

# Table of Contents

## Contents

<b>Executive Summary .....</b>	<b>ES-1</b>
ES.1    Introduction.....	ES-1
ES.2    Project Background.....	ES-1
ES.3    Document Overview .....	ES-3
ES.3.1.    Purpose of this RDEIR/SDEIS.....	ES-3
ES.3.2.    Intended Use of this RDEIR/SDEIS .....	ES-4
ES.4    Scoping and Public Involvement Process .....	ES-4
ES.5    Project Overview .....	ES-5
ES.6    CEQA Objectives and NEPA Purpose and Need .....	ES-6
ES.7    Project Alternatives.....	ES-7
ES.7.1.    No Project Alternative.....	ES-7
ES.7.2.    Action Alternatives .....	ES-7
ES.8    Project Impacts and Mitigation Measures.....	ES-13
ES.9    Areas of Known Controversy .....	ES-14
ES.10   Commenting on this RDEIR/SDEIS.....	ES-15
<b>Chapter 1          Introduction .....</b>	<b>1-1</b>
1.1      Sites Project Authority .....	1-1
1.2      Project Background.....	1-2
1.2.1.    CALFED Record of Decision .....	1-2
1.2.2.    Proposition 1 of 2014—Water Storage Investment Program.....	1-3
1.2.3.    Water Infrastructure Improvements for the Nation Act of 2016.....	1-3
1.2.4.    Governor’s Executive Order N-10-19 and the Water Resiliency Portfolio.....	1-4
1.2.5.    Value Planning Process.....	1-5
1.3      Scoping and Public Comments .....	1-5
1.3.1.    Scoping.....	1-5
1.3.2.    Comments Received on the 2017 Draft EIR/EIS .....	1-6
1.4      CEQA Objectives and NEPA Purpose and Need .....	1-6
1.5      Type and Intended Use of this RDEIR/SDEIS .....	1-7
1.5.1.    Type of Document.....	1-7
1.5.2.    Intended Use of this RDEIR/SDEIS .....	1-8
1.6      Level of Detail and Scope of this RDEIR/SDEIS.....	1-9
1.7      Areas of Known Controversy .....	1-9
1.8      Document Organization .....	1-10

1.9	References.....	1-11
1.9.1.	Printed References.....	1-11
<b>Chapter 2</b>	<b>Project Description and Alternatives.....</b>	<b>2-1</b>
2.1	Alternatives Development Process .....	2-1
2.1.1.	Evaluated Prior to 2019.....	2-1
2.1.2.	Value Planning Process and Alternatives Post-2019.....	2-2
2.2	CEQA and NEPA Requirements .....	2-3
2.2.1.	CEQA Requirements.....	2-3
2.2.2.	NEPA Requirements .....	2-4
2.3	Overview of Alternatives .....	2-4
2.4	No Project/No Action Alternative.....	2-7
2.5	Elements Common to Alternatives 1, 2, and 3.....	2-8
2.5.1.	Facilities .....	2-8
2.5.2.	Operations and Maintenance Common to Alternatives 1, 2, and 3.....	2-29
2.5.3.	Construction Considerations Common to Alternatives 1, 2, and 3 .....	2-45
2.5.4.	Project Commitments and Best Management Practices .....	2-54
2.5.5.	Proposition 1 Benefits Common to Alternatives 1, 2, and 3 .....	2-56
2.6	Alternative 1 Specific Elements.....	2-56
2.6.1.	Sites Reservoir and Related Facilities .....	2-57
2.6.2.	TRR East Facilities.....	2-58
2.6.3.	New and Existing Roadways.....	2-59
2.6.4.	Operations and Maintenance .....	2-60
2.7	Alternative 2 Specific Elements.....	2-60
2.7.1.	Sites Reservoir and Related Facilities .....	2-61
2.7.2.	TRR West Facilities .....	2-61
2.7.3.	Conveyance to Sacramento River .....	2-62
2.7.4.	New and Existing Roadways.....	2-63
2.7.5.	Operations and Maintenance .....	2-64
2.8	Alternative 3 Specific Elements.....	2-64
2.9	References.....	2-64
<b>Chapter 3</b>	<b>Environmental Analysis.....</b>	<b>3-1</b>
3.1	Introduction.....	3-1
3.2	Analysis.....	3-1
3.2.1.	Existing Conditions and No Project Alternative .....	3-1
3.2.2.	Regulations and Regulatory Setting .....	3-4
3.2.3.	Study Areas .....	3-4
3.2.4.	Methods.....	3-4
3.2.5.	Determination of Impacts.....	3-5
3.2.6.	Mitigation Measures.....	3-8

3.3	Additional Analyses.....	3-8
3.4	Other Required Analyses .....	3-9
3.5	References.....	3-9
3.5.1.	Printed References.....	3-9
<b>Chapter 4</b>	<b>Regulatory and Environmental Compliance: Project Permits, Approvals, and Consultation Requirements .....</b>	<b>4-1</b>
4.1	Introduction.....	4-1
<b>Chapter 5</b>	<b>Surface Water Resources.....</b>	<b>5-1</b>
5.1	Introduction.....	5-1
5.2	Environmental Setting .....	5-3
5.2.1.	River and Hydrologic Systems.....	5-3
5.2.2.	Water Supply and Service Areas.....	5-22
5.3	Hydrologic Modeling Methods.....	5-25
5.4	Hydrologic Modeling Results .....	5-27
5.4.1.	CALSIM.....	5-27
5.4.2.	CBD Hydraulic Modeling .....	5-46
5.5	Methods of Analysis .....	5-46
5.5.1.	Construction .....	5-46
5.5.2.	Operation.....	5-48
5.5.3.	Thresholds of Significance .....	5-48
5.6	Impact Analysis and Mitigation Measures.....	5-49
5.7	References.....	5-58
5.7.1.	Printed References.....	5-58
5.7.2.	Personal Communications.....	5-63
<b>Chapter 6</b>	<b>Surface Water Quality .....</b>	<b>6-1</b>
6.1	Introduction.....	6-1
6.2	Environmental Setting .....	6-4
6.2.1.	Overview of Surface Water Quality Objectives.....	6-4
6.2.2.	Constituents .....	6-5
6.3	Methods of Analysis .....	6-27
6.3.1.	Construction .....	6-29
6.3.2.	Operation.....	6-30
6.3.3.	Thresholds of Significance.....	6-47
6.4	Impact Analysis and Mitigation Measures.....	6-49
6.5	References.....	6-103
6.5.1.	Printed References.....	6-103
6.5.2.	Personal Communications.....	6-113
<b>Chapter 7</b>	<b>Fluvial Geomorphology .....</b>	<b>7-1</b>
7.1	Introduction.....	7-1

7.2	Environmental Setting .....	7-3
7.2.1.	Drainages in Proximity to Antelope Valley .....	7-3
7.2.2.	Other Valley Drainages .....	7-5
7.2.3.	Sacramento River .....	7-5
7.2.4.	Colusa Basin Drain.....	7-7
7.2.5.	Delta and Yolo Bypass .....	7-8
7.3	Methods of Analysis .....	7-8
7.3.1.	Construction .....	7-9
7.3.2.	Operation.....	7-9
7.3.3.	Thresholds of Significance .....	7-11
7.4	Impact Analysis and Mitigation Measures.....	7-11
7.5	References.....	7-27
7.5.1.	Printed References.....	7-27
<b>Chapter 8</b>	<b>Groundwater Resources .....</b>	<b>8-1</b>
8.1	Introduction.....	8-1
8.2	Environmental Setting .....	8-2
8.3	Methods of Analysis .....	8-4
8.3.1.	Construction .....	8-5
8.3.2.	Operation.....	8-5
8.3.3.	Thresholds of Significance.....	8-7
8.4	Impact Analysis and Mitigation Measures.....	8-7
8.5	References.....	8-22
8.5.1.	Printed References.....	8-22
<b>Chapter 9</b>	<b>Vegetation and Wetland Resources .....</b>	<b>9-1</b>
9.1	Introduction.....	9-1
9.2	Environmental Setting .....	9-6
9.3	Physical Setting.....	9-6
9.3.1.	Vegetation and Wetland Resource Types in the Study Area.....	9-8
9.3.2.	Sensitive Natural Communities.....	9-8
9.3.3.	Wetlands and Non-Wetland Waters .....	9-9
9.3.4.	Special-Status Plant Species.....	9-10
9.3.5.	Invasive Plant Species.....	9-12
9.4	Methods of Analysis .....	9-12
9.4.1.	Construction .....	9-13
9.4.2.	Operation.....	9-16
9.4.3.	Thresholds of Significance.....	9-17
9.5	Impact Analysis and Mitigation Measures.....	9-17
9.6	References.....	9-64
9.6.1.	Printed References.....	9-64

9.6.2.	Personal Communications .....	9-66
<b>Chapter 10</b>	<b>Wildlife Resources .....</b>	<b>10-1</b>
10.1	Introduction.....	10-1
10.2	Environmental Setting .....	10-7
10.2.1.	Methods for Assessing Wildlife Resources in the Study Area.....	10-7
10.2.2.	Land Cover Types and Associated Common Wildlife Species.....	10-8
10.2.3.	Special-Status Wildlife Species.....	10-15
10.3	Methods of Impact Analysis .....	10-29
10.3.1.	Construction .....	10-30
10.3.2.	Operation .....	10-33
10.3.3.	Thresholds of Significance .....	10-34
10.4	Impact Analysis and Mitigation Measures.....	10-34
10.5	References .....	10-147
10.5.1.	Printed References.....	10-147
10.5.2.	Personal Communications .....	10-156
<b>Chapter 11</b>	<b>Aquatic Biological Resources .....</b>	<b>11-1</b>
11.1	Introduction.....	11-1
11.2	Environmental Setting .....	11-8
11.2.1.	Fish and Aquatic Species of Management Concern.....	11-8
11.2.2.	Habitat Conditions and Environmental Stressors.....	11-10
11.1.1.	Delta and Suisun Bay/Marsh.....	11-10
11.2.3.	Sacramento River Flood Bypasses (Butte Basin, Sutter Bypass, and Yolo Bypass) .....	11-25
11.2.4.	Upstream of Delta .....	11-30
11.2.5.	San Pablo and San Francisco Bays.....	11-49
11.2.6.	Local Drainages.....	11-50
11.3	Methods of Analysis .....	11-53
11.3.1.	Construction .....	11-53
11.3.2.	Operations .....	11-56
11.3.3.	Maintenance .....	11-63
11.3.4.	Thresholds of Significance .....	11-64
11.4	Impact Analysis and Mitigation Measures.....	11-64
11.5	References.....	11-341
11.5.1.	Printed References.....	11-341
11.5.2.	Personal Communications .....	11-375
<b>Chapter 12</b>	<b>Geology and Soils .....</b>	<b>12-1</b>
12.1	Introduction.....	12-1
12.2	Environmental Setting .....	12-6
12.2.1.	Geology .....	12-6

12.2.2.	Seismicity .....	12-10
12.2.3.	Soils .....	12-16
12.2.4.	Paleontological Resources.....	12-17
12.3	Methods of Analysis .....	12-21
12.3.1.	Thresholds of Significance.....	12-24
12.4	Impact Analysis and Mitigation Measures.....	12-25
12.5	References.....	12-66
12.5.1.	Printed References.....	12-66
12.5.2.	Personal Communications.....	12-68
<b>Chapter 13</b>	<b>Minerals.....</b>	<b>13-1</b>
13.1	Introduction.....	13-1
13.2	Environmental Setting .....	13-2
13.3	Methods of Analysis .....	13-3
13.3.1.	Construction .....	13-3
13.3.2.	Operation.....	13-4
13.3.3.	Thresholds of Significance.....	13-4
13.4	Impact Analysis and Mitigation Measures.....	13-4
13.5	References.....	13-10
13.5.1.	Printed References.....	13-10
<b>Chapter 14</b>	<b>Land Use.....</b>	<b>14-1</b>
14.1	Introduction.....	14-1
14.2	Environmental Setting .....	14-2
14.2.1.	Glenn County .....	14-2
14.2.2.	Colusa County.....	14-3
14.2.3.	Yolo County .....	14-6
14.3	Methods of Analysis .....	14-6
14.3.1.	Thresholds of Significance.....	14-7
14.4	Impact Analysis and Mitigation Measures.....	14-8
14.5	References.....	14-17
14.5.1.	Printed References.....	14-17
<b>Chapter 15</b>	<b>Agriculture and Forestry Resources.....</b>	<b>15-1</b>
15.1	Introduction.....	15-1
15.2	Environmental Setting .....	15-5
15.2.1.	Glenn County .....	15-5
15.2.2.	Colusa County.....	15-7
15.2.3.	Yolo County .....	15-9
15.3	Methods of Analysis .....	15-10
15.3.1.	Thresholds of Significance.....	15-13
15.4	Impact Analysis and Mitigation Measures.....	15-14

15.5	References.....	15-36
15.5.1.	Printed References.....	15-36
15.5.2.	Personal Communications.....	15-39
<b>Chapter 16</b>	<b>Recreation Resources.....</b>	<b>16-1</b>
16.1	Introduction.....	16-1
16.2	Environmental Setting.....	16-3
16.2.1.	Project Setting.....	16-3
16.2.2.	Regional Setting.....	16-3
16.3	Methods of Analysis.....	16-8
16.3.1.	Construction.....	16-8
16.3.2.	Operation.....	16-8
16.3.3.	Thresholds of Significance.....	16-8
16.3.4.	Impact Analysis and Mitigation Measures.....	16-9
16.4	References.....	16-18
16.4.1.	Printed References.....	16-18
<b>Chapter 17</b>	<b>Energy.....</b>	<b>17-1</b>
17.1	Introduction.....	17-1
17.2	Environmental Setting.....	17-3
17.2.1.	Electricity.....	17-3
17.2.2.	Petroleum Products.....	17-9
17.3	Methods of Analysis.....	17-10
17.3.1.	Construction.....	17-10
17.3.2.	Operations.....	17-11
17.3.3.	Thresholds of Significance.....	17-13
17.4	Modeling Results.....	17-13
17.4.1.	Electricity.....	17-14
17.4.2.	Petroleum Products.....	17-25
17.5	Impact Analysis and Mitigation Measures.....	17-26
17.6	References.....	17-46
17.6.1.	Printed References.....	17-46
17.6.2.	Personal Communications.....	17-47
<b>Chapter 18</b>	<b>Navigation, Transportation, and Traffic.....</b>	<b>18-1</b>
18.1	Introduction.....	18-1
18.2	Environmental Setting.....	18-4
18.2.1.	Project Access Roads.....	18-4
18.2.2.	Roadway Classification and Roadway Capacity.....	18-10
18.2.3.	Regional Study Area.....	18-13
18.2.4.	Modes of Transportation Other Than Private Vehicles.....	18-14
18.2.5.	Navigation.....	18-17

18.3	Methods of Analysis .....	18-17
18.3.2.	Other Modes of Transportation .....	18-23
18.3.3.	Geometric Design Hazards and Emergency Access .....	18-23
18.3.4.	Navigation .....	18-24
18.3.5.	Transportation Topics Eliminated from Further Analysis.....	18-24
18.3.6.	Thresholds of Significance .....	18-25
18.4	Impact Analysis and Mitigation Measures.....	18-26
18.5	References.....	18-52
18.5.1.	Printed References.....	18-52
18.5.2.	Personal Communications.....	18-54
<b>Chapter 19</b>	<b>Noise.....</b>	<b>19-1</b>
19.1	Introduction.....	19-1
19.2	Environmental Setting .....	19-2
19.2.1.	Fundamental Concepts of Noise and Vibration.....	19-2
19.2.2.	Noise Sources in the Study Area.....	19-3
19.2.3.	Surrounding Sensitive Land Uses .....	19-4
19.3	Methods of Analysis .....	19-4
19.3.1.	Sensitive Receptors .....	19-4
19.3.2.	Construction Noise and Vibration.....	19-6
19.3.3.	Operational Noise.....	19-10
19.3.4.	Thresholds of Significance .....	19-10
19.4	Impact Analysis and Mitigation Measures.....	19-12
19.5	References.....	19-25
19.5.1.	Printed References.....	19-25
<b>Chapter 20</b>	<b>Air Quality .....</b>	<b>20-1</b>
20.1	Introduction.....	20-1
20.2	Environmental Setting .....	20-4
20.2.1.	Criteria Pollutants.....	20-4
20.2.2.	Toxic Air Contaminants .....	20-8
20.2.3.	Valley Fever .....	20-9
20.2.4.	Regional Climate and Meteorology .....	20-9
20.2.5.	Existing Air Quality Conditions.....	20-10
20.2.6.	Sensitive Receptors .....	20-15
20.3	Methods of Analysis .....	20-17
20.3.1.	Construction .....	20-17
20.3.2.	Operation .....	20-19
20.3.3.	CEQA Thresholds of Significance .....	20-21
20.4	Impact Analysis and Mitigation Measures.....	20-25
20.5	References.....	20-63



20.5.1.	Printed References.....	20-63
20.5.2.	Personal Communications.....	20-66
<b>Chapter 21</b>	<b>Greenhouse Gas Emissions.....</b>	<b>21-1</b>
21.1	Introduction.....	21-1
21.2	Environmental Setting .....	21-2
21.2.1.	Global Climate Change .....	21-2
21.3	Methods of Analysis .....	21-5
21.3.1.	Construction .....	21-5
21.3.2.	Operations .....	21-7
21.3.3.	Thresholds of Significance.....	21-9
21.4	Impact Analysis and Mitigation Measures.....	21-11
21.5	References.....	21-31
21.5.1.	Printed References.....	21-31
<b>Chapter 22</b>	<b>Cultural Resources.....</b>	<b>22-1</b>
22.1	Introduction.....	22-1
22.2	Environmental Setting .....	22-3
22.2.1.	Cultural Resources Study Area .....	22-4
22.2.2.	Cultural Resources Background.....	22-4
22.2.3.	Methods for Identifying Cultural Resources .....	22-13
22.2.4.	Summary of Archaeological Resources in the Study Area .....	22-14
22.2.5.	Summary of Historic Built Resources in the Study Area.....	22-17
22.3	Methods of Analysis .....	22-21
22.3.1.	Thresholds of Significance.....	22-21
22.3.2.	Resources Occurrence by Project Components.....	22-22
22.4	Impact Analysis and Mitigation Measures.....	22-26
22.5	References.....	22-43
22.5.1.	Printed References.....	22-43
<b>Chapter 23</b>	<b>Tribal Cultural Resources .....</b>	<b>23-1</b>
23.1	Introduction.....	23-1
23.2	Environmental Setting .....	23-6
23.2.1.	Yocha Dehe Wintun Nation .....	23-7
23.2.2.	Cachil Dehe Band of Wintun Indians (Colusa Indian Community).....	23-8
23.3	Methods of Analysis .....	23-9
23.3.1.	Construction and Operation.....	23-12
23.3.2.	Thresholds of Significance.....	23-12
23.4	Impact Analysis and Mitigation Measures.....	23-13
23.5	References.....	23-19
23.5.1.	Printed References.....	23-19
<b>Chapter 24</b>	<b>Visual Resources.....</b>	<b>24-1</b>

24.1	Introduction.....	24-1
24.2	Environmental Setting .....	24-4
24.2.1.	Regional Landscape .....	24-4
24.2.2.	Project Landscape .....	24-5
24.3	Methods of Analysis .....	24-8
24.3.1.	Construction .....	24-9
24.3.2.	Operation.....	24-9
24.3.3.	Thresholds of Significance.....	24-9
24.4	Impact Analysis and Mitigation Measures.....	24-10
24.5	References.....	24-26
24.5.1.	Printed References.....	24-26
<b>Chapter 25</b>	<b>Population and Housing.....</b>	<b>25-1</b>
25.1	Introduction.....	25-1
25.2	Environmental Setting .....	25-2
25.3	Methods of Analysis .....	25-3
25.3.1.	Thresholds of Significance.....	25-3
25.4	Impact Analysis and Mitigation Measures.....	25-4
25.5	References.....	25-7
25.5.1.	Printed References.....	25-7
<b>Chapter 26</b>	<b>Public Services and Utilities .....</b>	<b>26-1</b>
26.1	Introduction.....	26-1
26.2	Environmental Setting .....	26-4
26.2.1.	Public Services .....	26-4
26.2.2.	Utilities.....	26-6
26.3	Methods of Analysis .....	26-13
26.3.1.	Construction .....	26-13
26.3.2.	Operation.....	26-16
26.3.3.	Thresholds of Significance.....	26-17
26.4	Impact Analysis and Mitigation Measures.....	26-18
26.5	References.....	26-37
26.5.1.	Printed References.....	26-37
26.5.2.	Personal Communications.....	26-40
<b>Chapter 27</b>	<b>Public Health and Environmental Hazards.....</b>	<b>27-1</b>
27.1	Introduction.....	27-1
27.2	Environmental Setting .....	27-5
27.2.1.	Hazards and Hazardous Materials.....	27-5
27.2.2.	Wildfire Hazards .....	27-9
27.2.3.	Public Health Hazards Related to Methylmercury and HABs .....	27-11
27.2.4.	Mosquitos and Vectors.....	27-14

27.3	Methods of Analysis .....	27-15
27.3.1.	Hazards and Hazardous Materials .....	27-15
27.3.2.	Wildfire Hazards .....	27-17
27.3.3.	Bioaccumulation of Methylmercury in Fish.....	27-18
27.3.4.	Harmful Algal Blooms .....	27-18
27.3.5.	Mosquitos and Vectors.....	27-18
27.3.6.	Thresholds of Significance .....	27-18
27.4	Impact Analysis and Mitigation Measures.....	27-20
27.5	References.....	27-48
27.5.1.	Printed References.....	27-48
<b>Chapter 28</b>	<b>Climate Change .....</b>	<b>28-1</b>
28.1	Introduction.....	28-1
28.2	Affected Environment.....	28-2
28.2.1.	Climate .....	28-2
28.2.2.	Global Climate Trends .....	28-3
28.2.3.	Climate Change Effects on California.....	28-4
28.2.4.	Water Management and Climate .....	28-5
28.3	Methods of Analysis .....	28-7
28.3.1.	Indicators.....	28-9
28.4	Surface Water Resources, the Project, and Climate Change.....	28-10
28.4.1.	Modeling Results.....	28-11
28.5	Potential Project-Related Climate Change Effects .....	28-25
28.5.1.	Surface Water Resources and Fluvial Geomorphology .....	28-25
28.5.2.	Surface Water Quality .....	28-26
28.5.3.	Groundwater Resources .....	28-28
28.5.4.	Wildlife and Vegetation Resources .....	28-28
28.5.5.	Aquatic Biological Resources .....	28-29
28.5.6.	Public Health, Environmental Hazards, Environmental Justice, and Socioeconomics.....	28-31
28.5.7.	Energy, Air Quality, and Greenhouse Gas Emissions.....	28-32
28.5.8.	Other.....	28-33
28.6	References.....	28-35
28.6.1.	Printed References.....	28-35
<b>Chapter 29</b>	<b>Indian Trust Assets .....</b>	<b>29-1</b>
29.1	Introduction.....	29-1
29.2	Affected Environment.....	29-2
29.3	Methods of Analysis .....	29-2
29.3.1.	Construction .....	29-2
29.3.2.	Operations .....	29-3

29.3.3.	Evaluation Criteria .....	29-3
29.4	Environmental Consequences .....	29-3
29.5	References .....	29-5
29.5.1.	Printed References .....	29-5
<b>Chapter 30</b>	<b>Environmental Justice and Socioeconomics .....</b>	<b>30-1</b>
30.1	Introduction .....	30-1
30.2	Affected Environment .....	30-6
30.2.1.	Minority Populations .....	30-7
30.2.2.	Income and Poverty .....	30-7
30.2.3.	Population and Demographics .....	30-8
30.2.4.	Employment .....	30-8
30.2.5.	Property Taxes and County Revenue .....	30-9
30.2.6.	Agriculture .....	30-9
30.2.7.	Municipal and Industrial Water Use .....	30-10
30.3	Methods of Analysis .....	30-11
30.3.1.	Environmental Justice .....	30-11
30.3.2.	Socioeconomics .....	30-14
30.3.3.	Evaluation Criteria .....	30-19
30.4	Environmental Consequences .....	30-19
30.5	References .....	30-28
30.5.1.	Printed References .....	30-28
<b>Chapter 31</b>	<b>Cumulative Impacts .....</b>	<b>31-1</b>
31.1	Regulatory Requirements for Analysis .....	31-1
31.2	Cumulative Project Selection and Approach .....	31-1
31.3	Cumulative Impacts Analysis by Resource .....	31-18
31.3.1.	Surface Water Resources and Water Quality .....	31-18
31.3.2.	Fluvial Geomorphology .....	31-25
31.3.3.	Groundwater Resources .....	31-27
31.3.4.	Vegetation and Wetland Resources .....	31-28
31.3.5.	Wildlife Resources .....	31-31
31.3.6.	Aquatic Biological Resources .....	31-34
31.3.7.	Geology and Soils .....	31-43
31.3.8.	Minerals .....	31-44
31.3.9.	Land Use .....	31-45
31.3.10.	Agriculture and Forestry Resources .....	31-46
31.3.11.	Recreation Resources .....	31-49
31.3.12.	Energy .....	31-50
31.3.13.	Navigation, Transportation, and Traffic .....	31-55
31.3.14.	Noise .....	31-57

31.3.15.	Air Quality.....	31-58
31.3.16.	Greenhouse Gas Emissions .....	31-64
31.3.17.	Cultural Resources .....	31-65
31.3.18.	Tribal Cultural Resources.....	31-67
31.3.19.	Visual Resources .....	31-68
31.3.20.	Population and Housing .....	31-70
31.3.21.	Public Services and Utilities.....	31-71
31.3.22.	Public Health and Environmental Hazards.....	31-73
31.3.23.	Indian Trust Assets .....	31-76
31.3.24.	Environmental Justice and Socioeconomics .....	31-77
31.4	References.....	31-78
31.4.1.	Printed References.....	31-78
31.4.2.	Personal Communications.....	31-85
<b>Chapter 32</b>	<b>Other Required Analyses.....</b>	<b>32-1</b>
32.1	Introduction.....	32-1
32.2	Growth-Inducing Impacts .....	32-1
32.2.1.	Introduction .....	32-1
32.2.2.	Construction .....	32-1
32.2.3.	Operation and Maintenance.....	32-2
32.2.4.	Operation and Water Supply .....	32-3
32.3	Relationship Between Short-Term Uses and Long-Term Productivity .....	32-11
32.4	Irreversible or Irrecoverable Resource Commitments.....	32-12
32.4.1.	Introduction .....	32-12
32.4.2.	Commitments of Resources.....	32-13
32.4.3.	Potential Environmental Accidents .....	32-14
32.4.4.	Commitment of Future Generations to Similar Uses .....	32-14
32.5	Environmentally Superior/Environmentally Preferable Alternative.....	32-15
32.6	References.....	32-22
32.6.1.	Printed References.....	32-22
<b>Chapter 33</b>	<b>Consultation and Coordination and List of Preparers .....</b>	<b>33-1</b>
33.1	Consultation and Coordination .....	33-1
33.1.1.	Consultation .....	33-1
33.1.2.	Coordination.....	33-1
33.1.3.	Revised DEIR/Supplemental DEIS and Project Approval Process.....	33-6
33.2	List of Preparers and Contributors .....	33-7
33.2.1.	Introduction .....	33-7
33.2.2.	Contributors to the Revised DEIR/Supplemental DEIS.....	33-7
<b>Chapter 34</b>	<b>Revised Draft EIR/Supplemental Draft EIS Document Distribution.....</b>	<b>34-1</b>

**Appendix 1**

Appendix 1A, Introduction to Appendices and Models

**Appendix 2**

Appendix 2A, Alternatives Screening and Evaluation

Appendix 2B, Additional Alternatives Screening and Evaluation

Appendix 2C, Construction Means, Methods, and Assumptions

Appendix 2D, Best Management Practices, Management Plans, and Technical Studies

**Appendix 4**

Appendix 4A, Regulatory Requirements

**Appendix 5**

Appendix 5A, Surface Water Resources Modeling of Alternatives

Appendix 5A1, Model Assumptions

Appendix 5A2, CALSIM II Model Assumptions Callouts

Appendix 5A3, DSM2 Model Assumptions Callouts

Appendix 5A4, HEC5Q and Reclamation Temperature Model Assumptions Callouts

Appendix 5A5, CALSIM II Model Delivery Specifications

Appendix 5A6, Model Limitations and Improvements

Appendix 5A7, Daily Pattern Development for the Estimation of Daily Flows and Weir Spills in CALSIM II

Appendix 5B, Water Resources System Modeling

Appendix 5B1, Project Operations

Appendix 5B2, River Operations

Appendix 5B3, Delta Operations

Appendix 5B4, Regional Deliveries

Appendix 5B5, Water Supply

Appendix 5C, Upper Sacramento River Daily River Flow and Operations Model

**Appendix 6**

Appendix 6A, California State Water Resources Control Board Constituents of Concern

Appendix 6B1, Sacramento-San Joaquin Delta Modeling, Salinity Results

Appendix 6B2, Sacramento-San Joaquin Delta Modeling, Chloride Results

Appendix 6B3, Sacramento-San Joaquin Delta Modeling, X2 Results

Appendix 6C, River Temperature Modeling

Appendix 6D, Sites Reservoir Discharge Temperature Modeling

Appendix 6E, Water Quality Data

Appendix 6F, Mercury and Methylmercury

**Appendix 7**

Appendix 7A, Fluvial Geomorphic Setting Information

Appendix 7B, Hydrodynamic Geomorphic Modeling Results

**Appendix 8**

Appendix 8A, Groundwater Resources

Appendix 8B, Groundwater Modeling

**Appendix 9**

Appendix 9A, Special-Status Plant Species

Appendix 9B, Vegetation and Wetland Methods and Information

**Appendix 10**

Appendix 10A, Wildlife Database Results

Appendix 10B, Wildlife Habitat Models and Methods

Appendix 10C, Special-Status Wildlife Impacts Tables

**Appendix 11**

Appendix 11A, Aquatic Species Life Histories

Appendix 11B, Upstream Fisheries Impact Assessment Quantitative Methods

Appendix 11D, Fisheries Water Temperature Assessment

Appendix 11E, Reservoir Fish Species Analysis

Appendix 11F, Smelt Analysis

Appendix 11H, Salmonid Population Modeling (SALMOD)

Appendix 11I, Winter Run Chinook Salmon Life Cycle Modeling

Appendix 11J, Through-Delta Survival of Juvenile Salmonids

Appendix 11K, Weighted Usable Area Analysis

Appendix 11L, Sturgeon Analysis

Appendix 11M, Yolo and Sutter Bypass Flow and Weir Spill Analysis

Appendix 11N, Other Flow-Related Upstream Analyses

Appendix 11O, Anderson-Martin Models

Appendix 11P, Riverine Flow-Survival

Appendix 11Q, Other Delta Species Analyses

**Appendix 12**

Appendix 12A, Soil Survey Map

Appendix 12B, Soil Map Units

**Appendix 17**

Appendix 17A, CVP/SWP Power Modeling

**Appendix 19**

Appendix 19A, Noise Definitions and Noise Calculations

**Appendix 20**

Appendix 20A, Methodology for Air Quality and GHG Emissions Calculations

Appendix 20C, Ambient Air Quality and Health Risk Analysis Technical Report

Appendix 20D, Photochemical Modeling Study to Support a Health Impact Analysis

**Appendix 22**

Appendix 22A, Cultural Resources

**Appendix 24**

Appendix 24A, Landscape Character Photos and Associated Maps

Appendix 24B, Regional and Project Landscape Description

**Appendix 27**

Appendix 27A, Environmental Records Search

**Appendix 28**

Appendix 28A, Climate Change

**Appendix 30**

Appendix 30A, Regional Economics Modeling

Appendix 30B, Economics Model Comparison

**Appendix 33**

Appendix 33A, 2017 Draft EIR/EIS Chapter 36, Consultation and Coordination

Appendix 33B, Previous Scoping Processes

Appendix 33C, Planning Aid Memorandum



## Tables

	<b>Page</b>
ES-1	Defining Characteristics of Action Alternatives ..... ES-8
ES-2	Summary of Impacts and Mitigation Measures..... ES-16
2-1	Summary of Alternatives 1, 2, and 3 ..... 2-5
2-2	Summary of I/O Tower Design Characteristics ..... 2-18
2-3	Main Dams, Saddle Dams, and Saddle Dikes for Alternatives 1, 2, and 3 ..... 2-19
2-4	Sites Project Roads and Purposes Common to Alternatives 1, 2, and 3..... 2-24
2-5	Summary of Project Diversion Criteria ..... 2-31
2-6	Pumping Summary for Alternatives 1, 2, and 3 ..... 2-40
2-7	Potential Generating Summary for Alternatives 1, 2, and 3..... 2-40
2-8	General Construction Timing and Sequencing..... 2-50
2-9	Estimated Temporary Construction Power Requirements ..... 2-51
2-10	General Reservoir Characteristics of Alternative 1 ..... 2-58
2-11	General Reservoir Characteristics of Alternative 2 ..... 2-61
4-1	Federal Permits, Approvals, Reviews, and Consultation Requirements ..... 4-2
4-2	State Permits, Approvals, Reviews, and Consultation Requirements ..... 4-5
4-3	Local Permits, Approvals, Reviews, and Consultation Requirements ..... 4-7
5-1a	Summary of Construction Impacts and Mitigation Measures for Surface Water Resources . 5-2
5-1b	Summary of Operation Impacts and Mitigation Measures for Surface Water Resources..... 5-2
5-2	Summary of Daily Flow Measured in the CBD Discharging to the Sacramento River at Knights Landing between 1984 and 2012. .... 5-9
5-3	Summary of Daily Flow Measured (cfs) in the Sacramento River below Wilkins Slough between 1985 and 2020. .... 5-12
5-4	Summary Flood Control Facilities and Management of the SRFCP..... 5-13
5-5	Lower Sacramento River Leveed Capacity. .... 5-15
5-6	Probability of Flows Exceeding Leveed Capacity, Sacramento River..... 5-15

5-7 Summary of Feather River Flow Requirements in NMFS 2016 Biological Opinion ..... 5-17

5-8 Summary of Daily Flow Measured (cfs) in the Yolo Bypass near Woodland between 1986 and 2020. .... 5-19

5-9 Types and Examples of CVP Water Recipients ..... 5-22

5-10 Storage Partner Summary Table..... 5-23

5-11 Simulated Shasta Lake Storage: No Action Alternative (TAF) and Percent Change between No Action and Alternatives 1, 2, and 3 ..... 5-30

5-12 Simulated Sacramento River Flow at Bend Bridge: No Action Alternative (cfs) and Percent Change between No Action and Alternatives 1, 2, and 3 ..... 5-31

5-13 Simulated Sacramento River Diversion at Red Bluff: No Action Alternative (cfs) and Change in cfs between No Action and Alternatives 1, 2, and 3 (cfs, Not Percent Change) ..... 5-31

5-14 Simulated Flow in Sacramento River below Red Bluff Pumping Plant: No Action Alternative (cfs) and Percent Change between No Action and Alternatives 1, 2, and 3 ..... 5-32

5-15 Simulated Hamilton City Diversion: No Action Alternative (cfs) and Change in cfs between No Action and Alternatives 1, 2, and 3 (cfs, Not Percent Change) ..... 5-32

5-16 Simulated Sacramento River Flow downstream of Hamilton City near Wilkins Slough: No Action Alternative (cfs) and Percent Change between No Action and Alternatives 1, 2, and 3 ..... 5-33

5-17 Simulated Sites Reservoir Storage for All Alternatives (TAF) ..... 5-33

5-18 Simulated Sites Reservoir Release for All Alternatives (cfs) ..... 5-33

5-19 Simulated Sites Reservoir Release to Sacramento River (Release to Dunnigan Pipeline minus Release to Yolo Bypass) for All Alternatives (cfs) ..... 5-34

5-20 Simulated Sites Reservoir Release to Yolo Bypass for All Alternatives (cfs) ..... 5-35

5-21 Simulated Total Yolo Bypass Flow: No Action Alternative (cfs) and Percent Change between No Action and Alternatives 1, 2, and 3 ..... 5-35

5-22 Simulated Lake Oroville Storage: No Action Alternative (TAF) and Percent Change between No Action and Alternatives 1, 2, and 3 ..... 5-36

5-23 Simulated Feather River Flow at Mouth: No Action Alternative (cfs) and Percent Change between No Action and Alternatives 1, 2, and 3 ..... 5-36

5-24 Simulated Folsom Lake Storage: No Action Alternative (TAF) and Percent Change between No Action and Alternatives 1, 2, and 3 ..... 5-37

5-25 Simulated American River Flow at H Street: No Action Alternative (cfs) and Percent Change between No Action Alternatives 1, 2, and 3 ..... 5-37

5-26 Simulated Sacramento River Flow at Freeport: No Action Alternative NAA (cfs) and Percent Change between No Action Alternatives 1, 2, and 3..... 5-38

5-27 Simulated Delta Outflow: No Action Alternative (cfs) and Percent Change between No Action and Alternatives 1, 2, and 3 ..... 5-38

5-28 Simulated Delta Exports (Banks and Jones): No Action Alternative (cfs) and Percent Change between No Action and Alternatives 1, 2, and 3 ..... 5-38

5-29 Simulated San Luis Reservoir Storage: No Action Alternative (TAF) and Percent Change between No Action and Alternatives 1, 2, and 3 ..... 5-39

5-30 Simulated Sites Water Supply Deliveries..... 5-41

5-31 Simulated CVP and SWP Water Supply Deliveries: No Action Alternative (TAF) and Alternatives 1, 2, and 3 Minus No Action (TAF)..... 5-43

5-32 CALSIM II Modeled Flood Flows ..... 5-44

5-33 Summary of Expected Construction Water Use for Alternatives 1, 2, and 3 ..... 5-49

5-34 Percent Change between the No Action Alternative and Alternatives 1, 2, and 3 ..... 5-52

6-1a Summary of Construction Impacts and Mitigation Measures for Surface Water Quality Resources ..... 6-1

6-1b Summary of Operation Impacts and Mitigation Measures for Surface Water Quality Resources ..... 6-2

6-2 Monthly Average and Average of the Daily Maximum Water temperatures (°F) in the Yolo Bypass at Lisbon Weir, the Sacramento River Deep Water Ship Channel, and the Sacramento River at Rio Vista during 2015–2020..... 6-6

6-3 Nutrients, Organic Carbon and Dissolved Oxygen ..... 6-11

6-4 Water Quality Criteria and Objectives for Mercury and Methylmercury Applicable to the Study Area..... 6-18

6-5 Total Mercury Concentrations in Surface Waters in the Study Area. .... 6-19

6-6 Total Methylmercury Concentrations in Surface Waters in the Study Area. .... 6-20

6-7 Potential Mechanisms of Operational Effects on Water Quality ..... 6-28

6-8a Sites Reservoir Average End-of-Month Water Surface Elevation (ft) as Simulated by CALSIM for Dry Water Years ..... 6-38

6-8b Sites Reservoir Average End-of-Month Water Surface Elevation (ft) as Simulated by CALSIM for Critically Dry Water Years ..... 6-38

6-8c Sites Reservoir Minimum End-of-Month Water Surface Elevation (ft) for the CALSIM 82-Year Simulation Period ..... 6-38

6-9 Metals Water Quality Standards..... 6-43

6-10 Approach for Evaluating Significance of Operations Effects on Water Quality (Impact WQ-2) ..... 6-48

6-11 Estimated Concentrations of Total Mercury and Methylmercury in Sites Reservoir in the Short-Term ..... 6-54

6-12a Estimated Change in Sacramento River Water Temperature (°F) when Sites Reservoir Water is Released to the Dunnigan Pipeline under Alternative 1A ..... 6-61

6-12b Estimated Change in Sacramento River Water Temperature (°F) when Sites Reservoir Water is Released to the Dunnigan Pipeline under Alternative 1B ..... 6-62

6-12c Estimated Change in Sacramento River Water Temperature (°F) when Sites Reservoir Water is Released to the Dunnigan Pipeline under Alternative 2 ..... 6-62

6-12d Estimated Change in Sacramento River Water Temperature (°F) when Sites Reservoir Water is Released to the Dunnigan Pipeline under Alternative 3 ..... 6-62

6-13 Estimated Electrical Conductivity (EC in  $\mu\text{mhos/cm}$ ) of Reservoir Release if Salt Pond Water were to Mix Directly with the Release ..... 6-65

6-14 Clifton Court Forebay (SWP Banks Pumping Plant) Electrical Conductivity: No Action Alternative ( $\mu\text{S/cm}$ ) and Percent Change between No Action and Alternatives 1, 2, and 3 (positive value indicates an increase) ..... 6-66

6-15 Jones CVP Pumping Plant Electrical Conductivity: No Action Alternative ( $\mu\text{S/cm}$ ) and Percent Change between No Action and Alternatives 1, 2, and 3 (positive value indicates an increase) ..... 6-67

6-16 X2: No Action Alternative (km) and Change between No Action and Alternatives 1, 2, and 3 (km) ..... 6-68

6-17 Mallard Island Electrical Conductivity: No Action Alternative ( $\mu\text{S/cm}$ ) and Percent Change between No Action and Alternatives 1, 2, and 3 ..... 6-68

6-18 Estimated Long-Term Average Concentrations of Total Mercury and Methylmercury in Sites Reservoir ..... 6-73

6-19 Arsenic Concentrations in the Sacramento River, Sites Reservoir, and Regulatory Standards. .... 6-86

6-20 Modeled Monthly Average Sites Reservoir Water Temperatures (°F) ..... 6-88

7-1a Summary of Construction Impacts and Mitigation Measures for Fluvial Geomorphology ... 7-1

7-1b Summary of Operation Impacts and Mitigation Measures for Fluvial Geomorphology..... 7-2

7-2 Drainage Geomorphic Characteristics Summary ..... 7-4

7-3 Percent Exceedance Values of USRDOM Modeled Monthly Average Flow for No Action  
Alternative and Alternatives 1, 2, and 3 ..... 7-17

7-4 Flow and Percent Change between the No Action Alternative and  
Alternatives 1, 2, and 3 ..... 7-18

8-1a Summary of Construction Impacts between Alternatives ..... 8-1

8-1b Summary of Operation Impacts between Alternatives ..... 8-2

8-2 Summary of Groundwater Resources in the Study Area ..... 8-3

9-1a Summary of Construction Impacts and Mitigation Measures for Vegetation and Wetland  
Resources ..... 9-1

9-1b Summary of Operations Impacts and Mitigation Measures for Vegetation and Wetland  
Resources ..... 9-5

9-2a Alternatives 1 and 3 Acreages of Permanent Impacts on Special-Status Plant Habitats,  
Sensitive Natural Communities, and Wetland and Non-Wetland Water Types in Project  
Component Areas ..... 9-19

9-2b Alternatives 1 and 3 Acreages of Temporary Impacts on Special-Status Plant Habitats,  
Sensitive Natural Communities, and Wetland and Non-Wetland Water Types in Project  
Component Areas ..... 9-21

9-3 Acreages of Permanent and Temporary Impacts on Modeled Special-Status Plant Species  
Habitat in the Study Area ..... 9-23

9-4a Alternative 2 Acreages of Permanent Impacts on Special-Status Plant Habitats, Sensitive  
Natural Communities, and Wetland and Non-Wetland Water Types in Project Component  
Areas ..... 9-29

9-4b Alternative 2 Acreages of Temporary Impacts on Special-Status Plant Habitats, Sensitive  
Natural Communities, and Wetland and Non-Wetland Water Types in Project Component  
Areas ..... 9-31

9-5 Comparison of Alternatives 1, 2, and 3 Permanent and Temporary Impacts on Special-Status  
Plant Habitats, Sensitive Natural Communities, and Wetland and Non-Wetland Water Types  
..... 9-33

10-1a Summary of Construction Impacts and Mitigation Measures for Wildlife Resources ..... 10-1

10-1b Summary of Operation Impacts and Mitigation Measures for Wildlife Resources ..... 10-5

10-2a Acreages of Permanent and Temporary Impacts on Modeled Special-Status Vernal Pool  
Branchiopod Habitat in the Study Area ..... 10-36

10-2b      Acreages of Permanent and Temporary Impacts on Modeled Special-Status Terrestrial Invertebrate Habitat in the Study Area..... 10-41

10-2c      Acreages of Permanent and Temporary Impacts on Modeled Special-Status Amphibian and Reptile Habitats in the Study Area ..... 10-60

10-2d      Acreages of Permanent and Temporary Impacts on Modeled Special-Status Bird Habitats in the Study Area ..... 10-85

10-2e      Acreages of Permanent and Temporary Impacts on Modeled Habitat for Special-Status Mammals in the Study Area ..... 10-125

11-1a      Summary of Construction Impacts and Mitigation Measures for Aquatic Biological Resources ..... 11-4

11-1b      Summary of Operations and Maintenance Impacts and Mitigation Measures for Aquatic Biological Resources ..... 11-4

11-2        Aquatic Species of Management Concern by Area of Occurrence ..... 11-9

11-3        Stone Corral Creek Daily and Monthly Flows Near Sites, USGS 11390672 ..... 11-53

11-4        Methods for Analysis of Potential Effects on Fish and Aquatic Resources ..... 11-59

11-5        Interim Criteria for Injury to Fish from Impact Pile-Driving Activities ..... 11-66

11-6        Red Bluff Diversion as Percentage of Sacramento River Flow, Averaged by Month and Water Year Type, from CALSIM Modeling..... 11-88

11-7        Hamilton City Diversion as Percentage of Sacramento River Flow, Averaged by Month and Water Year Type, from CALSIM Modeling..... 11-89

11-8        Number and Proportion of Juvenile Chinook Salmon Released and Recaptured at the Hamilton City Intake, 2007. .... 11-99

11-9        Number of Month and Water Year Type Combinations that Satisfy Both Criteria for Being Biologically Meaningful in the Water Temperature Index Value Analysis, Winter-run Chinook Salmon, Sacramento River ..... 11-106

11-10      Distributions of Spawning Redds among WUA River Segments as Percent of Total in the Sacramento River for Chinook Salmon Runs. .... 11-108

11-11      Mean Annual Number of Days in January–June With Yolo Bypass Floodplain Inundation by Alternative and Water Year Type..... 11-114

11-12      Mean Annual Number of Days in September–June With Yolo Bypass Floodplain Inundation by Alternative and Water Year Type..... 11-115

11-13      Estimated Mean Daily Inundated Habitat (Acres <1 Meter Deep) for Juvenile Salmonids in the Yolo Bypass and the Percent Differences (in parentheses) for the No Action Alternative (NAA) and Alternatives 1–3 (Alt 1A, Alt 1B, Alt 2, and Alt 3). .... 11-115

11-14 Estimated Mean Daily January through April Inundated Habitat (Acres <1 Meter Deep) for Juvenile Salmonids in the Yolo Bypass and the Differences (in parentheses) for the No Action Alternative (NAA) and Alternatives 1–3 (Alt 1A, Alt 1B, Alt 2, and Alt 3). ..... 11-118

11-15 Mean and Median of Estimated Change in Colusa Basin Drain Water Temperature (°F) from Sites Reservoir Releases, August–October ..... 11-120

11-16 Probability of Juvenile Chinook Salmon Through-Delta Survival, Averaged by Month and Water Year Type, Based on Perry et al. (2018). ..... 11-124

11-17 Entrainment Loss of Juvenile Winter-Run Chinook Salmon At SWP Banks Pumping Plant, Averaged by Water Year Type, Based on the Salvage-Density Method. .... 11-126

11-18 Entrainment Loss of Juvenile Winter-Run Chinook Salmon At CVP Jones Pumping Plant, Averaged by Water Year Type, Based on the Salvage-Density Method. .... 11-127

11-19 Mean Female Adult Winter-Run Chinook Salmon Escapement by Water Year Type Based on IOS. .... 11-128

11-20 Mean Winter-Run Chinook Salmon Proportional Egg Survival by Water Year Type Based on IOS. .... 11-128

11-21 Winter-Run Chinook Salmon Proportional Fry Survival by Water Year Type Based on IOS. .... 11-129

11-22 Winter-Run Chinook Salmon Proportional Juvenile River Migration Survival by Water Year Type Based on IOS..... 11-129

11-23 Winter-Run Chinook Salmon Proportional Juvenile Through-Delta Migration Survival by Water Year Type Based on IOS. .... 11-129

11-24 Abundance and Percentage of Spring-Run Chinook Salmon Adult Escapement Upstream and Downstream of the Red Bluff and Hamilton City Intakes, 2009–2018. .... 11-137

11-25 Number of Month and Water Year Type Combinations that Satisfy Both Criteria for Being Biologically Meaningful in the Water Temperature Index Value Analysis, Spring-run Chinook Salmon, Sacramento River ..... 11-142

11-26 Number of Month and Water Year Type Combinations that Satisfy Both Criteria for Being Biologically Meaningful in the Water Temperature Index Value Analysis, Spring-run Chinook Salmon, Feather River ..... 11-150

11-27 Entrainment Loss of Juvenile Spring-Run Chinook Salmon At SWP Banks Pumping Plant, Averaged by Water Year Type, Based on the Salvage-Density Method. .... 11-154

11-28 Entrainment Loss of Juvenile Spring-Run Chinook Salmon At CVP Jones Pumping Plant, Averaged by Water Year Type, Based on the Salvage-Density Method. .... 11-154

11-29 Abundance and Percentage of Fall-Run and Late Fall–Run Chinook Salmon Adult Escapement Upstream and Downstream of the Red Bluff and Hamilton City Intakes, 2009–2018. .... 11-166

11-30 Number of Month and Water Year Type Combinations that Satisfy Both Criteria for Being Biologically Meaningful in the Water Temperature Index Value Analysis, Fall-run Chinook Salmon, Sacramento River ..... 11-171

11-31 Number of Month and Water Year Type Combinations that Satisfy Both Criteria for Being Biologically Meaningful in the Water Temperature Index Value Analysis, Late Fall–run Chinook Salmon, Sacramento River ..... 11-172

11-32 Number of Unmarked and Marked Chinook Salmon Collected at Wallace Weir, in Relation to Fish Trap Capture Effort (Hours). ..... 11-181

11-33 Number of Month and Water Year Type Combinations that Satisfy Both Criteria for Being Biologically Meaningful in the Water Temperature Index Value Analysis, Fall-run Chinook Salmon, Feather River ..... 11-183

11-34 Number of Month and Water Year Type Combinations that Satisfy Both Criteria for Being Biologically Meaningful in the Water Temperature Index Value Analysis, Fall-run Chinook Salmon, American River ..... 11-186

11-35 Entrainment Loss of Juvenile Fall-Run Chinook Salmon At SWP Banks Pumping Plant, Averaged by Water Year Type, Based on the Salvage-Density Method. .... 11-190

11-36 Entrainment Loss of Juvenile Fall-Run Chinook Salmon At CVP Jones Pumping Plant, Averaged by Water Year Type, Based on the Salvage-Density Method. .... 11-190

11-37 Entrainment Loss of Juvenile Late Fall-Run Chinook Salmon At SWP Banks Pumping Plant, Averaged by Water Year Type, Based on the Salvage-Density Method. .... 11-190

11-38 Entrainment Loss of Juvenile Late Fall-Run Chinook Salmon At CVP Jones Pumping Plant, Averaged by Water Year Type, Based on the Salvage-Density Method. .... 11-191

11-39 Number of Month and Water Year Type Combinations that Satisfy Both Criteria for Being Biologically Meaningful in the Water Temperature Index Value Analysis, Steelhead, Sacramento River ..... 11-200

11-40 Number of Month and Water Year Type Combinations that Satisfy Both Criteria for Being Biologically Meaningful in the Water Temperature Index Value Analysis, Steelhead, Feather River ..... 11-208

11-41 Number of Month and Water Year Type Combinations that Satisfy Both Criteria for Being Biologically Meaningful in the Water Temperature Index Value Analysis, Steelhead, American River ..... 11-212

11-42 Entrainment Loss of Juvenile Steelhead At SWP Banks Pumping Plant, Averaged by Water Year Type, Based on the Salvage-Density Method..... 11-215

11-43 Entrainment Loss of Juvenile Steelhead At CVP Jones Pumping Plant, Averaged by Water Year Type, Based on the Salvage-Density Method..... 11-215

11-44 Rotary Screw Trap Catches of Sturgeon at GCID..... 11-220



11-45 Number of Month and Water Year Type Combinations that Satisfy Both Criteria for Being Biologically Meaningful in the Water Temperature Index Value Analysis, Green Sturgeon, Sacramento River ..... 11-222

11-46 CALSIM II Monthly Average Flow (cfs) by Month and Water Year Type Below Red Bluff Diversion Dam for the No Action Alternative (NAA) and Alternatives 1A, 1B, 2, and 3, and Percent Differences between Them (in Parentheses). ..... 11-224

11-47 CALSIM II Monthly Average Flow (cfs) by Month and Water Year Type at Bend Bridge for the No Action Alternative (NAA) and Alternatives 1A, 1B, 2, and 3, and Percent Differences between Them (in Parentheses)..... 11-226

11-48 CALSIM II Monthly Average Flow (cfs) by Month and Water Year Type at Hamilton City for the No Action Alternative (NAA) and Alternatives 1A, 1B, 2, and 3, and Percent Differences between Them (in Parentheses). ..... 11-228

11-49 CALSIM II Monthly Average Flow (cfs) by Month and Water Year Type at Wilkins Slough for the No Action Alternative (NAA) and Alternatives 1A, 1B, 2, and 3, and Percent Differences between Them (in Parentheses). ..... 11-231

11-50 Number of Month and Water Year Type Combinations that Satisfy Both Criteria for Being Biologically Meaningful in the Water Temperature Index Value Analysis, Green Sturgeon, Feather River ..... 11-236

11-51 CALSIM II Monthly Average Flow (cfs) by Month and Water Year Type in the Feather River at Thermalito Afterbay Outlet for the No Action Alternative (NAA) and Alternatives 1A, 1B, 2, and 3, and Percent Differences between Them (in Parentheses). ..... 11-237

11-52 Salvage of Juvenile Green Sturgeon At SWP Banks Pumping Plant, Averaged by Water Year Type, Based on the Salvage-Density Method. .... 11-241

11-53 Salvage of Juvenile Green Sturgeon At CVP Jones Pumping Plant, Averaged by Water Year Type, Based on the Salvage-Density Method. .... 11-241

11-54 Salvage of Juvenile White Sturgeon At SWP Banks Pumping Plant, Averaged by Water Year Type, Based on the Salvage-Density Method. .... 11-247

11-55 Salvage of Juvenile White Sturgeon At CVP Jones Pumping Plant, Averaged by Water Year Type, Based on the Salvage-Density Method. .... 11-248

11-56 Year-Class Strength of White Sturgeon Based on April–May Regression with Delta Outflow..... 11-248

11-57 Year-Class Strength of White Sturgeon Based on March–July Regression with Delta Outflow..... 11-249

11-58 Density of Adult *Eurytemora affinis* Based on March–May Regression with X2. .... 11-261

11-59 Density of Adult + Juvenile *Eurytemora affinis* Based on March–June Regression with Delta Outflow (Hennessy and Burris 2017)..... 11-261

11-60 Mean June–September Delta Inflow (Cubic Feet per Second) by Alternative and Water Year Type..... 11-262

11-61 Mean March–May South Delta Exports (Cubic Feet Per Second) by Alternative and Water Year Type. .... 11-262

11-62 Mean July–September Delta Outflow (Cubic Feet Per Second) by Alternative and Water Year Type..... 11-263

11-63 Density of Adult + Juvenile *Pseudodiaptomus forbesi* Based on June–September Regression with Delta Outflow (Hennessy and Burris 2017). .... 11-263

11-64 Mean January QWEST (Cubic Feet Per Second) by Alternative and Water Year Type. 11-268

11-65 Mean February QWEST (Cubic Feet Per Second) by Alternative and Water Year Type. .... 11-269

11-66 Mean March QWEST (Cubic Feet Per Second) by Alternative and Water Year Type. .. 11-269

11-67 Mean December–March X2 (Kilometers Upstream of Golden Gate Bridge) by Alternative and Water Year Type. .... 11-269

11-68 Density of *Neomysis mercedis* Based on March–May Regression with Delta Outflow (Hennessy and Burris 2017). .... 11-270

11-69 Mean Longfin Smelt Fall Midwater Trawl Index by Water Year Type from Nobriga and Rosenfield (2016) Model, Based on Good Juvenile Survival Scenario. .... 11-271

11-70 Mean Longfin Smelt Fall Midwater Trawl Index by Water Year Type from Nobriga and Rosenfield (2016) Model, Based on Poor Juvenile Survival Scenario..... 11-272

11-71 Mean Longfin Smelt Fall Midwater Trawl Index Based on January–June X2. .... 11-274

11-72 Tidal Habitat Restoration Mitigation for Longfin Smelt (Acres)..... 11-275

11-73 Percentage of Pacific Lamprey Spawning Months with >50% Flow Reduction in the Next Month, Used as a Proxy for Redd Dewatering Risk for Locations in the Sacramento River, and Percent Differences (in parentheses) between the No Action Alternative (NAA) and Alternatives 1–3 (Alt 1A, Alt 1B, Alt 2, and Alt 3). .... 11-277

11-74 Percentage of River Lamprey Spawning Months with >50% Flow Reduction in the Next Month, Used as a Proxy for Redd Dewatering Risk for Locations in the Sacramento River, and Percent Differences (in parentheses) between the No Action Alternative (NAA) and Alternatives 1–3 (Alt 1A, Alt 1B, Alt 2, and Alt 3). .... 11-278

11-75 Percent of Pacific and River Lamprey Ammocoetes Stranded During 7-Year Rearing Period in the Sacramento River at Keswick Dam and Differences in the Percentages for the No Action Alternative (NAA) and Alternatives 1, 2, and 3 (Alt 1A, Alt 1B, Alt 2, and Alt 3). January through August Results Pertain to Pacific Lamprey and the February through June Results Pertain to River Lamprey..... 11-279

11-76 Percent of Pacific and River Lamprey Ammocoetes Stranded During 7-Year Rearing Period in the Sacramento River at Bend Bridge and Differences in the Percentages for the No Action Alternative (NAA) and Alternatives 1–3 (Alt 1A, Alt 1B, Alt 2, and Alt 3). January through August Results Pertain to Pacific Lamprey and the February through June Results Pertain to River Lamprey..... 11-281

11-77 Percent of Pacific and River Lamprey Ammocoetes Stranded During 7-Year Rearing Period in the Sacramento River at Hamilton City and Differences in the Percentages for the No Action Alternative (NAA) and Alternatives 1–3 (Alt 1A, Alt 1B, Alt 2, and Alt 3). January through August Results Pertain to Pacific Lamprey and the February through June Results Pertain to River Lamprey. .... 11-284

11-78 Percentage of Pacific and River Lamprey Spawning Months with >50% Flow Reduction in the Next Month, Used as a Proxy for Redd Dewatering Risk in the Feather River at Thermalito Afterbay, and Percent Differences (in parentheses) between the No Action Alternative (NAA) and Alternatives 1–3 (Alt 1A, Alt 1B, Alt 2, and Alt 3). .... 11-287

11-79 Percent of Pacific and River Lamprey Ammocoetes Stranded During 7-Year Rearing Period in the Feather River at Gridley Gage and Differences in the Percentages for the No Action Alternative (NAA) and Alternatives 1–3 (Alt 1A, Alt 1B, Alt 2, and Alt 3). January through August Results Pertain to Pacific Lamprey and the February through June Results Pertain to River Lamprey..... 11-288

11-80 Percentage of Pacific Lamprey Spawning Months with >50% Flow Reduction in the Next Month, Used as a Proxy for Redd Dewatering Risk for Locations in the American River, and Percent Differences (in parentheses) between the No Action Alternative (NAA) and Alternatives 1–3 (Alt 1A, Alt 1B, Alt 2, and Alt 3). .... 11-291

11-81 Percentage of River Lamprey Spawning Months with >50% Flow Reduction in the Next Month, Used as a Proxy for Redd Dewatering Risk for Locations in the American River, and Percent Differences (in parentheses) between the No Action Alternative (NAA) and Alternatives 1–3 (Alt 1A, Alt 1B, Alt 2, and Alt 3). .... 11-291

11-82 Percent of Pacific and River Lamprey Ammocoetes Stranded During 7-Year Rearing Period in the American River at Nimbus Dam and Differences in the Percentages for the No Action Alternative (NAA) and Alternatives 1–3 (Alt 1A, Alt 1B, Alt 2, and Alt 3). January through August Results Pertain to Pacific Lamprey and the February through June Results Pertain to River Lamprey..... 11-292

11-83 Salvage of Pacific Lamprey At SWP Banks Pumping Plant, Averaged by Water Year Type, Based on the Salvage-Density Method..... 11-294

11-84 Salvage of Pacific Lamprey At CVP Jones Pumping Plant, Averaged by Water Year Type, Based on the Salvage-Density Method..... 11-294

11-85 Salvage of River Lamprey At SWP Banks Pumping Plant, Averaged by Water Year Type, Based on the Salvage-Density Method..... 11-295

11-86 Salvage of River Lamprey At CVP Jones Pumping Plant, Averaged by Water Year Type, Based on the Salvage-Density Method..... 11-295

11-87 Salvage of Unknown Species of Lamprey At SWP Banks Pumping Plant, Averaged by Water Year Type, Based on the Salvage-Density Method..... 11-295

11-88 Salvage of Unknown Species of Lamprey At CVP Jones Pumping Plant, Averaged by Water Year Type, Based on the Salvage-Density Method..... 11-296

11-89 Estimated Mean Daily Inundated Habitat (Acres <1 Meter Deep) for Sacramento Splittail in the Yolo Bypass and the Percent Differences (in parentheses) for the No Action Alternative (NAA) and Alternatives 1–3 (Alt 1A, Alt 1B, Alt 2, and Alt 3). ..... 11-302

11-90 Estimated Mean Daily January through April Inundated Habitat (Acres <1 Meter Deep) for Sacramento Splittail in the Yolo Bypass and the Differences (in parentheses) for the No Action Alternative (NAA) and Alternatives 1–3 (Alt 1A, Alt 1B, Alt 2, and Alt 3). ..... 11-304

11-91 Salvage of Sacramento Splittail At SWP Banks Pumping Plant, Averaged by Water Year Type, Based on the Salvage-Density Method. .... 11-309

11-92 Salvage of Sacramento Splittail At CVP Jones Pumping Plant, Averaged by Water Year Type, Based on the Salvage-Density Method. .... 11-309

11-93 Salvage of Starry Flounder At SWP Banks Pumping Plant, Averaged by Water Year Type, Based on the Salvage-Density Method..... 11-310

11-94 Salvage of Starry Flounder At CVP Jones Pumping Plant, Averaged by Water Year Type, Based on the Salvage-Density Method..... 11-311

11-95 Starry Flounder Bay Otter Trawl Index, Averaged by Water Year Type, as a Function of Mean March–June X2. .... 11-311

11-96 Salvage of Striped Bass At SWP Banks Pumping Plant, Averaged by Water Year Type, Based on the Salvage-Density Method..... 11-317

11-97 Salvage of Striped Bass At CVP Jones Pumping Plant, Averaged by Water Year Type, Based on the Salvage-Density Method. .... 11-317

11-98 Striped Bass Summer Towner Abundance Index, Averaged by Water Year Type, as a Function of Mean April–June X2..... 11-318

11-99 Striped Bass Fall Midwater Trawl Abundance Index, Averaged by Water Year Type, as a Function of Mean April–June X2..... 11-318

11-100 Striped Bass Bay Midwater Trawl Abundance Index, Averaged by Water Year Type, as a Function of Mean April–June X2..... 11-318

11-101 Striped Bass Bay Otter Trawl Abundance Index, Averaged by Water Year Type, as a Function of Mean April–June X2..... 11-319

11-102 Mean Fall (September–December) X2, Averaged by Water Year Type..... 11-319

11-103 Salvage of American Shad at SWP Banks Pumping Plant, Averaged by Water Year Type, Based on the Salvage-Density Method..... 11-325

11-104 Salvage of American Shad at CVP Jones Pumping Plant, Averaged by Water Year Type, Based on the Salvage-Density Method..... 11-325

11-105 American Shad Fall Midwater Trawl Abundance Index, Averaged by Water Year Type, as a Function of Mean February–May X2..... 11-325

11-106 American Shad Bay Midwater Trawl Abundance Index, Averaged by Water Year Type, as a Function of Mean February–May X2..... 11-326

11-107 Salvage of Threadfin Shad at SWP Banks Pumping Plant, Averaged by Water Year Type, Based on the Salvage-Density Method..... 11-327

11-108 Salvage of Threadfin Shad at CVP Jones Pumping Plant, Averaged by Water Year Type, Based on the Salvage-Density Method..... 11-327

11-109 Salvage of Largemouth Bass at SWP Banks Pumping Plant, Averaged by Water Year Type, Based on the Salvage-Density Method..... 11-332

11-110 Salvage of Largemouth Bass at CVP Jones Pumping Plant, Averaged by Water Year Type, Based on the Salvage-Density Method..... 11-332

11-111 California Bay Shrimp Bay Otter Trawl Abundance Index, Averaged by Water Year Type, as a Function of Mean April–June X2. .... 11-333

12-1a Summary of Construction Impacts and Mitigation Measures for Geology and Soils Resources..... 12-1

12-1b Summary of Operations Impacts and Mitigation Measures for Geology and Soils Resources..... 12-4

12-2 Regional and Local Fault Information ..... 12-13

12-3 Paleontological Sensitivity Ratings ..... 12-17

12-4 University of California Museum of Paleontology Vertebrate Fossil Records, by Formation Extent and Study Area Counties, and Paleontological Sensitivity of Geologic Units in the Study Area..... 12-18

12-5 Society of Vertebrate Paleontology’s Recommended Treatment for Paleontological Resources ..... 12-24

12-6 Location of Faults Relative to Alternative 1 or 3 Structures ..... 12-26

12-7 Ground-Disturbing Construction Activities and the Geologic Units Affected ..... 12-53

13-1a Summary of Construction Impacts and Mitigation Measures for Mineral Resources ..... 13-1

13-1b Summary of Operations Impacts and Mitigation Measures for Mineral Resources ..... 13-2

14-1a Summary of Construction Impacts and Mitigation Measures for Land Use Resources..... 14-1

14-1b Summary of Operations Impacts and Mitigation Measures for Land Use Resources..... 14-2

14-2 Summary of Glenn County Land Use and Zoning Designations ..... 14-3

14-3 Summary of Colusa County Land Use and Zoning Designations ..... 14-5

14-4 Summary of Yolo County Land Use and Zoning Designations ..... 14-6

14-5 Summary of Alternatives 1 and 3 Components in Glenn, Colusa, and Yolo Counties ..... 14-10

14-6 Summary of Alternative 2 Components in Glenn, Colusa, and Yolo Counties ..... 14-14

15-1a Summary of Construction Impacts and Mitigation Measures for Agriculture Resources.... 15-2

15-1b Summary of Operations Impacts and Mitigation Measures for Agriculture Resources..... 15-3

15-2 Important Farmland, Farmland of Local Importance, and Grazing Land as Designated under the FMMP in Glenn County in 2006, 2016, and 2018 (acres) ..... 15-6

15-3 Land Designated under FPPA in Glenn County (acres)..... 15-6

15-4 Zoned Agricultural Land in Glenn County (acres)..... 15-7

15-5 Land under Williamson Act and Farmland Security Zone Contracts in Glenn County (acres)..... 15-7

15-6 Important Farmland, Farmland of Local Importance, and Grazing Land as Designated under the FMMP in Colusa County in 2006 and 2016 (acres) ..... 15-7

15-7 Land under FPPA in Colusa County (acres) ..... 15-8

15-8 Zoned Agricultural Land in Colusa County (acres) ..... 15-8

15-9 Land under Williamson Act and Farmland Security Zone Contracts in Colusa County (acres) ..... 15-8

15-10 Important Farmland, Farmland of Local Importance, and Grazing Land as Designated under the FMMP in Yolo County in 2006 and 2016 (acres) ..... 15-9

15-11 Land under FPPA in Yolo County (acres) ..... 15-9

15-12 Zoned Agricultural Land in Yolo County (acres) ..... 15-9

15-13 Land under Williamson Act and Farmland Security Zone Contracts in Yolo County (acres) ..... 15-10

15-14 Williamson Act Minimum Parcel Size Requirements by County ..... 15-11

15-15 FMMP Important Farmland Temporarily Disturbed and Permanently Converted by Project Facilities under All Alternatives (acres)..... 15-15

15-16 Land Zoned for Agricultural Use Permanently Disturbed by Project Facilities under Alternatives 1, 2, and 3 (acres)..... 15-20

15-17 Land under Williamson Act Contract Permanently Disturbed by Project Facilities under Alternatives 1, 2, and 3 (acres)..... 15-22

15-18 Acreage of Remnant Parcels of Williamson Act Contracted Land below County Thresholds Permanently Created by Project Facilities under Alternatives 1, 2, and 3 (acres) ..... 15-23

15-19 Important Farmland as Designated under FPPA outside FMMP Important Farmland Temporarily Affected and Permanently Used by Project Facilities under Alternatives 1, 2, and 3 (acres) ..... 15-29

15-20 Modeled Average Release Water Temperatures by Alternative (°F)..... 15-35

15-21 Modeled 90% Exceedance (Tenth Percentile) for Release Water Temperatures by Alternative (°F) ..... 15-35

16-1a Summary of Construction Impacts and Mitigation Measures for Recreation Resources..... 16-2

16-1b Summary of Operations Impacts and Mitigation Measures for Recreation Resources..... 16-2

16-2 Key Recreational Characteristics of Recreation Areas Potentially Affected by Project-Related Changes to SWP or CVP Operations ..... 16-3

16-3 Federal and State Wildlife Refuges in the Sacramento Valley along the Sacramento River ..... 16-7

16-4 Average Modeled Water Surface Elevation in Shasta Lake (feet) ..... 16-11

16-5 90th Percent Exceedance Values of Modeled Water Surface Elevation in Shasta Lake (feet)..... 16-11

16-6 Average Modeled Water Surface Elevation in Lake Oroville (feet) ..... 16-12

16-7 90th Percent Exceedance Values of Modeled Water Surface Elevation in Lake Oroville (feet) ..... 16-12

16-8 Average Modeled Water Surface Elevation in Folsom Lake (feet) ..... 16-12

16-9 90th Percent Exceedance Values of Modeled Water Surface Elevation in Folsom Lake (feet) ..... 16-13

16-10 Average Modeled Water Surface Elevation in San Luis Reservoir (feet)..... 16-13

16-11 90th Percent Exceedance Values of Modeled Water Surface Elevation in San Luis Reservoir (feet) ..... 16-13

16-12 Sites Reservoir Delivery of Level 4 Water to North-of-Delta Refuges (thousand acre-feet)..... 16-16

17-1a Summary of Construction Impacts and Mitigation Measures for Energy Resources ..... 17-2

17-1b Summary of Operations Impacts and Mitigation Measures for Energy Resources..... 17-2

17-2a 2019 Total System Electricity Generation ..... 17-5

17-2b 2018 Total System Electricity Generation ..... 17-6

17-3 In-State Electricity Generation by Fuel Type (GWh) ..... 17-7

17-4 Comparison of CED 2019 and CEDU 2020 Low-, Mid-, and High-Case Demand Baseline—  
Statewide Consumption (GWh) and Net Peak Demand (MW)..... 17-8

17-5 Annual Electricity Consumption by County for the Electricity Supply Study Area in 2019  
(GWh)..... 17-9

17-6 Annual Gasoline Sales for the Petroleum Products Study Area (millions of gallons per year)  
..... 17-9

17-7 Annual Diesel Fuel Sales for the Petroleum Products Study Area (millions of gallons per  
year)..... 17-10

17-8 Temporary Electricity Requirements and Consumption for Construction of Alternatives 1, 2,  
and 3 (kVA, kW, and kWh per year)..... 17-15

17-9 CVP, SWP, and Project Facilities Operation Energy Consumption (GWh/year)<sup>1</sup>—No Action  
Alternative (NAA), Alternative 1A and Alternative 1B..... 17-17

17-10 CVP, SWP, and Project Facilities Operation Energy Consumption (GWh/year)<sup>1</sup> —No Action  
Alternative (NAA) and Alternative 2 ..... 17-21

17-11 CVP, SWP, and Project Facilities Operation Energy Consumption (GWh/year)<sup>1</sup>—No Action  
Alternative (NAA) and Alternative 3 ..... 17-23

17-12a Diesel Fuel and Gasoline Consumption for Construction of Alternatives 1, 2, and 3 (gallons  
per year and total gallons) for Construction Period..... 17-25

17-12b Diesel Fuel and Gasoline Consumption for Operation of Alternatives 1, 2, and 3 (gallons per  
year and total gallons) for 2030–2040 Modeled Operating Period ..... 17-26

17-13 Project Operations Electricity Demand and Net Reduction in CVP/SWP System Electricity  
Generation for Alternatives as Percentages of Statewide and Regional  
Electricity Demand..... 17-40

18-1a Summary of Construction Impacts and Mitigation Measures for Navigation, Transportation,  
and Traffic ..... 18-2

18-1b Summary of Operations Impacts and Mitigation Measures for Navigation, Transportation,  
and Traffic ..... 18-3

18-2 Sites Reservoir Project Access Roads ..... 18-5



18-3 Existing Conditions Average Daily Traffic..... 18-9

18-4 Roadway Classifications ..... 18-10

18-5 Roadway Segment Level of Service Characteristics ..... 18-11

18-6 Existing Roadway Segment Level of Service ..... 18-12

18-7 Existing Recreation Areas in the Regional Study Area..... 18-13

18-8 Regional Urban Populations Likely to Make Recreational Trips to Sites Reservoir ..... 18-14

18-9 Roadway Segment Level of Service Thresholds..... 18-19

18-10 Sites Reservoir Recreational Trip Origins..... 18-22

18-11 Alternatives 1 and 3 Estimated Construction Daily Trips ..... 18-26

18-12 Alternatives 1 and 3 Roadway Levels of Service during Construction..... 18-28

18-13 Alternatives 1 and 3 Roadway Level of Service during Peak Recreation, Operations, and Maintenance ..... 18-31

18-14 Alternative 2 Estimated Construction Daily Trips ..... 18-33

18-15 Alternative 2 Roadway Level of Service during Construction..... 18-35

18-16 Sites Reservoir Estimated Recreational Daily Trips from Population Centers ..... 18-38

18-17 Daily Trips Relocated to Sites Reservoir from Other Recreation Locations..... 18-39

18-18 Alternatives 1 and 3 Daily Vehicle Miles Traveled Change ..... 18-40

18-19 Alternative 2 Daily Vehicle Miles Traveled Change ..... 18-42

19-1a Summary of Construction Impacts and Mitigation Measures for Noise Resources..... 19-1

19-1b Summary of Operations Impacts and Mitigation Measures for Noise Resources..... 19-2

19-2 Summary of Sensitive Receptors..... 19-5

19-3 Commonly Used Construction Equipment Noise Levels..... 19-7

19-4 Caltrans Vibration Guidelines for Potential Damage to Structures..... 19-8

19-5 Caltrans Guidelines for Vibration Annoyance Potential ..... 19-9

19-6 Typical Vibration Source Levels for Construction Equipment ..... 19-9

19-7 Construction Noise Levels by Project Component ..... 19-12

19-8 Construction Noise Abatement Plan and Construction Noise Attenuation ..... 19-14

20-1a Summary of Construction Impacts and Mitigation Measures for Air Quality Resources....20-1

20-1b Summary of Operation Impacts and Mitigation Measures for Air Quality Resources .....20-3

20-2 Sources and Potential Health and Environmental Effects of Criteria Pollutants.....20-5

20-3 Ambient Air Quality Monitoring Data (2017–2019) .....20-12

20-4a Federal Attainment Status of Four Counties in the Study Area .....20-14

20-4b State Attainment Status of Four Counties in the Study Area .....20-14

20-5 Summary of Sensitive Receptors.....20-15

20-6 CEQA Emissions Thresholds for Air Districts in the Study Area .....20-22

20-7 NEPA Thresholds for Nonattainment Areas in the Study Area (tons per year).....20-23

20-8 Localized Ambient Air Quality Significant Impact Levels ( $\mu\text{g}/\text{m}^3$ ) .....20-23

20-9 Criteria Pollutant and Precursor Emissions from Construction of Alternatives 1–3 – without Best Management Practices.....20-26

20-10 Criteria Pollutant and Precursor Emissions from Construction of Alternatives 1–3 – with Best Management Practices.....20-27

20-11 Criteria Pollutant and Precursor Emissions from Maintenance Activities and Recreational Activity (Worst-Case Year).....20-42

20-12 Criteria Pollutant and Precursor Emissions from Construction of Alternatives 1–3 in Nonattainment Areas of the SVAB – without Best Management Practices.....20-43

20-13 Criteria Pollutant and Precursor Emissions from Construction of Alternatives 1–3 in the Nonattainment Areas of the SVAB – with Best Management Practices.....20-44

20-14 Criteria Pollutant and Precursor Emissions from Operations in the Nonattainment Areas of the SVAB .....20-45

20-15 Excess Cancer and Noncancer Health Risks from Project Construction .....20-46

20-16 Maximum CAAQS and NAAQS Criteria Pollutant Concentration Impacts During Construction ( $\mu\text{g}/\text{m}^3$ ) [Non-Particulate Matter Pollutants] .....20-51

20-17 Alternative 1 and 3 Maximum Particulate Matter Concentration Impacts During Construction ( $\mu\text{g}/\text{m}^3$ ) .....20-52

20-18 Alternative 2 Maximum Particulate Matter Concentration Impacts During Construction ( $\mu\text{g}/\text{m}^3$ ) .....20-56

21-1a Summary of Construction Impacts between Alternatives .....21-1

21-1b Summary of Operations Impacts between Alternatives ..... 21-2

21-2 Lifetimes and Global Warming Potentials of Key Greenhouse Gases ..... 21-3

21-3 Global, National, State, and Local Greenhouse Gas Emissions Inventories ..... 21-5

21-4 Greenhouse Gas Emissions from Construction Alternatives 1, 2 and 3 a (metric tons CO<sub>2</sub>e)  
..... 21-12

21-5 Annual Greenhouse Gas Emissions from Alternative 1 Operations (metric tons CO<sub>2</sub>e) ... 21-14

21-6 Summary of Metric Ton Reduction (metric tons CO<sub>2</sub>e)..... 21-17

21-7 Annual Greenhouse Gas Emissions from Alternative 2 Operations (metric tons CO<sub>2</sub>e) ... 21-27

21-8 Annual Greenhouse Gas Emissions from Alternative 3 Operations (metric tons CO<sub>2</sub>e) ... 21-30

22-1a Summary of Construction Impacts and Mitigation Measures for Cultural Resources ..... 22-2

22-1b Summary of Operations Impacts and Mitigation Measures for Cultural Resources ..... 22-3

22-2 Archaeological Periods of the Sacramento Valley ..... 22-5

22-3a Early Native American Archaeological Property Types ..... 22-15

22-3b Post-Contact Archaeological Property Types ..... 22-16

22-4 Significant Historic Built Resources ..... 22-17

22-5 Ineligible Built Environment Resources ..... 22-20

22-6a Alternatives 1 and 3 Project Components and Cultural Resources ..... 22-22

22-6b Alternative 2 Project Components and Cultural Resources ..... 22-24

22-7a Summary of Potentially Significant Built Resources Types Within or Outside of the  
Alternatives 1 and 3 Inundation Areas ..... 22-28

22-7b Summary of Potentially Significant Built Resources Types Within or Outside of the  
Alternative 2 Inundation Areas ..... 22-32

22-8 Summary of Early Native American Archaeological Property Types Within or Outside of the  
Alternative 1 and 3 Inundation Areas..... 22-35

22-9 Summary of Post-Contact Archaeological Property Types Within or Outside of the  
Alternative 1 and 3 Inundation Areas..... 22-35

22-10 Summary of Early Native American Archaeological Property Types Within or Outside of the  
Alternative 2 Inundation Areas ..... 22-39

22-11 Summary of Post-Contact Archaeological Property Types Within or Outside of the Alternative 2 Inundation Areas ..... 22-40

23-1a Summary of Construction Impacts and Mitigation Measures for Tribal Cultural Resources ..... 23-2

23-1b Summary of Operations Impacts and Mitigation Measures for Tribal and Cultural Resources ..... 23-4

23-2 Summary of AB 52 Consultation ..... 23-11

23-3 Additional Outreach to California Native American Tribes ..... 23-11

24-1a Summary of Construction Impacts and Mitigation Measures for Visual Resources..... 24-3

24-1b Summary of Operations Impacts and Mitigation Measures for Visual Resources..... 24-3

24-2 Summary of Existing Project Landscape ..... 24-7

25-1a Summary of Construction Impacts and Mitigation Measures for Population and Housing Resources ..... 25-1

25-1b Summary of Operations Impacts and Mitigation Measures for Population and Housing Resources ..... 25-2

25-2 Current and Projected Populations of Colusa, Glenn, and Yolo Counties ..... 25-2

25-3 Housing Units in the Study Area..... 25-3

26-1a Summary of Construction Impacts and Mitigation Measures for Public Service and Utilities Resources ..... 26-2

26-1b Summary of Operations Impacts and Mitigation Measures for Public Service and Utilities Resources ..... 26-3

26-2 Summary of Glenn County Wastewater Treatment ..... 26-8

26-3 Summary of Colusa County Wastewater Treatment ..... 26-9

26-4 Estimates of Solid Waste as a Result of Demolition ..... 26-33

27-1a Summary of Construction Impacts and Mitigation Measures for Public Health and Environmental Hazards ..... 27-2

27-1b Summary of Operations Impacts and Mitigation Measures for Public Health and Environmental Hazards ..... 27-4

27-2 Project Facilities and Associated Responsibility Areas ..... 27-10

28-1 Summary of Project Operation Effects with Climate Change by Alternative ..... 28-2

28-2 Baseline Climate Conditions in Glenn, Colusa, Tehama, and Yolo Counties (Historical Modeled Baseline from 1961–1990)..... 28-3

28-3 Climate Change Trends for Hydrologic Regions Participating with Sites Reservoir ..... 28-5

28 4 Variables Analyzed in Climate Change Model ..... 28-9

28 5 Benefit Criteria for Climate Change Model Variables ..... 28-10

28-6 Shasta Lake Storage: Alternatives Compared with NAA (No Project) without Climate Change (a) and with Climate Change (b) — Critically Dry Water Years..... 28-12

    a) Without climate change..... 28-12

    b) With climate change..... 28-12

28-7 Sacramento River Flow at Bend Bridge: Alternatives Compared with NAA (No Project) without Climate Change (a) and with climate change (b) — Critically Dry Water Years..... 28-13

    a) Without climate change..... 28-13

    b) With climate change..... 28-13

28-8 Sacramento River Flow at Bend Bridge: Alternatives Compared with NAA (No Project) without Climate Change (a) and with climate change (b) — Wet Water Years. .... 28-13

    a) Without climate change..... 28-13

    b) With climate change..... 28-14

28-9 RBPP Diversions: Alternatives Compared with NAA (No Project) without Climate Change (a) and with climate change (b) — Wet Water Years. .... 28-14

    a) Without climate change..... 28-14

    b) With climate change..... 28-14

28-10 Hamilton City Diversions: Alternatives Compared with NAA (No Project) without Climate Change (a) and with climate change (b) — Wet Water Years. .... 28-15

    a) Without climate change..... 28-15

    b) With climate change..... 28-15

28-11 Sacramento River Flow near Wilkins Slough: Alternatives Compared with NAA (No Project) without Climate Change (a) and with climate change (b) — Critically Dry Water Years..... 28-16

    a) Without climate change..... 28-16

b) With climate change .....28-16

28-12 Sacramento River Flow near Wilkins Slough: Alternatives Compared with NAA (No Project) without Climate Change (a) and with climate change (b) — Wet Water Years. ....28-16

a) Without climate change .....28-16

b) With climate change .....28-17

28-13 Sites Reservoir (Total) Storage: Alternatives Compared with NAA (No Project) without Climate Change (a) and with climate change (b) — Critically Dry Water Years. ....28-17

a) Without climate change .....28-17

b) With climate change .....28-17

28-14 Sites Reservoir Releases (Total): Alternatives Compared with NAA (No Project) without Climate Change (a) and with climate change (b) — Critically Dry Water Years. ....28-18

a) No climate change .....28-18

b) With climate change .....28-18

28-15 Sites Reservoir Release to Sacramento River: Alternatives Compared with NAA (No Project) without Climate Change (a) and with climate change (b) — Critically Dry Water Years.....28-19

a) Without climate change .....28-19

b) With climate change .....28-19

28-16 Folsom Storage: Alternatives Compared with NAA (No Project) without Climate Change (a) and with climate change (b) — Critically Dry Water Years. ....28-19

a) Without climate change .....28-19

b) With climate change .....28-20

28-17 Lake Oroville Storage: Alternatives Compared with NAA (No Project) without Climate Change (a) and with Climate Change (b) — Critically Dry Water Years.....28-20

a) Without climate change .....28-20

b) With climate change .....28-20

28-18 Feather River Flow at Mouth: Alternatives Compared with NAA (No Project) without Climate Change (a) and with climate change (b) — Critically Dry Water Years. ....28-21

a) Without climate change .....28-21

b) With climate change .....28-21

28-19 American River Flow at H Street: Alternatives Compared with NAA (No Project) without Climate Change (a) and with climate change (b) — Critically Dry Water Years. .... 28-21

    a) Without climate change..... 28-21

    b) With climate change..... 28-22

28-20 Total SWP and CVP Exports: Alternatives Compared with NAA (No Project) without Climate Change (a) and with climate change (b) — Critically Dry Water Years. .... 28-22

    a) Without climate change..... 28-22

    b) With climate change..... 28-22

28-21 Yolo Bypass Flow: Alternatives Compared with NAA (No Project) without Climate Change (a) and with climate change (b) — Critically Dry Water Years..... 28-23

    a) Without climate change..... 28-23

    b) With climate change..... 28-23

28-22 Yolo Bypass Flow: Alternatives Compared with NAA (No Project) without Climate Change (a) and with climate change (b) — Wet Water Years ..... 28-24

    a) Without climate change..... 28-24

    b) With climate change..... 28-24

28-23 Delta Outflow: Alternatives Compared with NAA (No Project) without Climate Change (a) and with climate change (b) — Critically Dry Water Years. .... 28-24

    a) Without climate change..... 28-24

    b) With climate change..... 28-25

29-1a Summary of Construction Effects on ITAs by Alternative ..... 29-1

29-1b Summary of Operations Effects on ITAs by Alternative ..... 29-2

30-1a Summary of Construction Impacts and Mitigation Measures for Environmental Justice and Socioeconomics Resources ..... 30-2

30-1b Summary of Operations Impacts and Mitigation Measures for Environmental Justice and Socioeconomics Resources ..... 30-4

30-2 Population by Race and Ethnicity in 2019 of Glenn, Colusa, and Yolo Counties and California (percent) ..... 30-7

30-3 2019 Income Levels and Poverty Rates in Glenn, Colusa, and Yolo Counties and California ..... 30-7

30-4 2019 Socioeconomic Population Characteristics for Glenn, Colusa, and Yolo Counties and California..... 30-8

30-5 Summary of 2019 Average Employment Rates for Glenn, Colusa, and Yolo Counties and Statewide ..... 30-8

30-6 Substantial Adverse Effects Summary and Mitigation Measures ..... 30-12

30-7 Summary of Socioeconomic Effects Approaches ..... 30-17

31-1 Cumulative Project List..... 31-4

32-1 Summary of Simulated Sites Reservoir Annual Averages of Agricultural Deliveries (Thousand Acre Feet/Year) ..... 32-4

32-2 Sites Reservoir Agricultural Deliveries Compared to Total Agricultural Deliveries ..... 32-5

32-3 Summary of Simulated Sites Reservoir Annual Averages of Municipal and Industrial Deliveries (Thousand Acre Feet/Year)..... 32-7

32-4 Simulated Sites Reservoir Municipal and Industrial Deliveries Compared to Total Municipal and Industrial Deliveries ..... 32-8

32-5 Simulated Metropolitan Water District Water Deliveries (TAF/Year) ..... 32-10

32-6 Population Growth from 2000 to 2020..... 32-10

32-7 Projected Population Growth from 2020 to 2040..... 32-11

32-8 Summary of Significant Impacts of Each Alternative Before and After Implementation of Mitigation Measures ..... 32-17

33-1 Reclamation Staff Contributors ..... 33-7

33-2 Authority Staff Contributors ..... 33-8

33-3 Project Integration Team Contributors ..... 33-9

33-4 Consultant and Subconsultant Contributors ..... 33-9

34-1 Locations of Available Copies of the Sites Reservoir Project RDEIR/SDEIS ..... 34-1



## Figures

	<b>Page</b>
ES-1	Regional Map ..... follows page ES-6
ES-2	Vicinity Map ..... follows page ES-6
ES-3	Local Vicinity..... follows page ES-6
ES-4	Sites Reservoir Project Storage Partners Service Areas ..... follows page ES-6
ES-5	Alternatives 1 and 3 Regulating Reservoirs and Conveyance and Sites Reservoir Facilities ..... follows page ES-12
ES-6	Alternatives 1 and 3 Conveyance to Sacramento River Components ..... follows page ES-12
ES-7	Alternative 2 Regulating Reservoirs and Conveyance and Sites Reservoir Facilities ..... follows page ES-12
ES-8	Alternative 2 Conveyance to Sacramento River Components ..... follows page ES-12
1-1	Regional Map ..... follows page 1-1
1-2	Vicinity Map ..... follows page 1-1
1-3	Local Vicinity..... follows page 1-1
2-1	Alternatives 1 and 3 Regulating Reservoirs and Conveyance and Sites Reservoir Facilities ..... follows page 2-5
2-2	Alternatives 1 and 3 Conveyance to Sacramento River Components ..... follows page 2-5
2-3	Alternative 2 Regulating Reservoirs and Conveyance and Sites Reservoir Facilities ..... follows page 2-5
2-4	Alternative 2 Conveyance to Sacramento River Components ..... follows page 2-5
2-5	Sacramento River Conveyance Components ..... follows page 2-9
2-6	Red Bluff Pumping Plant ..... follows page 2-9
2-7	GCID Main Canal Head Gate Structure ..... follows page 2-9
2-8	GCID System Upgrades ..... follows page 2-10
2-9	GCID System Upgrades Continued..... follows page 2-10
2-10A	Terminal Regulating Reservoir East Facilities Site Plan..... follows page 2-11
2-10B1	Terminal Regulating Reservoir West Main Reservoir Plan ..... follows page 2-11
2-10B2	Terminal Regulating Reservoir West Reservoir Extension Plan..... follows page 2-11

2-10B3 Terminal Regulating Reservoir West Inlet/Outlet Canal Plan ..... follows page 2-11

2-11A Terminal Regulating Reservoir East and West Alts Pumping  
Generating Plant..... follows page 2-11

2-11B Terminal Regulating Reservoir East and West Alts Pumping  
Generating Plant..... follows page 2-11

2-12 Terminal Regulating Reservoir East or West Substation ..... follows page 2-12

2-13A Terminal Regulating Reservoir East Pipelines..... follows page 2-12

2-13B Terminal Regulating Reservoir West Pipelines ..... follows page 2-12

2-14 Funks Reservoir Facilities Site Plan..... follows page 2-13

2-15 Funks Reservoir Stockpile and Haul Route Plan ..... follows page 2-13

2-16A Funks Pumping Generating Plant Facilities ..... follows page 2-13

2-16B Funks Pumping Generating Plant Facilities ..... follows page 2-13

2-17 Alternatives 1 and 3 Conveyance Complex Facilities..... follows page 2-14

2-18 WAPA Schematic Sketch..... follows page 2-15

2-19 PG&E Schematic Sketch ..... follows page 2-15

2-20 Double-Circuit Source Transmission Poles ..... follows page 2-15

2-21 Alternatives 1 and 3 Funks Reservoir to Terminal Regulating Reservoir East or West  
Electrical Interconnection..... follows page 2-17

2-22 Administration and Operations Building ..... follows page 2-17

2-23 Maintenance and Storage Building ..... follows page 2-17

2-24 Plan of Inlet/Outlet Works Site ..... follows page 2-17

2-25 Profile of Inlet/Outlet Works Site..... follows page 2-17

2-26 Sites Dam Plan ..... follows page 2-19

2-27 Sites Dam Section ..... follows page 2-19

2-28 Golden Gate Dam Plan..... follows page 2-20

2-29 Golden Gate Dam Section ..... follows page 2-20

2-30 Saddle Dike Section ..... follows page 2-20

2-31 Saddle Dam 8B Spillway ..... follows page 2-20

2-32 TC Canal Intake Site Plan ..... follows page 2-21

2-33 Dunnigan CBD Discharge Site Plan..... follows page 2-21

2-34 Recreation Areas ..... follows page 2-22

2-35 Local Access, Construction Access, and Maintenance Access Roads ..... follows page 2-23

2-36 Available Diversion Capacity versus Streamflow at Red Bluff  
Pumping Plant ..... follows page 2-33

2-37 Available Diversion Capacity versus Streamflow at the GCID Hamilton City  
Pump Station ..... follows page 2-33

2-38 Onsite Borrow Area Details ..... follows page 2-51

2-39 Sites Lodoga Road Realignment and Bridge..... follows page 2-59

2-40 Dunnigan Sacramento River Discharge Site Plan ..... follows page 2-63

5-1 Daily Flow in Stone Corral Creek near Sites (cfs) ..... 5-5

5-2 100-Year Inundation Areas Relative to the Project Facilities ..... follows page 5-6

5-3 100-Year Inundation Areas Relative to Northern California's  
Central Valley..... follows page 5-11

5-4 100-Year Inundation Areas Relative to the Dunnigan Pipeline ..... follows page 5-11

5-5 100-Year Inundation Areas Relative to the GCID ..... follows page 5-11

6-1 Electrical Conductivity Measurements from the Sacramento River and  
Colusa Basin Drain..... 6-9

6-2 Estimated Effect of Evaporation from Sites Reservoir on a Hypothetical Constituent through  
Time as Derived from CALSIM Results..... 6-33

6-3 Relationships between Flow Metric and Total Aluminum Concentrations..... 6-45

6-4 Estimated Total Concentration of Aluminum before and after Settling of  
Suspended Sediment..... 6-46

6-5 Estimated Aqueous Methylmercury Concentrations at Freeport for Alternatives 1, 2, and 3  
and the No Project Alternative for Annual Average Flows..... 6-77

6-6 Estimated Fish Tissue Methylmercury Concentrations at Freeport for Alternatives 1, 2, and 3  
and the No Project Alternative for Annual Average Flows..... 6-78

6-7 Estimated Aqueous Methylmercury Concentrations at Freeport for Alternatives 1, 2, and 3  
and the No Project Alternative for Mean Monthly Flows in July – November of Dry and  
Critically Dry Water Years..... 6-80

6-8 Estimated Fish Tissue Methylmercury Concentrations at Freeport for Alternatives 1, 2, and 3 and the No Project Alternative for Mean Monthly Flows in July – November of Dry and Critically Dry Water Years..... 6-80

6-9 Estimated Total Aluminum Concentration in Inflow to Sites Reservoir, in Sites Reservoir, and in the Sacramento River at the Sites Discharge Location..... 6-84

6-10 Estimated Total Copper Concentration in Inflow to Sites Reservoir, in Sites Reservoir, and in the Sacramento River at the Sites Discharge Location..... 6-84

6-11 Estimated Total Iron Concentration in Inflow to Sites Reservoir, in Sites Reservoir, and in the Sacramento River at the Sites Discharge Location ..... 6-85

6-12 Estimated Total Lead Concentration in Inflow to Sites Reservoir, in Sites Reservoir, and in the Sacramento River at the Sites Discharge Location..... 6-85

7-1 Sacramento River Reaches ..... follows page 7-8

8-1 Subbasins of the Sacramento Valley Groundwater Basin ..... follows page 8-2

11-1 Aquatic Biological Resources Study Area ..... 11-2

11-2 Local Drainages, Stone Corral and Funks Creeks ..... 11-52

11-3 Mean Monthly Catch Per Beach Seine of Juvenile Winter-Run Chinook Salmon in the Sacramento River Between River Mile 164 and River Mile 298, 1981–1991 ..... 11-82

11-4 Mean Monthly Catch Per Beach Seine of Juvenile Winter-Run Chinook Salmon in the Sacramento River Between River Mile 71 and River Mile 144, 1981–2019 ..... 11-83

11-5 Daily Percentage of Sacramento River Flow Entering the Oxbow Containing the Hamilton City Intake, 2018, Divided into Five Groups Based on Percentage of Hamilton City River Flow Diverted by the Intake ..... 11-85

11-6 Winter-Run Chinook Salmon Fork Length (a) Capture Proportions, (b) Cumulative Capture Size Curve, and (c) Average Weekly Median Boxplots, As Sampled at Red Bluff Diversion Dam Rotary Screw Traps, July 2002–June 2013. .... 11-87

11-7 Predicted Screen Passage Time for Juvenile Chinook Salmon (44-mm Standard Length) Encountering the Red Bluff and Hamilton City Fish Screens at Approach Velocity of 0.33 Feet per Second During the Day and Night..... 11-93

11-8 Predicted Screen Passage Time for Juvenile Chinook Salmon (79-mm Standard Length) Encountering the Red Bluff and Hamilton City Fish Screens at Approach Velocity of 0.33 Feet per Second During the Day and Night..... 11-94

11-9 Predicted Number of Screen Contacts for Juvenile Chinook Salmon (44-mm Standard Length) Encountering the Red Bluff and Hamilton City Fish Screens at Approach Velocity of 0.33 Feet per Second During the Day and Night..... 11-95

11-10 Predicted Number of Screen Contacts for Juvenile Chinook Salmon (79-mm Standard Length) Encountering the Red Bluff and Hamilton City Fish Screens at Approach Velocity of 0.33 Feet per Second During the Day and Night..... 11-96

11-11 Streamflow Overtopping the Fish Screen Structure at Glenn-Colusa Irrigation District Hamilton City Pumping Plant, February 18, 2017. .... 11-102

11-12 Segments 2–6 of the Sacramento River Used in U.S. Fish and Wildlife Service Studies to Determine Spawning and Rearing Weighted Usable Area (WUA) ..... 11-110

11-13 Mean Monthly Catch Per Beach Seine of Juvenile Spring-Run Chinook Salmon in the Sacramento River Between River Mile 164 and River Mile 298, 1981–1991 ..... 11-134

11-14 Mean Monthly Catch Per Beach Seine of Juvenile Spring-Run Chinook Salmon in the Sacramento River Between River Mile 71 and River Mile 144, 1981–2019 ..... 11-135

11-15 Spring-Run Chinook Salmon Fork Length (a) Capture Proportions, (b) Cumulative Capture Size Curve, and (c) Average Weekly Median Boxplots, As Sampled at Red Bluff Diversion Dam Rotary Screw Traps, October 2002–June 2013 ..... 11-139

11-16 Mean Monthly Catch Per Beach Seine of Juvenile Fall-Run Chinook Salmon in the Sacramento River Between River Mile 164 and River Mile 298, 1981–1991 ..... 11-161

11-17 Mean Monthly Catch Per Beach Seine of Juvenile Fall-Run Chinook Salmon in the Sacramento River Between River Mile 71 and River Mile 144, 1981–2019 ..... 11-162

11-18 Mean Monthly Catch Per Beach Seine of Juvenile Late Fall-Run Chinook Salmon in the Sacramento River Between River Mile 164 and River Mile 298, 1981–1991 ..... 11-163

11-19 Mean Monthly Catch Per Beach Seine of Juvenile Late Fall-Run Chinook Salmon in the Sacramento River Between River Mile 71 and River Mile 144, 1981–2019 ..... 11-164

11-20 Fall-Run Chinook Salmon Fork Length (a) Capture Proportions, (b) Cumulative Capture Size Curve, and (c) Average Weekly Median Boxplots, As Sampled at Red Bluff Diversion Dam Rotary Screw Traps, July 2002–June 2013. .... 11-168

11-21 Late Fall-Run Chinook Salmon Fork Length (a) Capture Proportions, (b) Cumulative Capture Size Curve, and (c) Average Weekly Median Boxplots, As Sampled at Red Bluff Diversion Dam Rotary Screw Traps, July 2002–June 2013 ..... 11-169

11-22 Steelhead Fork Length (a) Capture Proportions, (b) Cumulative Capture Size Curve, and (c) Average Weekly Median Boxplots, As Sampled at Red Bluff Diversion Dam Rotary Screw Traps, July 2002–June 2013 ..... 11-197

11-23 Overview of Flow-Tolerance Limitations of Green (GS) and White (WS) Sturgeon Throughout the Sacramento-San Joaquin Watershed According to Location and Time of Year, Based on Critical Swimming Speed ..... 11-219

11-24 Green Sturgeon a) Annual Total Length Capture Boxplots and b) Annual Cumulative Capture Trends with 10-Year Mean Trend Line, from Rotary Screw Trap Sampling at Red Bluff Diversion Dam, 2003–2012 ..... 11-220

11-25 Nocturnal Distribution Pattern of Capture of Larval Green Sturgeon at Red Bluff Diversion Dam Outfall and Tehama Bridge in 2010. .... 11-221

11-26 Managed Flow Pulse in the Yolo Bypass Toe Drain at Lisbon Weir and Chlorophyll Concentration at Rio Vista During 2016 Pilot North Delta Food Subsidy From Colusa Basin Drain Action ..... 11-251

11-27 Managed Flow Pulse in the Yolo Bypass Toe Drain at Lisbon Weir and Chlorophyll Concentration at Rio Vista During 2016 Pilot North Delta Food Subsidy From Colusa Basin Drain Action ..... 11-252

11-28 Managed Flow Pulse in the Yolo Bypass Toe Drain at Lisbon Weir and Chlorophyll Concentration from North (RCS) to South (STTD) in the Yolo Bypass During 2018 Pilot North Delta Food Subsidy From Colusa Basin Drain Action ..... 11-253

11-29 Chlorophyll Concentration at Rio Vista Before, During, and After 2018 Pilot North Delta Food Subsidies Action..... 11-254

11-30 Dissolved Oxygen in the Yolo Bypass Toe Drain at Liberty Island During 2018 ..... 11-256

11-31 Dissolved Oxygen in the Yolo Bypass Toe Drain at Lisbon Weir (Blue Line) and Sacramento River at River Vista (Black Line) During 2019 ..... 11-256

11-32 Dissolved Oxygen Cache Slough at Liberty Island During 2018 ..... 11-257

11-33 Dissolved Oxygen Cache Slough at Liberty Island During 2019 ..... 11-257

11-34 Water Temperature in the Yolo Bypass Toe Drain at Liberty Island During 2018 ..... 11-258

11-35 Water Temperature in the Yolo Bypass Toe Drain at Lisbon Weir (Blue Line) and Sacramento River at Rio Vista (Black Line) During 2019..... 11-259

11-36 Violin Plots of Longfin Smelt Fall Midwater Trawl Index by Water Year Type from Nobriga and Rosenfield (2016) Model..... 11-271

11-37 95% Confidence Intervals of Longfin Smelt Fall Midwater Trawl Index by Water Year Type from Nobriga and Rosenfield (2016) Model ..... 11-273

12-1A Geologic Map of the Study Area (Central Portion)..... follows page 12-6

12-1B Geologic Map of the Study Area (Northern Portion) ..... follows page 12-6

12-1C Geologic Map of the Study Area (Southern Portion) ..... follows page 12-6

12-2 Detailed Geologic Map of Dam and Inundation Area..... follows page 12-8

12-3 Cross Section of Geologic Structures ..... follows page 12-11

12-4 Regional and Sites Reservoir Faults..... follows page 12-13

12-5 Regional Seismicity ..... follows page 12-13

12-6 Division of Safety of Dams’ Fault Slip Consequence-Hazard Matrix ..... follows page 12-27

12-7 Median and 84th Percentile Deterministic Seismic Response Spectra ..... follows page 12-31

15-1A Cropland in the Project Area ..... follows page 15-6

15-1B Cropland in the Project Area ..... follows page 15-6

15-1C Cropland in the Project Area ..... follows page 15-6

15-2A Important Farmland and Grazing Land in the Project Area ..... follows page 15-6

15-2B Important Farmland and Grazing Land in the Project Area ..... follows page 15-6

15-2C Important Farmland and Grazing Land in the Project Area ..... follows page 15-6

15-3A Agricultural Zoning in Project Area..... follows page 15-6

15-3B Agricultural Zoning in Project Area..... follows page 15-6

15-3C Agricultural Zoning in Project Area..... follows page 15-6

15-4A Land under Williamson Act and Farmland Security Zone Contracts  
in the Project Area..... follows page 15-6

15-4B Land under Williamson Act and Farmland Security Zone Contracts  
in the Project Area..... follows page 15-6

15-4C Land under Williamson Act and Farmland Security Zone Contracts  
in the Project Area..... follows page 15-6

16-1 Reservoirs and Other Recreation Near the Study Area ..... follows page 16-3

18-1 Reservoirs and Other Recreation Near the Study Area ..... follows page 18-13

18-2 Population Centers Near the Study Area..... follows page 18-14

20-1 Project Area to Study Area..... follows page 20-9

20-2 Ozone and PM2.5 Federal Attainment and Non-Attainment Areas  
in the Study Area..... follows page 20-43

27-1 State Responsibility Areas and Alternatives 1, 2, and 3..... follows page 27-9

27-2 Fire Hazard Severity Zones ..... follows page 27-10

30-1 Minority-Based Environmental Justice Populations ..... follows page 30-20

30-2 Low Income-Based Environmental Justice Populations ..... follows page 30-21

## Acronyms

Acronym	Definition
°F	Fahrenheit
µg/L	micrograms per liter
µg/m <sup>3</sup>	micrograms per cubic meter
µS/cm	microsiemens per centimeter
µmhos/cm	micromhos per centimeter
1D	one-dimensional
2017 Draft EIR/EIS	Public Draft EIR/EIS for the Project in 2017
AAQA	Ambient Air Quality Analysis
AASHTO	Association of State Highway and Transportation Officials
ACID	Anderson-Cottonwood Irrigation District
ACM	asbestos-containing materials
ADIs	areas of potential direct impacts
ADL	aerially deposited lead
AF	acre-feet
AFY	acre-feet per year
AICP	American Institute of Certified Planners
AIPCP	Aquatic Invasive Plant Control Program
AP-42	EPA's AP-42 <i>Compilation of Air Pollutant Emission Factors</i>
APN	Assessor's Parcel Number
ATLs	Advisory Tissue Levels
Authority	Sites Project Authority
Bay-Delta Plan	Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary
BGEPA	Bald and Golden Eagle Protection Act
BiOp	biological opinion
BMOs	Basin Management Objectives
BMPs	best management practices
BRWL	blue-rich with lamps
C&HRR	Colusa & Hamilton Railroad



<b>Acronym</b>	<b>Definition</b>
C.F.R.	Code of Federal Regulations
CAAQS	California ambient air quality standards
CAISO	California Independent System Operator
CAL FIRE	California Department of Forestry and Fire Protection
Cal. Code Regs	California Code of Regulations
CalEEMod	California Emissions Estimator Model
CalGEM	California Geologic Energy Management Division
CalGreen	California Green Building Standards Code
CalISO	California Independent System Operator
CalOES	Governor's Office of Emergency Services
Cal-OSHA	California-Occupational Safety and Health Administration
Caltrans	California Department of Transportation
CARB	California Air Resources Board
CBD	Colusa Basin Drain
CCAPCD	Colusa County Air Pollution Control District
CCR	California Code of Regulations
CCWD	Contra Costa Water District
CDFW	California Department of Fish and Wildlife
CEC	California Energy Commission
Central Valley Basin Plan	Water Quality Control Plan for the Sacramento and San Joaquin River Basins
Central Valley RWQCB	Central Valley Regional Water Quality Control Board
CEP	Certified Environmental Planner
CEQ	Council on Environmental Quality's
CEQA	California Environmental Quality Act
CERS	California Environmental Reporting System
CESA	California Endangered Species Act
CFNR	California Northern Railroad
CFR	Code of Federal Regulations
cfs	cubic feet per second
CGA	Colusa Groundwater Authority
CGS	California Geological Survey

<b>Acronym</b>	<b>Definition</b>
CH <sub>4</sub>	methane
CHP	California Highway Patrol
CHRIS	California Historical Resources Information Center
CNDDB	California Natural Diversity Database
CNEL	community noise equivalent level
CNPS	California Native Plant Society
CO	carbon monoxide
CO <sub>2</sub>	carbon dioxide
CO <sub>2e</sub>	carbon dioxide equivalent
CPT	cone penetration test
CPUC	California Public Utilities Commission
CPUE	catch per unit effort
CRHR	California Register of Historical Resources
CRPR	California Rare Plant Rank
CRSBZ	Coast Ranges – Sierran Block Boundary Zone
CT 2035	2035 Central Tendency
CTR	California Toxics Rule
CUPA	Certified Unified Program Agencies
CVFPB	Central Valley Flood Protection Board
CVHM	Central Valley Hydrologic Model
CVJV	Central Valley Joint Venture
CVP	Central Valley Project
CVPIA	Central Valley Project Improvement Act
CWA	Clean Water Act
CWC	California Water Commission
dB	decibels
dBA	A-weighted decibel
DBPs	disinfection byproducts
DBW	Division of Boating and Waterways
DCC	Delta Cross Channel
DDT	dichlorodiphenyltrichloroethane
Delta	Sacramento–San Joaquin River Delta

<b>Acronym</b>	<b>Definition</b>
DO	dissolved oxygen
DOC	California Department of Conservation
dph	days post hatch
DPM	diesel particulate matter
DPR	California Department of Parks and Recreation
DPS	distinct population segment
DRMS	Delta Risk Management Strategy
DSOD	California Department of Water Resources, Division of Safety of Dams
DWR	California Department of Water Resources
EC	electrical conductivity
EDWPA	El Dorado Water & Power Authority
EFH	essential fish habitat
EID	El Dorado Irrigation District
EIR/EIS	Environmental Impact Report/Environmental Impact Statement
EMF	Electric Magnetic Field
EMFAC	Emissions Factors
EMTs	emergency medical technicians
EO	Executive Order
ERP	Ecosystem Restoration Program
ERS	emergency release structures
ESA	Endangered Species Act
ESU	evolutionarily significant unit
ET <sub>o</sub>	evapotranspiration
FCWCD	Flood Control and Water Conservation District
FEMA	Federal Emergency Management Agency
FERC	Federal Energy Regulatory Commission
FHSZs	fire hazard severity zones
FL	fork length
FMMP	Farmland Mapping and Monitoring Program
FMUs	future mitigation units
FPPA	Farmland Protection Policy Act
ft/s	feet per second

<b>Acronym</b>	<b>Definition</b>
FR	Federal Register
FRSA	Feather River Service Area
g	acceleration speed of gravity
gallons/day	gallons per day
GCAPCD	Glenn County Air Pollution Control District
GCID	Glenn-Colusa Irrigation District
GHG	greenhouse gas
GIS	geographic information system
GPS	Global Positioning System
GSPs	Groundwater Sustainability Plans
Guthion	azinphos-methyl
GWh	gigawatt-hours
GWMPs	Groundwater Management Plans
GWP	global warming potential
HABs	harmful algal blooms
HAPC	Habitat Area of Particular Concern
HCM	Highway Capacity Manual
HCP	Habitat Conservation Plan
HEC-SSP	Hydraulic Engineering Center's Statistical Software Package
HFC	high-flow channel
HFCs	hydrofluorocarbons
HMMPs	Hazardous Materials Management Plans
HOR	Head of Old River
hp	horsepower
HRA	health risk assessment
HSC	Health and Safety Code
I-	Interstate
I/O	Inlet/Outlet
I/O Works	Inlet/Outlet Works
I:E	inflow to exports
I-5	Interstate 5
IHN	Infectious Hematopoietic Necrosis

<b>Acronym</b>	<b>Definition</b>
in/sec	inches per second
IPaC	Information, Planning, and Consultation
IPCC	Intergovernmental Panel on Climate Change
ISWEBE	Inland Surface Waters, Enclosed Bays, and Estuaries
ITAs	Indian Trust Assets
ITP	Incidental Take Permit
kg	kilogram
KLOG	Knights Landing Outfall Gates
kV	kilovolt
kVA	kilovolt-amperes
kW	kilowatts
LBP	lead-based paint
LCPSIM	Least Cost Planning Simulation
LESA	Land Evaluation and Site Assessment
LFC	low-flow channel
LMP	Land Management Plan
LOS	level of service
LRA	Local Responsibility Area
LRFD	Load and Resistance Factor Design
M&I	municipal and industrial
MAF	million acre-feet
MAR	Managed Aquifer Recharge
MCLs	maximum contaminant levels
MCRP	Master of Community and Regional Planning
METS	Medical Transportation Service
mg	milligrams
mg/L	milligrams per liter
MGD	million gallons per day
mm	millimeters
MOU	memorandum of understanding
MP	Mile Post
mph	miles per hour

<b>Acronym</b>	<b>Definition</b>
MPO	Metropolitan Planning Organizations
MRR	minimum release requirement
MRZs	Mineral Resource Zones
msl	mean sea level
MT	metric tons
MUTCD	Manual for Uniform Traffic Control Devices
MVA	megavolt amperes
MW	megawatt
MWI	Maxwell Water Intertie
N <sub>2</sub> O	nitrous oxide
NAA	No Action Alternative
NAAQS	national ambient air quality standards
NCCP	Natural Community Conservation Plan
NEPA	National Environmental Policy Act
NFH	National Fish Hatchery
NGOs	nongovernmental organizations
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NO	nitric oxide
NO <sub>2</sub>	nitrogen dioxide
NOA	naturally occurring asbestos
NODOS	North-of-Delta Offstream Storage
NOI	Notice of Intent
NOP	Notice of Preparation
NO <sub>x</sub>	nitrogen oxides
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NTU	nephelometric turbidity units
NWR	National Wildlife Refuge
NZE	near-zero emission
OEHHA	Office of Environmental Health Hazard Assessment
OES	Office of Emergency Services

<b>Acronym</b>	<b>Definition</b>
OHP	Office of Historic Preservation
OMWEM	Other Municipal Water Economics Model
OPR	Office of Planning and Research
Pb	lead
PCBs	polychlorinated biphenyls
PECs	potential environmental concerns
PFCs	perfluorocarbons
PG&E	Pacific Gas and Electric Company
PGP	pumping generating plant
PM	particulate matter
PM10	particulates 10 microns in diameter or less
PM2.5	2.5 microns in diameter or less
PMF	probable maximum flood
POD	Pelagic Organism Decline
POI	point of interconnection
Portfolio	2020 Water Resilience Portfolio
ppm	parts per million
ppt	parts per thousand
PPV	peak particle velocity
PRMMP	paleontological resources monitoring and mitigation plan
Project	Sites Reservoir Project
Proposition 1	Water Quality, Supply, and Infrastructure Improvement Act of 2014
PSPS	Public Safety Power Shutoff
pTms	pre-Tertiary
RBDD	Red Bluff Diversion Dam
RBPP	Red Bluff Pumping Plant
RCP	Representative Concentration Pathway
RCRA	Resource Conservation and Recovery Act
RDEIR/SDEIS	Revised Draft Environmental Impact Report/Supplemental Draft Environmental Impact Statement
Reclamation	U.S. Department of the Interior, Bureau of Reclamation
RM	River Mile

<b>Acronym</b>	<b>Definition</b>
RMP	Reservoir Management Plan
RMS	root mean square
ROC ON LTO	Reinitiation of Consultation on the Long-Term Operation of the Central Valley Project and the State Water Project
ROD	Record of Decision
ROGs	reactive organic gases
ROV	remote operated vehicle
RPAs	Reasonable and Prudent Actions
RPS	Renewable Portfolio Standard
RTP	regional transportation plan
RTS	reservoir-triggered seismicity
RV	recreational vehicle
RWQCB model	Central Valley Regional Water Quality Control Board TMDL model
SALMOD	Salmonid Population Modeling
SB	Senate Bill
SCADA	Supervisory Control and Data Acquisition
SDC	California Department of Transportation Seismic Design Criteria
SEL	sound exposure level
Settlement	Stipulation of Settlement
SF <sub>6</sub>	sulfur hexafluoride
SGMA	Sustainable Groundwater Management Act
SHPO	State Historic Preservation Officer
SLCPs	short-lived climate pollutants
SMAQMD	Sacramento Metropolitan Air Quality Management District
SO <sub>2</sub>	sulfur dioxide
SOI	Secretary of Interior
SPCCPs	Spill Prevention, Containment, and Countermeasure Plans
SPFC	State Plan of Flood Control
SPRR	Southern Pacific Railroad
SR	State Route
SRA	shaded riverine aquatic
SRBPP	Sacramento River Bank Protection Project



<b>Acronym</b>	<b>Definition</b>
SRFCP	Sacramento River Flood Control Project
SST	Salmonid Scoping Team
SSURGO	Soil Survey Geographic
State ITP	SWP Incidental Take Permit for Long-term Operations of the State Water Project in the Sacramento-San Joaquin Delta
State Water Board	State Water Resources Control Board
SURF	California Department of Pesticide Regulation's Surface Water Database
SVAB	Sacramento Valley Air Basin
SVP	Society of Vertebrate Paleontology
SWAMP	Surface Water Ambient Monitoring Program
SWAP	Statewide Agricultural Production
SWP	State Water Project
SWPPP	Stormwater Pollution Prevention Plan
SWRCB	State Water Resources Control Board
TACs	toxic air contaminants
TAF	thousand acre-feet
TAF/yr	thousand acre-feet per year
TCCA	Tehama-Colusa Canal Authority
TC Canal	Tehama-Colusa Canal
TCAPCD	Tehama County Air Pollution Control District
TCD	temperature control device
TDS	total dissolved solids
TL	trophic level
TMDL	Total Maximum Daily Load
TMP	Traffic Management Plan
TOC	total organic carbon
TRAX	Tehama Rural Area Express
TRR	Terminal Regulating Reservoir
U.S.C.	United States Code
UCMP	University of California Museum of Paleontology
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency

<b>Acronym</b>	<b>Definition</b>
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
USRDOM	Upper Sacramento River Daily Operations Model
USTs	underground storage tanks
VHFHSZ	Very High Fire Hazard Severity Zone
VMT	vehicle miles traveled
VP	Value Planning
WA	Wildlife Area
WAPA	Western Area Power Administration
WCG	wildlife crossing species guild
WDL	Water Data Library
WEAP	Worker Environmental Awareness Program
WIIN Act	Water Infrastructure Improvements for the Nation Act
WNV	West Nile virus
WRLCM	Winter-Run Chinook Salmon Life Cycle Model
WSE	water surface elevation
WSIP	Water Storage Investment Program
WUA	weighted usable area
ww	wet weight
WWD	Westlands Water District
YBHR	Yolo Bypass Habitat Restoration
YSAQMD	Yolo Solano Air Quality Management District
ZE	zero emission