flood in a very large, but reasonably foreseeable flood event).	**Improve Flood Risk Management:** Reduce damages once flooding occurs.
	Reduce economic vulnerability when flooding occurs. Reduce the extent to which property or other floodplain assets are damaged when faced with oncoming flood waters.	**Improve Flood Risk Management:** Reduce damages once flooding occurs.
	Increase system performance for economically developed areas. Reduce the extent to which river flows from storm events and runoff are likely to cause flooding in already established areas of economic development.	**Improve Flood Risk Management:** Reduce the chance of flooding.
	Produce or maintain economic benefits on floodplains. Maintain agricultural or industrial productivity, increase fisheries production, provide water supply or quality benefits, or reduce transactional costs (usually related to O&M and permitting) on floodplains.	Promote Multi-Benefit Projects, and Improve Operations & Maintenance
Enriching Experiences	**Provide recreational benefits.** Increase the number of floodplain-related recreational opportunities or access points.	Promote Multi-Benefit Projects
	Support societal/aesthetic values. Increase flood protection or visitation opportunities for areas or sites of cultural, social or aesthetic value.	Promote Multi-Benefit Projects
	Provide education and public awareness. Increase access to and the number of floodplain or flood risk-related educational opportunities.	Promote Multi-Benefit Projects
	Protect significant farmland. Maintain acreage of culturally significant farmland.	Promote Multi-Benefit Projects

G.2 The What and How: Defining Lower-Level Outcomes

The intended outcomes of 2017 refined SSIA portfolio are diverse, as is the landscape within which those outcomes are to be achieved. As such, the SSIA approach and any refinements to it developed in each 5-year update must include a broad mix of management action types. The following sections provide some introductory discussion on the types of management actions, in various areas of interest, which typically have the greatest potential for achieving CVFPP goals and related societal values. This discussion will help to inform the types of management actions from within the broader CVFPP portfolio that will be prioritized for investment.

G.2.1 Providing for Public Health and Safety and Supporting a Stable Economy

> **Resiliency**
> Resiliency is the ability of the system to respond to and recover from stressful events directly related to the outcomes (or services) for which investments are being made (such as public safety, the economy, or the environment).

The CVFPP's primary goal, improve flood risk management, implies the need for actions that resiliently reduce and limit risks to lives and economic assets across the Sacramento and San Joaquin river basins. The term "resiliently" emphasizes that the goal is not just to reduce and limit risk in the short term, but to reliably achieve those outcomes for future generations. This requires that the floodplain management system have the strength and adaptability to sustain new stressors (such as population growth or changing hydrology with climate change). The 2012 CVFPP introduced the concepts of flood risk, floodplain development, and flood risk management. To follow on and refine those concepts, flood-specific outcomes have described six other concepts that are affected by flood management decisions: life exposure, economic exposure, human vulnerability, economic vulnerability, system performance in populated areas, and system performance in economically valuable areas. Resilient, long-lasting reductions to life and economic risks require that a diverse mix of these outcomes be managed for and addressed across the Central Valley—a focus on minimized or reduced exposure in some places, increased system performance for others, and reduced vulnerability valley-wide. The most resilient and effective management actions will differ greatly depending on the scale, area of interest (systemwide, urban, rural, or small community), and site-specific circumstances. The following section reviews each of these approaches to floodplain management, and discusses the contexts in which they are most appropriate and effective.

Managing Life and Economic Risk by Minimizing the Number of People and Economic Assets within the Floodplain

Actions that minimize the number of people and economic assets within the floodplain ultimately reduce exposure. Exposure reduction is one of the most *resilient* ways to manage life and economic risk for the following reasons:

- The types of actions that reduce life or economic exposure (e.g., easements, flood risk awareness campaigns) typically do not preclude other flood management actions from being taken later, thereby preserving adaptive capacity within the system.

- Minimizing exposure limits risk regardless of the system's ability to maintain infrastructure as it ages, which itself depends on outside economic and political pressures that compete with or otherwise affect flood system O&M funding.

- Minimizing exposure limits risk regardless of how accurate our current understanding is of the likelihood of various flood scenarios—an understanding that has changed considerably over the last 50 years, and will likely continue to do so as additional years of data become available. Generally speaking, fewer people or economic assets in a given floodplain will result in fewer lives lost or economic damages when that area floods. This is in stark contrast to something like a new levee or levee upgrade in a currently unpopulated area, which can

actually increase risk over time (IPCC, 1994; California Floodplain Management Task Force Independent Panel, 2007) and is typically built based on a given design flow or level of protection.

However, resiliency is meaningless without efficacy. Investments are only worthwhile if they noticeably reduce or limit risk. A focus on exposure is generally most effective at reducing lives lost or economic damages over time in rural areas and small communities located in higher-risk portions of the floodplain, where there is still a danger of significant risk intensification in the future.

Managing Life and Economic Risk by Reducing Vulnerability When Flooding Occurs

Even with the realization of major physical improvements to the flood management system, the risk of flooding can never be completely eliminated. There is a risk that floods can exceed the design capacity of the flood protection system, or that its elements, such as levees or drainage facilities, can fail. This risk is called residual flood risk. When levees fail or overtop, the consequence to safety and property may be much higher than in an unprotected floodplain, because such failures can occur suddenly, quickly, and without adequate warning. Even the best flood-control systems or structures cannot completely eliminate the risk of flooding from all flood events.

Managing Residual Risk

"While managing residual risk in fully-developed urban areas would likely emphasize such things as evacuation plans and emergency warnings… residual risk management and recovery in rural areas is directly tied to prevention of risk intensification and to establishment of new rural programs within California (including structure elevation on earthen pads or by physical raises; ring levees around small communities and farmsteads; and non-structural land use considerations)."

—Mark Cowin, DWR Director (DWR, 2016a)

The refined SSIA portfolio recognizes the necessity of residual risk management measures. There is always a chance that flooding will occur in areas with the potential for life or economic losses, so actions that reduce human or economic vulnerability to impending floodwaters are a necessary component of any management action portfolio, regardless of geographic context.

Many of the management actions that focus on reduced vulnerability are also very effective at bolstering system resilience in terms of limiting risk to lives and/or property over long time periods. For instance, emergency response plans and training can be updated as circumstances change or new knowledge becomes available, and flood-proofing actions improve floodplain properties' ability to withstand floodwaters while not precluding other types of risk reduction actions in the future.

Managing Life and Economic Risk by Increasing System Performance in Populous Areas

Risk is already considerably high in some areas, and a focus on reducing current risk levels is needed. Increasing system performance or improving the ability to convey larger flows past these high-risk areas is the most effective means of managing risk. This is especially true for already densely populated urban areas or small communities, in which opportunities for reducing or minimizing exposure are much more limited.

Some management actions that improve system performance are more resilient than others. For example, an increase in designated floodplain area up or downstream of urban areas that can absorb and mitigate high flows is preferable to infrastructure hardening because it reduces pressure on other parts of the system, adds flexibility, and is usually less expensive to maintain over time. However, such expansions are often not possible within the urban footprint where development is already densely concentrated behind existing levees.

Managing Economic Risk by Balancing Risk and Rewards on Floodplains

Central Valley flood management contributes to the societal value of a stable economy by helping to balance economic productivity and risk on floodplains. An important implication of this concept of economic balance is that occasional damages are tolerable to the extent that they are balanced by economic revenue from floodplain productivity over time. This productivity can come either from industrial or agricultural use of floodplain lands, or from ecosystem and other floodplain services like fisheries production and groundwater recharge. Many of the CVFPP supporting goals address this productivity side of the economic balance. This is especially true for the goal of promoting multi-benefit projects; not only are they often a more cost-effective means of reducing risk while achieving other outcomes like ecosystem functionality and/or recreational benefits, but many of these other benefits often provide a positive impact on California's economy. A good example of this is the potential for transitory storage or habitat restoration projects that also provide groundwater recharge services. Also critically important to the economic balance on floodplains are routine operations and maintenance actions that help to maintain system performance over time, so that risk-based land use decisions remain economically viable over long periods.

G.2.2 Sustaining Vital Ecosystems

Although the primary focus of flood management is typically on outcomes that contribute toward the societal values of public safety and economic stability, flood management decisions also have important implications for the vitality of the State's ecosystems. Flood corridors and systems are often located collocated within extremely valuable wetland and riparian ecosystems with high levels of biodiversity. These ecosystems also provide critical habitats for many endangered and threatened species. As such, one of the CVFPP's supporting goals is to promote ecosystem functions, which implies that flood managers must work to reconcile reduced economic or public health and safety risks with the sustained existence and vitality of these ecosystems. The CVFPP does this by finding ways to increase the amount and functionality of floodplain and related habitats, and by increasing access and reducing stressors for a diversity of native species that use and benefit from those habitats.

There are generally two approaches to promoting ecosystem functions:

- Traditional restoration relies on restoring natural hydrologic and geomorphic processes to the landscape, with the idea being that these processes then do the work of forming, re-forming, connecting, and maintaining dynamic and functional habitats that serve native species.

- Habitats must often function within less naturally dynamic landscapes that also serve multiple human uses. Therefore, some degree of ongoing management in such areas may be necessary in order to reconcile human uses with ecosystem functionality in a beneficial way to native species.

In general, restoration actions that make room for and re-introduce natural hydrologic and geomorphic processes to the channel or floodplain are more resilient than those that require vigilant management. When feasible, the traditional restoration approach is usually more effective. However, opportunities for more traditional habitat restoration are limited, and will have to be mixed with reconciliation approaches if ecosystem vitality is to be maintained at the basin scale.

The CVFPP Conservation Strategy (DWR, 2016b) explores many different types of improvements that could be made to Central Valley river corridors and floodplain-related landscapes to support the native species and natural habitats. The recommended management actions that result from this effort represent a combination of the restoration and reconciliation actions. Based on these recommendations, the following types of flood management actions have the greatest potential for resiliently increasing functional habitat, contributing to the recovery of native species, and maintaining native species diversity and abundance over time:

- Habitat restoration projects in rural areas aimed at increased acreage of marsh or riparian habitat

- Habitat reconnection through removal of fish barriers or other means

- Levee setbacks, bypasses, and some types of transitory floodplain storage that do one or more of the following:

  - Increase natural bank and/or river meander potential
  - Improve floodplain connectivity
  - Increase length of shaded riverine habitat
  - Increase acreage of riparian and marsh habitats
  - Reduce levee revetment
  - Increase fish passage or mitigate fish stranding

- Performance-based O&M activities that incorporate ecosystem functions and critical habitats, including management of restored areas and removal of invasive vegetation

- Improved reservoir operations that allow for or mimic more natural downstream flow regimes

- Easements and/or land acquisitions that allow for increased habitat acreage, improved habitat quality (through more active management), or increased floodplain connectivity

G.2.3 Providing Opportunities for Enriching Experiences

As with sustaining vital ecosystems, providing opportunities for enriching experiences has not been the primary focus of flood management. However, flood management decisions also have important implications for the State's ability to provide opportunities for enriching experiences in the flood management system for all Californians. Many flood corridors with extremely valuable wetland and riparian ecosystems and riverine accessibility provide Californians an outlet to nature for enjoyment and educational purposes. The broad public benefit gained from these types of experiences should not be discounted. Moreover, they should be leveraged,

because Californians who understand, respect, and enjoy the flood system are more likely to financially and politically support it, and appropriately respond to flood crises when they occur.

Actions that provide opportunities for enriching experiences include:

- **Provide recreational benefits:** increase the number of floodplain-related recreational opportunities or access points. For example, provide a bike path along a levee access road or levee crown.

- **Support societal/aesthetic values:** increase flood protection or visitation opportunities for areas or sites of cultural, social, or aesthetic value. For example, protect the historical community of Locke in the Sacramento–San Joaquin Delta for future generations.

- **Provide education and public awareness:** increase access to, and the number of, floodplain or flood risk-related educational opportunities. For example, provide information plaques about flooding at wetland viewing areas.

- **Protect significant farmland:** Maintain acreage of culturally significant farmland. For example, protect farmland that creates a community and way of life centered on historical significance.

Describing and justifying investments that will achieve CVFPP goals depends on applying the outcome-driven planning approach, which focuses on the outcome of an action versus the action itself as described above. Closely tied to this outcome-driven approach is the four levels of outcome and the societal values. It is important to understand how the concepts and the interconnectivity of the outcomes discussed here are associated with overall prioritization of the 2017 refined SSIA portfolio, and influenced the recommended investments. For a direct discussion on the prioritization of the 2017 refined SSIA portfolio, please refer to Section 3 of the CVFPP Investment Strategy TM.

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