Appendix A

M&I Contractor Data Summary

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Contractor [1]	Contract No.	Maximum Contract Amount (acre-feet [AF])	Central Valley Project (CVP) Municipal & Industrial (M&I) Historical Use (AF) [2]	Estimated 2010 Public Health & Safety (PHS) Value (AF)	2010 Non-CVP Supplies (AF)			Projected CVP M&I Demand in 2030 (AF)	Estimated 2030 PHS Value (AF)	2030 Non-CVP Supplies (AF)			Data Sources and Assumptions
					Normal Year	Dry Year	Critical Year			Normal Year	Dry Year	Critical Year	
		Data provided by Bureau of Reclamation (Reclamation)	Based on last 3 years of deliveries unconstrained by availability of CVP water; unadjusted	Based on Reclamation's formula: (Population * 55 gpd) + (80% of Commercial & Instit.) + (90% of Indust.) + (10% for losses); unless otherwise noted	Based on information provided in contractor Urban Water Management Plans (UWMPs) or Reclamation data; Recycled water supplies are not included; UWMP Data: Dry year = 1st year of multi-year dry period; Critical year = single dry year.			Assumed to be full contract amount for M&I Contractors; see notes for Ag contractors	Based on Reclamation's formula: (Population * 55 gpd) + (80% of Commercial & Instit.) + (90% of Indust.) + (10% for losses); unless otherwise noted	Based on information provided in contractor UWMPs or Reclamation data; Recycled water supplies are not			
M&I Contractors													
Redding Basin													
Bella Vista Water District	14-06-200-851A-LTR1	24,578	6,899	2,705	0	0	0	24,578	3,625	0	0	0	Based on extrapolation from 2009 Reclamation PHS calculations using average area growth rate. (California Department of Finance [DOF] 2007a; City of Redding 2012; Shasta County 2004)
Centerville Community Services District (CSD)	14-06-200-3367X-LTR1	2,900	978	489	900	900	900	2,900	1,450	900	900	900	No data available on population, demand, or supplies. 2010 PHS assumed to be half of historical use. 2030 PHS assumed to be half of 2030 demand. Non-CVP supplies provided by Centerville CSD. (Centerville CSD 2012)
City of Redding	14-06-200-5272A-LTR1	6,140	5,382	16,206	40,000	40,000	37,314	6,140	22,388	40,000	40,000	37,314	Based on data from 2005 UWMP. (City of Redding 2006)
City of Shasta Lake	4-07-20-W1134-LTR1	4,400	2,867	1,236	2,000	2,000	2,000	4,400	1,656	2,000	2,000	2,000	Based on extrapolation from 2009 Reclamation PHS calculations using average area growth rate. (California DOF 2007a; City of Redding 2012; Shasta County 2004)
Clear Creek CSD	14-06-200-489-A-LTR1	15,300	2,016	680	30	30	30	15,300	911	30	30	30	Based on extrapolation from 2009 Reclamation PHS calculations using average area growth rate. (California DOF 2007a; City of Redding 2012; Shasta County 2004)
Mountain Gate CSD	14-06-200-6998-LTR1	1,350	832	416	0	0	0	1,350	675	0	0	0	No data available on population, demand, or supplies. 2010 PHS assumed to be half of historical use. 2030 PHS assumed to be half of 2030 demand. Non-CVP supplies assumed to be 0.
Shasta CSD	14-06-200-862A-LTR1	1,000	782	391	0	0	0	1,000	500	0	0	0	No data available on population, demand, or supplies. 2010 PHS assumed to be half of historical use. 2030 PHS assumed to be half of 2030 demand. Non-CVP supplies assumed to be 0.
Shasta County Water Agency	14-06-200-3367A-LTR1	1,022	393	355	0	0	0	1,022	601	0	0	0	Based on 2008 Reclamation water needs assessment. (Reclamation 2008)
U.S. Forest Service (Shasta)	14-06-200-3464A-LTR1	10	-	0	0	0	0	10	5	0	0	0	No data available on population, demand, or supplies. 2010 PHS assumed to be half of historical use. 2030 PHS assumed to be half of 2030 demand. Non-CVP supplies assumed to be 0.
American River Division													
City of Roseville	14-06-200-3474A-IR1	32,000	30,913	10,997	14,000	30,000	30,000	32,000	20,499	34,000	30,000	30,000	Based on data from 2010 UWMP and clarifications from City of Roseville. (City of Roseville 2011, 2012a, and 2012b)
East Bay Municipal Utility District (EBMUD)	14-06-200-5183A-LTR1	133,000	133,000	148,714	242,000	153,000	130,000	133,000	166,131	257,000	165,000	136,000	Based on data from 2010 UWMP and clarifications from EBMUD. EBMUD historical use defined in contract with Reclamation. (EBMUD 2011)
El Dorado Irrigation District	14-06-200-1357A-LTR1	7,550	5,728	9,636	59,640	57,080	57,080	7,550	14,715	107,140	57,080	57,080	Based on data from 2010 UWMP. (El Dorado Irrigation District 2011)
Placer County Water Agency	14-06-200-5082A	35,000	0	27,855	248,972	216,575	172,725	35,000	34,732	256,494	225,664	172,725	Based on data from 2010 UWMP. (Placer County Water Agency 2011)
Sacramento County Water Agency	6-07-20-W1372	22,000	4,877	14,360	41,000	42,232	45,930	22,000	28,242	70,498	65,198	92,498	Based on data from 2010 UWMP. (Sacramento County Water Agency 2011)
	assignment from SMUD	30,000	-					30,000					
Sacramento Municipal Utility District (SMUD)	14-06-200-5198A	30,000	6,021	26,685	18,024	18,024	18,024	30,000	37,637	18,024	18,024	18,024	Demand and non-CVP supplies based on 2008 Reclamation water needs assessment. Historical use provided by SMUD. (Reclamation 2008; SMUD 2012)
San Juan Water District	6-07-20-W1373-LTR1	24,200	6,558	14,813	58,000	58,000	58,000	24,200	16,194	58,000	58,000	58,000	Based on data from 2010 UWMP. (San Juan Water District 2011)
Delta Division													
City of Tracy	14-06-200-7858A	10,000						10,000					
(Westside)	7-07-20-W0045-IR11-B	2,500	10,000	8,399	14,333	18,833	13,833	2,500	16,045	25,000	30,700	24,200	Based on data from 2010 UWMP. Historical use provided by City of Tracy.
(Banta-Carbona)	14-06-200-4305A-IR11-B	5,000						5,000					(City of Tracy 2011 and 2012)
Contra Costa Water District (CCWD)	I75r-3401A-LTR1	195,000	170,000	70,827	28,500	23,000	23,000	195,000	115,127	30,700	28,300	28,300	Based on data from 2010 UWMP. Historical use provided by CCWD. (CCWD 2011 and 2012)
U.S. Department of Veteran Affairs	3-07-20-W1124-LTR1	850	70	35	0	0	0	850	425	0	0	0	No data available on population, demand, or supplies. 2010 PHS assumed to be half of historical use. 2030 PHS assumed to be half of 2030 demand. Non-CVP supplies assumed to be 0.

Contractor [1]	Contract No.	Maximum Contract Amount (acre-feet [AF])	Central Valley Project (CVP) Municipal & Industrial (M&I) Historical Use (AF) [2]	Estimated 2010 Public Health & Safety (PHS) Value (AF)	2010 Non-CVP Supplies (AF)			Projected CVP M&I Demand in 2030 (AF)	Estimated 2030 PHS Value (AF)	2030 Non-CVP Supplies (AF)			Data Sources and Assumptions
					Normal Year	Dry Year	Critical Year			Normal Year	Dry Year	Critical Year	
		Data provided by Bureau of Reclamation (Reclamation)	Based on last 3 years of deliveries unconstrained by availability of CVP water; unadjusted	Based on Reclamation's formula: (Population * 55 gpd) + (80% of Commercial & Instit.) + (90% of Indust.) + (10% for losses); unless otherwise noted	Based on information provided in contractor Urban Water Management Plans (UWMPs) or Reclamation data; Recycled water supplies are not included; UWMP Data: Dry year = 1st year of multi-year dry period; Critical year = single dry year.			Assumed to be full contract amount for M&I Contractors; see notes for Ag contractors	Based on Reclamation's formula: (Population * 55 gpd) + (80% of Commercial & Instit.) + (90% of Indust.) + (10% for losses); unless otherwise noted	Based on information provided in contractor UWMPs or Reclamation data; Recycled water supplies are not			
Export Area/South of Sacramento-San Joaquin River Delta													
City of Avenal	14-06-200-4619A	3,500	2,820	2,810	0	0	0	3,500	4,271	0	0	0	Based on extrapolation from 2009 Reclamation PHS calculations using average area growth rate. (California DOF 2007b, 2007c, and 2007d; City of Coalinga 2006; San Benito County Water District et al 2011; SCVWD 2010)
City of Coalinga	14-06-200-4173A	10,000	7,189	3,011	0	0	0	10,000	3,245	1,500	1,500	1,500	Based on data from 2005 UWMP. (City of Coalinga 2006)
City of Huron	14-06-200-7081A	3,000	1,120	708	0	0	0	3,000	1,076	0	0	0	Based on extrapolation from 2009 Reclamation PHS calculations using average area growth rate. (California DOF 2007b, 2007c, and 2007d; City of Coalinga 2006; San Benito County Water District et al 2011; SCVWD 2010)
San Benito County Water District	8-07-20-W0130	43,800	4,026	3,358	9,950	4,004	4,004	43,800	7,419	9,950	7,608	7,608	Based on data from 2010 UWMP. (San Benito County Water District et al 2011)
Santa Clara Valley Water District (SCVWD)	7-07-20-W0023	152,500	152,500	224,572	320,700	216,200	287,840	119,400	280,921	319,050	216,200	310,990	Based on data from 2010 UWMP. (SCVWD 2010; SCVWD 2012)
State of California	14-06-200-8033A	10	8	3	0	0	0	10	4	0	0	0	Based on extrapolation from 2009 Reclamation PHS calculations using average area growth rate. (California DOF 2007b, 2007c, and 2007c; City of Coalinga 2006; San Benito County Water District et al 2011; SCVWD 2010)
Agriculture Contractors With Small Amount of M&I Deliveries													
Sacramento River													
Colusa County Water District	14-06-200-304-A-LTR1	68,164	201	101	22,000	22,000	22,000	285	143	22,000	22,000	22,000	Supply data based on 2008 Reclamation water needs assessment. No data available on demand or population. 2010 PHS assumed to be half of historical use. 2030 demand estimate based on extrapolation of historical use using average area growth rate. 2030 PHS assumed to be half of 2030 demand. (California DOF 2007e, 2007f, 2007g, and 2007h; Reclamation 2008)
Corning Water District	14-06-200-6575-LTR1	23,000	6	3	5,800	5,800	5,800	9	4	5,800	5,800	5,800	Supply data based on 2008 Reclamation water needs assessment. No data available on demand or population. 2010 PHS assumed to be half of historical use. 2030 demand estimate based on extrapolation of historical use using average area growth rate. 2030 PHS assumed to be half of 2030 demand. (California DOF 2007e, 2007f, 2007g, and 2007h; Reclamation 2008)
Dunnigan Water District	14-06-200-399-A-LTR1	19,000	136	68	6,500	6,500	6,500	193	97	6,500	6,500	6,500	Supply data based on 2008 Reclamation water needs assessment. No data available on demand or population. 2010 PHS assumed to be half of historical use. 2030 demand estimate based on extrapolation of historical use using average area growth rate. 2030 PHS assumed to be half of 2030 demand. (California DOF 2007e, 2007f, 2007g, and 2007h; Reclamation 2008)
Kanawha Water District	14-06-200-466-A-LTR1	45,000	5	3	174	174	174	7	4	174	174	174	Supply data based on 2008 Reclamation water needs assessment. No data available on demand or population. 2010 PHS assumed to be half of historical use. 2030 demand estimate based on extrapolation of historical use using average area growth rate. 2030 PHS assumed to be half of 2030 demand. (California DOF 2007e, 2007f, 2007g, and 2007h; Reclamation 2008)
Orland-Artois Water District	14-06-200-8382A-LTR1	53,000	10	5	13,700	13,700	13,700	14	7	13,700	13,700	13,700	Supply data based on 2008 Reclamation water needs assessment. No data available on demand or population. 2010 PHS assumed to be half of historical use. 2030 demand estimate based on extrapolation of historical use using average area growth rate. 2030 PHS assumed to be half of 2030 demand. (California DOF 2007e, 2007f, 2007g, and 2007h; Reclamation 2008)

Contractor [1]	Contract No.	Maximum Contract Amount (acre-feet [AF])	Central Valley Project (CVP) Municipal & Industrial (M&I) Historical Use (AF) [2]	Estimated 2010 Public Health & Safety (PHS) Value (AF)	2010 Non-CVP Supplies (AF)			Projected CVP M&I Demand in 2030 (AF)	Estimated 2030 PHS Value (AF)	2030 Non-CVP Supplies (AF)			Data Sources and Assumptions
					Normal Year	Dry Year	Critical Year			Normal Year	Dry Year	Critical Year	
		Data provided by Bureau of Reclamation (Reclamation)	Based on last 3 years of deliveries unconstrained by availability of CVP water; unadjusted	Based on Reclamation's formula: (Population * 55 gpd) + (80% of Commercial & Instit.) + (90% of Indust.) + (10% for losses); unless otherwise noted	Based on information provided in contractor Urban Water Management Plans (UWMPs) or Reclamation data; Recycled water supplies are not included; UWMP Data: Dry year = 1st year of multi-year dry period; Critical year = single dry year.			Assumed to be full contract amount for M&I Contractors; see notes for Ag contractors	Based on Reclamation's formula: (Population * 55 gpd) + (80% of Commercial & Instit.) + (90% of Indust.) + (10% for losses); unless otherwise noted	Based on information provided in contractor UWMPs or Reclamation data; Recycled water supplies are not			
Delta Division													
Byron-Bethany Irrigation District	14-06-200-785-LTR1	20,600	800	400	0	0	0	1,112	556	0	0	0	No data available on population, demand, or supplies. 2010 PHS assumed to be half of historical use. 2030 demand estimate based on extrapolation of historical use using average area growth rate. 2030 PHS assumed to be half of 2030 demand. Non-CVP supplies assumed to be 0. (California DOF 2007i and 2007j; CCWD 2011; City of Tracy 2011)
Del Puerto Water District	14-06-200-922-LTR1	140,210	27	14	3,000	3,000	3,000	38	19	3,000	3,000	3,000	Supply data based on 2008 Reclamation water needs assessment. No data available on demand or population. 2010 PHS assumed to be half of historical use. 2030 demand estimate based on extrapolation of historical use using average area growth rate. 2030 PHS assumed to be half of 2030 demand. (California DOF 2007i and 2007j; CCWD 2011; City of Tracy 2011; Reclamation 2008)
Export Area/South of Sacramento-San Joaquin River Delta													
Pacheco Water District	6-07-20-W0469 (SLC/DMC)	10,080	12	6	4,597	4,597	4,597	18	9	4,597	4,597	4,597	Supply data based on 2009 Water Management Plan. No data available on demand or population. 2010 PHS assumed to be half of historical use. 2030 demand estimate based on extrapolation of historical use using average area growth rate. 2030 PHS assumed to be half of 2030 demand. (California DOF 2007b, 2007c, and 2007d; City of Coalinga 2006; Pacheco Water District 2010; San Benito County Water District et al 2011; SCVWD 2010)
Panoche Water District	14-06-200-7864A (SLC/DMC)	94,000	88	44	0	0	0	134	67	0	0	0	No data available on population, demand, or supplies. 2010 PHS assumed to be half of historical use. 2030 demand estimate based on extrapolation of historical use using average area growth rate. 2030 PHS assumed to be half of 2030 demand. Non-CVP supplies assumed to be 0. (California DOF 2007b, 2007c, and 2007d; City of Coalinga 2006; San Benito County Water District et al 2011; SCVWD 2010)
San Luis Water District	14-06-200-7773A (SLC/DMC)	125,080	1,085	543	0	0	0	1,649	825	0	0	0	No data available on population, demand, or supplies. 2010 PHS assumed to be half of historical use. 2030 demand estimate based on extrapolation of historical use using average area growth rate. 2030 PHS assumed to be half of 2030 demand. Non-CVP supplies assumed to be 0. (California DOF 2007b, 2007c, and 2007d; City of Coalinga 2006; San Benito County Water District et al 2011; SCVWD 2010)
Westlands Water District [3]	14-06-200-495A-IR1	1,186,688	4,015	1,131	130,000	130,000	130,000	6,103	3,051	130,000	130,000	130,000	Based on extrapolation from 2009 Reclamation PHS calculations using average area growth rate. (California DOF 2007b, 2007c, and 2007d; City of Coalinga 2006; San Benito County Water District et al 2011; SCVWD 2010)
Cross Valley Canal													
Fresno County	14-06-200-8292A-IR12	3,000	541	271	0	0	0	828	414	0	0	0	No data available on demand or supplies. 2010 PHS assumed to be half of historical use. 2030 demand estimate based on extrapolation of historical use using average area growth rate. 2030 PHS assumed to be half of 2030 demand. Non-CVP supplies assumed to be 0. (California DOF 2007b, 2007k, and 2007l; Reclamation 2008)
Hills Valley Irrigation District	14-06-200-8466A-IR12	3,346	0	0	1,048	1,048	1,048	0	0	1,048	1,048	1,048	Supply data based on 2008 Reclamation water needs assessment. No data available on M&I demand or population. No historical use of M&I water. 2030 demand estimate also assumed to be zero. (Reclamation 2008)
Kern-Tulare Water District (includes Rag Gulch Water District)	14-06-200-8601A-IR12	53,300	0	0	6,873	6,873	6,873	0	0	6,873	6,873	6,873	Supply data based on 2008 Reclamation water needs assessment. No data available on M&I demand or population. No historical use of M&I water. 2030 demand estimate also assumed to be zero. (Reclamation 2008)
Lower Tule River Irrigation District	14-06-200-8237A-IR12	31,102	0	0	66,040	66,040	66,040	0	0	66,040	66,040	66,040	Supply data based on 2008 Reclamation water needs assessment. No data available on M&I demand or population. No historical use of M&I water. 2030 demand estimate also assumed to be zero. (Reclamation 2008)
Pixley Irrigation District	14-06-200-8238A-IR12	31,102	0	0	42,259	42,259	42,259	0	0	42,259	42,259	42,259	Supply data based on 2008 Reclamation water needs assessment. No data available on M&I demand or population. No historical use of M&I water. 2030 demand estimate also assumed to be zero. (Reclamation 2008)
Tri-Valley Water District	14-06-200-8565A-IR12	1,142	0	0	0	0	0	0	0	0	0	0	No data available on demand or supplies.

Contractor [1]	Contract No.	Maximum Contract Amount (acre-feet [AF])	Central Valley Project (CVP) Municipal & Industrial (M&I) Historical Use (AF) [2]	Estimated 2010 Public Health & Safety (PHS) Value (AF)	2010 Non-CVP Supplies (AF)			Projected CVP M&I Demand in 2030 (AF)	Estimated 2030 PHS Value (AF)	2030 Non-CVP Supplies (AF)			Data Sources and Assumptions
					Normal Year	Dry Year	Critical Year			Normal Year	Dry Year	Critical Year	
		Data provided by Bureau of Reclamation (Reclamation)	Based on last 3 years of deliveries unconstrained by availability of CVP water; unadjusted	Based on Reclamation's formula: (Population * 55 gpd) + (80% of Commercial & Instit.) + (90% of Indust.) + (10% for losses); unless otherwise noted	Based on information provided in contractor Urban Water Management Plans (UWMPs) or Reclamation data; Recycled water supplies are not included; UWMP Data: Dry year = 1st year of multi-year dry period; Critical year = single dry year.			Assumed to be full contract amount for M&I Contractors; see notes for Ag contractors	Based on Reclamation's formula: (Population * 55 gpd) + (80% of Commercial & Instit.) + (90% of Indust.) + (10% for losses); unless otherwise noted	Based on information provided in contractor UWMPs or Reclamation data; Recycled water supplies are not			
Tulare County	14-06-200-8293A-IR12	5,308	573	287	0	0	0	877	438	0	0	0	No data available on demand or supplies. 2010 PHS assumed to be half of historical use. 2030 demand estimate based on extrapolation of historical use using average area growth rate. 2030 PHS assumed to be half of 2030 demand. Non-CVP supplies assumed to be 0. (California DOF 2007b, 2007k, and 2007l)

Notes: AF = acre-feet; CCWD = Contra Costa Water District; CSD = Community Services District; CVP = Central Valley Project; DOF = Department of Finance; EBMUD = East Bay Municipal Utility District; M&I = municipal and industrial; PHS = public health and safety; Reclamation = Bureau of Reclamation; SMUD = Sacramento Municipal Utility District; UWMP = Urban Water Management Plan; WD = Water District

[1] The following contractors are mixed use, but considered "Primarily M&I" for the purposes of this table: Bella Vista Water District; Clear Creek CSD; City of Tracy; Santa Clara Valley Water District; and San Benito County Water District.
[2] Unconstrained years for historical use calculations: North of Delta - 2006, 2007, 2010; American River - 2006, 2007, 2010; South of Delta - 2003, 2005, 2006
[3] Westlands Water District contract amount includes contract for 1,150,000 AF and the following assignments: Broadview WD assignment = 27,000 AF, Centinella WD = 2,500 AF, Mercy Springs WD = 4,198 AF, Widren WD = 2,990 AF. Only assignment with M&I water use is Broadview WD.

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Appendix B
Water Operations Model Documentation

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Appendix B
Water Operations Model Documentation

B.1 Background and Project Description

The purpose of the Central Valley Project (CVP) Municipal and Industrial Water Shortage Policy (M&I WSP) is to:

- Define water shortage terms and conditions applicable to CVP M&I water service contractors;
- Establish CVP water supply levels that, together with the M&I water contractors' drought water conservation measures and other water supplies, would assist the M&I water service contractors in their efforts to protect public health and safety during severe or continuing droughts; and
- Provide information to M&I water service contractors for their use in water supply planning and development of drought contingency plans.

This technical appendix to the Environmental Impact Statement (EIS) describes modeling tools and assumptions used in analysis of M&I WSP alternatives. The EIS evaluated alternatives that were either proposed for consideration or designed to cover the range of potential CVP allocation procedures. Each alternative was simulated in a model of the CVP and State Water Project (SWP) to determine effects on water supply to CVP contractors, operations of CVP and SWP facilities, and environmental effects. Model results for each alternative were compared to results of a No Action Alternative to quantify changes in water deliveries, reservoir storage levels, river flows, and CVP/SWP operations in the Sacramento-San Joaquin River Delta (Delta). Simulated water deliveries were used in the economic analysis of each alternative. Simulated reservoir storage, river flow, Delta outflow and exports were used to evaluate environmental effects during preparation of the EIS. Key model results are summarized and presented in this report for each alternative.

B.2 Water Operations Modeling

Water operations modeling is a key step in the analysis of M&I WSP alternatives. Water operations model results frequently serve as the basis of subsequent economic and environmental analyses. This section provides a brief description of the model used to analyze alternatives. Descriptions include model assumptions and modifications made to baseline model files provided by the Bureau of Reclamation (Reclamation). Model limitations for analysis of M&I WSP alternatives are also described.

B.2.1 Operations Model

CalSim II was used to simulate CVP/SWP operations, including CVP allocations and deliveries to water service contractors. CalSim II is a planning model designed to simulate operations of CVP and SWP reservoirs and water delivery systems. CalSim II simulates flood control operating criteria, water delivery policies, in-stream flow, and Delta outflow requirements. CalSim II is the best available tool for modeling CVP and SWP operations and is the primary system-wide hydrologic model used by California Department of Water Resources (DWR) and Reclamation to conduct planning and impact analyses of potential projects.

CalSim II is a simulation by optimization model. The model simulates operations by solving a mixed-integer linear program to maximize an objective function for each month of the simulation. CalSim II was developed by Reclamation and DWR to simulate operation of the CVP and SWP for defined physical conditions and a set of regulatory requirements. The model simulates these conditions using 82 years of historical hydrology from water year 1922 through 2003.

CalSim II modeling conducted for the M&I WSP was developed from a baseline model provided by Reclamation to the project team. Baseline CalSim II simulations at both existing and future levels of development were developed by Reclamation in January 2012. Baseline studies include actions under the reasonable and prudent alternatives from the National Oceanic Atmospheric Administration National Marine Fishery Service (NOAA Fisheries) 2009 Biological Opinion (BO) for Chinook salmon and United States Fish and Wildlife Service (USFWS) 2008 BO for delta smelt. Additional key assumptions governing CVP/SWP operations in CalSim II are described in Attachment A.

B.2.1.1 CalSim II Representation of Demands, Allocations, and Deliveries

A key aspect of CalSim II for comparison of M&I WSP alternatives is how the model simulates CVP contractor demands, CVP allocations, and water deliveries. Demands in CalSim II vary depending on the location in the system. Demands upstream of the Delta, in both the Sacramento and San Joaquin valleys are simulated based on current or projected land use and population estimates. These demands vary from year-to-year based on hydrology. Demands are calculated for areas supplied by CVP contractors and simulated deliveries are limited by allocations and contract amounts. Demands in CalSim II for areas supplied by

CVP exports from the Delta are approximated with CVP contract amounts. Therefore, these demands are constant every year in the model. This assumption is appropriate in the export service area where demand for CVP water typically exceeds the availability.

CalSim II simulates CVP allocations based on demands and available water supply. Starting in March each year, CalSim II calculates available CVP water supply as the sum of storage in CVP reservoirs (Trinity Lake, Shasta Lake, Folsom Lake, and CVP San Luis Reservoir) plus forecasted inflow on the Sacramento and American rivers plus inflow to Mendota Pool from the Kings River through the James Bypass. The sum of these terms, defined as the Water Supply Index, approximates the water available to the CVP. The Water Supply Index is used in conjunction with a Demand Index that approximates the CVP's ability to meet demands under current regulatory requirements. The Water Supply Index and Demand Index define the demand that can be met by the supply each year. This volume is split between current year deliveries and carryover storage to protect against future dry years. The estimate of current year deliveries is then used to determine allocations to CVP contractors. An initial allocation is made in March, updated in April, and a final allocation is made in May. This approach approximates the steps taken by CVP operators each year to determine available water supply, demands, and allocate water to CVP contractors.

Logic in CalSim II differentiates between north of Delta (NOD) and south of Delta (SOD) contractors. Allocations to NOD contractors are determined based on available water supply. Allocations to SOD contractors can be limited by both water supply and the ability to move water through the Delta under the simulated regulatory constraints and meet monthly demands. Therefore, in some years allocations to SOD contractors are lower than allocations to NOD contractors.

Reclamation does not have discretion to determine allocations to Sacramento River Settlement Contractors, San Joaquin River Exchange Contractors, certain named State Wildlife Areas and National Wildlife Refuges, and one of the privately owned/managed wetlands comprising the Grassland Resources Conservation District as identified under Section 3406(d) of the Central Valley Project Improvement Act (CVPIA). Annual allocations for these contractors are determined annually based on the forecasted full natural inflow to Shasta Lake. CalSim II simulates allocations to these contractors based on inflow to Shasta Lake.

CVP water service contractor allocations are based on available water supply. In years when the water supply is not adequate to provide full allocations to all water service contractors, allocations are cut based on rules in CalSim II. Allocation rules can be used to simulate different allocations between agricultural and M&I water service contracts as evaluated in several M&I WSP alternatives.

B.2.1.2 Modifications to Reclamation CalSim II Baselines

Baseline models provided by Reclamation required modifications for use in evaluating operations under M&I WSP alternatives, including the No Action Alternative. The follow sections describe key changes.

Redding Basin M&I Demand Baseline model demands for CVP water service contractors in the Redding Basin include both agricultural and M&I demands. Bella Vista Water District (WD) and Clear Creek Community Services District (CSD) are represented as mixed-use contractors that supply both agricultural and M&I water. For the purpose of evaluating M&I WSP alternatives (at a future level of development) all Redding Basin water service deliveries are assumed to meet M&I demands. This assumption is conservative and results in higher demands on the CVP under M&I WSP alternatives.

The baseline model also simulated all CVP water service deliveries occurring on an irrigation season pattern with minimal deliveries during winter months. This pattern of deliveries is not consistent with recent historical M&I delivery data for Redding Basin CVP water service contractors. Historical M&I delivery data for each contractor was provided by Reclamation's Northern California Area Office and reviewed to develop a monthly delivery pattern and representation of M&I deliveries. Baseline model deliveries, as a percent of annual deliveries, are compared with recent historical M&I delivery data in Figure B-1. Baseline model deliveries show higher deliveries than most contractors from April through July and lower deliveries the remainder of the year with essentially no deliveries from November through March.

The baseline model from Reclamation was modified to better represent actual historical M&I deliveries to Redding Basin contractors. An average Redding Basin M&I demand pattern was developed from historical M&I delivery data (see Figure B-1). The average demand pattern was further split between indoor and outdoor M&I use. Indoor M&I demand was assumed to be approximately equal to the percent of historical deliveries that occurred during winter months when outdoor demand is minimal. Therefore, monthly indoor demand is approximately four percent of the annual demand. Demand in excess of four percent in Figure B-1 is assumed to be for outdoor uses. Return flows from indoor uses were equal to deliveries, while return flows from outdoor uses were a fraction of the non-consumptive use. Modifications to Redding Basin deliveries and return flows from the Reclamation provided baseline models were done to maintain basin depletions in the baseline models.

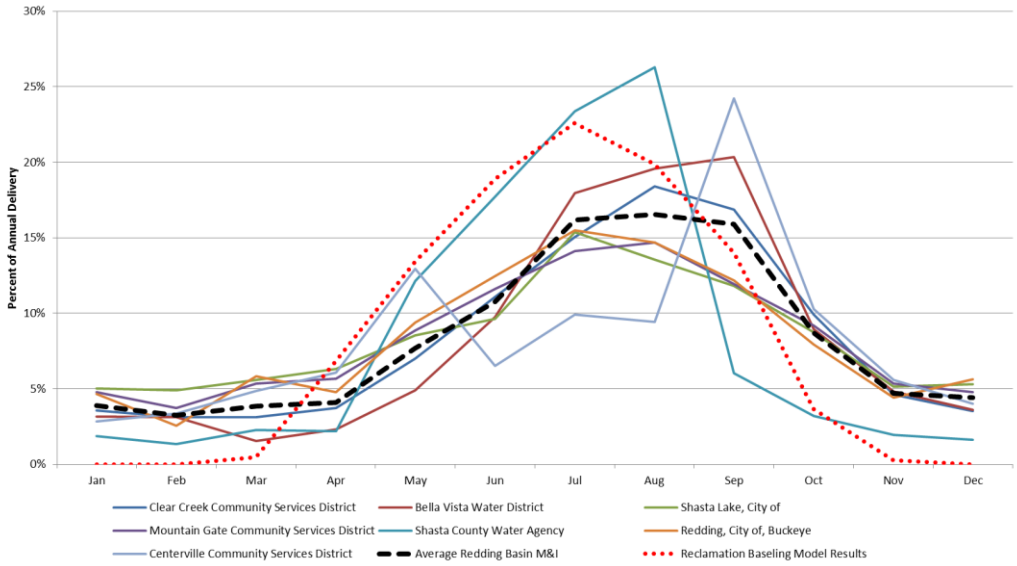


Figure B-1. Historical Redding Basin M&I Deliveries and Baseline Model Deliveries

CVP Contract for East Bay Municipal Utility District The baseline model from Reclamation included a simple representation of CVP deliveries to East Bay Municipal Utility District (EBMUD). EBMUD can divert CVP water from the Sacramento River through the Freeport Regional Water Project (Freeport Project). Representation of these deliveries in CalSim II has historically been a time-series developed with input from EBMUD representatives based on analysis of EBMUD's Mokelumne River project. The baseline model from Reclamation was modified to better represent EBMUD's contract with Reclamation, simulate EBMUD's Freeport Project diversions, and how diversions may change under each M&I WSP alternative.

EBMUD's contract for CVP water is unique in that EBMUD is only permitted to take delivery of CVP water when the March 1 forecast of October 1 total system storage in their reservoirs is less than 500 thousand acre-feet (TAF). In these years, the Reclamation contract limits EBMUD's delivery to a maximum of 133 TAF in a single year, and not more than 165 TAF in any period of three consecutive years. However, EBMUD's diversion capacity through the Freeport Project currently limits annual diversions to approximately 112 TAF. These contract and capacity limitations were added to the baseline model to evaluate M&I WSP alternatives.

The project team also worked with representatives from EBMUD to update and understand EBMUD's planned operation of the Freeport Project, and how operations may change under different CVP allocations. EBMUD provided updated information on years when total system storage is expected to be less than 500 TAF. Additionally, based on discussions with EBMUD, diversions were capped at 65 TAF in the first year and second years when permitted to take

delivery of CVP water, and 35 TAF in the third year so as not to exceed the 165 TAF limit. The three-year pattern repeats if EBMUD is contractually permitted to take delivery of CVP water for more than three consecutive years. Diversions can also be limited by CVP allocations, though the allocations are applied to the total contract amount of 133 TAF each year.

Small M&I Deliveries from Primarily Agricultural CVP Contractors
Historical M&I delivery data provided by Reclamation's area offices showed several contractors that primarily deliver agricultural water have delivered small volumes of M&I water in recent years. These small volumes were not represented in baseline models provided by Reclamation. Therefore, baseline models were modified to simulate delivery of this M&I water, subject to M&I allocations. Delivery of small volumes of M&I water were added to Tehama-Colusa Canal deliveries (approximately 500 acre-feet per year [AFY]), the upper Delta-Mendota Canal deliveries (approximately 1,150 AFY), and San Luis Unit deliveries (approximately 7,900 AFY). Annual volumes of future M&I delivery by these primarily agricultural water service contractors were estimated based on historical M&I delivery data and estimated regional growth rates. Contractual limits on agricultural deliveries were reduced by the volume of M&I water identified.

Additional M&I Delivery Adjustments The baseline model represented M&I deliveries from the upper Delta-Mendota Canal as agricultural deliveries and subject to agricultural allocations. This primarily affects M&I deliveries to the City of Tracy and the United States Department of Veteran Affairs. A separate M&I demand and delivery arc were added to the model and simulated M&I deliveries were constrained by SOD M&I allocations.

Baseline models identified several CVP water service contractors as mixed use, delivering both agricultural and M&I water. These contractors include Bella Vista WD and Clear Creek CSD in the Redding Basin, and San Benito County WD and Santa Clara Valley Water District (SCVWD) in the San Felipe Division. It was assumed that future demands for three of these contractors would be 100 percent M&I water. This assumption is conservative and results in higher demands on the CVP under M&I WSP alternatives. The exception is SCVWD that stated it intends to maintain the current split between agricultural and M&I deliveries into the future. That split has 119.4 TAF of M&I water and 33.1 TAF of agricultural water annually.

Sacramento River Water Reliability Study Reclamation baseline models included the Sacramento River Water Reliability Study at the future level of development. This project would construct a new diversion facility on the Sacramento River near Elverta for diversion to Placer County Water Agency contractors Roseville and Sacramento Suburban WD. The City of Sacramento would also divert water at this location. This project is not reasonably foreseeable at this time and was therefore removed from the baseline model. This required

shifting diversions that took place at the Elverta diversion back to the American River.

Existing Conditions and Maximum Historical Use Reclamation baseline models for the existing level of development included standard assumptions for CVP M&I demands. These demands have been developed and accepted by modelers at both Reclamation and DWR as representative of approximately existing level of development demands. However, for this analysis these demands were reviewed and compared to calculated values of maximum historical use. Maximum historical use values were developed in conjunction with Reclamation staff and provided to M&I contractors for review. Maximum historical use values for each M&I contractor were simulated in the Existing Conditions model run.

B.2.1.3 Level of Development

CalSim II simulations at a projected Level of Development (LOD) are used to depict how the modeled water system might operate with an assumed physical and institutional configuration imposed on a long-term hydrologic sequence. An existing LOD study assumes that current land use, facilities, and operational objectives are in place for each year of simulation (water year 1922 through 2003). The results are a depiction of the current environment. A future LOD study is needed to explore how the system may perform under an assumed future set of physical and institutional conditions. This future setting is developed by assuming year 2030 land use, facilities, and operational objectives.

Existing Level of Development The Existing Conditions CalSim II model simulation depicts how the Delta, its major tributaries, and the CVP/SWP operate at the current LOD without the Project. Parameters used to describe existing LOD hydrologic conditions and current operating rules were developed by Reclamation. Key assumptions defining the Existing Condition are provided in Attachment A. This set of land use, demands, and assumptions provide a reasonable simulation of current water system operations. These assumptions include actions under in the reasonable and prudent alternatives from NOAA Fisheries's 2009 BO for Chinook salmon and USFWS's 2008 BO for delta smelt.

Future Level of Development The No Action Alternative CalSim II simulation depicts how the Delta, its major tributaries, and the CVP/SWP may operate in the future without implementation on one of the action alternatives. Areas tributary to the Delta have experienced numerous physical and institutional changes over the decades, and are continuing to experience change. Projecting the availability of facilities, institutional, and regulatory requirements, and the practices that will affect the management of future water supplies and demands is a daunting task. Nevertheless, reasonable assumptions must be made regarding these items to estimate future conditions. Reasonably foreseeable changes incorporated in the No Action Alternative, as compared to the Existing Condition, which lead to the largest changes in the CVP/SWP system include:

- Land use conversion from agricultural demand to urban demand, primarily in the American River Basin
- Full San Joaquin River Restoration Program flows
- South Bay Aqueduct capacity expansion
- Expanded Los Vaqueros Reservoir capacity to 160,000 acre-feet (AF).

B.2.1.4 CalSim II Limitations

There are limitations to the use of CalSim II for most projects. CalSim II is a monthly model and does not capture daily fluctuations in flow, reservoir storage, or Delta exports.

CalSim II is a simulation by optimization model of a very complex system. This complexity, combined with mathematical optimization techniques, can create relatively large differences in model results in some months or years for comparatively small differences in simulated conditions in the CVP/SWP system. These differences are more model nuance than effects of a project alternative. Model runs in support of the EIS were reviewed for model nuances and in some cases adjustments were made to eliminate unrealistic differences between project alternatives. However, there can still be differences in simulation results that are more a function of the model than expected change due to a project alternative. Interpretation of these differences is important when reviewing results to avoid drawing erroneous conclusions.

A specific limitation of CalSim II for the M&I WSP analysis pertains to simulated allocations and deliveries to Reclamation's Cross Valley Canal (CVC) contractors. Based on historical delivery data, two CVC contractors deliver approximately 1,100 AFY of M&I water under their contracts with Reclamation. CVC contracts are unique within the CVP in that the source of water to supply these contracts is from the Delta, but the physical water delivered to these contractors is from the Friant Division through the Friant-Kern Canal. CVC contractors make arrangements and agreements to exchange their Delta supplies with Friant Division contractors such as Arvin-Edison Water Storage District (Arvin-Edison) that can take delivery of water from the Delta. CVC contractors take delivery of a portion of Arvin-Edison's Friant water in exchange for water from the Delta. CVC contract allocations are equal to SOD agricultural water service contracts.

CalSim II's representation of CVC contract deliveries is approximate and does not represent actual operations. CalSim II does not simulate deliveries to CVC contractors such that annual deliveries equal CVC contract totals multiplied by the SOD agricultural water service allocation. Additionally, CalSim II does not simulate exchange of Delta supplies for Friant Division supplies for CVC contractors.

These limitations do not have any meaningful effect on model results. The small quantities of M&I water delivered by CVC contractors, approximately 1,100 AFY, are beyond the level of accuracy in CalSim II.

B.2.1.5 Additional Limitations

Another limitation, beyond the scope of CalSim II, is related to coordination between CVP and SWP operations. CVP and SWP operations are linked through the 1986 Coordinated Operations Agreement (COA) that defines each project's obligations to meet demands within the Sacramento River basin and each project's share of water available for export from the Delta. The existing COA was signed in 1986 and has not been updated since that time. However, since that time there have been several significant changes in Delta regulations including State Water Resources Control Board Decision 1641, the NOAA Fisheries 2009 BO for Chinook salmon, and the USFWS 2008 BO for delta smelt. Each of these regulations had a significant effect on Delta operations such as increased required Delta outflow and restrictions to Delta exports.

The COA has not been updated to address these changes and Reclamation and DWR effectively operate under a "handshake" agreement to meet to requirements contained in these additional regulations. Modeling of project alternatives simulates the current method used by CVP and SWP operators to meet these requirements. However, the uncertainty surrounding COA should be considered when reviewing these model results.

B.3 Alternative 1: No Action Alternative

The No Action Alternative represents a projection of current conditions to the most reasonable future conditions that could occur during the life of the proposed federal action without any action alternative being implemented. Thus, the No Action Alternative provides a baseline against which action alternatives can be compared.

The No Action Alternative represents continued implementation of the current 2001 Draft M&I WSP, as modified by Alternative 1B of the 2005 Environmental Assessment. This existing draft policy is currently guiding Reclamation's operations of the CVP and the allocation of water to agricultural and M&I contractors and would continue to guide CVP allocations if none of the proposed action alternatives are chosen.

The allocation of available CVP water supplies between M&I and agricultural water service contractors under the No Action Alternative is presented in Table B-1. In years when CVP water supplies are not adequate to provide water to all water service contractors, M&I water service contractor allocations are maintained at 100 percent of their Contract Total as agricultural water service contractor allocations are reduced to 75 percent of their Contract Total. Then, both M&I and agricultural water service contractor allocations are reduced. M&I

allocations to 75 percent of historical use as agricultural water service contractor allocations are reduced to 50 percent of Contract Total. M&I water service contractor allocations are maintained at 75 percent of historical use until agricultural water service contractor allocations are reduced in incremental steps to 25 percent of Contract Total. Then allocations to both groups of contractors are again reduced together. M&I water service contractor allocations are reduced in incremental steps to 50 percent of historical use and agricultural water service contract allocations are reduced in incremental steps to zero.

In years when the M&I water service contractor allocations are less than 75 percent of historical use, Reclamation would attempt to provide the unmet public health and safety (PHS) needs, up to 75 percent of the M&I historical use, if the water is available. There are some years in which allocations to agricultural water service contractors are at or near zero. In those years, the increased deliveries for unmet PHS need to M&I water service contractors may not be fully realized. M&I water service contractor deliveries may be reduced below 75 percent of historical use and below the unmet PHS needs when CVP water is not available.

For an M&I water service contractor to be eligible for the M&I allocation, the water service contract must reference the M&I WSP. In addition, the water service contractor must: 1) have developed and be implementing a water conservation plan that meets CVPIA criteria; and 2) be measuring such water consistent with Section 3405(b) of the CVPIA. The No Action Alternative assumes that Reclamation will incorporate in all new, renewed, and amended water service contracts, as appropriate, a provision that references the M&I WSP.

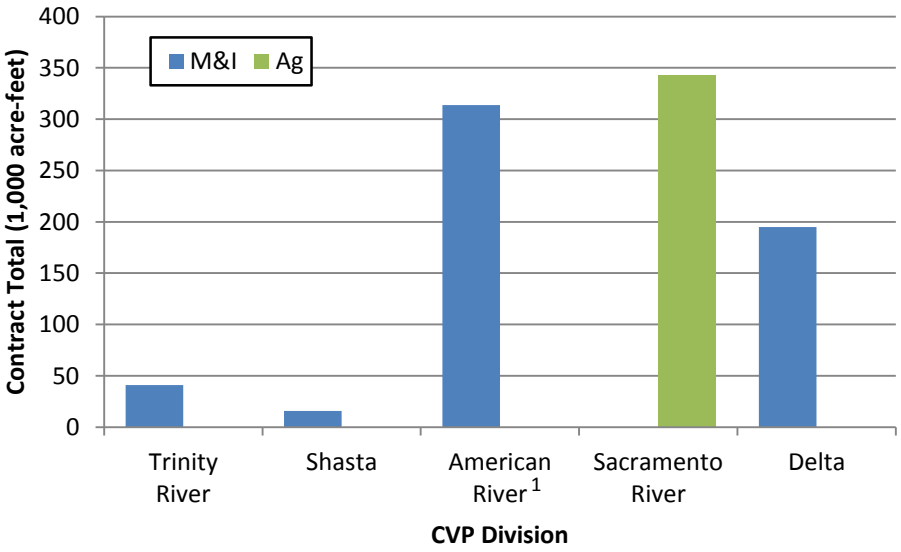
Table B-1. Alternative 1, No Action Alternative, Water Allocation Steps

Allocation Step	Allocation to Agricultural Water Service Contractors (% of contract total)	Allocation to M&I Water Service Contractors
1	100% to 75%	100% of Contract Total
2	70%	95% of historical use
3	65%	90% of historical use
4	60%	85% of historical use
5	55%	80% of historical use
6	50% to 25%	75% of historical use
7	20% [1]	The Maximum of: (1) 70% of M&I historical use or (2) Unmet PHS need up to 75% of historical use
8	15% [1]	The Maximum of: (1) 65% of M&I historical use or (2) Unmet PHS need up to 75% of historical use
9	10% [1]	The Maximum of: (1) 60% of M&I historical use or (2) Unmet PHS need up to 75% of historical use
10	5% [1]	The Maximum of: (1) 55% of M&I historical use or (2) Unmet PHS need up to 75% of historical use
11	0% [1]	The Maximum of: (1) 50% of M&I historical use or (2) Unmet PHS need up to 75% of historical use

[1] Allocations to agricultural water service contractors will be further reduced, if necessary, within the contract year to provide PHS needs to M&I water service contractors within the same contract year, provided CVP water is available.

The No Action Alternative represents a future condition and was modeled at a future level of development in CalSim II. It was assumed that at a future level of development all M&I water service contractor's historical use would equal the Contract Total.

One of several key facts that affect the operation of the CVP under each alternative is the difference in water service contract totals between agricultural and M&I contracts north and south of the Delta. Figures B-2 and B-3 summarize total contract quantities for agricultural and M&I water service contracts for north and south of the Delta. These figures are based on contract quantities provided by Reclamation.



[1] M&I contracts in the American River Division include 133,000 AF for EBMUD

Figure B-2. NOD Water Service Contract Totals by CVP Division

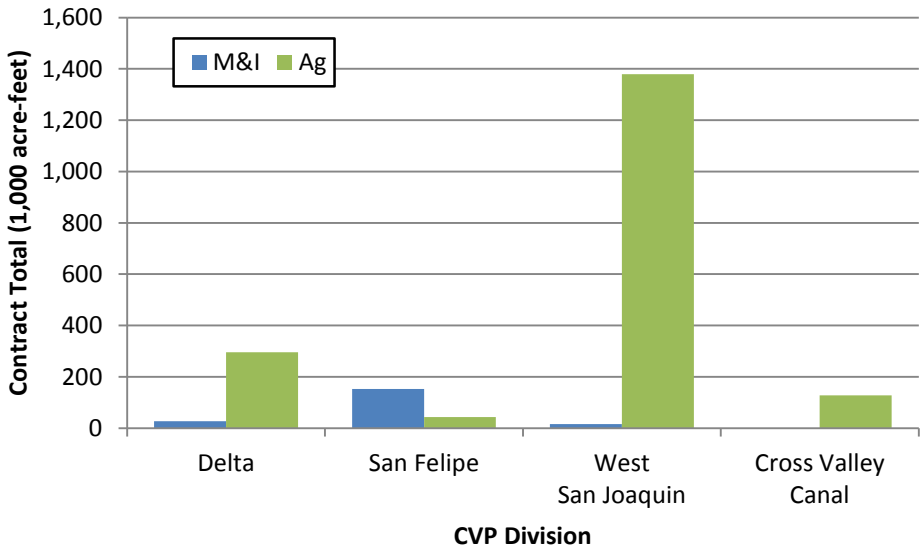


Figure B-3. SOD Water Service Contract Totals by CVP Division

Figures B-2 and B-3 illustrate several key facts related to total water service contracts and the geographical distribution of agricultural and M&I contracts. First, the majority of CVP M&I water service contracts are located north of the Delta in the American River and Delta divisions. Second, total water service contracts south of the Delta are significantly more than north of Delta with the vast majority being agricultural water service contracts. These facts lead to shifts in deliveries under the range of alternatives evaluated for the M&I WSP. Higher allocations to M&I water service contractors result in more deliveries north of the Delta, particularly in the American River and Delta division. Higher M&I allocations mean lower agricultural allocations and reduced CVP Delta exports and SOD deliveries. The opposite is also true wherein higher agricultural allocations results in reduced deliveries in the American River Division, higher CVP Delta exports, and higher SOD deliveries.

Unmet PHS needs were calculated based on the CalSim II results from the No Action Alternative. In most instances unmet PHS needs were a small volume of water in a limited number of years. Deliveries of unmet PHS need were not explicitly modeled in the No Action Alternative.

B.3.1 No Action Alternative Results

Results from the No Action Alternative simulation are used to depict operation of the CVP and SWP without any changes to the M&I WSP. No Action Alternative results are used for comparison with results from the other alternatives to assess the environmental effects of the action alternatives.

The primary difference between the No Action Alternative and each action alternative evaluated is the method used to share water between CVP agricultural and M&I water service contractors during times of shortage. Therefore, key outputs from the model are simulated allocations to NOD and SOD agricultural and M&I water service contractors, and simulated deliveries. Figures B-4 and B-5 and Table B-2 summarize these results for the No Action Alternative.

Figure B-4 illustrates simulated M&I water service contract allocations for NOD and SOD contractors for the No Action Alternative. SOD allocations are lower than NOD allocations in approximately 40 percent of the years due to limitations on moving water through the Delta and limitations on the ability to export Delta surplus in the winter to fill the CVP portion of San Luis Reservoir.

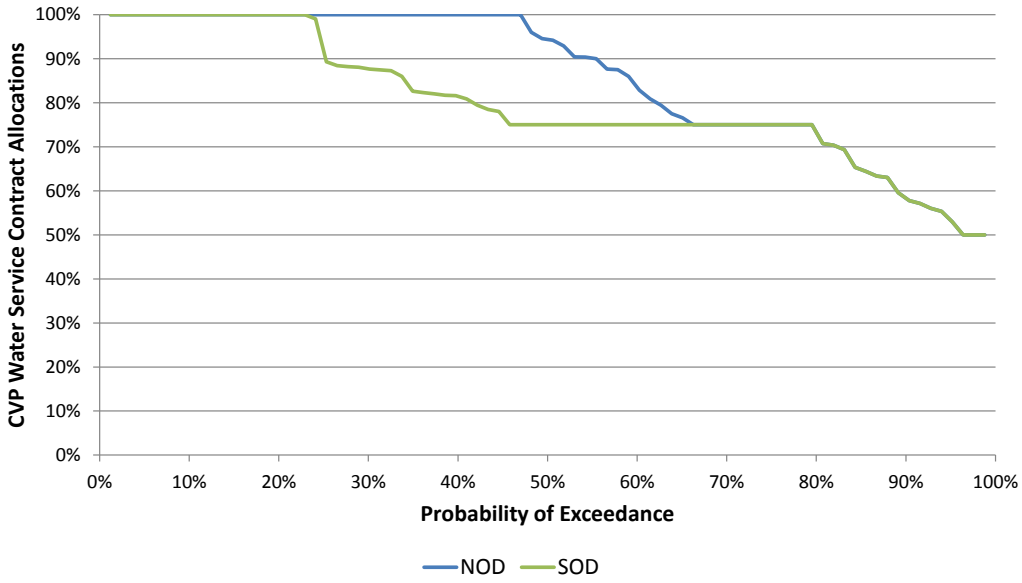


Figure B-4. CVP M&I Water Service Contract Allocations under the No Action Alternative

Figure B-5 illustrates simulated agricultural water service contract allocations for NOD and SOD contractors for the No Action Alternative. SOD allocations are lower than NOD allocations in approximately 60 percent of the years.

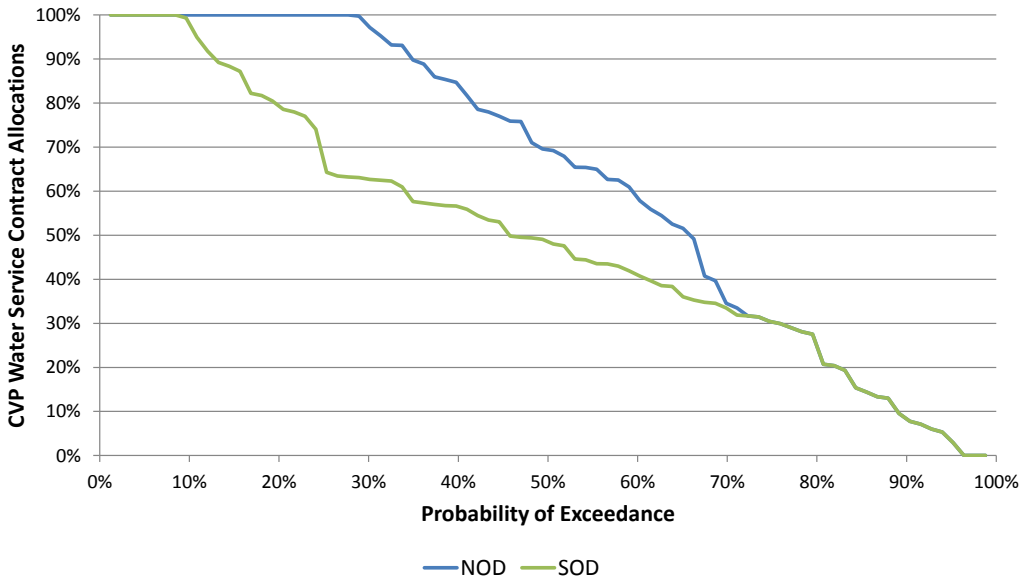


Figure B-5. CVP Agricultural Water Service Contract Allocations under the No Action Alternative

Table B-2 provides a summary of the average annual March through February contract year delivery to M&I and agricultural water service contractors in the NOD and SOD service areas by year type. The year type is the Sacramento Valley Water Year Type based on the 40-30-30 index. Average annual delivery for all years is also provided.

Table B-2. Summary of CVP Water Service Contract Deliveries under the No Action Alternative (TAF)

	M&I		Ag		Total		
Year Type	**NOD**	**SOD**	**NOD**	**SOD**	**NOD**	**SOD**	**Total**
Wet	391	193	290	1,354	681	1,548	2,229
Above Normal	407	173	281	1,053	688	1,226	1,915
Below Normal	358	159	184	741	543	900	1,442
Dry	332	150	124	573	456	723	1,180
Critical	299	117	35	170	335	287	621
All Years	**361**	**164**	**196**	**858**	**557**	**1,022**	**1,579**

Results presented in Table B-2 are summarized by NOD and SOD contractors, based on the allocation used to determine the volume of CVP water available to the contractor. NOD M&I water service contractors include contractors in the Redding area, American River basin, EBMUD, and Contra Costa Water District. These contractors are all allocated water using the NOD allocation provided by Reclamation. SOD M&I water service contractors include those in the San Felipe, West San Joaquin, and Delta divisions. These contractors are allocated water based on the SOD allocation provided by Reclamation.

In addition to water deliveries, CalSim II modeling of the No Action Alternative provides a baseline operation of the CVP and SWP for use in the environmental analysis. Baseline operations include reservoir storage levels, river flows, and Delta operations including inflow, outflow, and CVP and SWP exports. Table B-3 is a summary of average monthly values for key system parameters. Comparisons between these values and average monthly values for each alternative are provided in subsequent sections.

Table B-3. Summary of Key System Parameter for No Action Alternative

No Action Alternative	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Trinity Storage (TAF)	1,336	1,347	1,399	1,460	1,569	1,692	1,840	1,835	1,797	1,661	1,520	1,398
Trinity Storage (TAF)	2,588	2,570	2,738	3,008	3,278	3,636	3,933	3,958	3,650	3,164	2,848	2,666
Shasta Storage (TAF)	475	437	449	468	490	595	721	843	811	668	595	504
Folsom Storage (TAF)	1,743	1,802	1,934	2,149	2,368	2,585	2,860	2,994	2,880	2,411	2,120	1,800
Oroville Storage (TAF)	237	370	544	668	752	820	736	572	388	245	154	184
CVP San Luis Storage (TAF)	387	394	531	641	714	766	621	424	271	299	301	388
SWP San Luis Storage (TAF)	6,148	6,486	6,685	8,325	10,369	8,521	6,984	7,960	10,840	13,160	10,205	8,081
Sac. River at Keswick (cubic feet per second [cfs])	5,867	8,512	11,287	13,695	15,383	14,109	8,724	6,908	5,665	6,585	5,341	7,752
Sac. River at Navigational Control Point (NCP) (cfs)	1,639	2,654	3,280	4,331	5,051	3,695	3,198	3,429	3,509	3,611	2,272	2,737
American River at Nimbus (cfs)	1,477	2,526	3,121	4,198	4,903	3,529	3,009	3,224	3,252	3,079	1,790	2,536
American River at H St. (cfs)	3,272	3,084	5,865	11,105	12,830	12,890	8,802	7,748	6,280	8,144	5,778	7,463
Lower Feather River (cfs)	686	953	1,629	2,519	2,753	2,498	1,525	1,188	979	1,175	882	1,102
Sac. Basin into Delta (TAF)	368	693	1,335	2,595	2,884	2,620	1,831	1,372	753	485	267	587
Delta Outflow (TAF)	222	222	246	197	175	181	70	68	147	241	230	236
Jones Pumping Plant (TAF)	194	193	303	220	227	245	74	70	153	386	341	325
Banks Pumping Plant (TAF)												

B.4 Alternative 2: Equal Agricultural and M&I Allocation

Under Alternative 2, Equal Agricultural and M&I Allocation, M&I water service contractors would receive the same allocation as percent of Contract Total as agricultural water service contractors. This means that in years when the CVP water supplies are not adequate to provide water to all water service contractors, agricultural and M&I water service contractors would be reduced by the same percentage.

This allocation methodology would provide a larger volume of CVP water to agricultural water service contractors than the No Action Alternative. This alternative will facilitate a tradeoff analysis that considers the potential effects associated with a lower level of deliveries to M&I water service contractors.

In years when the CVP water supplies are not adequate to provide water to all water service contractors, M&I water service contractor allocations would be reduced at the same levels as agricultural water service contractor allocations. The reductions would be on a percentage basis of contract total, reflective of the available CVP water supply for that respective year.

Alternative 2 would have no provisions for unmet PHS deliveries that would be made available by Reclamation from CVP water supplies. During extremely low CVP water supply or shortage conditions, M&I water service contractors would need to rely on available non-CVP supplies. In cases where an M&I water service contractor does not own sufficient non-CVP supplies to meet their PHS demands, they would need to rely on water transfers and water exchanges (willing buyers and willing sellers) to make up the unmet portion of their PHS demand. This market driven system is in effect throughout California and has been used during previous water shortages.

B.4.1 Equal Agricultural and M&I Allocation Alternative Results

Results from the Alternative 2 are summarized and compared to the No Action Alternative. The primary difference between the No Action Alternative and the Alternative 2 is the method used to share water between CVP agricultural and M&I water service contractors during times of shortage. Therefore, key outputs from the model are simulated allocations to NOD and SOD agricultural and M&I water service contractors and simulated deliveries. Figures B-6 and B-7 and Tables B-4 and B-5 summarize these results for Alternative 2 and compare results to the No Action Alternative.

Figure B-6 illustrates simulated M&I water service contract allocations for NOD and SOD contractors under the Alternative 2 and the No Action Alternative. Allocations to both NOD and SOD M&I contractors are reduced under Alternative 2 in order to provide an equal allocation to agricultural water service contractors. M&I allocations can be as low as 5 percent of contract total to both NOD and SOD contractors, compared to minimum allocations of 50 percent under the No Action Alternative. Additionally, the probability of 100 percent

allocations to M&I water service contractors decreases by approximately 15 percent for both NOD and SOD contractors.

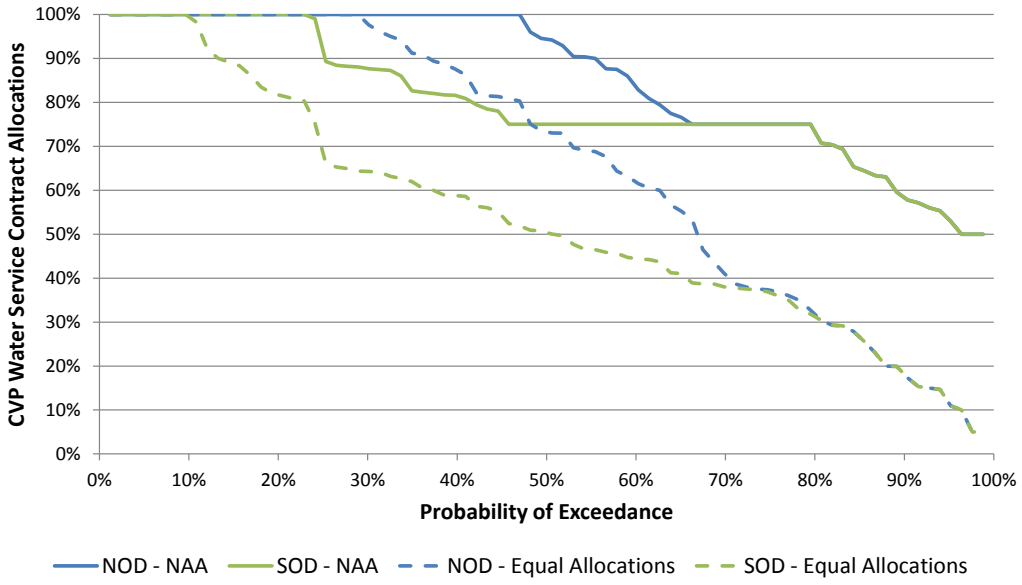


Figure B-6. Comparison of CVP M&I Water Service Contract Allocations under Alternative 2 and the No Action Alternative

Figure B-7 illustrates simulated agricultural water service contract allocations for NOD and SOD contractors under Alternative 2 and the No Action Alternative. Allocations to agricultural water service contracts increase in most years under Alternative 2. The minimum simulated allocation increases from 0 percent under the No Action Alternative to 5 percent under Alternative 2.

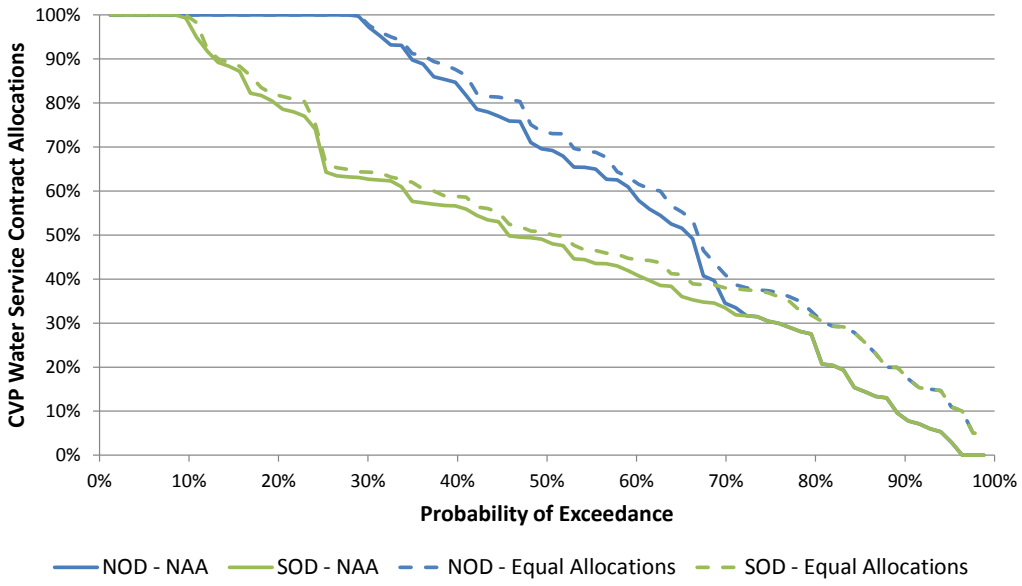


Figure B-7. Comparison of CVP Agricultural Water Service Contract Allocations under Alternative 2 and the No Action Alternative

Table B-4 provides a summary of the average annual March through February contract year delivery to M&I and agricultural water service contractors in the NOD and SOD service areas by year type. The year type is the Sacramento Valley Water Year Type based on the 40-30-30 index. Results are presented for Alternative 2 and the change in delivery from the No Action Alternative.

Table B-4. Summary of CVP Water Service Contract Deliveries under Alternative 2 and Change from the No Action Alternative (TAF)

	M&I		Ag		Total		
Year Type	**NOD**	**SOD**	**NOD**	**SOD**	**NOD**	**SOD**	**Total**
Wet	378	165	293	1,386	671	1,551	2,221
Above Normal	386	129	286	1,093	672	1,222	1,894
Below Normal	266	95	198	805	464	900	1,364
Dry	216	81	146	691	362	773	1,135
Critical	107	36	62	307	169	344	513
All Years	**283**	**110**	**209**	**932**	**492**	**1,042**	**1,534**
Change from No Action Alternative							
Wet	-13	-28	3	31	-10	3	-7
Above Normal	-21	-45	5	40	-16	-4	-20
Below Normal	-92	-65	14	65	-79	0	-79
Dry	-117	-69	22	118	-94	49	-45
Critical	-193	-81	27	138	-166	57	-109
All Years	**-77**	**-54**	**13**	**73**	**-65**	**20**	**-45**

Results presented in Table B-4 show that under Alternative 2, M&I deliveries decrease by approximately 130 TAF combined for NOD and SOD contractors while agricultural deliveries increase by approximately 85 TAF. This results in a total reduction in CVP water service contract deliveries of 45 TAF. Generally, changes in deliveries get larger with drier year types. In wetter year types the difference between allocations to agricultural and M&I contractors are smaller, and allocations may be equal if water supplies are adequate to provide 100 percent allocation to all contractors. In drier year types the differences in allocations are typically larger under the No Action Alternative as the existing M&I WSP preference to M&I contractors can provide M&I allocations that are 50 percent higher than agricultural allocations. These larger differences in the No Action Alternative create larger changes when allocations to M&I and agricultural contractors are equal under Alternative 2.

A comparison of key system parameters for reservoir storage, river flows, and the Delta is provided in the Table B-5. Results for Alternative 2 are compared with the No Action Alternative. Time-series plots of each parameter for the Alternative 2 and No Action Alternative are included in Attachment B.

Table B-5. Comparison of Key System Parameters Under Alternative 2 and Change from the No Action Alternative

Alternative 2	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Trinity Storage (TAF)	1,335	1,346	1,398	1,460	1,570	1,693	1,840	1,834	1,797	1,660	1,518	1,397
Shasta Storage (TAF)	2,582	2,567	2,735	3,006	3,274	3,632	3,926	3,948	3,640	3,158	2,840	2,659
Folsom Storage (TAF)	481	444	455	474	494	599	725	849	819	675	601	510
Oroville Storage (TAF)	1,740	1,799	1,932	2,147	2,366	2,583	2,859	2,992	2,882	2,412	2,119	1,797
CVP San Luis Storage (TAF)	242	380	557	677	759	817	731	566	379	234	152	185
SWP San Luis Storage (TAF)	397	404	545	655	724	774	628	431	276	305	308	397
Sac. River at Keswick (cfs)	6,146	6,432	6,677	8,313	10,387	8,530	7,036	8,018	10,831	13,118	10,262	8,031
Sac. River at NCP (cfs)	5,866	8,476	11,290	13,692	15,381	14,108	8,765	6,950	5,637	6,531	5,389	7,710
American River at Nimbus (cfs)	1,664	2,672	3,312	4,366	5,083	3,715	3,243	3,448	3,533	3,668	2,346	2,772
American River at H St. (cfs)	1,501	2,544	3,152	4,233	4,934	3,548	3,053	3,244	3,276	3,131	1,860	2,570
Lower Feather River (cfs)	3,276	3,076	5,848	11,104	12,830	12,882	8,791	7,740	6,221	8,175	5,770	7,492
Sac. Basin into Delta (TAF)	688	950	1,629	2,520	2,756	2,499	1,530	1,192	977	1,178	891	1,104
Delta Outflow (TAF)	370	689	1,331	2,597	2,888	2,622	1,835	1,377	754	487	267	589
Jones Pumping Plant (TAF)	223	224	247	195	177	180	70	68	148	244	238	237

Alternative 2	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Banks Pumping Plant (TAF)	195	194	308	222	225	244	74	70	151	390	345	328
Alternative 2 Minus No Action												
Trinity Storage (TAF)	-1	-1	-1	0	0	0	0	-1	-1	-1	-2	-1
Shasta Storage (TAF)	-6	-3	-3	-2	-3	-4	-7	-10	-10	-6	-8	-6
Folsom Storage (TAF)	6	7	6	5	5	4	4	6	8	8	6	6
Oroville Storage (TAF)	-3	-2	-1	-2	-2	-2	-2	-1	2	1	0	-3
CVP San Luis Storage (TAF)	5	10	13	9	7	-3	-5	-6	-9	-12	-2	1
SWP San Luis Storage (TAF)	9	10	14	15	10	8	7	7	5	6	6	9
Sac. River at Keswick (cfs)	-2	-53	-8	-12	18	9	51	58	-9	-42	57	-50
Sac. River at NCP (cfs)	-1	-36	4	-3	-3	-1	41	43	-28	-54	48	-42
American River at Nimbus (cfs)	24	18	32	35	32	19	44	20	24	57	74	35
American River at H St. (cfs)	24	18	31	35	32	19	44	19	23	52	70	34
Lower Feather River (cfs)	4	-8	-17	-1	-1	-8	-11	-9	-59	32	-8	29
Sac. Basin into Delta (TAF)	2	-3	0	1	2	1	4	4	-2	4	10	3
Delta Outflow (TAF)	2	-4	-4	3	5	2	5	5	0	2	0	2
Jones Pumping Plant (TAF)	1	2	0	-2	1	-1	0	0	2	3	9	1
Banks Pumping Plant (TAF)	1	1	5	2	-2	0	0	0	-2	4	4	3

Average monthly changes in CVP/SWP reservoir storage, river flows, and Delta operations are typically small. The largest and most consistent changes in CVP operations occur in the American River Division. Lower M&I allocations for American River Division M&I contractors reduce diversions out of and downstream of Folsom Lake. Lower diversions keep storage in Folsom Lake higher and more of this water is then allocated and released for delivery to SOD agricultural water service contractors. This increases flows on the lower American River supports higher exports CVP exports compared to the No Action Alternative.

B.5 Alternative 3: Full M&I Allocation Preference

Under Alternative 3, Full M&I Allocation Preference, M&I water service contractors would a 100 percent allocation as compared to all other alternatives. Under this alternative, Reclamation would attempt to provide a 100 percent allocation to M&I water service contractors during water shortage conditions, to the extent that adequate CVP water supplies are available. This would be

achieved by reducing the allocations to agricultural water service contractors as needed to maximize the frequency of 100 percent allocations to M&I water service contractors.

This allocation methodology would provide the lowest volume of CVP water to agricultural water service contractors compared to all other alternatives. Also, this alternative will facilitate a tradeoff analysis that considers the potential effects associated with providing larger volumes of CVP water to M&I water service contractors.

In years when CVP water supplies are not adequate to provide 100 percent allocation to all water service contractors, M&I water service contractor allocations are maintained at 100 percent of their Contract Total as agricultural water service contractor allocations are reduced as needed to provide for the 100 percent allocation to the M&I water service contractors. In years when agricultural water service contractor allocations are reduced to zero and CVP water supplies are not adequate to provide the 100 percent allocation to the M&I water service contractors, then allocation to M&I water service contractors would be reduced based on the available CVP water supply. Under these low water supply conditions, M&I water service contractor allocations could theoretically be reduced to zero.

The allocation of available CVP water supplies between M&I and agricultural water service contractors during shortage conditions is presented in Table B-6.

Table B-6. Alternative 3, Full M&I Allocation Preference, Water Allocation Steps

Allocation Step	Allocation to Agricultural Water Service Contractors (% of Contract Total)	Allocation to M&I Water Service Contractors (% of Contract Total)
1	100%	100%
2	95%	100%
3	90%	100%
4	85%	100%
5	80%	100%
6	75%	100%
7	70%	100%
8	65%	100%
9	60%	100%
10	55%	100%
11	50%	100%
12	45%	100%
13	40%	100%
14	35%	100%
15	30%	100%
16	25%	100%
17	20%	100%

Allocation Step	Allocation to Agricultural Water Service Contractors (% of Contract Total)	Allocation to M&I Water Service Contractors (% of Contract Total)
18	15%	100%
19	10%	100%
20	5%	100%
21[1]	0%	Between 100% to 0%

[1] Once agricultural water service contractor allocations have been reduced to zero and if CVP water supplies are not adequate to provide the full allocation to the M&I water service contractor allocations, then the allocation to the M&I water service contractors would be reduced and the M&I allocations would equal available CVP water supply.

B.5.1 Full M&I Preference Alternative Results

Results from Alternative 3 are summarized and compared to the No Action Alternative. The primary difference between the No Action Alternative and the Alternative 3 is the method used to share water between CVP agricultural and M&I water service contractors during times of shortage. Therefore, key outputs from the model are simulated allocations to NOD and SOD agricultural and M&I water service contractors and simulated deliveries. Figures B-8 and B-9 and Tables B-7 and B-8 summarize these results for Alternative 3 and compare with results from the No Action Alternative.

Figure B-8 illustrates simulated M&I water service contract allocations for NOD and SOD contractors for Alternative 3 and the No Action Alternative. Under Alternative 3, M&I allocations are equal for both NOD and SOD contractors. The probability of full M&I allocations under this alternative is greater than 90 percent.

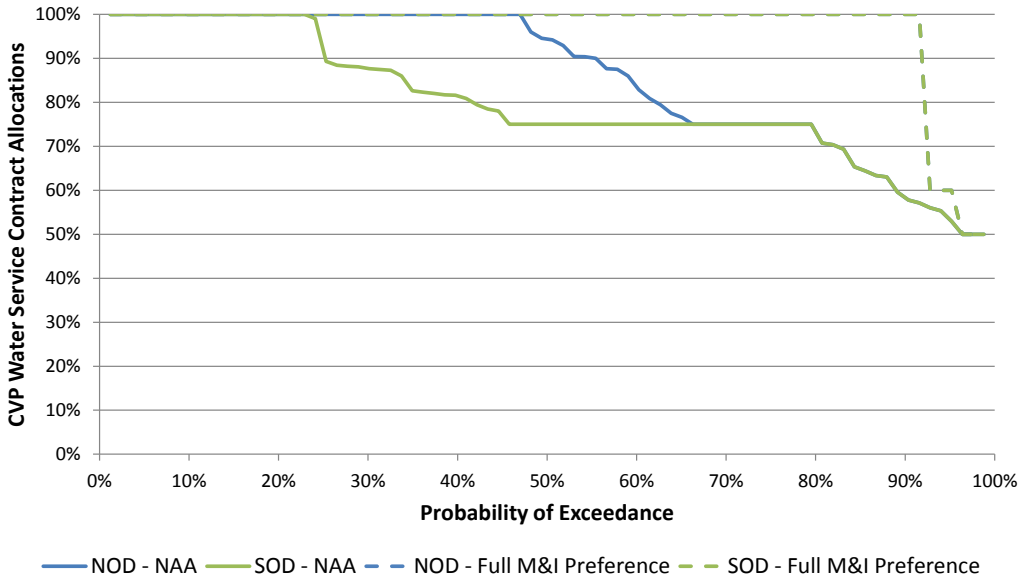


Figure B-8. Comparison of CVP M&I Water Service Contract Allocations under Alternative 3 and the No Action Alternative

Figure B-9 illustrates simulated agricultural water service contract allocations for NOD and SOD contractors for Alternative 3 and the No Action Alternative. Allocations to agricultural water service contractors are reduced more frequently with this alternative in order to maintain M&I allocations at 100 percent.

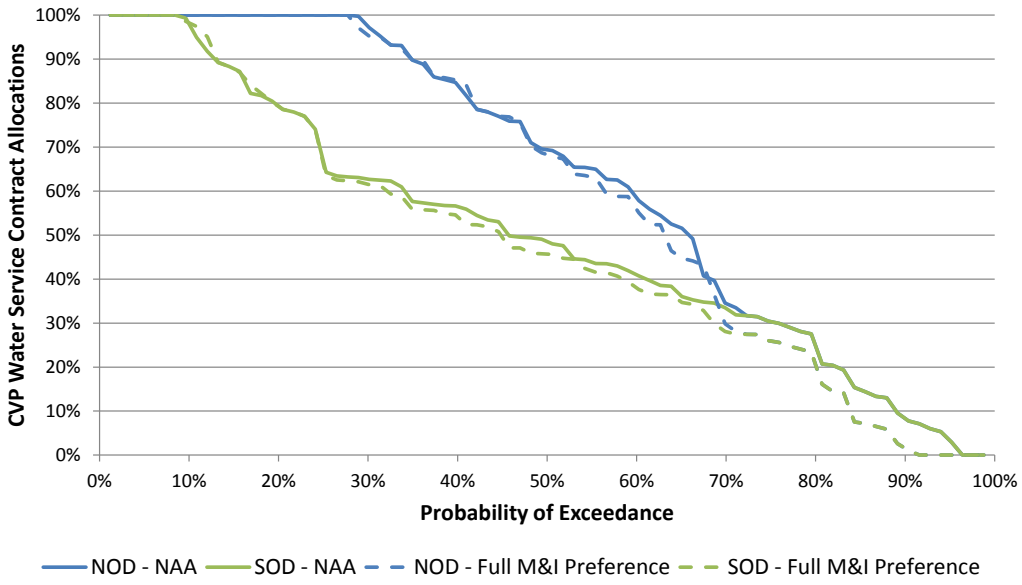


Figure B-9. Comparison of CVP Agricultural Water Service Contract Allocations under Alternative 3 and the No Action Alternative

Table B-7 provides a summary of the average annual March through February contract year delivery to M&I and agricultural water service contractors in the NOD and SOD service areas by year type. The year type is the Sacramento Valley Water Year Type based on the 40-30-30 index. Results are presented for Alternative 3 and the change in delivery from the No Action Alternative.

Table B-7. Summary of CVP Water Service Contract Deliveries under Alternative 3 and Change from the No Action Alternative (TAF)

	M&I		Ag		Total		
Year Type	**NOD**	**SOD**	**NOD**	**SOD**	**NOD**	**SOD**	**Total**
Wet	394	206	290	1,343	684	1,550	2,234
Above Normal	416	202	279	1,044	696	1,247	1,942
Below Normal	406	207	179	704	585	911	1,496
Dry	413	205	110	493	523	698	1,221
Critical	363	155	22	98	385	253	637
All Years	**399**	**198**	**190**	**819**	**588**	**1,017**	**1,605**

	M&I		Ag		Total		
Year Type	**NOD**	**SOD**	**NOD**	**SOD**	**NOD**	**SOD**	**Total**
Change from No Action Alternative							
Wet	3	13	0	-11	3	2	5
Above Normal	9	29	-2	-9	7	20	28
Below Normal	47	48	-5	-37	42	11	53
Dry	81	55	-14	-80	67	-25	42
Critical	64	38	-14	-72	50	-34	16
All Years	**38**	**34**	**-6**	**-40**	**31**	**-5**	**26**

Results presented in Table B-7 show the increase in deliveries to M&I contractors and the reduction to agricultural contractors north and south of Delta. The largest magnitude changes in deliveries occur in dry years as in these years M&I allocations are less than 100 percent, but there is still water allocated to agricultural contractors in the No Action Alternative. Under Alternative 3, this water is allocated to M&I contractors. Changes in critical years are less than dry years because in some critical years agricultural allocations are already zero under the No Action Alternative and cannot be further reduced to increase M&I allocations under Alternative 3.

A comparison of key system parameters for reservoir storage, river flows, and the Delta is provided in Table B-8. Results for Alternative 3 are compared with the No Action Alternative.

Table B-8. Comparison of Key System Parameters under Alternative 3 and Change from the No Action Alternative

Alternative 3	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**
Trinity Storage (TAF)	1,338	1,349	1,401	1,462	1,571	1,694	1,842	1,836	1,799	1,663	1,522	1,400
Shasta Storage (TAF)	2,589	2,570	2,739	3,010	3,279	3,637	3,935	3,962	3,654	3,166	2,849	2,666
Folsom Storage (TAF)	474	435	447	466	487	593	720	841	810	665	593	503
Oroville Storage (TAF)	1,738	1,797	1,929	2,145	2,365	2,582	2,857	2,990	2,874	2,406	2,114	1,796
CVP San Luis Storage (TAF)	229	364	536	662	750	818	735	572	388	248	154	180
SWP San Luis Storage (TAF)	390	397	530	640	714	767	621	424	272	301	305	390
Sac. River at Keswick (cfs)	6,134	6,507	6,674	8,315	10,363	8,529	6,964	7,936	10,835	13,203	10,220	8,083
Sac. River at NCP (cfs)	5,855	8,556	11,279	13,703	15,379	14,119	8,707	6,889	5,670	6,629	5,359	7,750
American River at Nimbus (cfs)	1,629	2,660	3,267	4,334	5,028	3,666	3,170	3,401	3,475	3,615	2,220	2,707
American River at H St. (cfs)	1,467	2,533	3,108	4,201	4,880	3,501	2,983	3,198	3,219	3,083	1,738	2,507
Lower Feather River (cfs)	3,293	3,087	5,879	11,102	12,810	12,883	8,805	7,753	6,317	8,152	5,776	7,429

Alternative 3	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**
Sac. Basin into Delta (TAF)	686	955	1,629	2,518	2,751	2,497	1,523	1,186	979	1,177	879	1,097
Delta Outflow (TAF)	369	692	1,339	2,593	2,880	2,619	1,828	1,370	755	483	263	586
Jones Pumping Plant (TAF)	219	224	246	198	177	180	70	68	145	241	227	235
Banks Pumping Plant (TAF)	195	194	299	220	227	245	74	70	154	384	341	322
Alternative 3 Minus No Action												
Trinity Storage (TAF)	2	1	2	2	1	1	2	2	2	2	1	2
Shasta Storage (TAF)	0	0	1	2	2	2	2	3	4	1	1	0
Folsom Storage (TAF)	-1	-2	-2	-3	-2	-2	-1	-1	-1	-3	-2	-1
Oroville Storage (TAF)	-5	-4	-4	-5	-4	-3	-3	-3	-5	-6	-5	-4
CVP San Luis Storage (TAF)	-7	-6	-9	-6	-2	-2	-1	-1	-1	2	0	-4
SWP San Luis Storage (TAF)	3	3	-1	-1	0	1	0	1	1	2	4	2
Sac. River at Keswick (cfs)	-14	21	-11	-11	-6	8	-20	-24	-5	43	15	2
Sac. River at NCP (cfs)	-12	44	-8	8	-4	10	-17	-18	5	44	18	-2
American River at Nimbus (cfs)	-11	7	-13	4	-23	-29	-29	-28	-34	3	-52	-31
American River at H St. (cfs)	-10	7	-13	4	-23	-28	-26	-26	-33	4	-52	-29
Lower Feather River (cfs)	22	3	14	-3	-20	-7	3	5	37	8	-2	-35
Sac. Basin into Delta (TAF)	0	2	0	0	-2	-1	-2	-2	0	3	-3	-4
Delta Outflow (TAF)	1	-2	4	-2	-4	-1	-2	-2	1	-1	-4	-1
Jones Pumping Plant (TAF)	-3	2	0	1	1	-1	0	0	-2	-1	-3	-1
Banks Pumping Plant (TAF)	1	2	-4	0	0	0	0	0	1	-2	0	-3

Average monthly changes in CVP/SWP reservoir storage, river flows, and Delta operations are typically small under Alternative 3. The largest and most consistent changes in CVP operations occur in the American River Division. Higher M&I allocations for American River Division M&I contractors increase diversions out of and downstream of Folsom Lake. Higher diversions reduce storage in Folsom Lake and flow in the lower American River.

B.6 Alternative 4: Updated M&I WSP

Alternative 4, Updated M&I WSP, is similar to the No Action Alternative. This alternative comprises the updated M&I WSP developed by Reclamation with stakeholder input received during the M&I WSP workshops held between May 2010 and January 2011. Reclamation used this stakeholder workshop process and stakeholder input to identify elements of the 2001 Draft M&I WSP (represented in the No Action Alternative) that could be improved. These updates are described in greater detail in the EIS.

The allocation method and reduction steps under Alternative 4 and the No Action Alternative are very similar. In years when the CVP water supplies are not adequate to provide the Contract Total to all water service contractors, M&I water service contractor allocations are maintained at 100 percent of their Contract Total as the agricultural water service contractor allocations are reduced to 75 percent of their Contract Total in several incremental steps. M&I water service contractor allocation reductions begin once the agricultural contractor allocations are reduced to 75 percent of Contract Total. At this point, M&I water service contractor allocations are reduced to 75 percent of their historical use in several incremental steps as agricultural water service contractor allocations are reduced to 50 percent of their Contract Total. The M&I water service contractor allocations are maintained at 75 percent of their historical use until agricultural water service contractor allocations are reduced in incremental steps to 25 percent of their Contract Total. Then, M&I water service contractor allocations are reduced in incremental steps to 50 percent of historical use until agricultural water service contractor allocations are reduced in incremental steps to zero.

In years when the M&I water service contractor allocations are less than 75 percent of historical use, M&I water service contractors may request an adjustment to their allocation to provide at least the unmet need portion of their PHS demand, up to a maximum of 75 percent of the M&I water service contractor historical use. There are some years in which allocations to agricultural water service contractors are at or near zero. In those years, the increased allocations to M&I water service contractors may not be fully realized. Also, though this alternative would target a minimum M&I water service contractor allocation of 50 percent of their historical use or unmet PHS need, whichever is greater, the increased allocation is not guaranteed and would only be made available to the extent that CVP water supplies are available.

The allocation of available CVP water supplies between M&I and agricultural water service contractors during shortage conditions under Alternative 4 is presented in Table B-9.

Table B-9. Alternative 4, Updated M&I WSP, Water Allocation Steps

Allocation Step	Allocation to Agricultural Water Service Contractors (% of Contract Total)	Allocation to M&I Water Service Contractors
1	100% - 75%	100% of contract total
7	70%	95% of historical use
8	65%	90% of historical use
9	60%	85% of historical use
10	55%	80% of historical use
11	50%-25%	75% of historical use [1]
12	20%	70% of historical use [1]
13	15%	65% of historical use [1]
14	10%	60% of historical use [1]
15	5%	55% of historical use [1]
16	0%	50% of historical use [1]

[1] Subject to PHS considerations described in Implementation Guidelines. Depending on CVP water supply conditions and CVP operational constraints, it is possible for M&I deliveries to be less than the unmet PHS needs and to be reduced below 50 percent if CVP water availability is insufficient.

B.6.1 Updated M&I WSP Results

Comparisons of Tables B-1 and B-9 show that the allocation method between the No Action Alternative and Alternative 4 are very similar. It is only when allocations to M&I contractors goes below 75 percent that there may be differences as the No Action Alternative considers PHS demand up to 75 percent of historical use. However, for the purpose of modeling both alternatives at a future LOD, it was assumed that all M&I water service contractors will have used their full contract total and historical use is equal to the contract total. The other changes made to update the M&I WSP relate to the calculation of historical use and updates to the language. Therefore, for modeling purposes, there is no difference between the No Action Alternative and the Alternative 4.

B.7 Alternative 5: M&I Contractor Suggested WSP

Alternative 5, M&I Contractor Suggested WSP, is similar to Alternative 4 (Updated M&I WSP). This alternative was developed and recommended by several M&I water service contractors who participated in the M&I WSP workshops held between May 2010 and January 2011. The differences between Alternative 4 and Alternative 5 include the following:

- Attempts to provide a greater level of assurance that CVP water will be allocated to M&I water service contractors to supply the unmet portion of the PHS demands during water shortage conditions.

- Would require modification to CVP operations, i.e., would provide increased carryover in CVP storage facilities to reserve water in storage to meet the ensuing year anticipated unmet portion of the M&I water service contractors' PHS demands.

- Increases the upper limit of when water would be reallocated from the agricultural water service contractors to provide at least the unmet PHS demands from 75 percent of historical use (used in Alternative 4) to 95 percent of historical use. This means that in years when the M&I water service contractor allocations are 95 percent of adjusted historical use or less, water would be reallocated from agricultural water service contractors to provide the greater of the allocation percentage of historical use or the PHS needs.

- Adjusts unconstrained year historical use first by the use of non-CVP supplies, then population growth, and finally extraordinary water conservation measures, before the three years of adjusted historical use are averaged to calculate the overall adjusted historical use.

- Qualifies the use of non-potable supplies when considering non-CVP supplies for the determination of PHS unmet need. Non-potable non-CVP supplies would not be included as available non-CVP water satisfying PHS needs except to the extent that they are used to meet non-domestic uses of commercial, institutional, and industrial demands.

Most of the differences between Alternative 4 and 5 surround delivery of any unmet PHS demand to M&I water service contractors. Several of these individual components are not addressed directly in the modeling because they apply to calculation of historical use and PHS need, or attempt to deliver a higher percentage of adjusted historical use. Modeling of project alternatives was completed at a future LOD and it was assumed that historical use was equal to the contract total for all contractors.

The first two proposed changes were addressed in the modeling by attempting to deliver 100 percent of any unmet PHS demand in all years. Future PHS demands were calculated by the project team and circulated to stakeholders for comment. PHS demands under normal, dry, and critical years were compared with simulated delivery of CVP contract water to each contractor for the No Action Alternative. Unmet PHS need was calculated as any PHS demand in excess of delivered CVP contract water. Unmet PHS need was zero or a small quantity of water in most years for most M&I water service contractors. CalSim II was re-run to simulate delivery of unmet PHS needs in all years to analyze the Alternative 5. This was done without the need to modify reservoir operations to increase carryover in CVP reservoirs to meet unmet PHS needs in subsequent years.

B.7.1 M&I Contractor Suggested WSP Results

There are minimal differences in model results between the No Action Alternative and Alternative 5. This is due to the relatively small volumes of unmet PHS demand calculated under the No Action Alternative. Delivery of these volumes of water under Alternative 5 has minimal effects on CVP/SWP operations and no effect on allocations to M&I or agricultural water service contractors.

Table B-10 provides a summary of the average annual March through February contract year delivery to M&I and agricultural water service contractors in the NOD and SOD service areas by year type for Alternative 5. The year type is the Sacramento Valley Water Year Type based on the 40-30-30 index. Results are presented for Alternative 5 and the change in delivery from the No Action Alternative.

Results presented in Table B-10 show a small increase in deliveries to SOD M&I contractors and a small decrease in deliveries to SOD agricultural contractors. The majority of these changes in deliveries are related to delivering unmet PHS need to the City of Avenal. The City of Avenal relies solely on CVP supplies to meet demands and may have unmet PHS need in the future if CVP allocations are less than 100 percent of contract total.

Table B-10. Summary of CVP Water Service Contract Deliveries under Alternative 5 and Change from the No Action Alternative (TAF)

	M&I		Ag		Total		
Year Type	**NOD**	**SOD**	**NOD**	**SOD**	**NOD**	**SOD**	**Total**
Wet	391	193	290	1,354	681	1,548	2,229
Above Normal	407	174	281	1,053	688	1,226	1,914
Below Normal	358	160	184	741	543	901	1,443
Dry	332	152	124	573	456	724	1,180
Critical	299	119	35	170	334	288	623
All Years	**361**	**165**	**196**	**858**	**557**	**1,023**	**1,579**
Change from No Action Alternative							
Wet	0.0	0.3	0.0	-0.2	0.0	0.1	0.1
Above Normal	0.0	0.5	0.0	-0.5	0.0	-0.1	-0.1
Below Normal	0.0	0.8	0.0	0.1	0.0	0.9	1.0
Dry	0.0	1.4	-0.1	-0.5	-0.1	0.9	0.8
Critical	-0.1	1.5	0.0	-0.1	-0.1	1.4	1.3
All Years	**0.0**	**0.8**	**0.0**	**-0.2**	**0.0**	**0.6**	**0.6**

A comparison of key system parameters for reservoir storage, river flows, and the Delta is provided in Table B-11. Results for Alternative 5 are compared with the No Action Alternative.

Table B-11. Comparison of Key System Parameters under Alternative 5 and Change from the No Action Alternative

Alternative 5	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**
Trinity Storage (1,000 AF)	1,336	1,347	1,399	1,460	1,569	1,692	1,840	1,835	1,797	1,661	1,520	1,398
Shasta Storage (1,000 AF)	2,588	2,570	2,738	3,008	3,277	3,635	3,932	3,958	3,650	3,164	2,848	2,665
Folsom Storage (1,000 AF)	475	437	449	468	490	595	721	843	811	668	595	504

Alternative 5	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**
Oroville Storage (1,000 AF)	1,743	1,802	1,934	2,149	2,368	2,585	2,860	2,994	2,880	2,411	2,120	1,800
CVP San Luis Storage (1,000 AF)	236	370	544	668	752	820	736	572	388	245	154	184
SWP San Luis Storage (1,000 AF)	387	394	531	641	714	766	621	424	271	299	301	388
Sac. River at Keswick (cfs)	6,148	6,486	6,685	8,325	10,368	8,520	6,984	7,959	10,840	13,161	10,206	8,082
Sac. River at NCP (cfs)	5,867	8,513	11,286	13,695	15,383	14,109	8,724	6,907	5,665	6,586	5,342	7,753
American River at Nimbus (cfs)	1,640	2,654	3,280	4,331	5,051	3,695	3,198	3,429	3,509	3,611	2,272	2,738
American River at H St. (cfs)	1,477	2,526	3,121	4,198	4,903	3,529	3,009	3,224	3,252	3,079	1,790	2,536
Lower Feather River (cfs)	3,271	3,084	5,865	11,105	12,831	12,890	8,803	7,749	6,280	8,144	5,778	7,463
Sac. Basin into Delta (1,000 AF)	686	953	1,629	2,519	2,753	2,498	1,525	1,188	979	1,175	882	1,102
Delta Outflow (1,000 AF)	368	693	1,335	2,595	2,884	2,620	1,831	1,372	753	485	267	587
Jones Pumping Plant (1,000 AF)	222	222	246	197	176	181	70	68	147	241	230	236
Banks Pumping Plant (1,000 AF)	194	193	303	220	227	244	74	70	153	386	341	325
Alternative 5 minus No Action												
Trinity Storage (1,000 AF)	0	0	0	0	0	0	0	0	0	0	0	0
Shasta Storage (1,000 AF)	0	0	0	0	0	0	0	0	0	0	0	0
Folsom Storage (1,000 AF)	0	0	0	0	0	0	0	0	0	0	0	0
Oroville Storage (1,000 AF)	0	0	0	0	0	0	0	0	0	0	0	0
CVP San Luis Storage (1,000 AF)	0	0	0	0	0	0	0	0	0	0	0	0
SWP San Luis Storage (1,000 AF)	0	0	0	0	0	0	0	0	0	0	0	0
Sac. River at Keswick (cfs)	0	0	-1	0	-1	0	0	-1	0	0	1	2
Sac. River at NCP (cfs)	0	0	0	0	0	0	0	-1	0	1	1	2
American River at Nimbus (cfs)	0	0	0	0	0	0	0	0	0	0	0	0
American River at H St. (cfs)	0	0	0	0	0	0	0	0	0	0	0	0
Lower Feather River (cfs)	0	0	0	0	0	0	0	0	0	0	0	0
Sac. Basin into Delta (1,000 AF)	0	0	0	0	0	0	0	0	0	0	0	0
Delta Outflow (1,000 AF)	0	0	0	0	0	0	0	0	0	0	0	0
Jones Pumping Plant (1,000 AF)	0	0	0	0	0	0	0	0	0	0	0	0
Banks Pumping Plant (1,000 AF)	0	0	0	0	0	0	0	0	0	0	0	0

Results presented in Table B-11 show there are essentially no changes in average monthly changes CVP/SWP reservoir storage, river flows, and Delta operations under Alternative 5.

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Attachment A
CalSim II Assumptions for Existing and Future No Action Conditions

	Period of Simulation: 82 years (1922-2003)	
	Existing Level Study	**Future Level Study**
HYDROLOGY		
Level of Development	2005 Level, *DWR Bulletin 160-98*[1]	2020 Level, *DWR Bulletin 160-98*[2]
Sacramento River Region Demands		
CVP	Land use based, limited by full contract M&I demand of max historical use	Land use based, full build-out of contract amounts
SWP (Feather River Service Area [FRSA])	Land use based, limited by full contract	
Non-Project	Land use based	
Woodland-Davis Clean Water Agency	Not included	
Antioch	Pre-1914 water right	
CVP Refuges	Recent historical Level 2 water needs	Firm Level 2 water needs
American River Basin Demands		
Water rights	2005 Level	2020 Level
CVP	2010 max historical use	2020 Level, contract total
San Joaquin River Basin Demands		
Friant Unit	Limited by contract amounts, based on current allocation policy	
Lower Basin	Land use based with district level operations and constraints	
Stanislaus River Basin[3]	Land use based, with New Melones Interim Operations Plan and NOAA Fisheries BO (June 2009), Actions 3.1.2 and 3.1.3[4]	
South of Delta Demands		
CVP	Full contract	
Contra Costa Water District	195 TAF/year (yr)	
SWP (with North Bay Aqueduct)	3.0-4.1 million AF (MAF)/yr	4.1 MAF/yr
SWP Article 21 Demand	Metropolitan Water District of Southern California up to 200 TAF/month (Dec-Mar), Kern County Water Agency demand up to 180 TAF/month and others up to 34 TAF/month	

	Period of Simulation: 82 years (1922-2003)	
	Existing Level Study	**Future Level Study**
FACILITIES		
Red Bluff Diversion Dam	Fish Passage Improvement Project in place with 2,500 cfs capacity	
Freeport Regional Water Project	Included with diversions to EBMUD	
Banks Pumping Capacity	Physical capacity is 10,300 cfs, 6,680 cfs permitted capacity up to 8,500 cfs (Dec 15th–Mar 15th) depending on Vernalis flow conditions[5] additional capacity of 500 cfs (up to 7,180 cfs) allowed for Jul–Sep for reducing impact of NOAA Fisheries BO on SWP (Jun 2009), Action 4.2.1[4]	
Jones Pumping Capacity	Exports up to 4,600 cfs permit capacity in all months	
Delta-Mendota Canal-California Aqueduct Intertie	Included with 400 cfs capacity	
Los Vaqueros Reservoir Capacity	103 TAF	160 TAF
South Bay Aqueduct	300 cfs	South Bay Aqueduct Enlargement to 430 cfs
REGULATORY STANDARDS		
Trinity River		
Minimum Flow below Lewiston Dam	Trinity EIS Preferred Alternative (369-815 TAF/yr)	
Trinity Reservoir End-of-September Minimum Storage	Trinity EIS Preferred Alternative (600 TAF as able)	
Clear Creek		
Minimum Flow below Whiskeytown Dam	Downstream water rights, 1963 Reclamation Proposal to USFWS and NPS, predetermined CVPIA 3406(b)(2) flows and NOAA Fisheries BO (June 2009) Action I.1.1[4]	
Upper Sacramento River		
Shasta Lake End-of-September Minimum Storage	NOAA Fisheries 2004 Winter-run BO (1900 TAF), predetermined CVPIA 3406(b)(2) flows, and NOAA Fisheries BO (Jun 2009) Action I.2.1[4]	
Minimum Flow below Keswick Dam	Flows for SWRCB Water Rights Order 90-5 and 1993 Winter-run BO temperature control, predetermined CVPIA 3406(b)(2) flows, and NOAA Fisheries BO (Jun 2009), Action I.2.2[4]	
Feather River		
Minimum Flow below Thermalito Diversion Dam	2006 Settlement Agreement (700/800 cfs)	
Minimum Flow below Thermalito Afterbay outlet	1983 DWR, California Department of Fish & Game (DFG) Agreement (750-1700 cfs)	

	Period of Simulation: 82 years (1922-2003)	
	Existing Level Study	**Future Level Study**
Yuba River		
Minimum flow below Daguerre Point Dam	D-1644 Operations (Lower Yuba River Accord)[6]	
American River		
Minimum Flow below Nimbus Dam	American River Flow Management as required by NOAA Fisheries BO (Jun 2009), Action 2.1[4]	
Minimum Flow at H Street Bridge	SWRCB D-893	
Lower Sacramento River		
Minimum Flow near Rio Vista	SWRCB D-1641	
Mokelumne River		
Minimum Flow below Camanche Dam	Federal Energy Regulatory Commission 2916-029, 1996 Joint Settlement Agreement (100-325 cfs)	
Minimum Flow below Woodbridge Diversion Dam	Federal Energy Regulatory Commission 2916-029, 1996 Joint Settlement Agreement (25-300 cfs)	
Stanislaus River		
Minimum Flow below Goodwin Dam	1987 Reclamation, DFG agreement, and flows required for NOAA Fisheries BO (Jun 2009) Actions III.1.2 and III.1.3[4]	
Minimum Dissolved Oxygen	SWRCB D-1422	
REGULATORY STANDARDS		
Merced River		
Minimum Flow below Crocker-Huffman Diversion Dam	Davis-Grunsky (180-220 cfs, Nov-Mar) and Cowell Agreement	
Minimum Flow at Shaffer Bridge	Federal Energy Regulatory Commission 2179 (25-100 cfs)	
Tuolumne River		
Minimum Flow at Lagrange Bridge	Federal Energy Regulatory Commission 2299-024, 1995 Settlement Agreement (94-301 TAF/yr)	
San Joaquin River		
San Joaquin River Restoration	Interim flows	Full flows
Maximum Salinity near Vernalis	SWRCB D-1641	
Minimum Flow near Vernalis	SWRCB D-1641, NOAA Fisheries BO (Jun 2009), Action 4.2.1[4]	

	Period of Simulation: 82 years (1922-2003)	
	Existing Level Study	**Future Level Study**
Sacramento River-San Joaquin River Delta		
Delta Outflow Index (Flow and Salinity)	SWRCB D-1641, USFWS BO (Dec 2008), Action 4[4]	
Delta Cross Channel Gates	SWRCB D-1641, NOAA Fisheries BO (Jun 2009) Action 4.1.2[4]	
Delta Exports	SWRCB D-1641, NOAA Fisheries BO (Jun 2009) Action 4.2.1[4]	
Combined Flow in Old and Middle River	USFWS BO (Dec 2008), Actions 1–3 and NOAA Fisheries BO (Jun 2009), Action 4.2.3[4]	
OPERATIONS CRITERIA		
Subsystem		
Upper Sacramento River		
Flow Objective for Navigation (Wilkins Slough)	NOAA Fisheries BO (Jun 2009) Action I.4[4]; 3,250 – 5,000 cfs based on CVP water supply condition	
American River		
Folsom Dam Flood Control	Variable 400/670 without outlet modifications	
Feather River		
Flow at Mouth	Maintain DFG/DWR flow target above Verona or 2,800 cfs Apr-Sep, dependent on Oroville inflow and FRSA allocation	
System-wide		
CVP Water Allocation		
CVP Settlement and Exchange	100% (75% in Shasta Critical years)	
CVP Refuges	100% (75% in Shasta Critical years)	
CVP Agriculture	100% - 0% based on supply; additionally limited due to D-1641, USFWS BO (Dec 2008) and NOAA Fisheries BO (Jun 2009) export restrictions[4]	
CVP Municipal & Industrial	100% - 0% based on supply; additionally limited due to D-1641, USFWS BO (Dec 2008) and NOAA Fisheries BO (Jun 2009) export restrictions[4]	
OPERATIONS CRITERIA		
SWP Water Allocation		
North of Delta (FRSA)	Contract specific	
South of Delta	Based on supply, Monterey Agreement; allocations limited due to D-1641, USFWS BO (Dec 2008) and NOAA Fisheries BO (Jun 2009) export restrictions[4]	

	Period of Simulation: 82 years (1922-2003)	
	Existing Level Study	**Future Level Study**
CVP/SWP Coordinated Operations		
Sharing of Responsibility for In Basin Use	1986 COA	
Sharing of Surplus Flows	1986 COA	
Sharing of Restricted Export Capacity	Equal sharing of export capacity under SWRCB D-1641, USFWS BO (Dec 2008) and NOAA Fisheries BO (Jun 2009) export restrictions[4]	
Transfers		
Lower Yuba River Accord[7]	Yuba River acquisitions for reducing impact of NOAA Fisheries BO export restrictions on SWP	
Phase 8	Not included	Included

[1] The Sacramento Valley hydrology used in the existing conditions CalSim II model reflects nominal 2005 land-use assumptions. The nominal 2005 land-use was determined by interpolation between the 1995 and projected 2020 land-use assumptions associated with Bulletin 160-98. The San Joaquin Valley hydrology reflects 2005 land-use assumptions developed by Reclamation. Existing-level projected land-use assumptions are being coordinated with the California Water Plan Update for future models.

[2] The Sacramento Valley hydrology used in the Future Conditions CalSim II model reflects 2020 land-use assumptions associated with Bulletin 160-98. The San Joaquin Valley hydrology reflects draft 2030 land-use assumptions developed by Reclamation. Development of future-level projected land-use assumptions are being coordinated with the California Water Plan Update for future models.

[3] The CalSim II model representation for the Stanislaus River does not necessarily represent Reclamation's current or future operational policies. A suitable plan for supporting flows has not been developed for NOAA Fisheries BO (Jun 2009), Action 3.1.3.

[4] In cooperation with Reclamation, NOAA Fisheries, USFWS, and DFG, DWR has developed assumptions for implementation of the USFWS BO (December 15, 2008) and NOAA Fisheries BO (June 4, 2009) in CalSim II.

[5] Current US Army Corps of Engineers permit for Harvey O. Banks Pumping Plant allows for an average diversion rate of 6,680 cfs in all months. Diversion rate can increase up to one-third of the rate of San Joaquin River flow at Vernalis during Dec 15th–Mar 15th up to a maximum diversion of 8,500 cfs, if Vernalis flow exceeds 1,000 cfs.

[6] D-1644 and the Lower Yuba River Accord are assumed to be implemented for Existing and Future Conditions. The Yuba River is not dynamically modeled in CalSim II. Yuba River hydrology and availability of water acquisitions under the Lower Yuba River Accord are based on modeling performed and provided by the Lower Yuba River Accord EIS/EIR study team.

[7] Acquisitions of Component 1 water under the Lower Yuba River Accord, and use of 500 cfs dedicated capacity at Banks Pumping Plant during Jul–Sep, are assumed to be used to reduce as much of the effect of the April–May Delta export actions on SWP contractors as possible.

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Attachment B
Comparison of No Action Alternative with Action Alternatives

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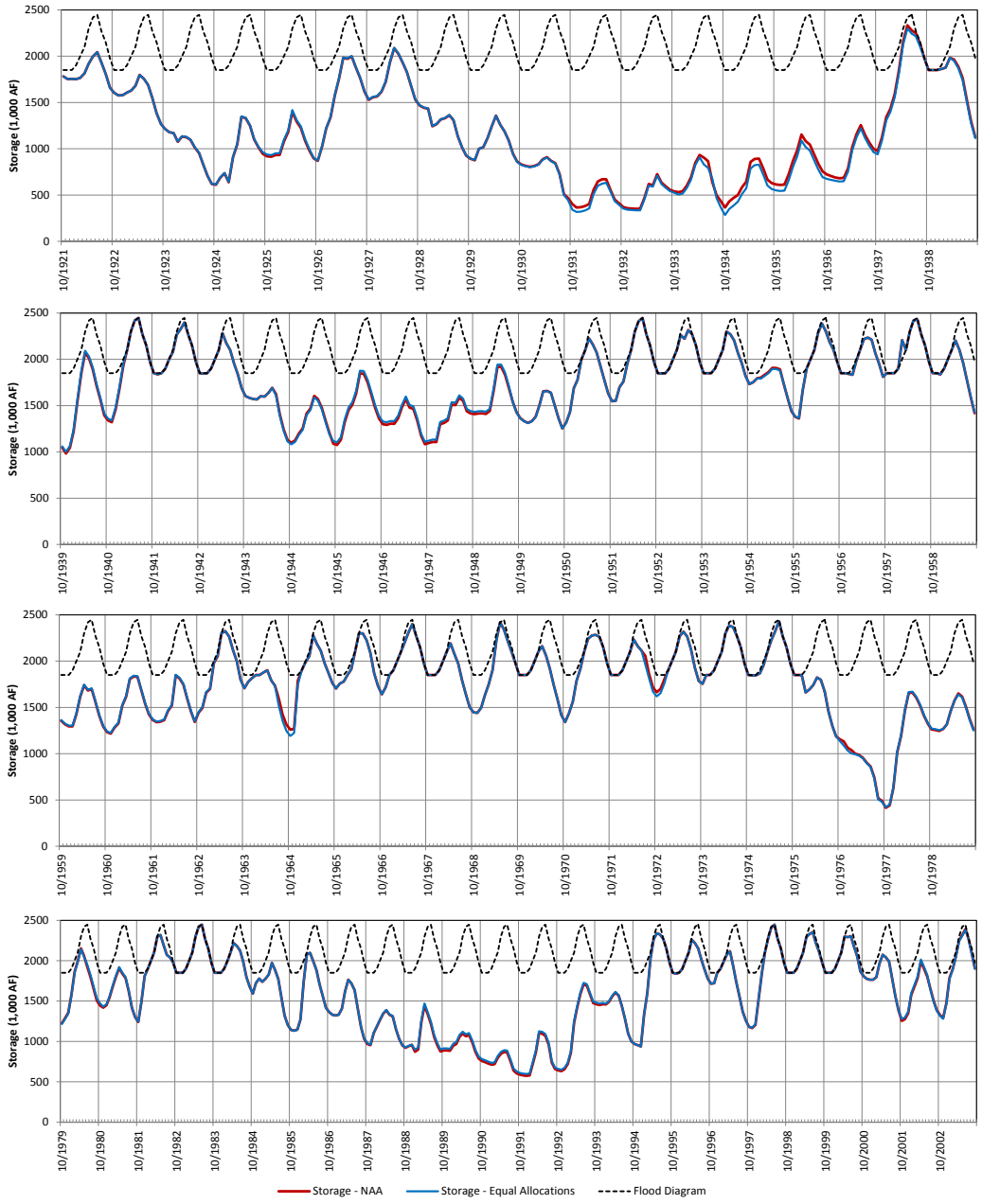

Figure 1. Comparison of Trinity Lake Storage for Alternative 2

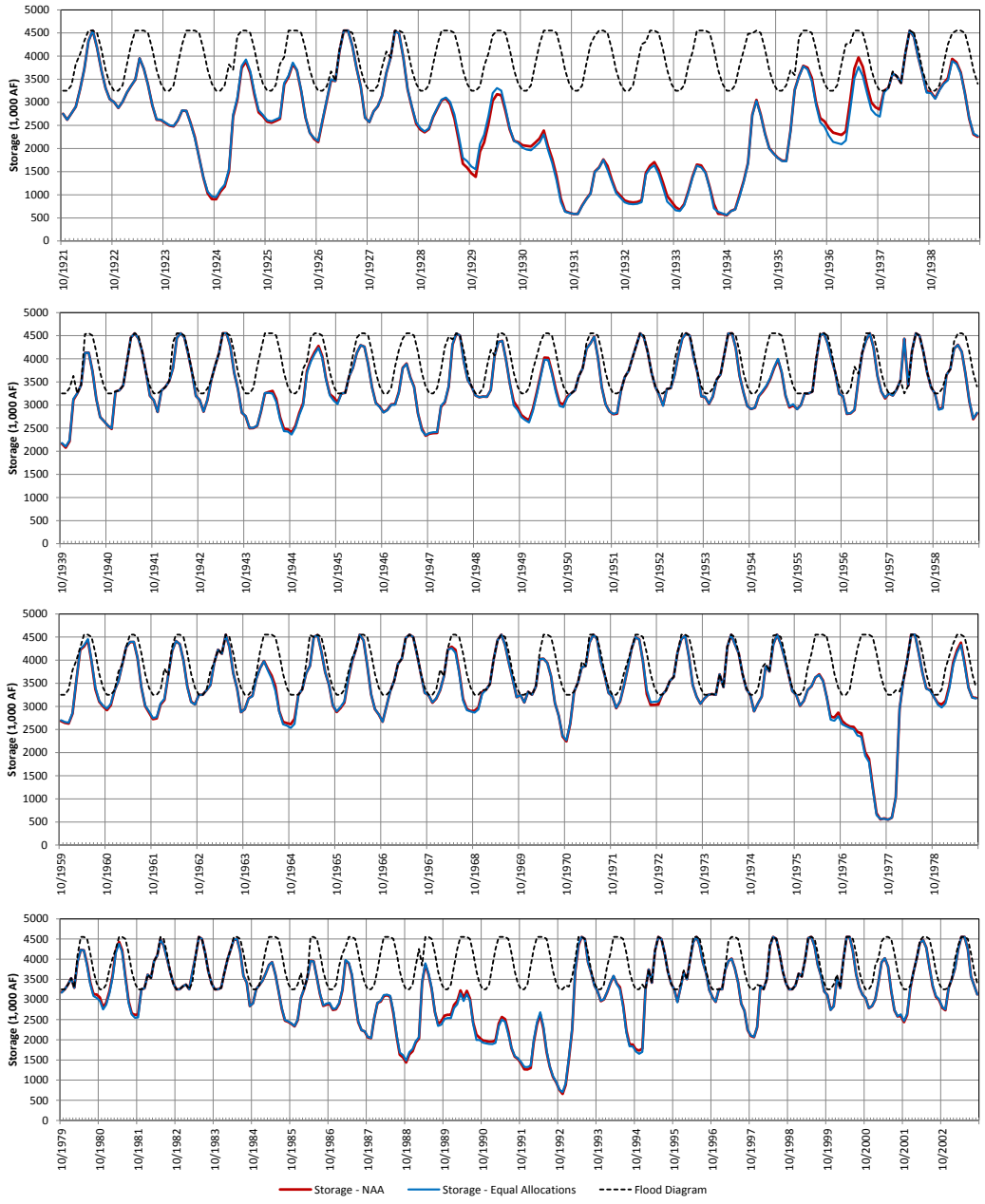

Figure 2. Comparison of Shasta Lake Storage for Alternative 2

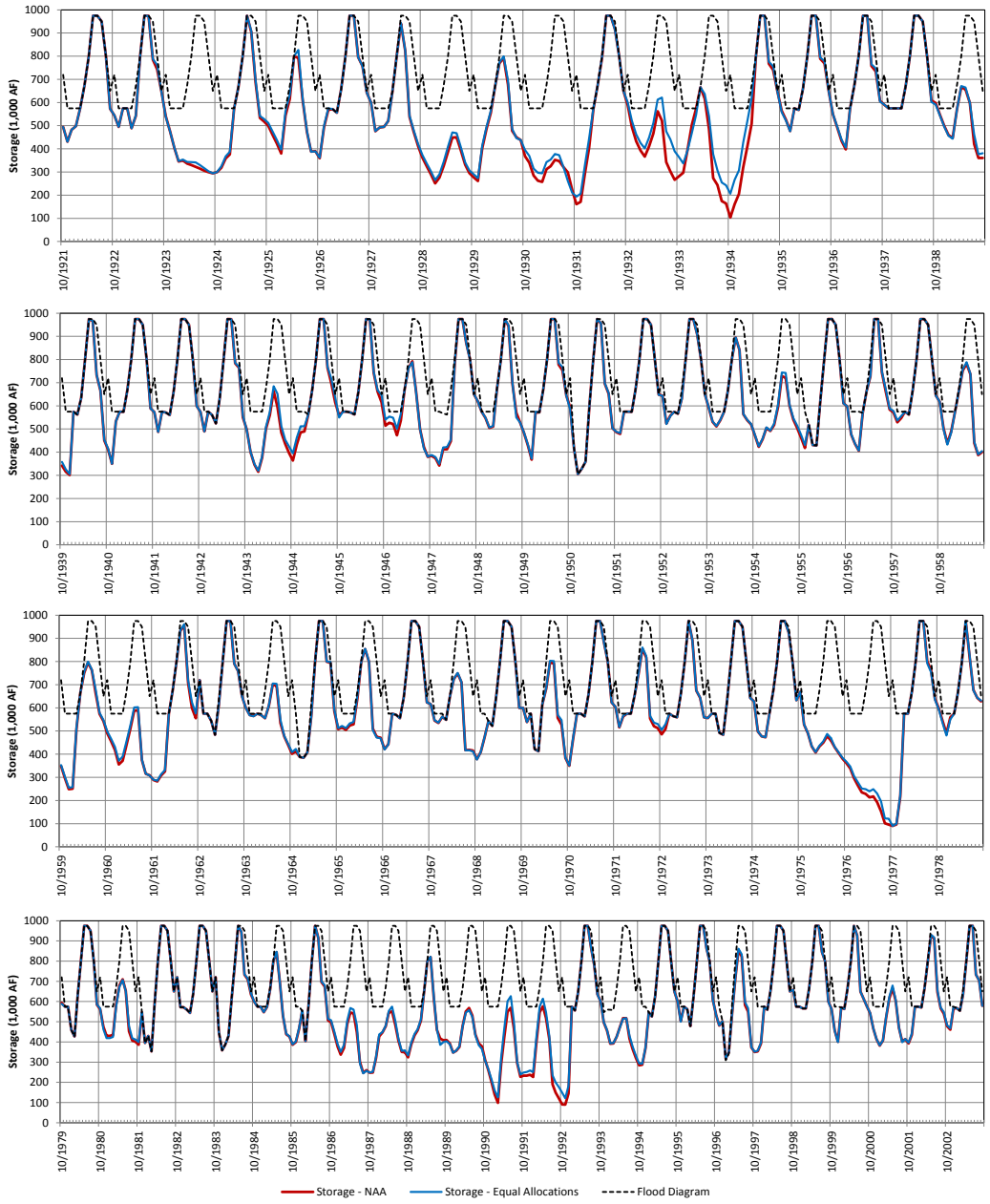

Figure 3. Comparison of Folsom Lake Storage for Alternative 2

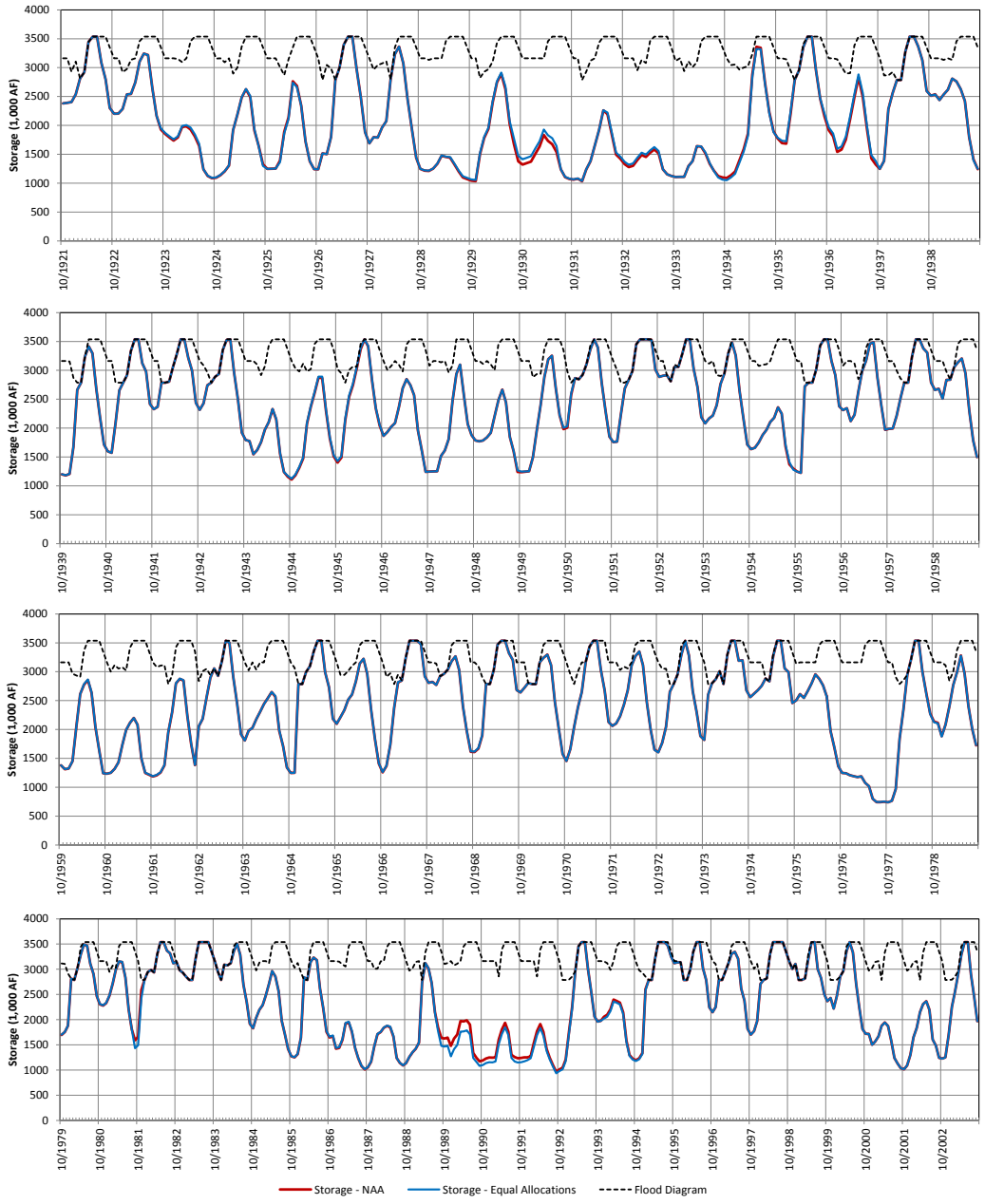

Figure 4. Comparison of Lake Oroville Storage for Alternative 2

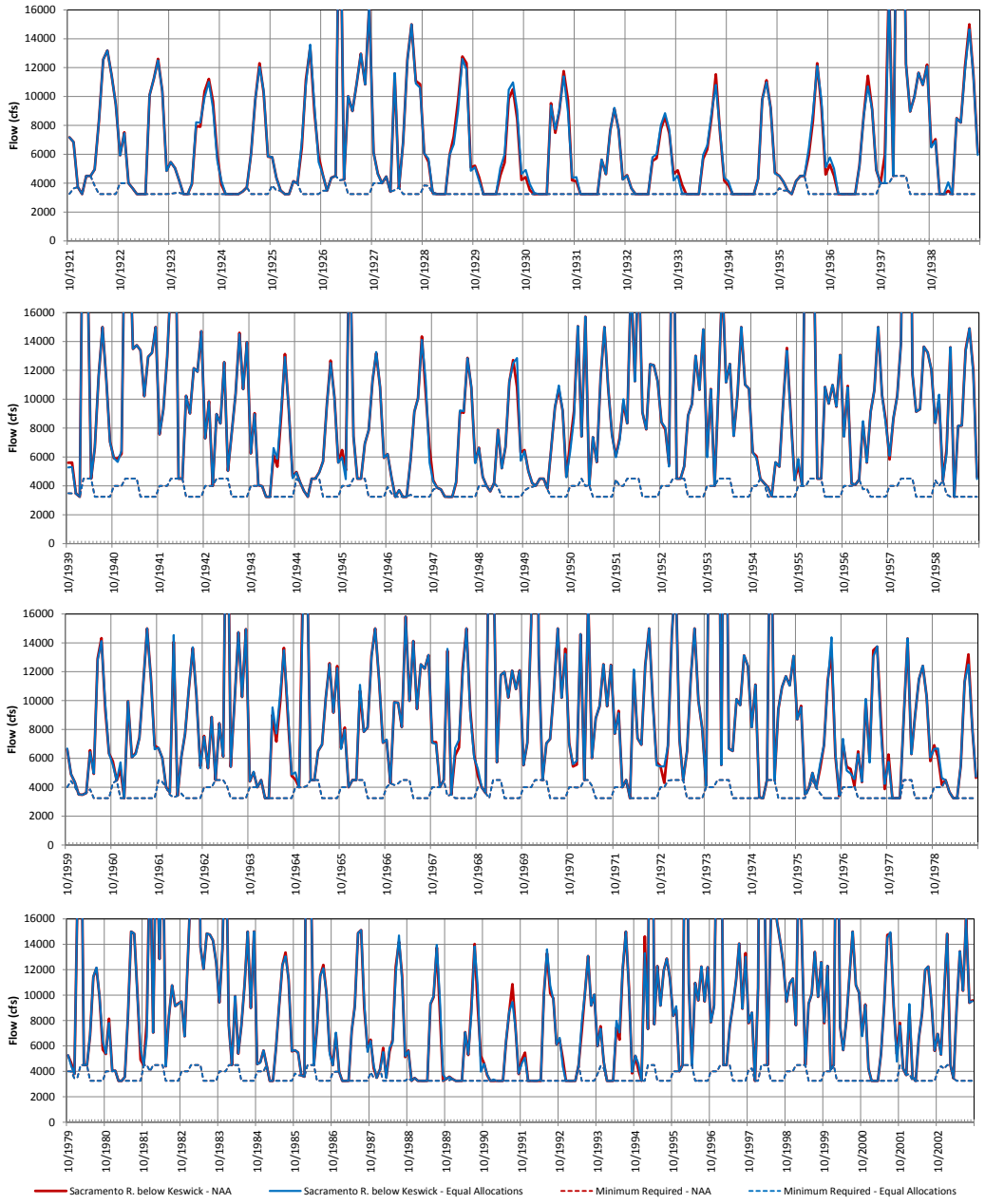

Figure 5. Comparison of Sacramento River below Keswick Flow for Alternative 2

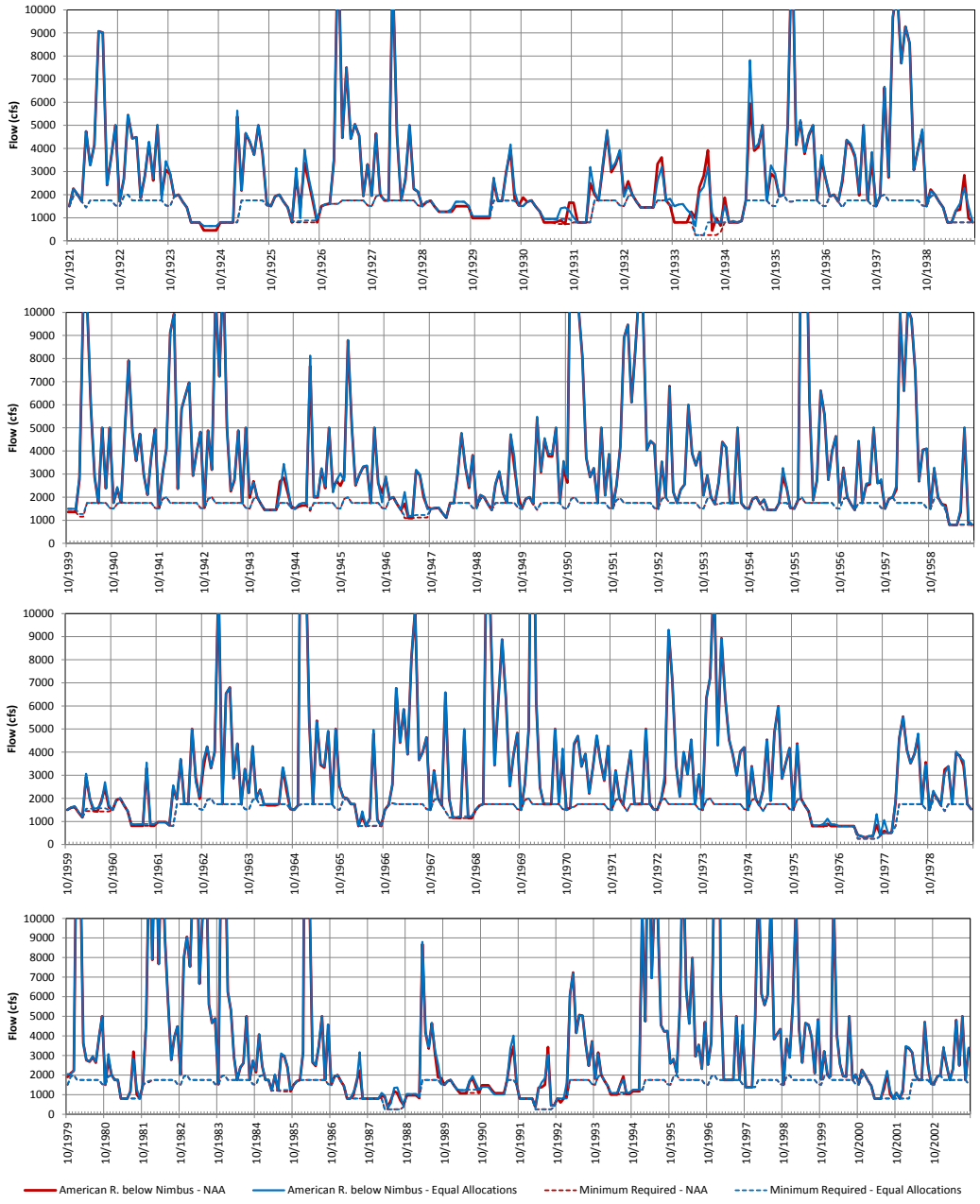

Figure 6. Comparison of American River below Nimbus Flow for Alternative 2

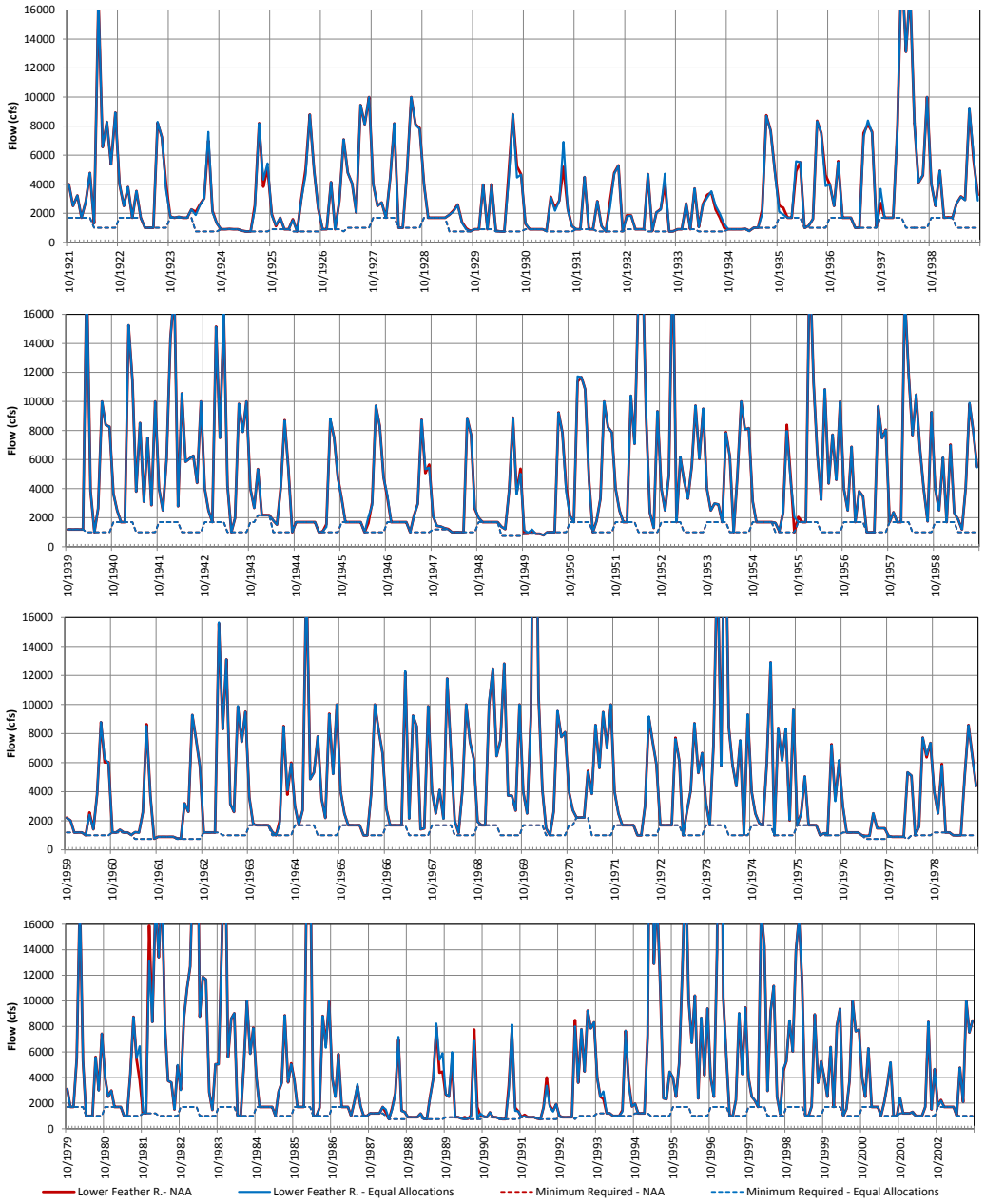

Figure 7. Comparison of Lower Feather River Flow for Alternative 2

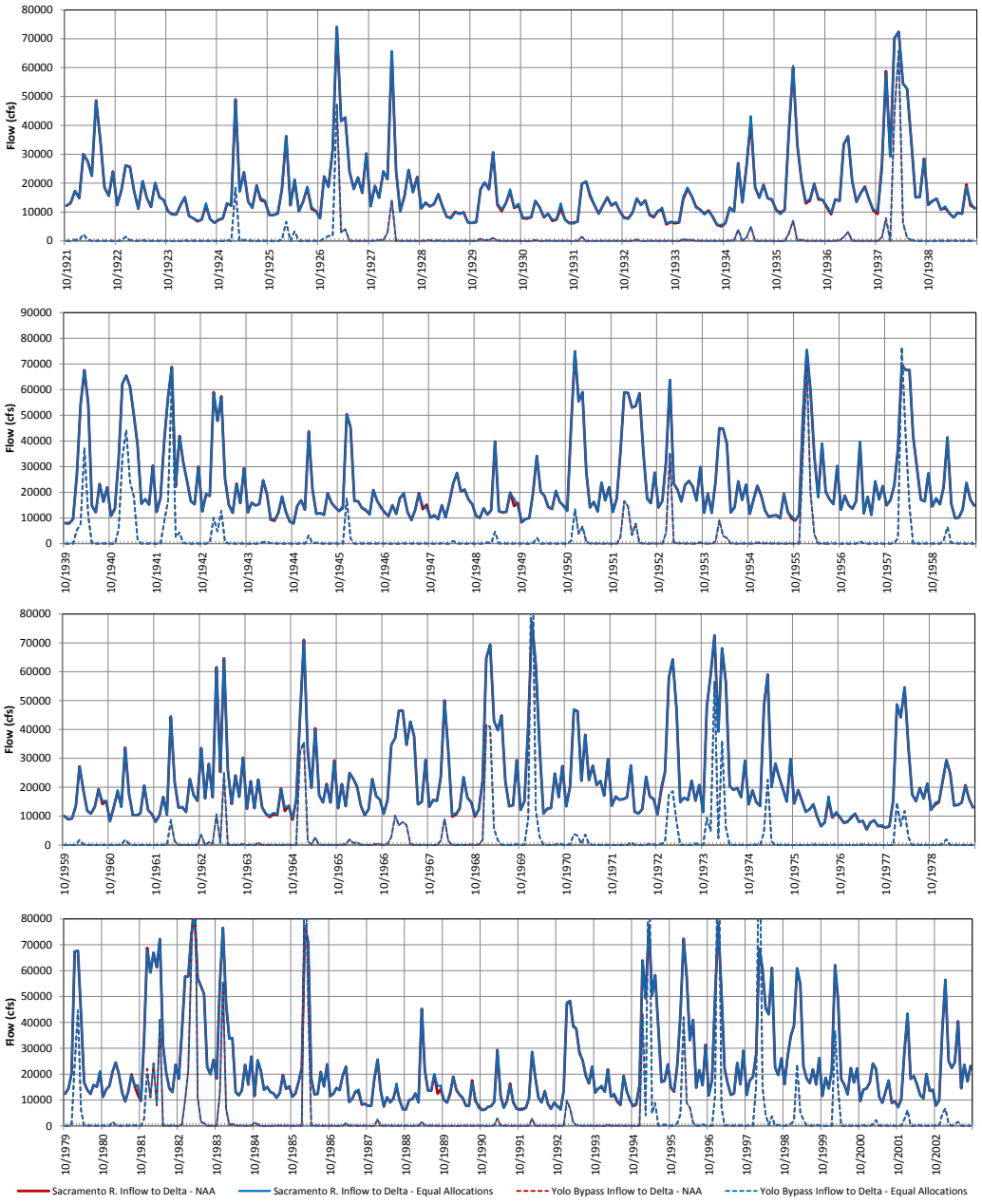

Figure 8. Comparison of Delta Inflow for Alternative 2

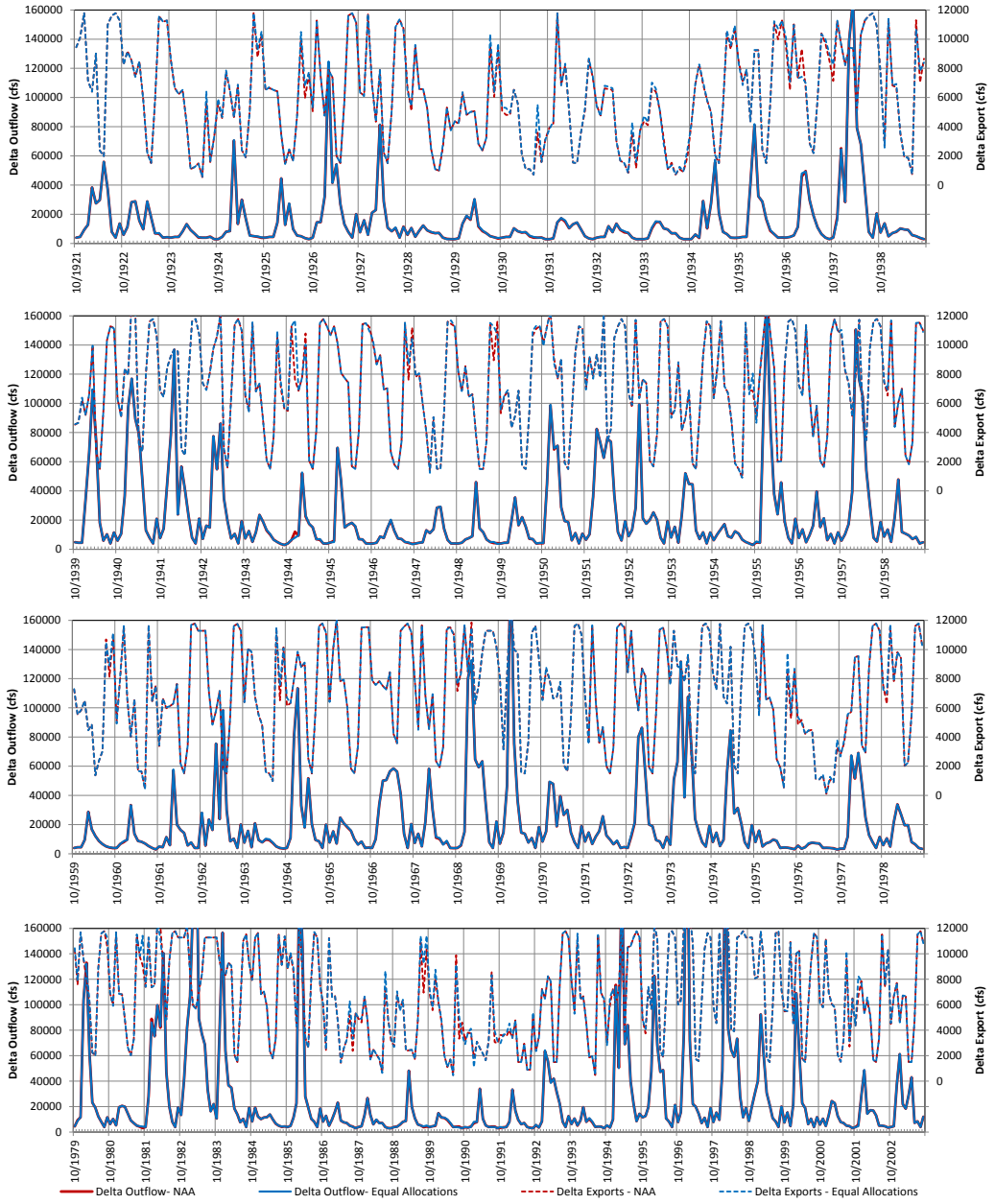

Figure 9. Comparison of Delta Outflow for Alternative 2

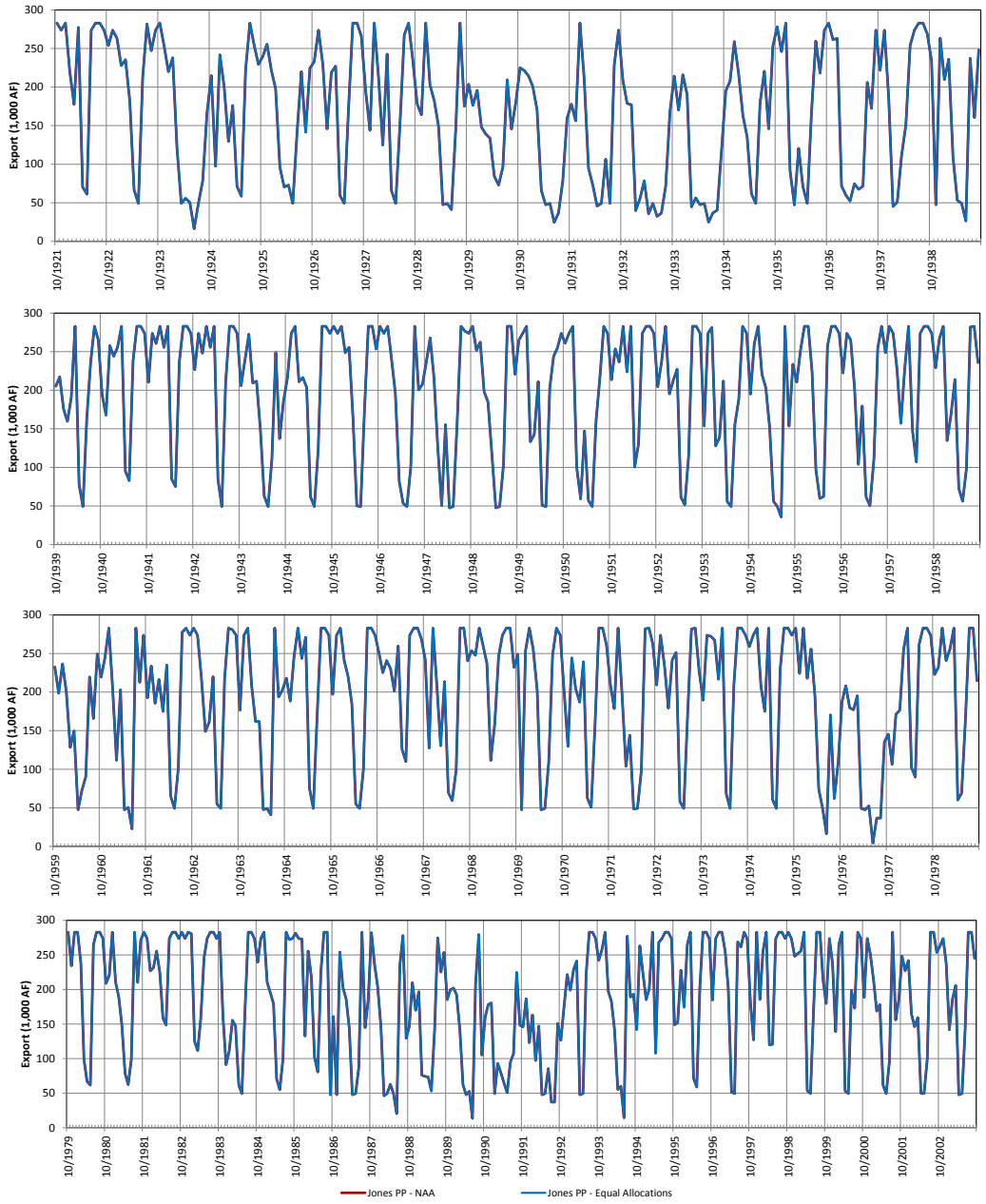

Figure 10. Comparison of Jones Pumping Plant for Alternative 2

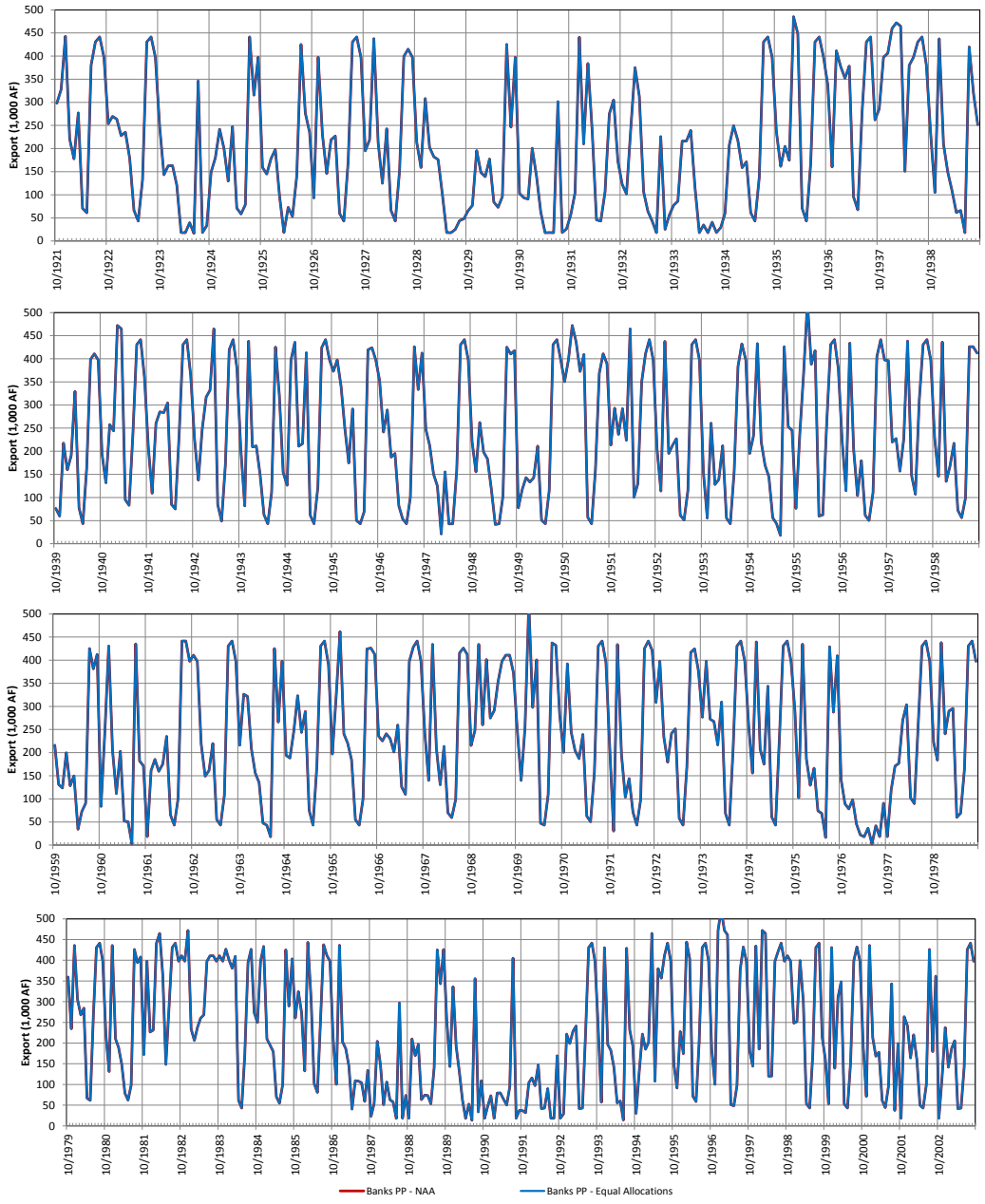

Figure 11. Comparison of Banks Pumping Plant for Alternative 2

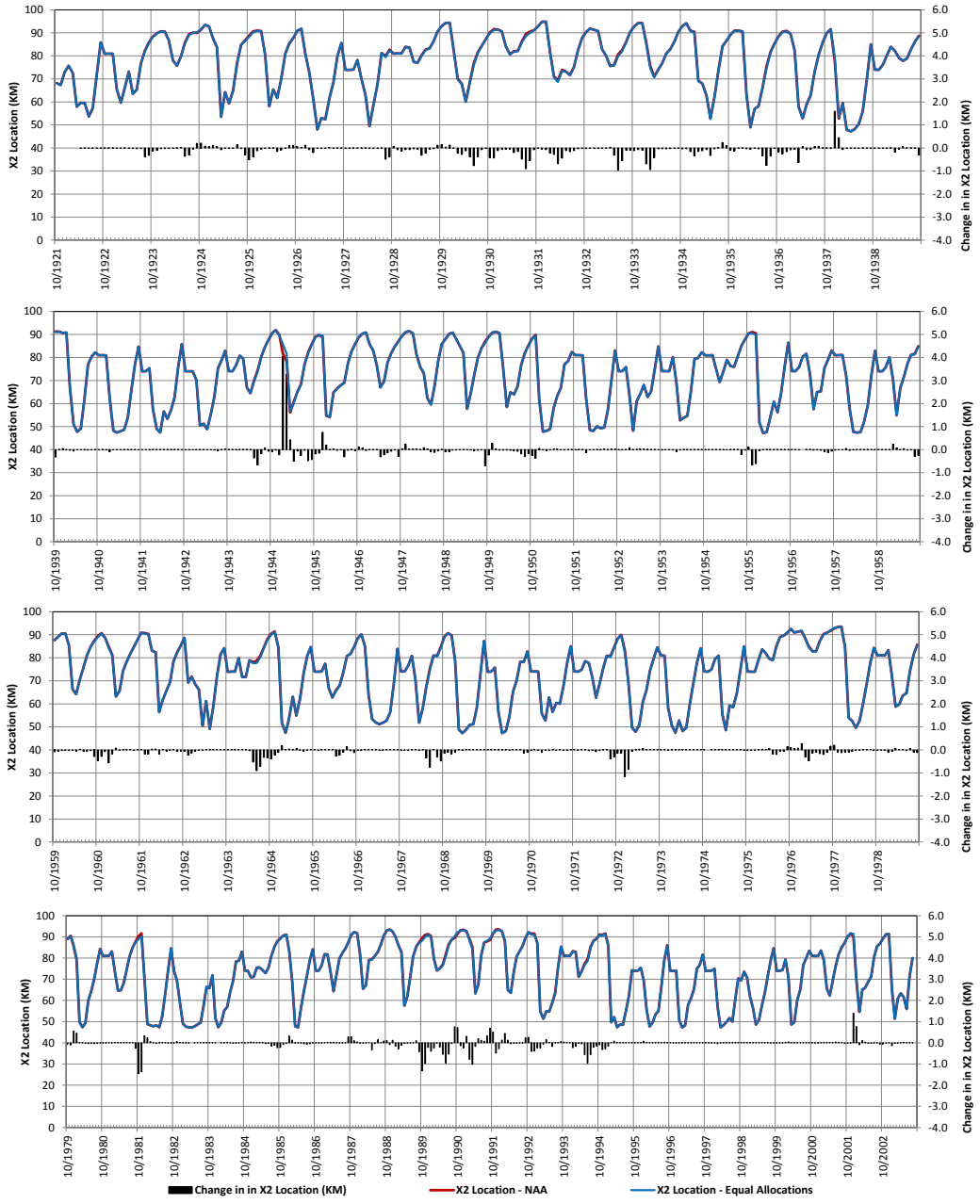

Figure 12. Comparison of X2 Location for Alternative 2

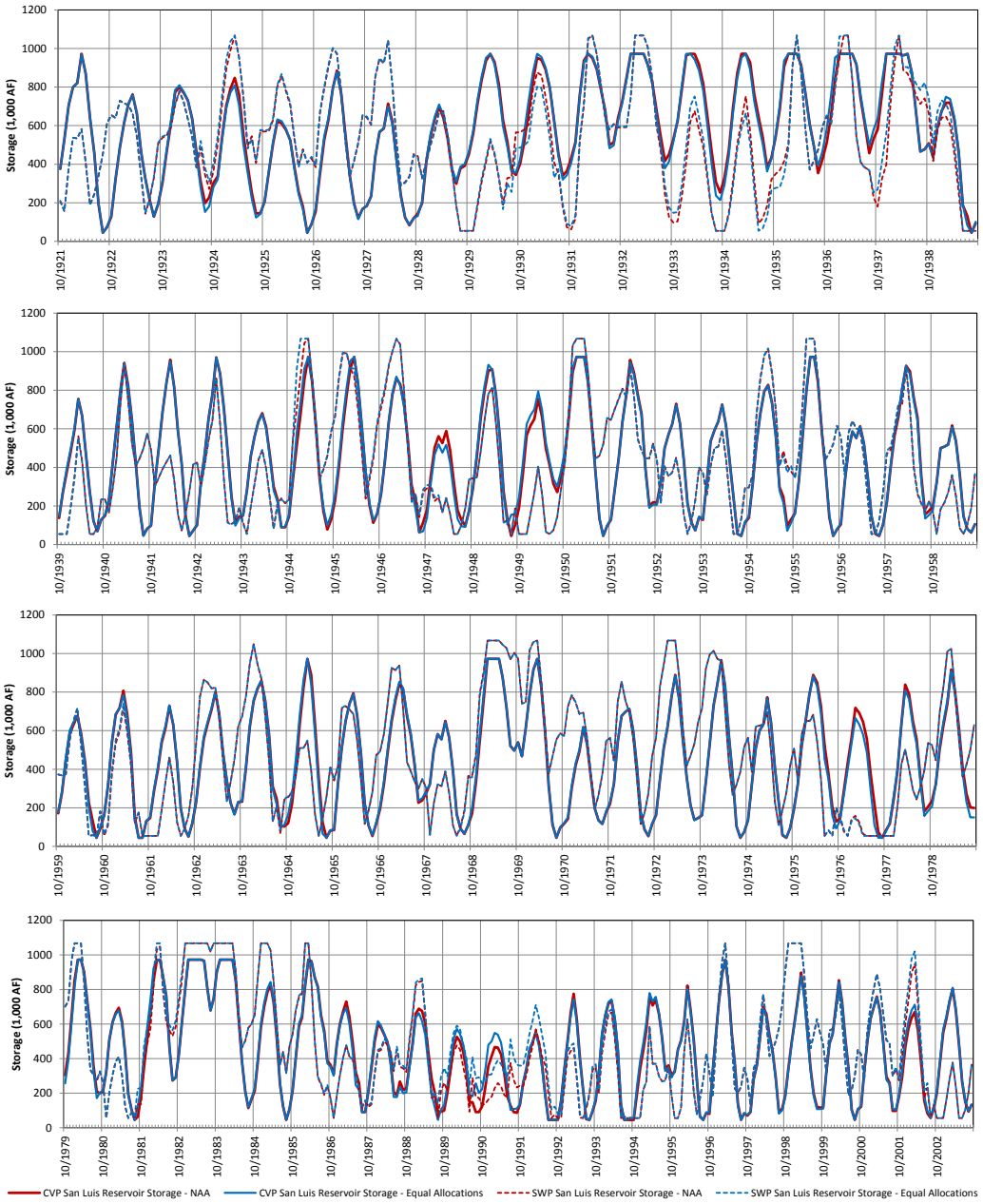

Figure 13. Comparison of San Luis Reservoir Storage for Alternative 2

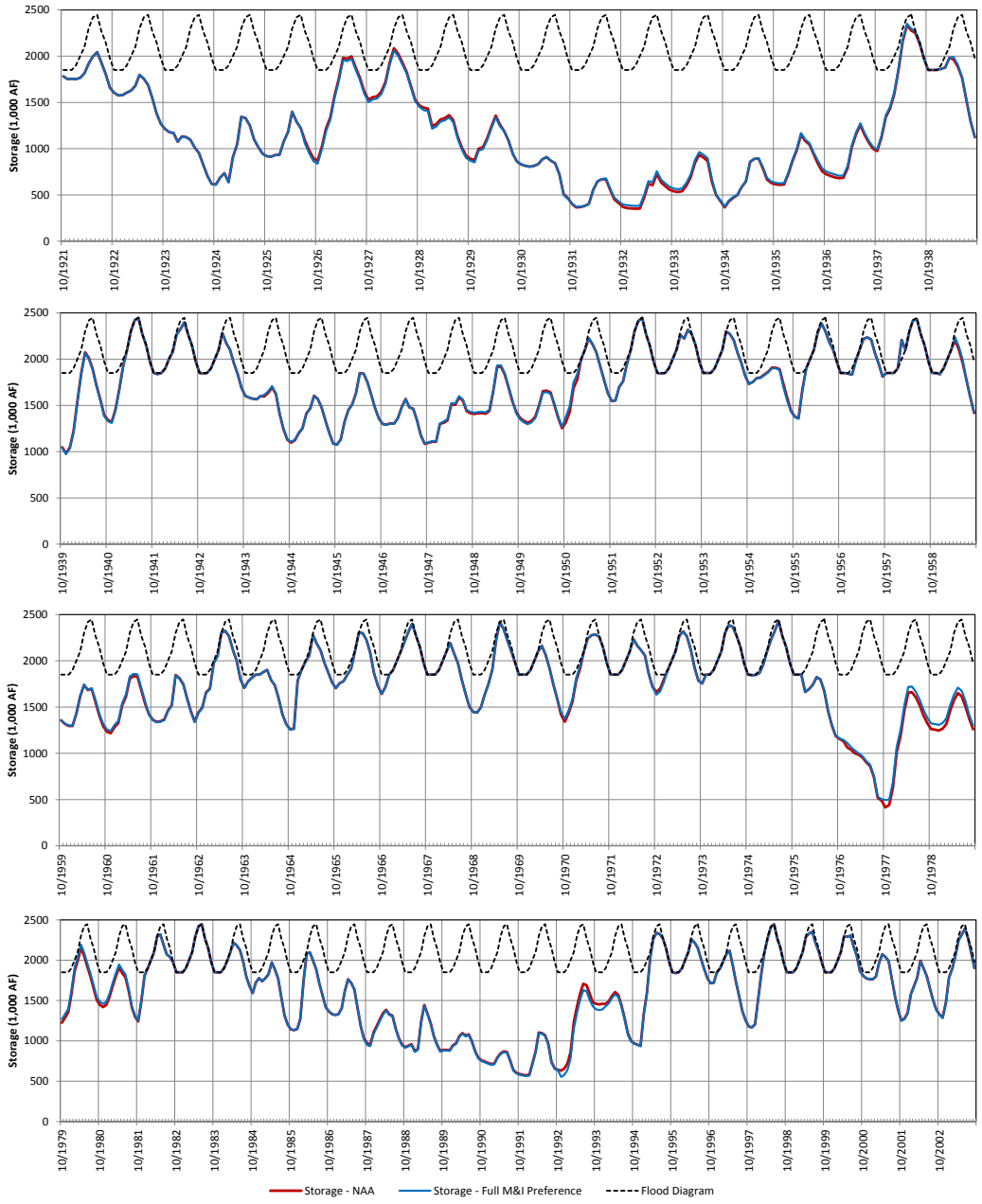

Figure 14. Comparison of Trinity Lake Storage for Alternative 3

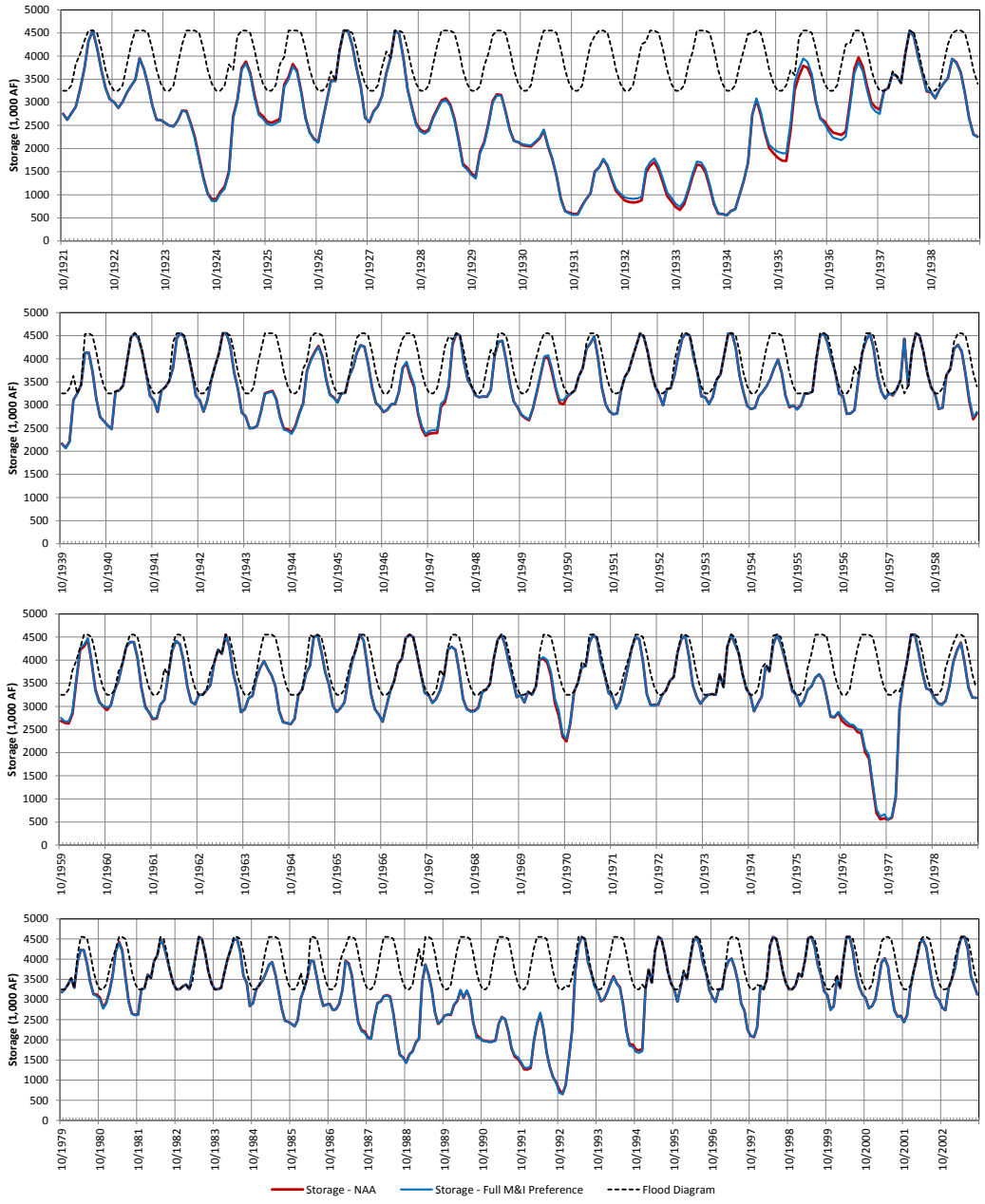

Figure 15. Comparison of Shasta Lake Storage for Alternative 3

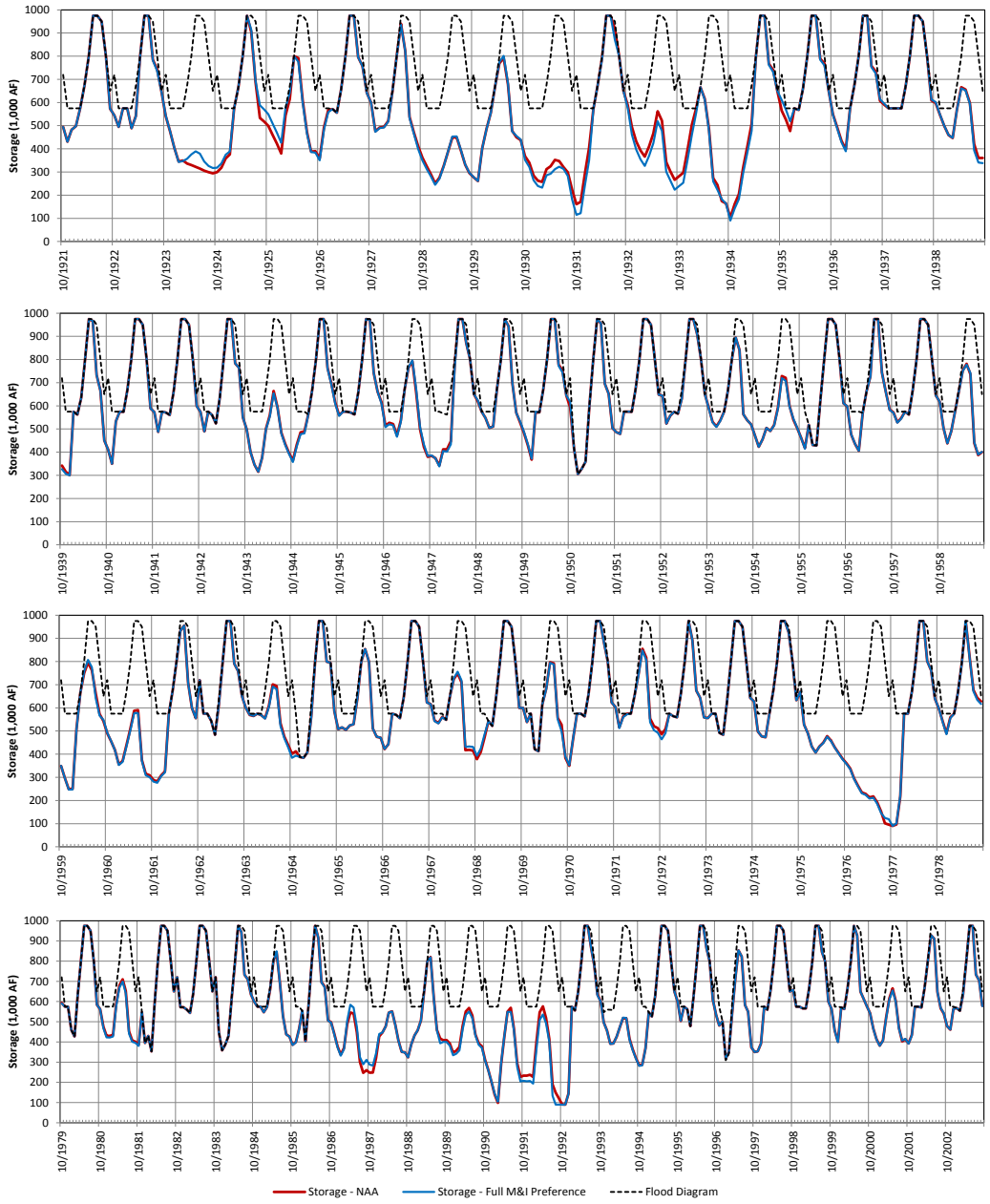

Figure 16. Comparison of Folsom Lake Storage for Alternative 3

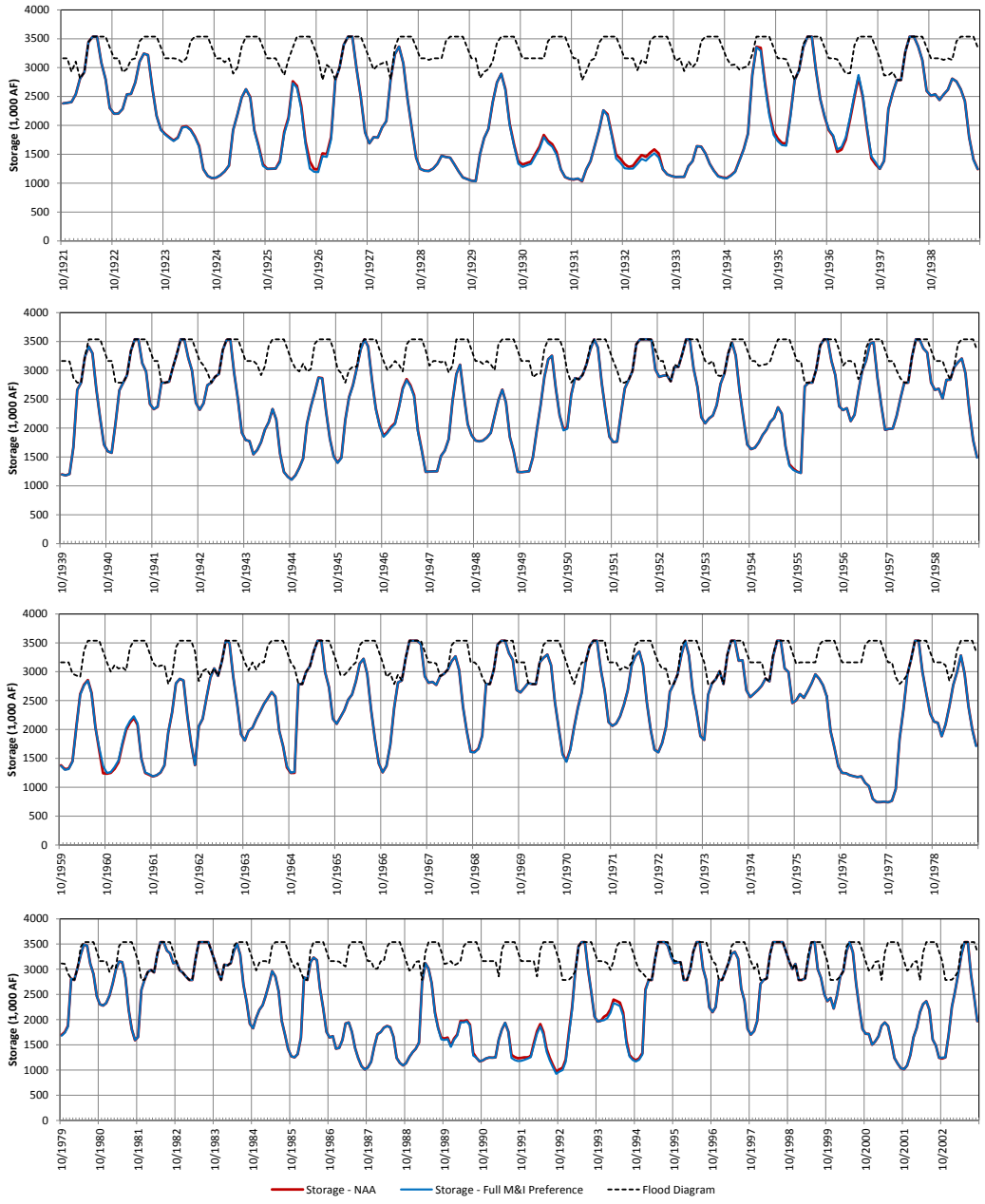

Figure 17. Comparison of Lake Oroville Storage for Alternative 3

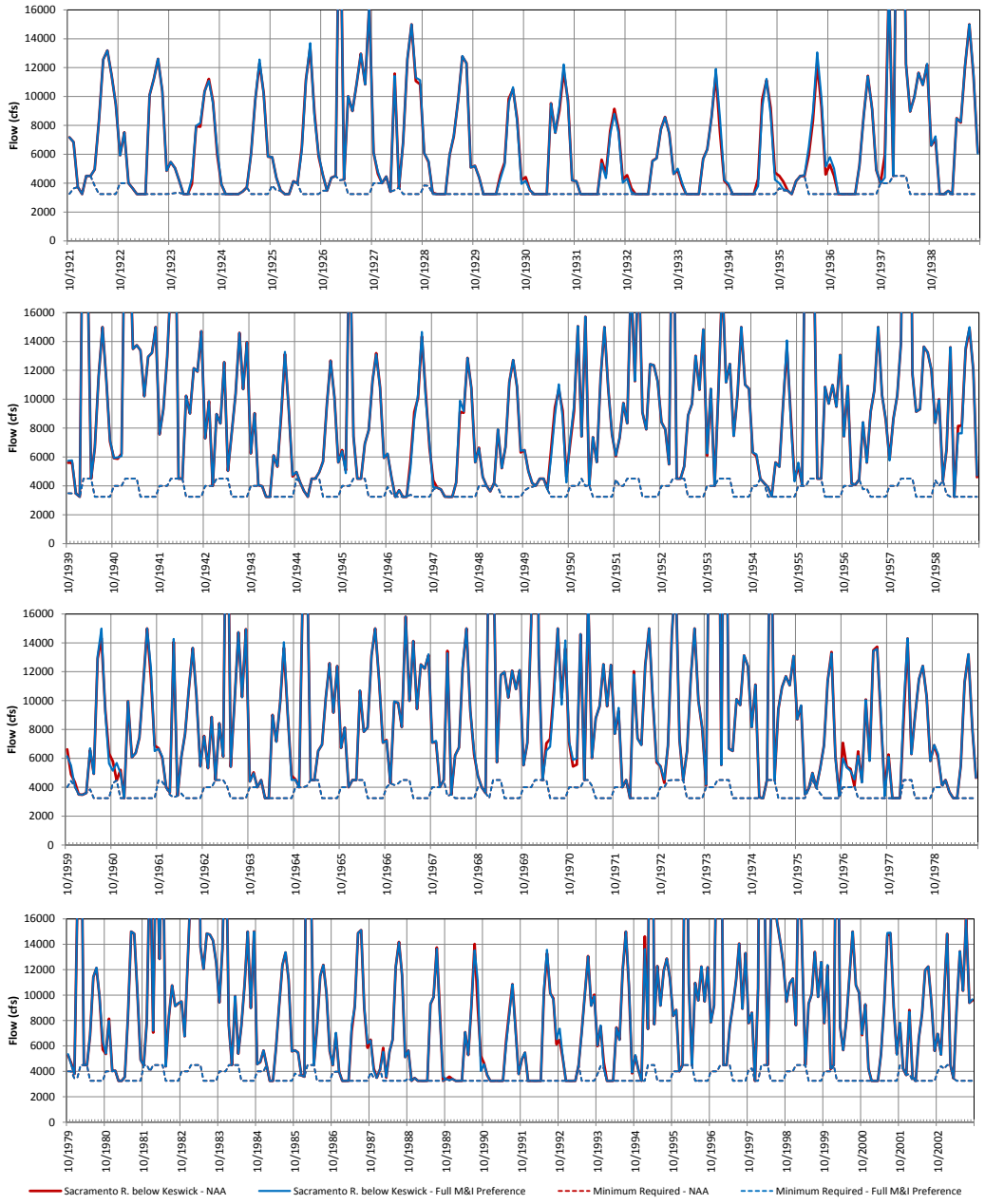

Figure 18. Comparison of Sacramento River below Keswick Flow for Alternative 3

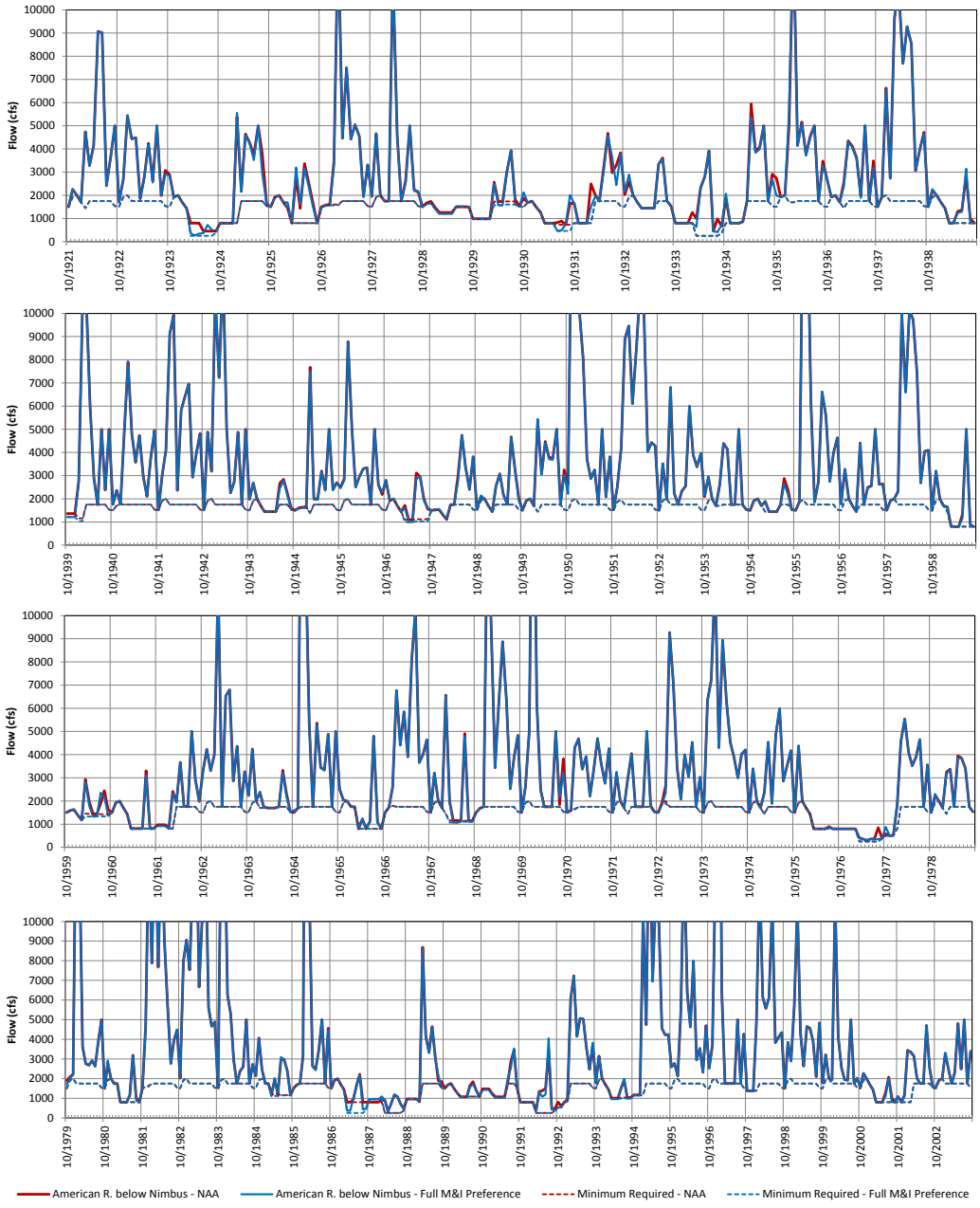

Figure 19. Comparison of American River below Nimbus Flow for Alternative 3

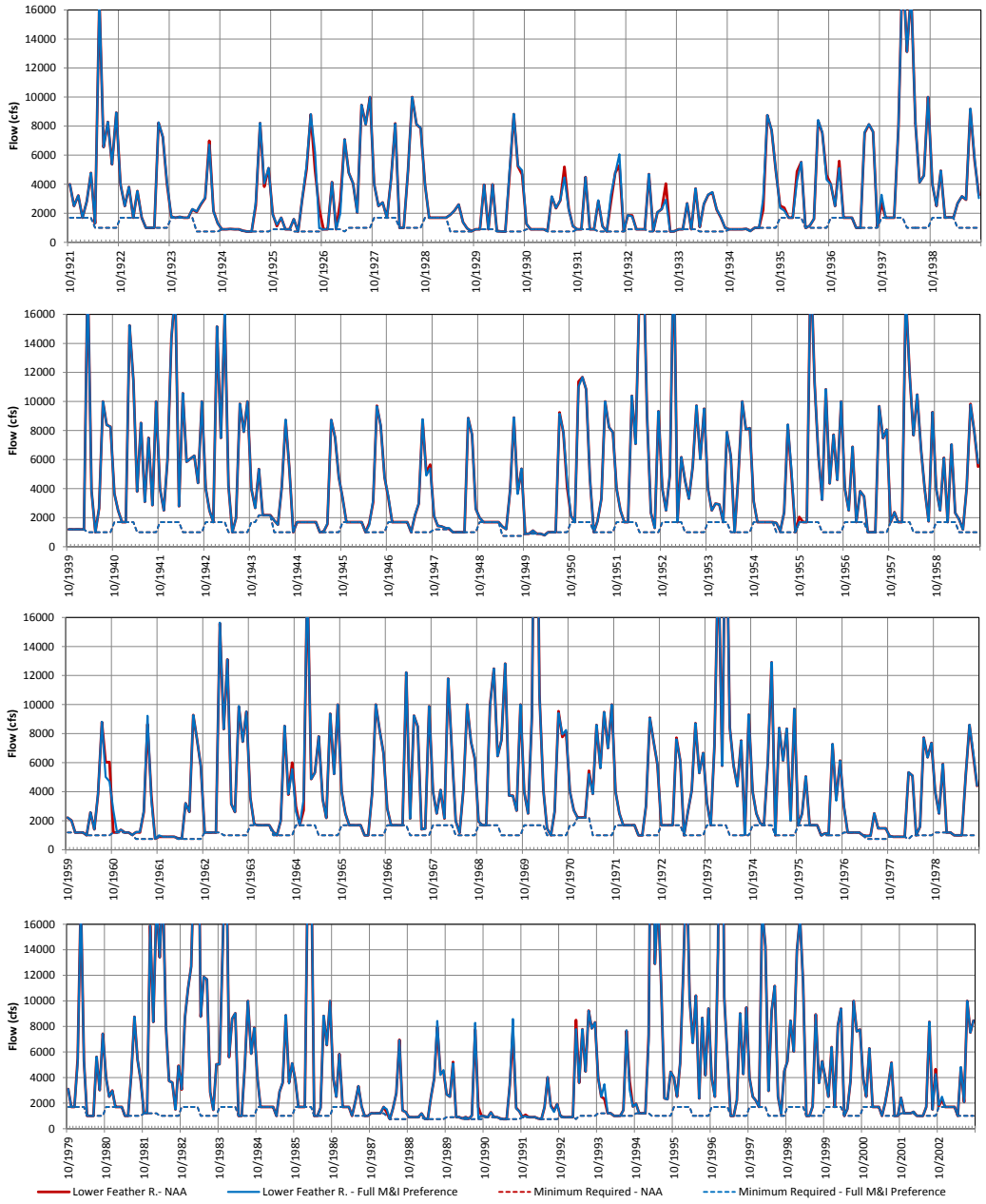

Figure 20. Comparison of Lower Feather River Flow for Alternative 3

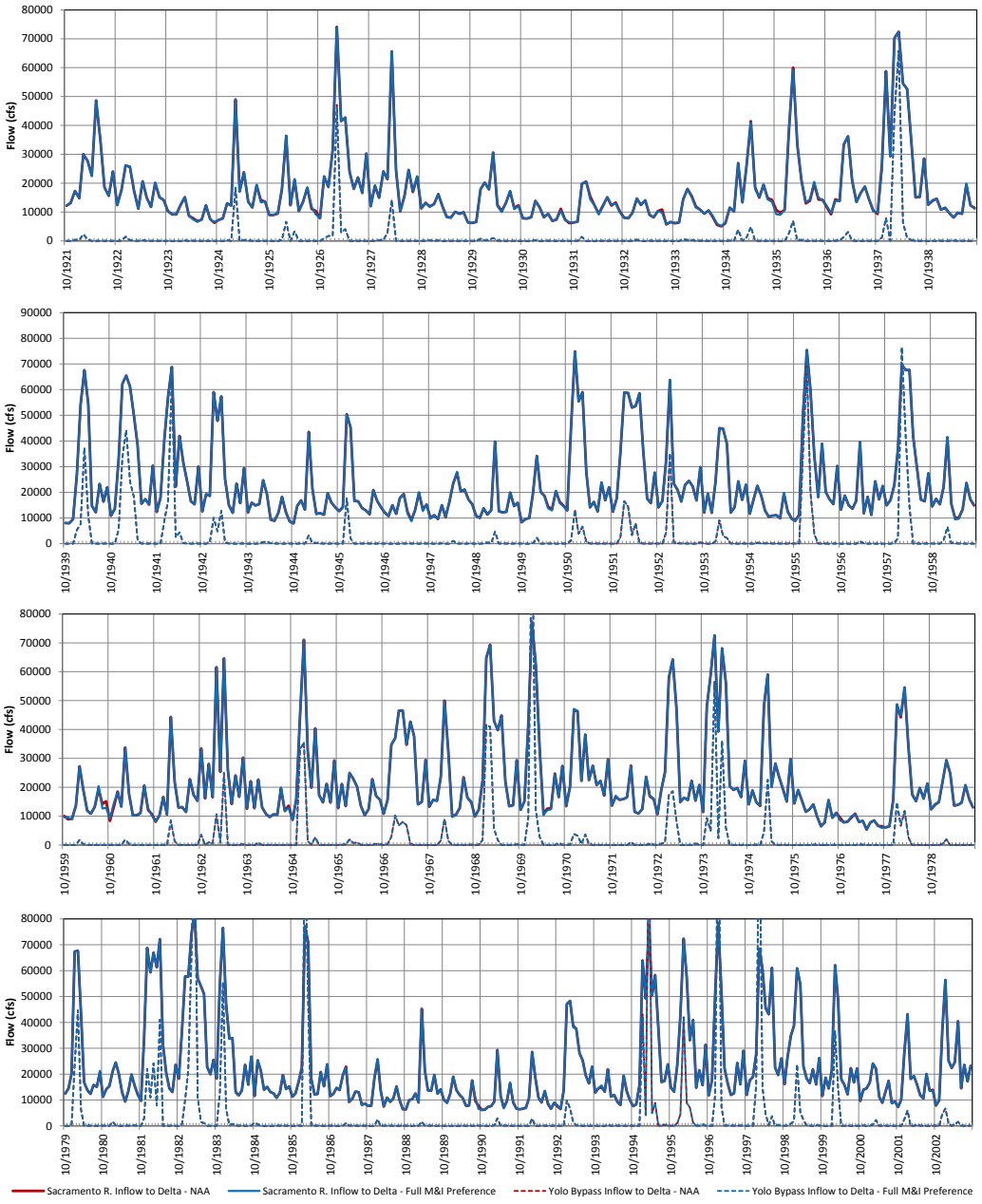

Figure 21. Comparison of Delta Inflow for Alternative 3

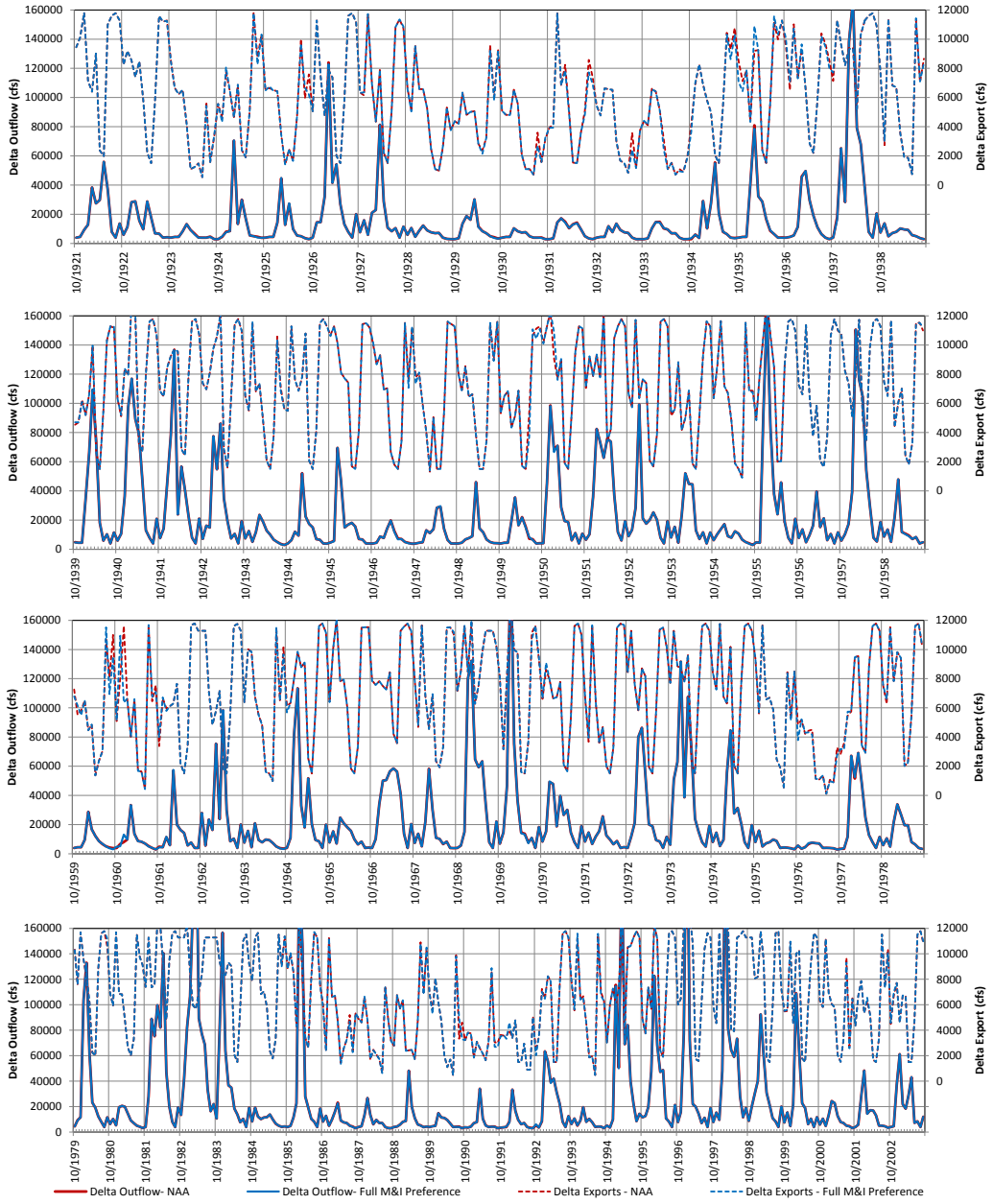

Figure 22. Comparison of Delta Outflow for Alternative 3

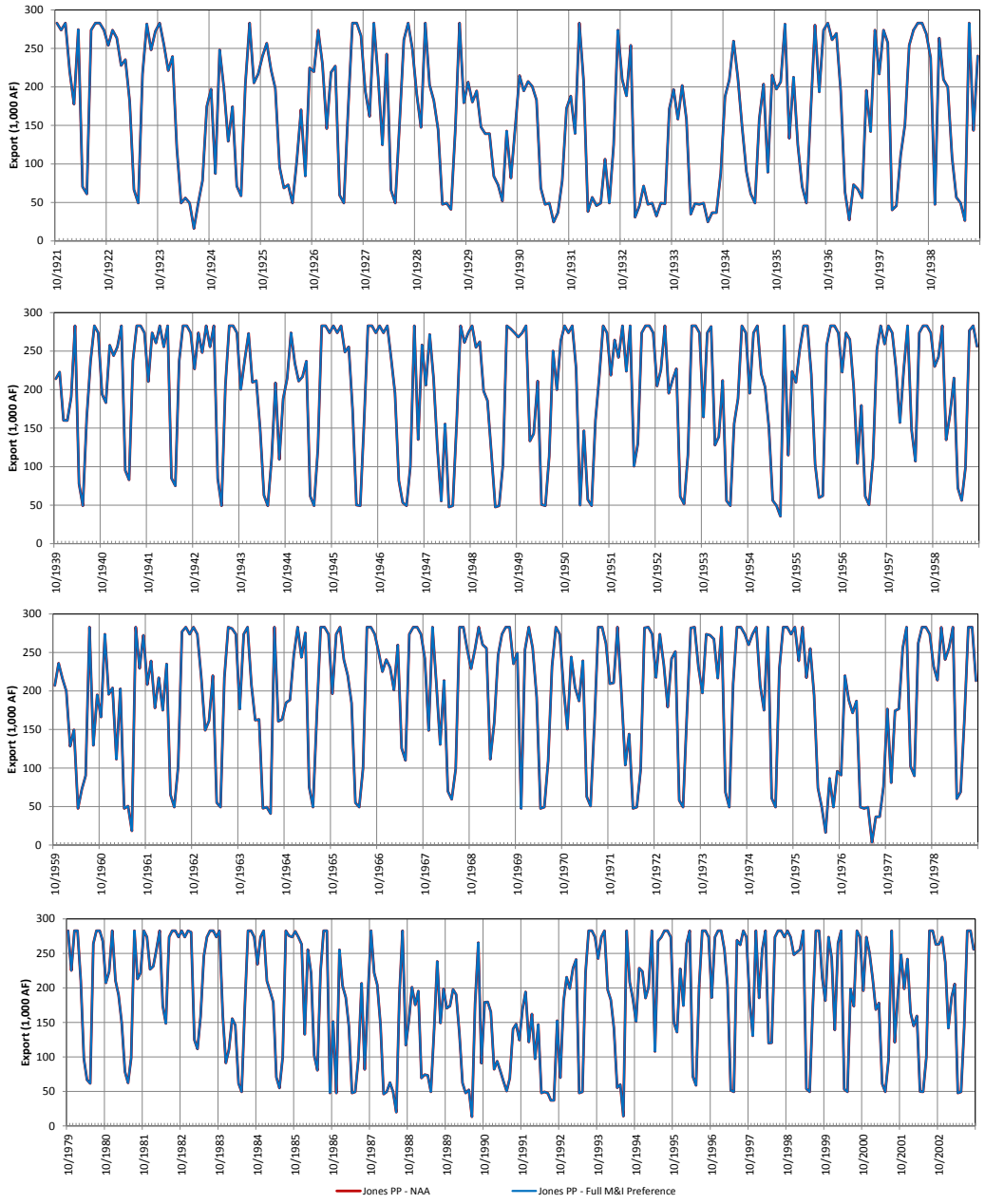

Figure 23. Comparison of Jones Pumping Plant for Alternative 3

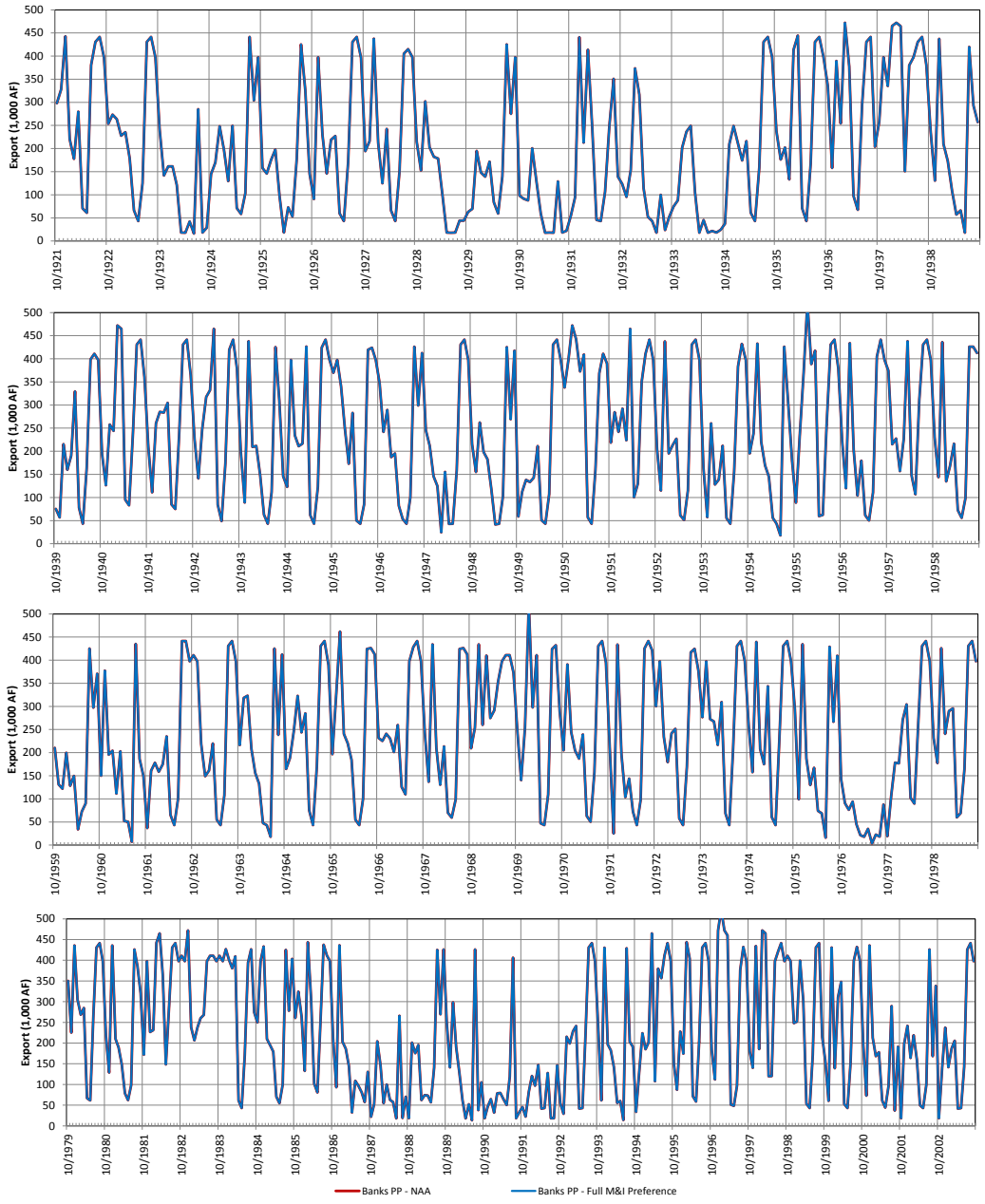

Figure 24. Comparison of Banks Pumping Plant for Alternative 3

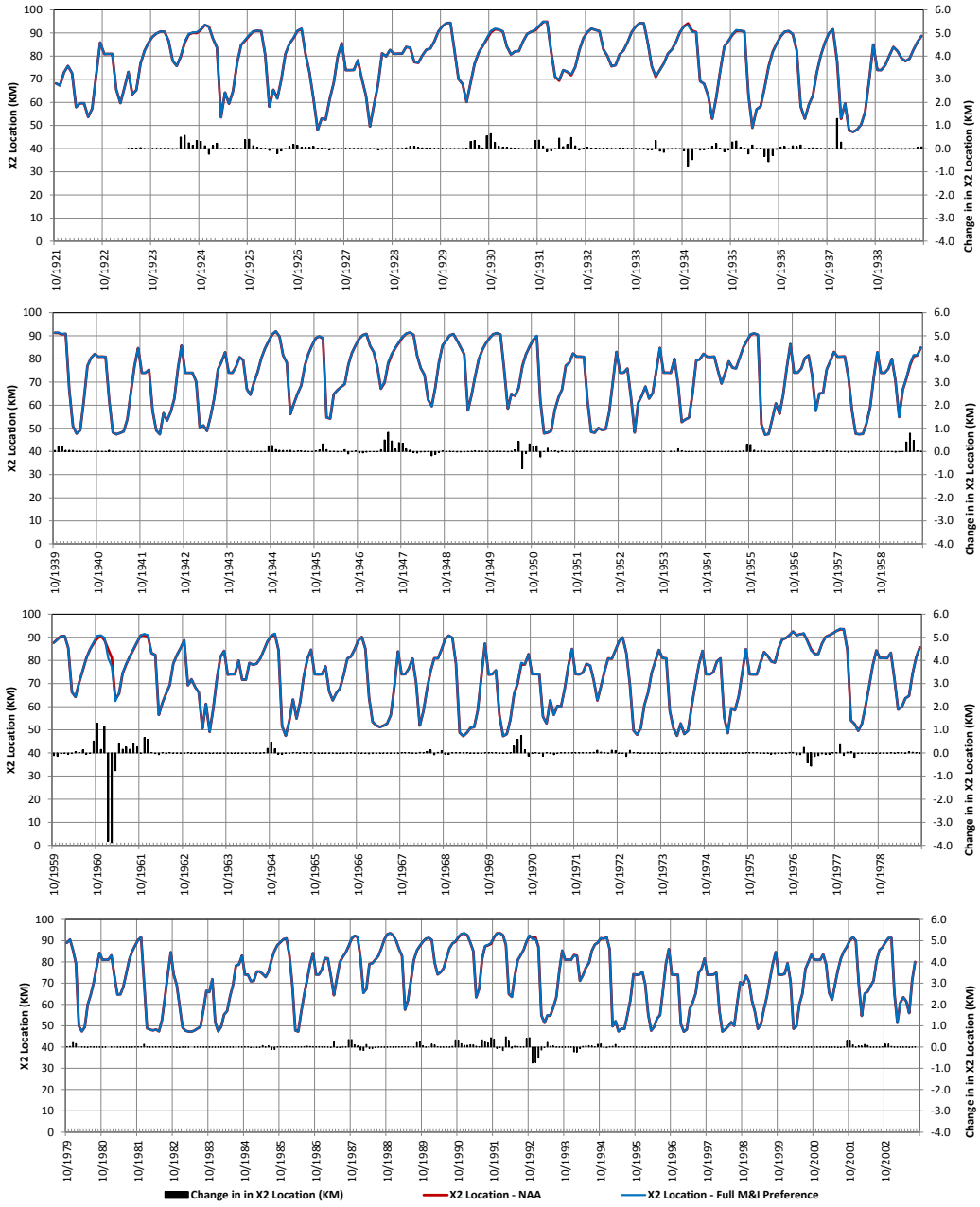

Figure 25. Comparison of X2 Location for Alternative 3

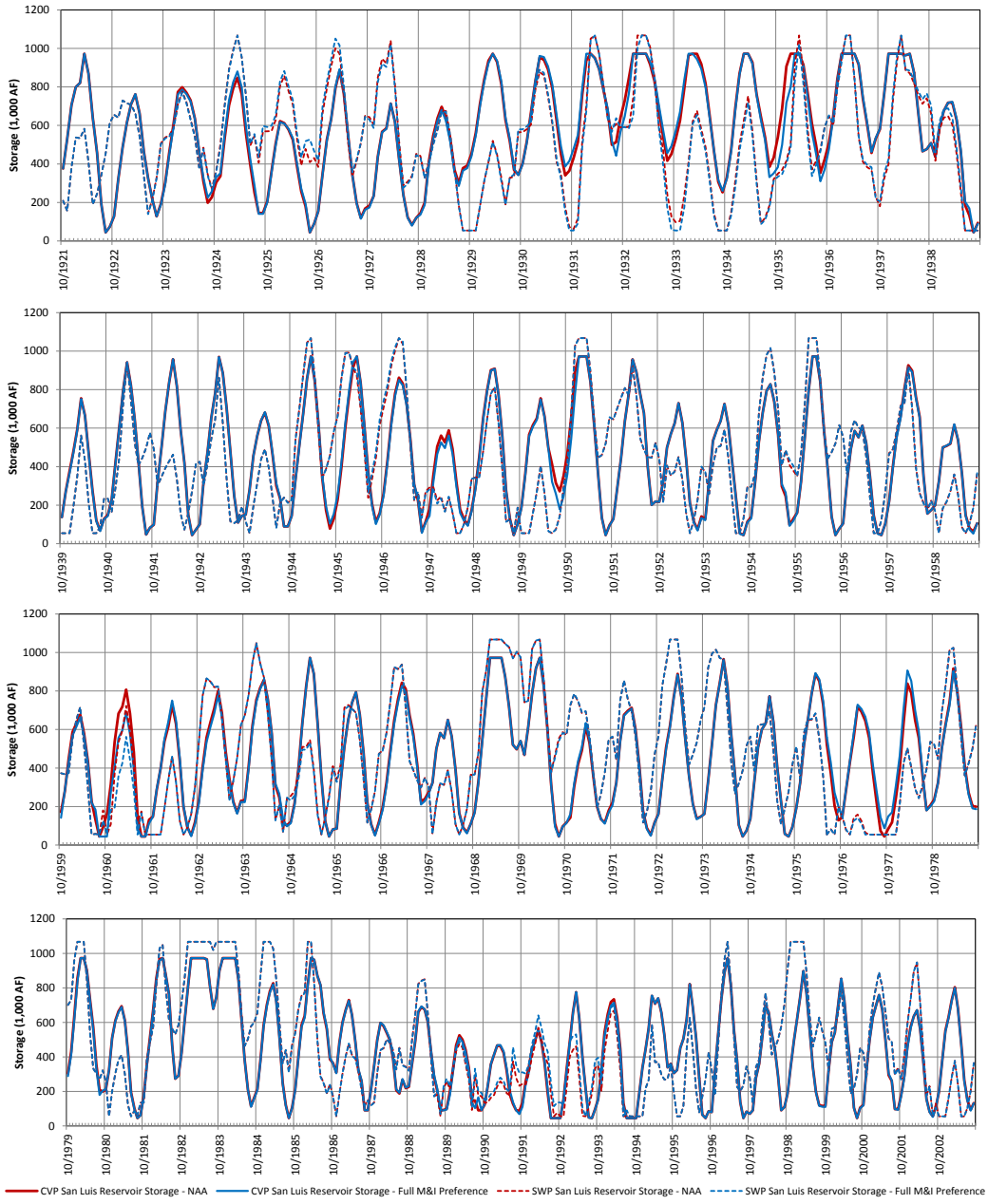

Figure 26. Comparison of San Luis Reservoir Storage for Alternative 3

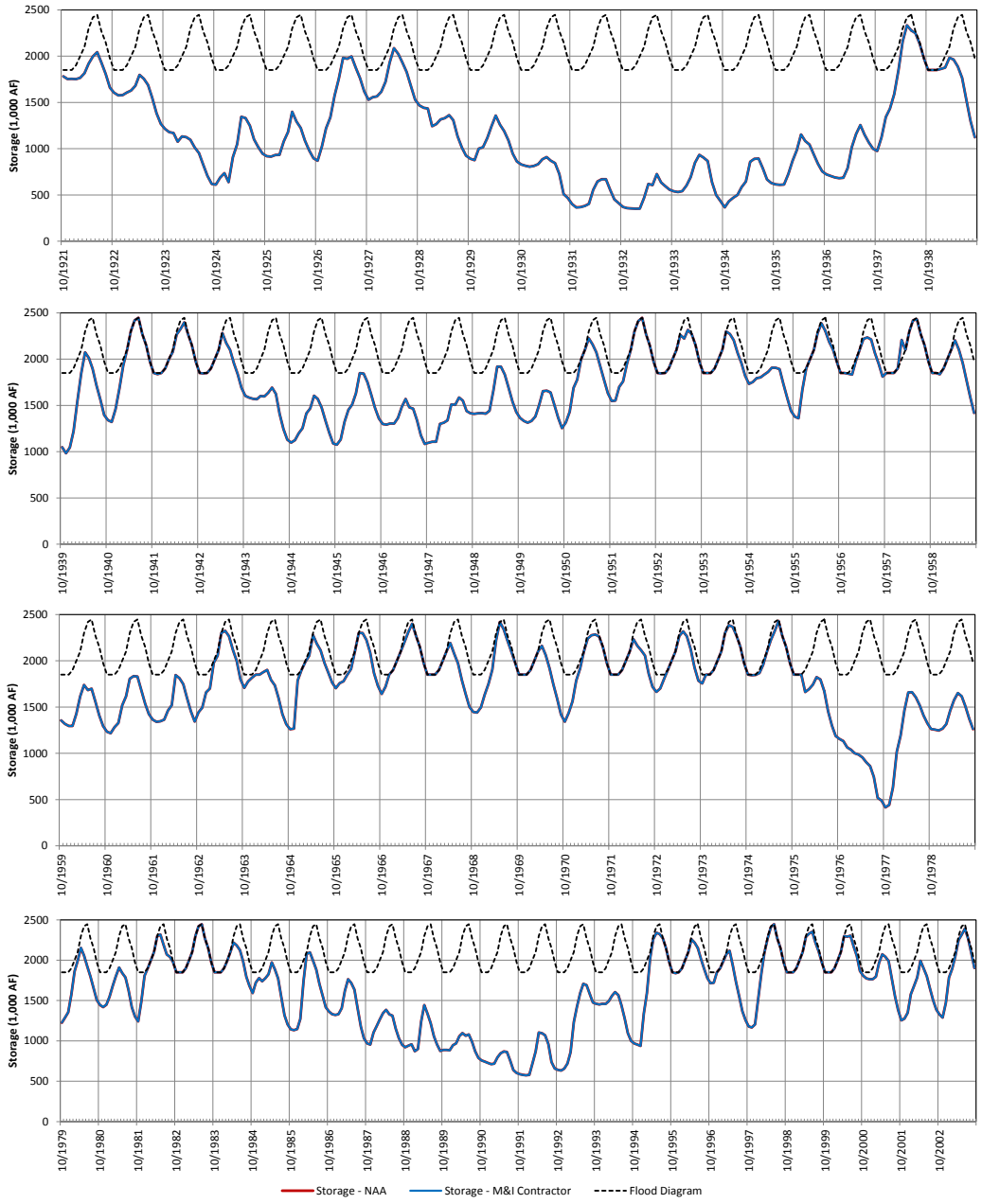

Figure 27. Comparison of Trinity Lake Storage for Alternative 5

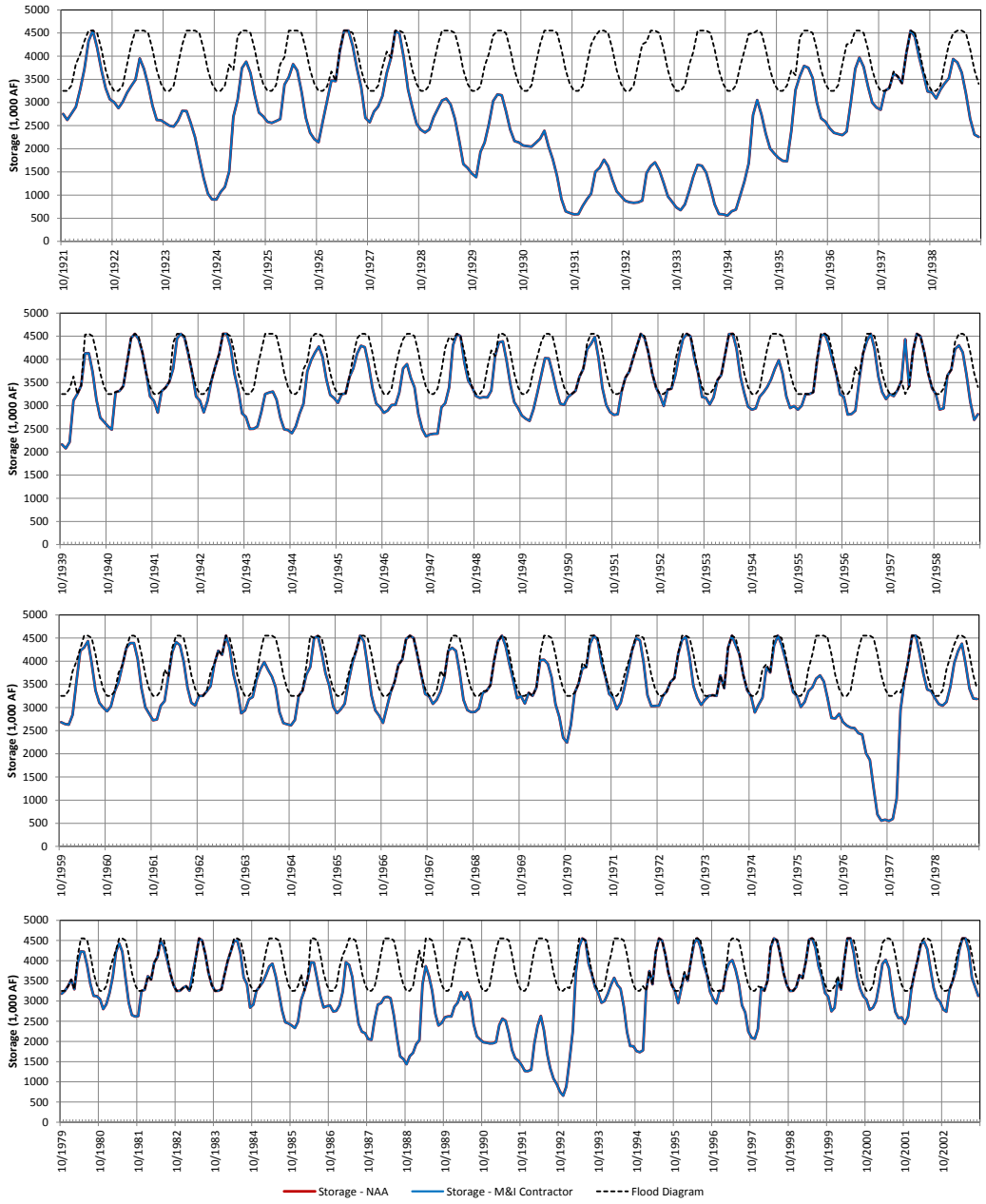

Figure 28. Comparison of Shasta Lake Storage for Alternative 5

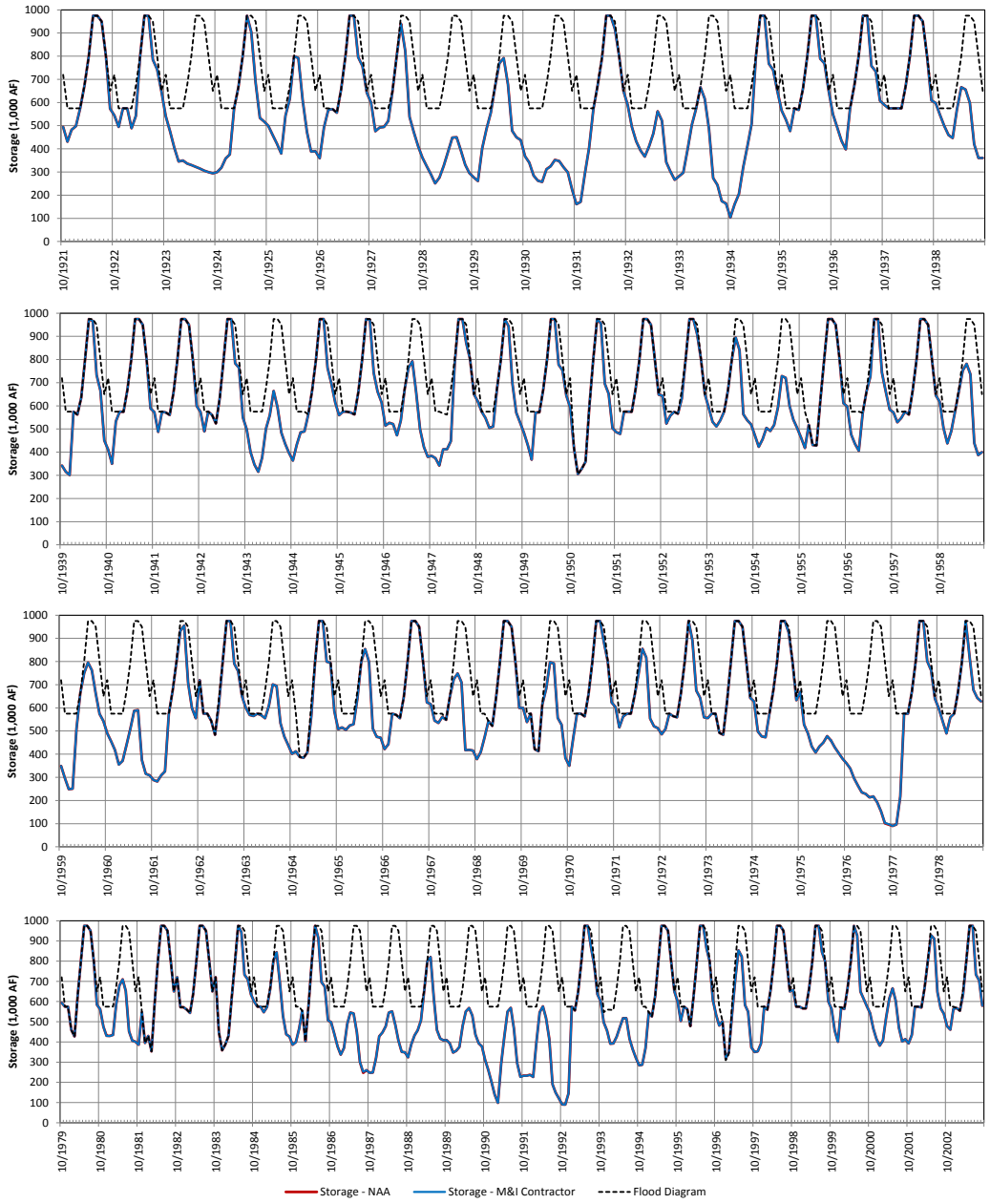

Figure 29. Comparison of Folsom Lake Storage for Alternative 5

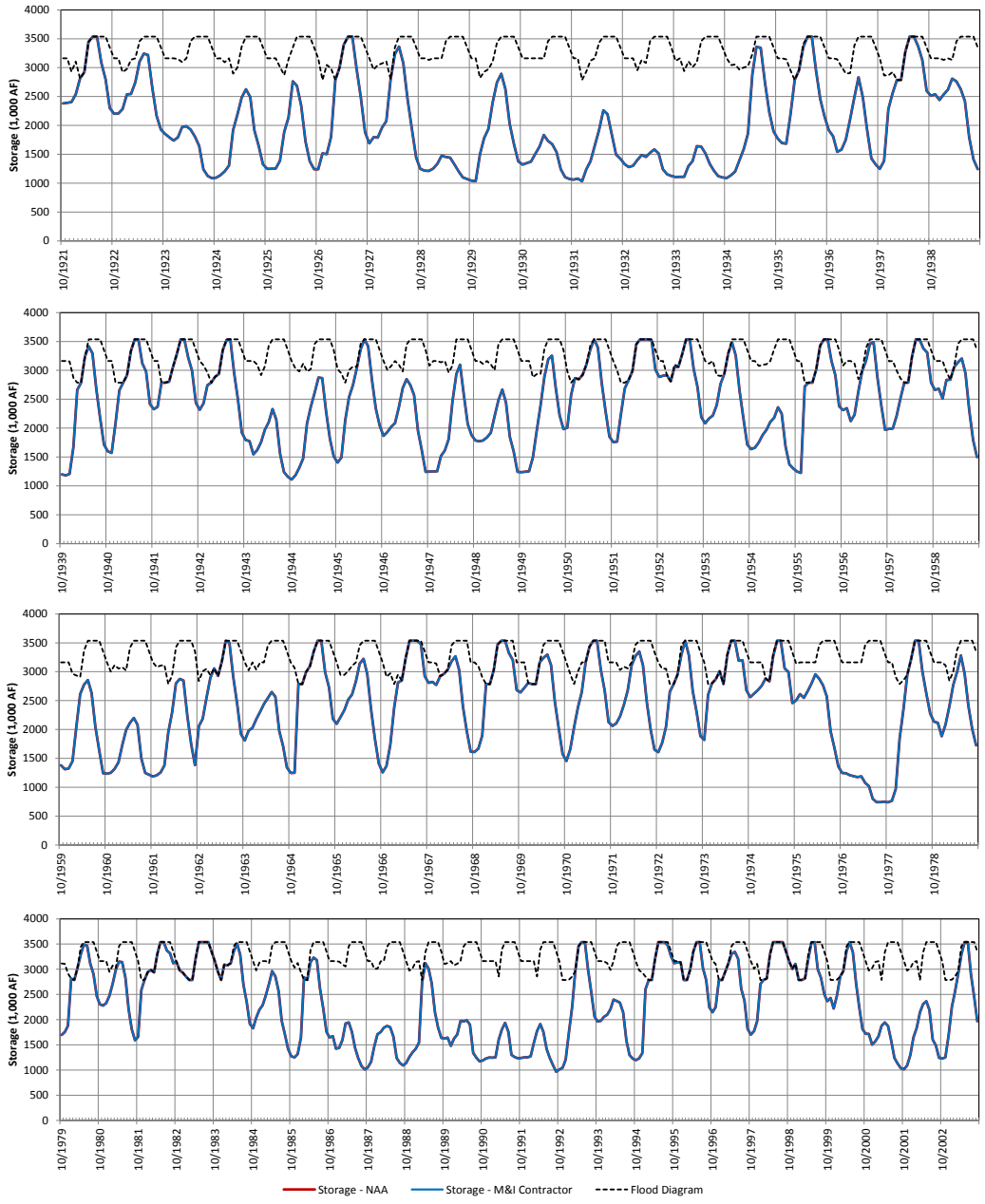

Figure 30. Comparison of Lake Oroville Storage for Alternative 5

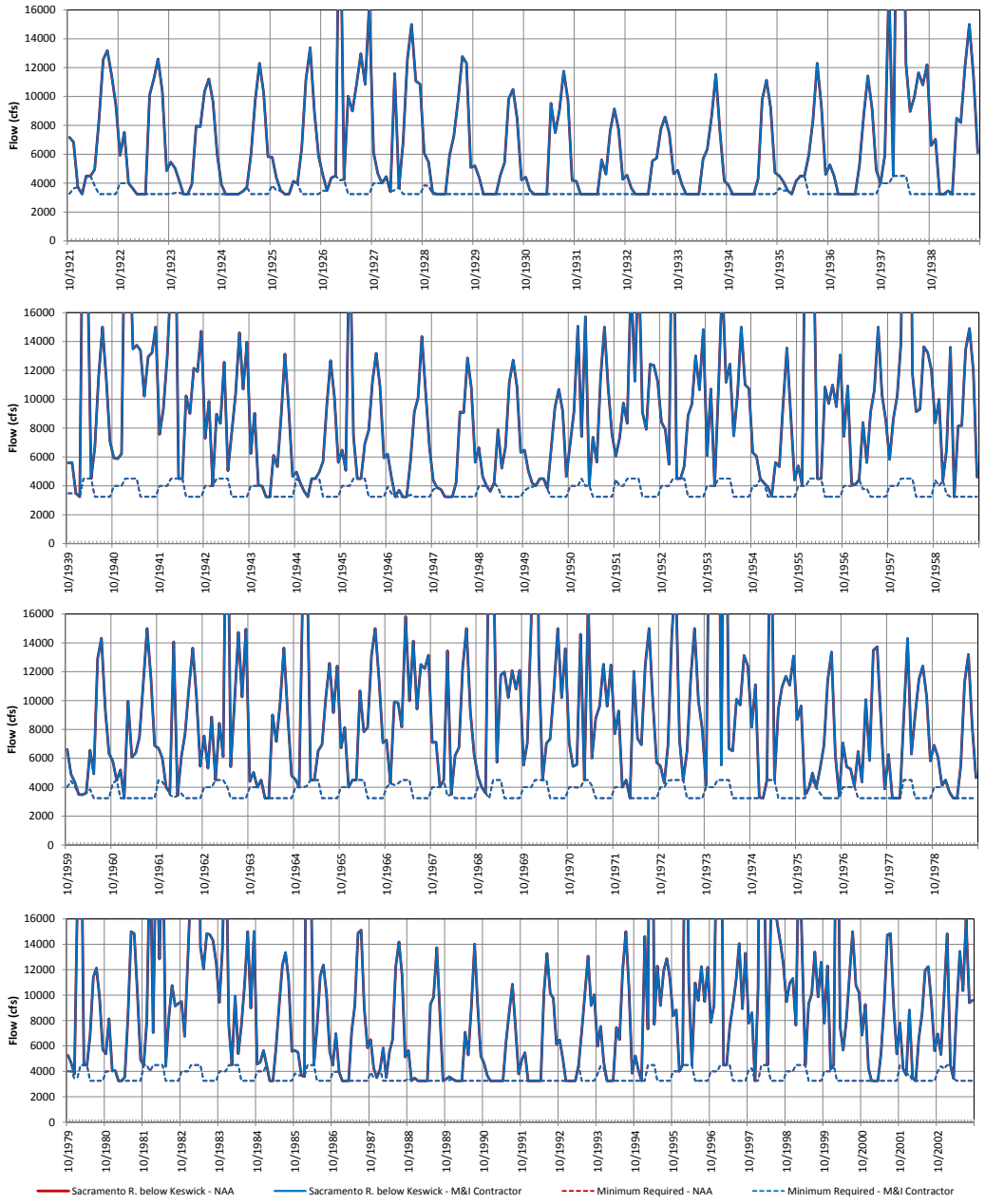

Figure 31. Comparison of Sacramento River below Keswick Flow for Alternative 5

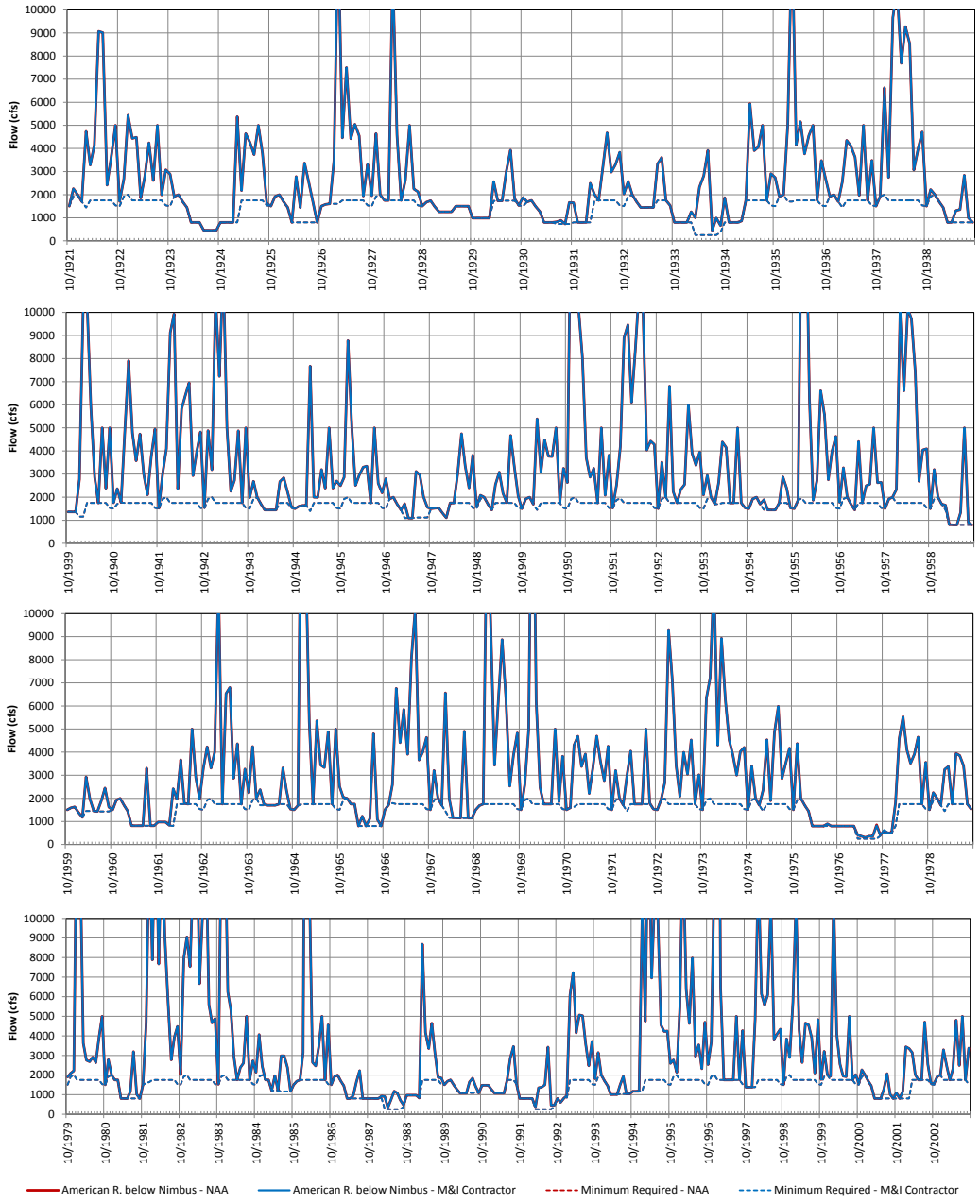

Figure 32. Comparison of American River below Nimbus Flow for Alternative 5

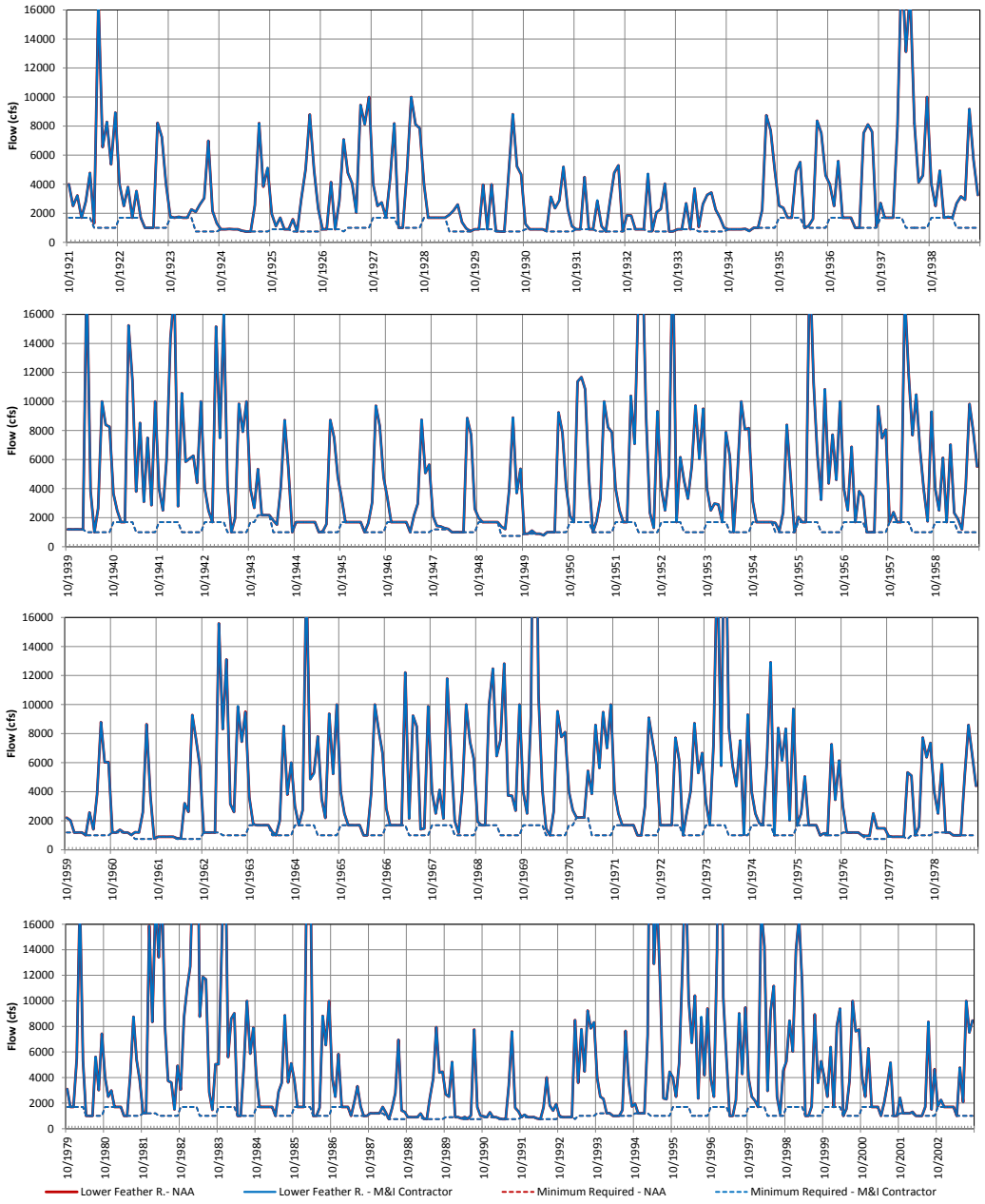

Figure 33. Comparison of Lower Feather River Flow for Alternative 5

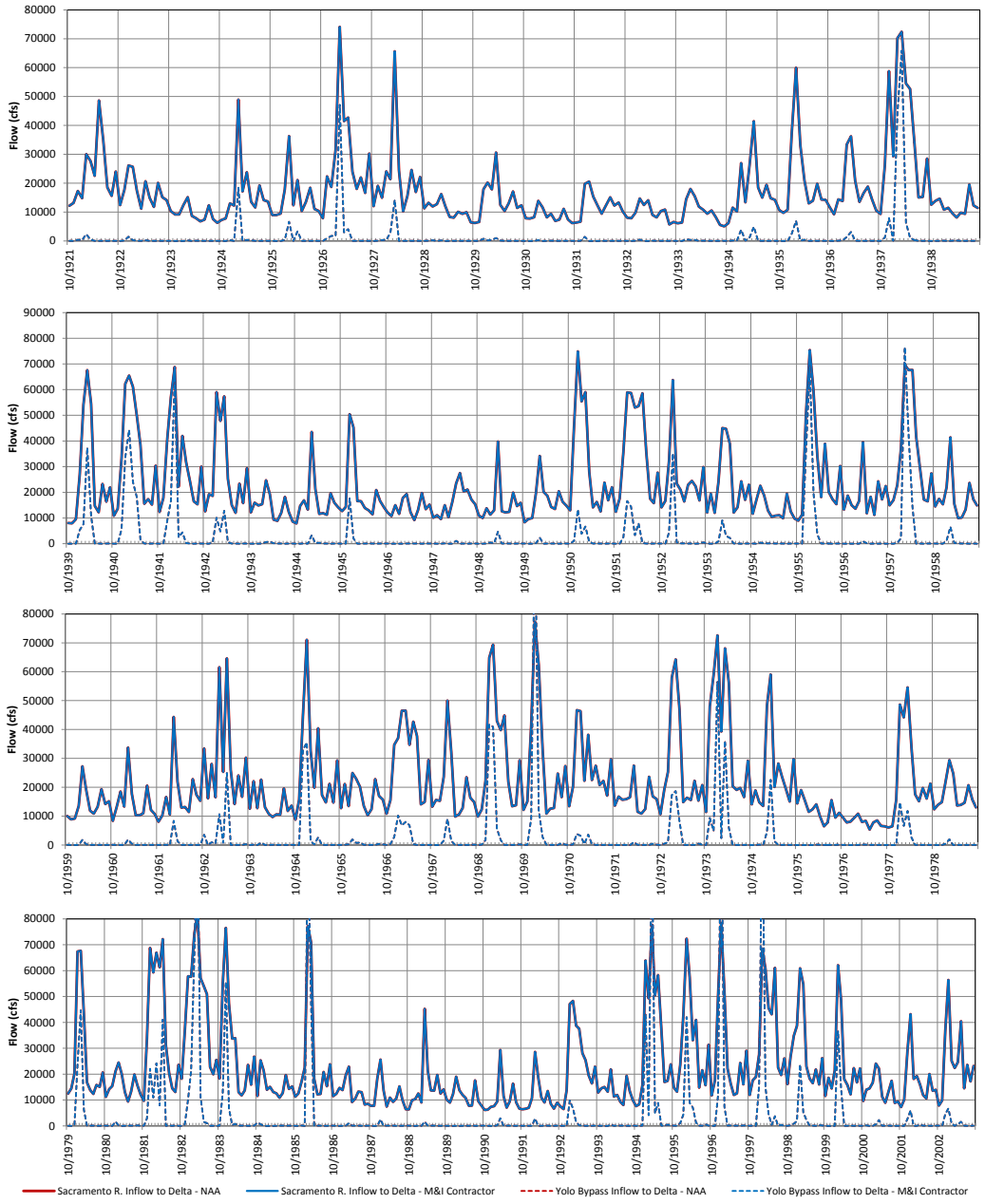

Figure 34. Comparison of Delta Inflow for Alternative 5

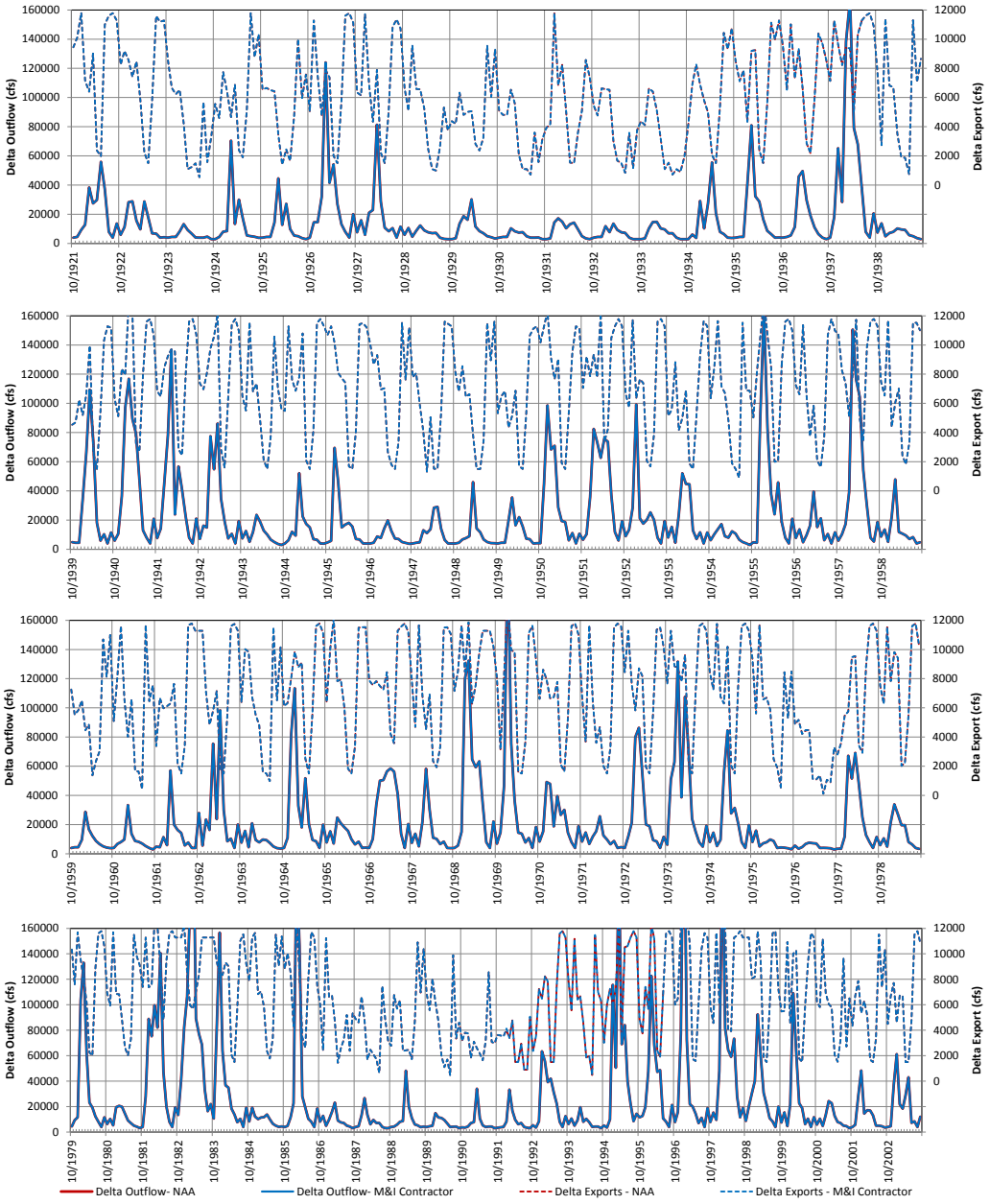

Figure 35. Comparison of Delta Outflow for Alternative 5

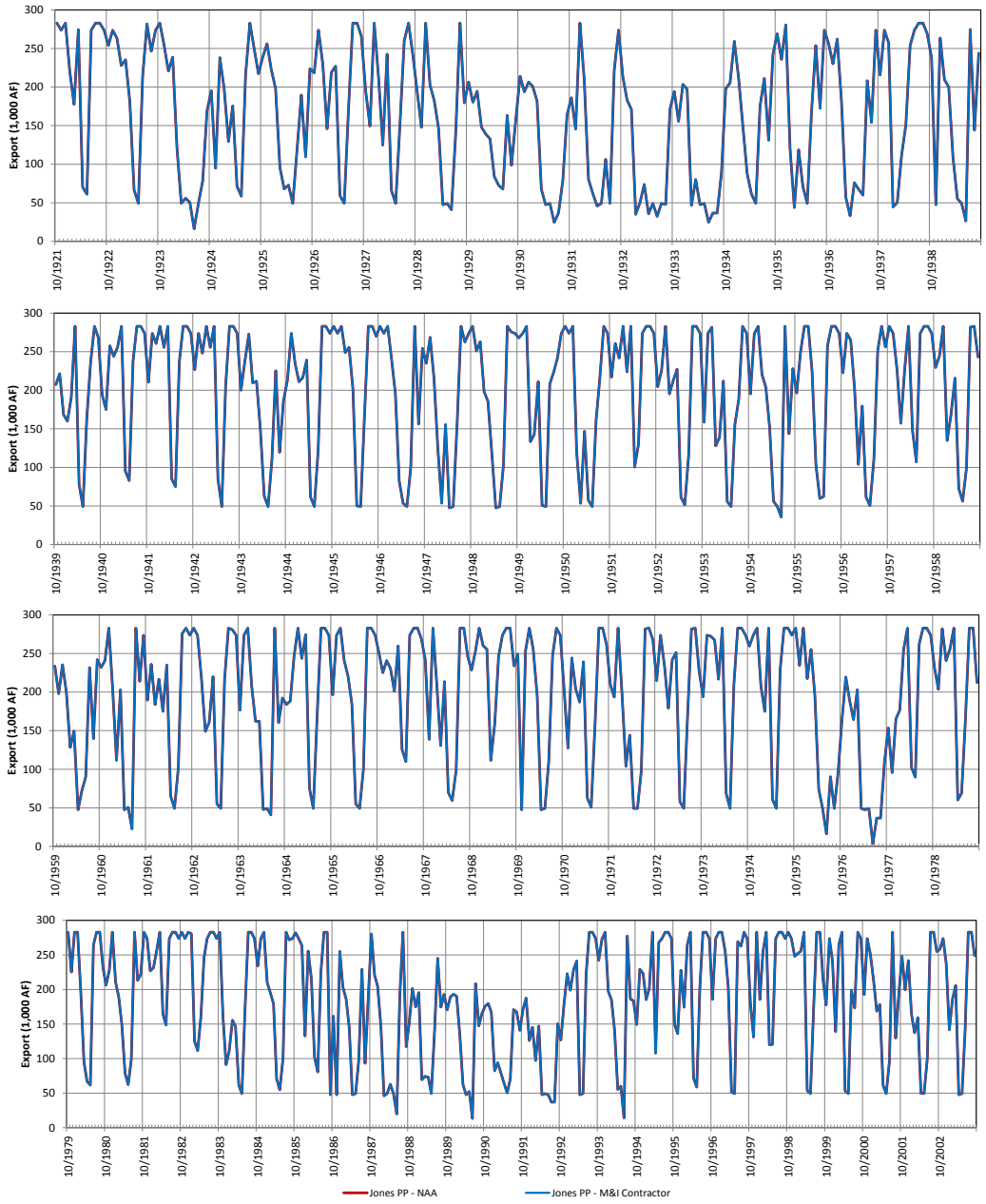

Figure 36. Comparison of Jones Pumping Plant for Alternative 5

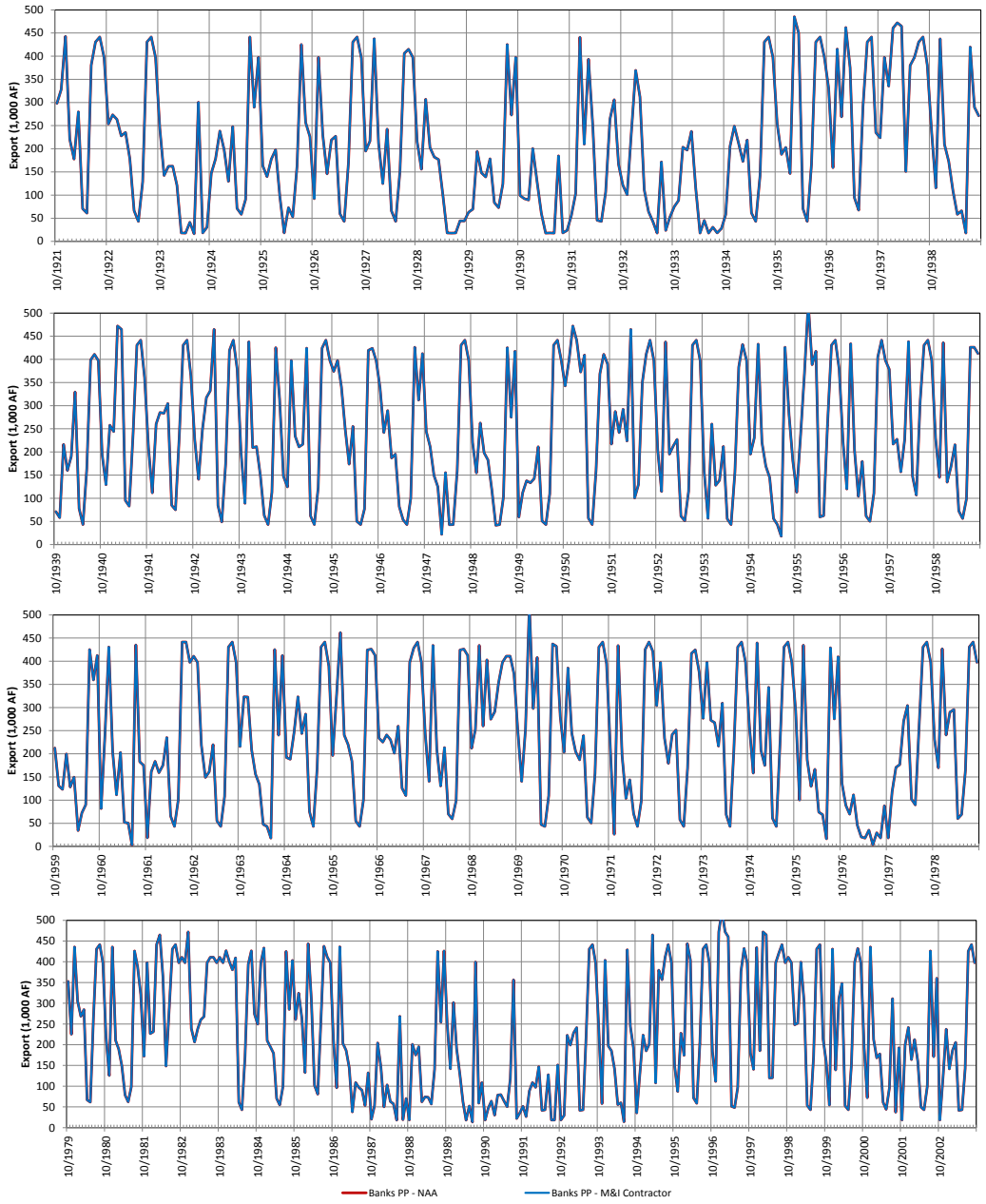

Figure 37. Comparison of Banks Pumping Plant for Alternative 5

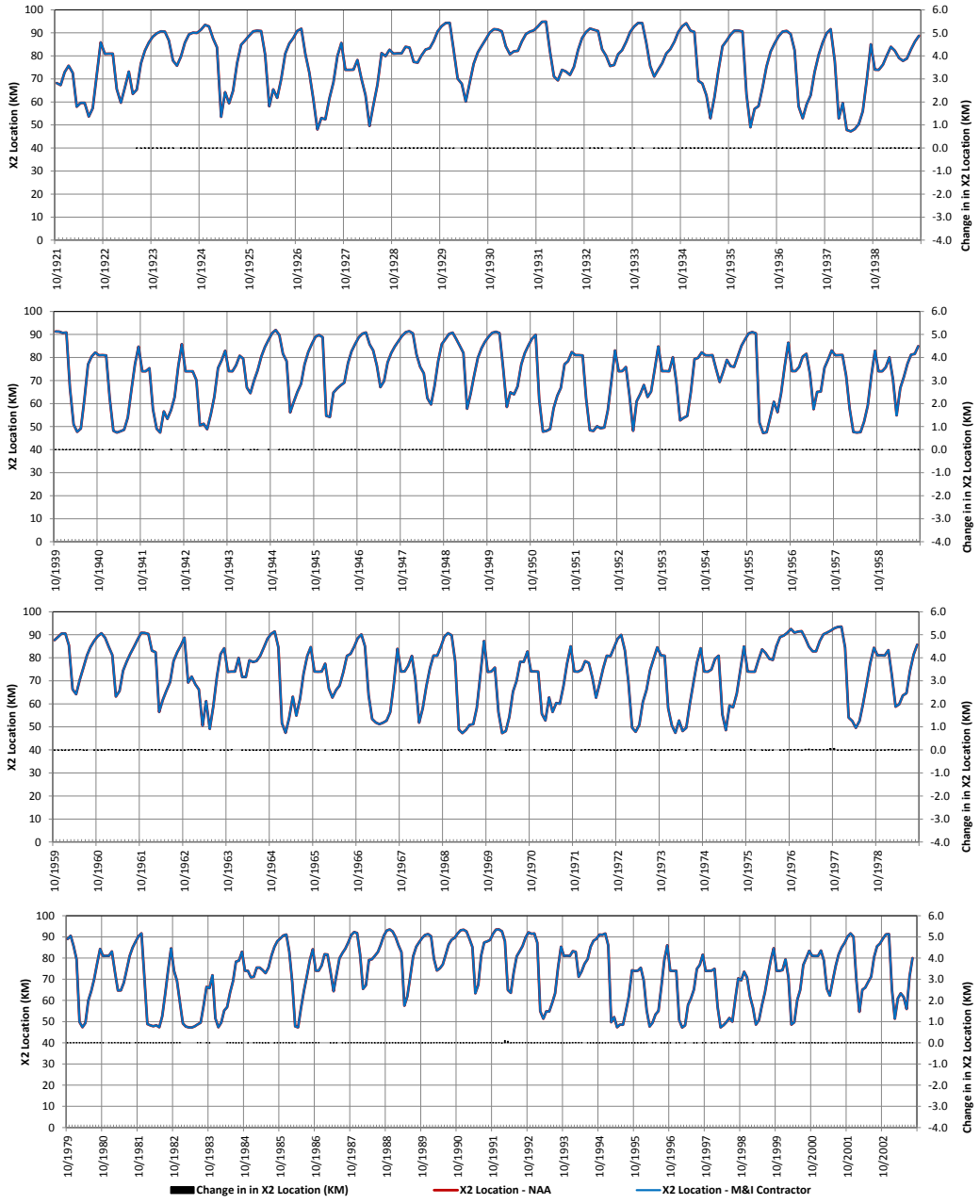

Figure 38. Comparison of X2 Location for Alternative 5

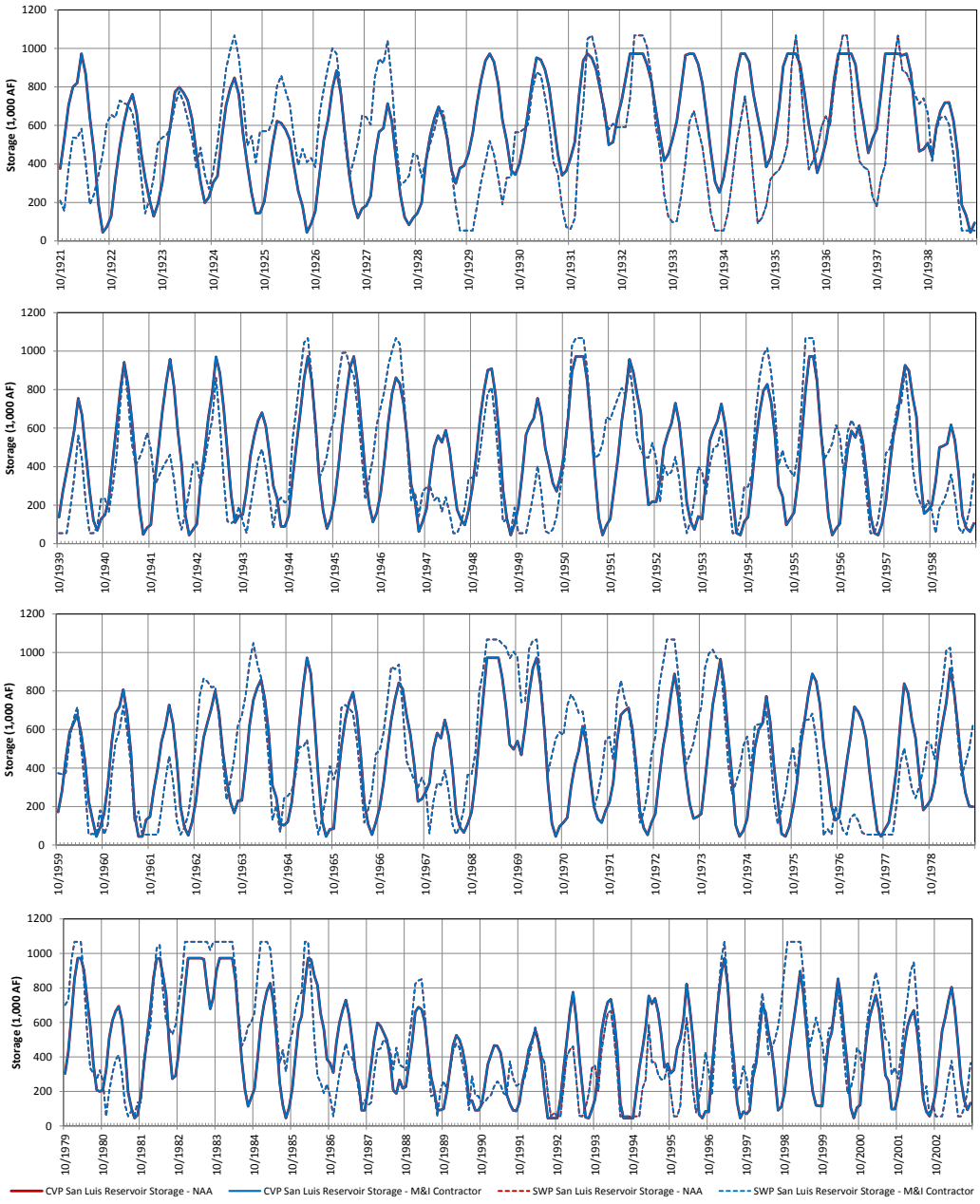

Figure 39. Comparison of San Luis Reservoir Storage for Alternative 5

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