

1 Pacific Lamprey

2 Construction and Maintenance of Water Conveyance Facilities

3 Impact AQUA-163: Effects of Construction of Water Conveyance Facilities on Pacific Lamprey

4 The potential effects of construction of the water conveyance facilities on Pacific lamprey would be
5 the same as those described for Alternative 4, Impact AQUA-163. This section provides additional
6 detail on underwater noise impacts which are also applicable to Impact AQUA-163 in Alternative 4.

7 Table 11-8 presents the life stages of Pacific lamprey and months of their potential presence in the
8 north, east, and south Delta during the proposed in-water construction window (June 1–October
9 31). Potential impacts of pile driving noise on Pacific lamprey are different from other fish species.
10 In a study of hearing in sturgeon and lamprey, Popper (2005) found that lamprey do not have the
11 typical hearing structures of other fish. Although there have been no studies to determine responses
12 of lamprey to sound (Popper 2005), ammocoetes are partially buried in the substrate, and the
13 substrate dampens vibrations and noise. As a result, at least some life stages of Pacific lamprey may
14 be less susceptible to injury from impact pile driving than other fish species.

15 Under Alternative 4A, adult, ammocoete, and macrophthalmia life stages could be present in the
16 vicinity of the proposed in-water pile driving locations (intakes, barge unloading facilities, CCF
17 cofferdams, CCF siphons, and Head of Old River operable barrier) during in-water pile driving
18 activities. While adults would primarily occur between June and July and macrophthalmia in June,
19 ammocoetes would occur throughout the year. However, the abundance of ammocoetes is low at all
20 in-water pile driving sites. Adults are considered moderately abundant in June and July near the
21 intakes, but of low abundance in the east and south Delta where barge landings would be located.
22 Macrophthalmia would be primarily migrating downstream, and during only a portion of the in-water
23 construction period. Therefore their exposure to pile driving sound levels would likely be limited.

24 Given the likely low numbers in the east and south Delta, the relatively small areas affected by
25 underwater noise in the east and south Delta, and the intermittent nature of pile driving activities,
26 exposure of Pacific lamprey to potentially harmful pile driving noise is expected to be limited to a
27 small proportion of the total population. Implementation of Mitigation Measures AQUA-1a and
28 AQUA-1b would reduce the magnitude of these effects. Overall, underwater construction noise
29 would be expected to adversely affect small numbers of Pacific lamprey and not result in significant
30 population-level effects.

31 *NEPA Effects:* As concluded for Alternative 4, Impact AQUA-163, the effect would not be adverse for
32 Pacific lamprey. Implementation of the measures described in Appendix 3B, *Environmental*
33 *Commitments*, such as *Environmental Training; Stormwater Pollution Prevention Plan; Erosion and*
34 *Sediment Control Plan; Hazardous Materials Management Plan; Spill Prevention, Containment, and*
35 *Countermeasure Plan; Disposal of Spoils, Reusable Tunnel Material, and Dredged Material; Fish Rescue*
36 *and Salvage Plan; and Barge Operations Plan* would guide rapid and effective response in the case of
37 **inadvertent spills of hazardous materials. This species' natural tolerance to turbidity**, would likely
38 avoid the risk of any adverse turbidity effects resulting from project construction. Construction
39 would not be expected to increase predation rates relative to baseline conditions. Construction will
40 result in both temporary and permanent alteration of rearing and migratory habitats used by Pacific
41 lamprey. However, Alternative 4A includes Environmental Commitment 4 to restore tidal habitat.
42 The direct effects of underwater construction noise on Pacific lamprey that may be present could be
43 adverse if they are exposed. However, implementation of Mitigation Measures AQUA-1a and AQUA-

1 1b, combined with the in-water work window that would minimize exposure, would reduce the
2 potential for effects from underwater noise and this effect would not be adverse.

3 *CEQA Conclusion:* As described in Alternative 4, Impact AQUA-163, the impact of the construction of
4 the water conveyance facilities on Pacific lamprey would not be significant except for construction
5 noise associated with pile driving. Construction of Alternative 4A involves several elements with the
6 potential to affect Pacific lamprey. However, these turbidity and hazardous material spill effects will
7 be effectively avoided and/or minimized through implementation of environmental commitments
8 (see Impact AQUA-1 and Appendix 3B, *Environmental Commitments: Environmental Training;*
9 *Stormwater Pollution Prevention Plan; Erosion and Sediment Control Plan; Hazardous Materials*
10 *Management Plan; Spill Prevention, Containment, and Countermeasure Plan; Disposal of Spoils,*
11 *Reusable Tunnel Material, and Dredged Material; Fish Rescue and Salvage Plan; and Barge Operations*
12 *Plan*). Implementation of Mitigation Measures AQUA-1a and AQUA-1b would reduce that noise
13 impact to less than significant.

14 Mitigation Measure AQUA-1a: Minimize the Use of Impact Pile Driving to Address Effects
15 of Pile Driving and Other Construction-Related Underwater Noise

16 Mitigation Measure AQUA-1b: Monitor Underwater Noise and if Necessary, Use an
17 Attenuation Device to Reduce Effects of Pile Driving and Other Construction-Related
18 Underwater Noise

19 Impact AQUA-164: Effects of Maintenance of Water Conveyance Facilities on Pacific Lamprey

20 *NEPA Effects:* The potential effects of the maintenance of water conveyance facilities under
21 Alternative 4A would be the same as those described for Alternative 4, Impact AQUA-164. As
22 concluded in Alternative 4, Impact AQUA-164, the impact would not be adverse for Pacific lamprey.

23 *CEQA Conclusion:* As described in Alternative 4, Impact AQUA-164, the impact of the maintenance
24 of water conveyance facilities on Pacific lamprey would be less than significant and no mitigation is
25 required.

26 Operations of Water Conveyance Facilities

27 Impact AQUA-165: Effects of Water Operations on Entrainment of Pacific Lamprey

28 *Water Exports*

29 The potential entrainment impacts of Alternative 4A on Pacific lamprey and river lamprey would be
30 similar to Alternative 4 for operating SWP/CVP south Delta export facilities and the proposed new
31 SWP/CVP North Delta intakes (Impact AQUA-165). Alternative 4A operational criteria are designed
32 to avoid or reduce potential entrainment and the effect would not be adverse.

33 The analysis of Pacific lamprey and river lamprey entrainment at the SWP/CVP south Delta export
34 facilities is combined because the salvage facilities do not distinguish between the two lamprey
35 species. Under Scenario H3_ELT, average annual entrainment of lamprey at the south Delta export
36 facilities would be substantially reduced by about 45% (Table 11-4A-115) across all year types
37 compared to the NAA_ELT. Entrainment losses would be further reduced under Scenario H4_ELT
38 compared to NAA_ELT. Therefore, Alternative 4A would not have adverse effects on lamprey.

1 *Predation Associated with Entrainment*

2 Entrainment-related predation loss of lamprey at the south Delta facilities would not be greater
 3 under this Alternative compared to the NNA-ELT and would be lower due to a reduction in
 4 entrainment loss. Conditions under Scenario H4_ELT would decrease predation loss relative to
 5 NAA_ELT and Scenario H3_ELT. Predation at the north Delta would be increased due to the
 6 installation of the proposed water export facilities on the Sacramento River. The effect on lamprey
 7 from predation loss at the north Delta facilities is unknown because of the lack of knowledge about
 8 their distribution and population abundances in the Delta.

9 *NEPA Effects:* Overall, the effect of entrainment and entrainment-related predation would not be
 10 adverse because entrainment, and predation associated with entrainment, would be reduced under
 11 Alternative 4A.

12 *CEQA Conclusion:* Annual entrainment losses of lamprey would be decreased under Scenario
 13 H3_ELT by 45% relative to Existing Conditions, and would be further decreased under Scenario
 14 H4_ELT. Lamprey predation loss at the south Delta facilities would not be increased relative to
 15 Existing Conditions and may be decreased due to reduction entrainment losses. Predation at the
 16 north Delta would be increased due to the installation of the proposed water export facilities on the
 17 Sacramento River. The effect on lamprey from predation loss at the north Delta facilities is unknown
 18 because of the lack of knowledge about their distribution and population abundances in the Delta.
 19 Overall, the effect of predation loss on lamprey under Alternative 4A would be similar or lower than
 20 existing conditions, consistent with the change in entrainment. Overall, the impacts of Alternative
 21 4A water operations to Pacific lamprey are considered less than significant because they would
 22 reduce entrainment and potentially entrainment-related predation. Consequently, no mitigation
 23 would be required.

24 Table 11-4A-115. Lamprey Annual Entrainment Index^a at the SWP and CVP Salvage Facilities for
 25 Alternative 4A (Scenario H3_ELT)

Water Year Type	Absolute Difference (Percent Difference)	
	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
All Years	-1,526 (-45%)	-1,504 (-45%)

Note: Negative numbers indicate lower values under Alternative 4A (i.e., the calculations are based on Alternative 4A minus the baseline).

^a Estimated annual number of fish lost, based on non-normalized data.

26
 27 Impact AQUA-166: Effects of Water Operations on Spawning and Egg Incubation Habitat for
 28 Pacific Lamprey

29 In general, Alternative 4A would not affect the quality and quantity of spawning and egg incubation
 30 habitat for Pacific lamprey relative to the NAA_ELT.

31 H3_ELT/ESO_ELT

32 Flow-related impacts to Pacific lamprey spawning habitat were evaluated by estimating effects of
 33 flow alterations on egg exposure, called redd dewatering risk, and effects on water temperature.
 34 Rapid reductions in flow can dewater redds leading to mortality. Locations for each river used in the
 35 dewatering risk analysis were based on available literature, personal conversations with agency

experts, and spatial limitations of the CALSIM II model, and include the Sacramento River at Keswick, Sacramento River at Red Bluff, Trinity River downstream of Lewiston, Feather River at Thermalito Afterbay, and the American River at Nimbus Dam and at the confluence with the Sacramento River. Pacific lamprey spawn in these rivers between January and August so flow reductions during those months have the potential to dewater redds, which could result in incomplete development of the eggs to ammocoetes (the larval stage). Water temperature results from the SRWQM and the Reclamation Temperature Model were used to assess the exceedances of water temperatures under all model scenarios in the upper Sacramento, Trinity, Feather, and American rivers.

Dewatering risk to redd cohorts was characterized by the number of cohorts experiencing a month-over-month reduction in flows (using CALSIM II outputs) of greater than 50%. Small-scale spawning location suitability characteristics (e.g., depth, velocity, and substrate) of river lamprey are not adequately described to employ a more formal analysis such as a weighted usable area analysis. Therefore, there is uncertainty that these values represent actual redd dewatering events, and results should be treated as rough estimates of flow fluctuations under each model scenario. Results were expressed as the number of cohorts exposed to dewatering risk and as a percentage of the total number of cohorts anticipated in the river based on the applicable time-frame, January to August.

There would be minimal differences between H3_ELT and NAA_ELT in exposure to flow reductions in all rivers except for a small (10%) increase in the Feather River at Thermalito Afterbay (Table 11-4A-116). These results indicate that H3_ELT would not have biologically meaningful effects on Pacific lamprey redd cohorts in all locations analyzed because the difference represents only 2 percent (11 out of 656) of total hypothetical redd cohorts.

Table 11-4A-116. Differences between Model Scenarios in Dewatering Risk of Pacific Lamprey Redd Cohorts^a

Location	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
Sacramento River at Keswick	13 (24%)	1 (-2%)
Sacramento River at Red Bluff	15 (28%)	5 (8%)
Trinity River downstream of Lewiston	-1 (-1%)	1 (1%)
Feather River at Thermalito Afterbay	-26 (-17%)	11 (10%)
American River at Nimbus Dam	27 (32%)	5 (5%)
American River at Sacramento River Confluence	31 (33%)	8 (7%)

^a Difference and percent difference between model scenarios in the number of Pacific lamprey redd cohorts experiencing a month-over-month reduction in flows of greater than 50%. Positive values indicate a higher value in H3_ELT than in Existing Conditions or NAA_ELT.

Significant reduction in survival of eggs and embryos of Pacific lamprey were observed at 22°C (71.6°F; Meeuwig et al. 2005). Therefore, in the Sacramento River, this analysis predicted the number of consecutive 49 day periods for the entire 82-year CALSIM period during which at least one day exceeds 22°C (71.6°F) using daily data from SRWQM. For other rivers, the analysis predicted the number of consecutive 2 month periods during which at least one month exceeds 22°C (71.6°F) using monthly averaged data from the Reclamation temperature model. Each individual day or month starts a new “egg cohort” such that there are 19,928 cohorts for the Sacramento River, corresponding to 82 years of eggs being laid every day each year from January 1 through August 31,

1 and 648 cohorts for the other rivers using monthly data over the same period. The incubation
2 periods used in this analysis are conservative and represent the extreme long end of the egg
3 incubation period (Brumo 2006). Also, the utility of the monthly average time step is limited
4 because the extreme temperatures are masked; however, no better analytical tools are currently
5 available for this analysis. Exact spawning locations of Pacific lamprey are not well defined.
6 Therefore, this analysis uses the widest range in which the species is thought to spawn in each river.

7 In most locations, egg cohort exposure would not differ between NAA_ELT and H3_ELT (Table 11-
8 4A-117). However, the number of cohorts exposed under H3_ELT would be 92% lower than those
9 under NAA_ELT in the Trinity River at Lewiston. Also, the number of cohorts exposed under H3_ELT
10 would be 93% greater than those under NAA_ELT in the Feather River below Thermalito Afterbay.
11 Although a 92% reduction and a 93% increase appear substantial, these values represent only 23
12 and 37 egg cohorts, respectfully, or 3.5% and 5.7% of the 648 total hypothetical cohorts. Therefore,
13 these increases and decreases in egg cohort exposure are small relative to the total population. As a
14 result, they would not have a biologically meaningful effect.

15 Table 11-4A-117. Differences (Percent Differences) between Model Scenarios in Pacific Lamprey
16 Egg Cohort Temperature Exposure^a

Location	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
Sacramento River at Keswick	0 (NA)	0 (NA)
Sacramento River at Hamilton City	506 (NA)	23 (5%)
Trinity River at Lewiston	0 (0%)	-23 (-92%)
Trinity River at North Fork	0 (NA)	0 (0%)
Feather River at Fish Barrier Dam	0 (NA)	0 (NA)
Feather River below Thermalito Afterbay	53 (221%)	37 (93%)
American River at Nimbus	42 (382%)	2 (4%)
American River at Sacramento River Confluence	96 (171%)	2 (1%)
Stanislaus River at Knights Ferry	0 (NA)	0 (NA)
Stanislaus River at Riverbank	23 (1150%)	0 (0%)

NA = could not be calculated because the denominator was 0.

^a Difference and percent difference between model scenarios in the number of Pacific lamprey egg cohorts experiencing water temperatures above 71.6°F during January to August on at least one day during a 49-day incubation period in the Sacramento River or for at least one month during a 2-month incubation period for in other rivers each model scenario. Positive values indicate a higher value in H3_ELT than in EXISTING CONDITIONS or NAA_ELT.

17
18 H4_ELT/HOS

19 Flows during January through August under H4_ELT would generally be similar to or greater than
20 flows under H3_ELT in all rivers except the Feather River. As a result, the redd dewatering risk
21 analysis was not conducted for H4_ELT in these rivers and results for H4_ELT would be the same as
22 those for H3_ELT.

23 In the Feather River at Thermalito Afterbay, there would be 23 more cohorts (20%) exposed to a
24 50% month over month drop in flow rate under H4_ELT relative to NAA_ELT (Table 11-4A-118).
25 Although relatively large, this value represents <4% of the population of ammocoetes (23 out of 648

1 total cohorts). Therefore, it is not expected that this increase in exposure would have a biologically
2 meaningful effect to the population.

3 Table 11-4A-118. Differences between Model Scenarios in Dewatering Risk of Pacific Lamprey
4 Redd Cohorts in the Feather River at Thermalito Afterbay^a

Measurement	EXISTING CONDITIONS vs. H4_ELT	NAA_ELT vs. H4_ELT
Difference (Percent Difference)	-14 (-9%)	23 (20%)

^a Difference and percent difference between model scenarios in the number of Pacific lamprey redd cohorts experiencing a month-over-month reduction in flows of greater than 50%. Positive values indicate a higher value in H4 than in Existing Conditions or NAA_ELT.

5
6 Water temperatures would not differ between H4_ELT and H3_ELT and, therefore, no egg cohort
7 temperature analyses were conducted. Overall, results for H4_ELT would be similar to those for
8 H3_ELT.

9 *NEPA Effects:* Collectively, these modeling results indicate that the effect is not adverse because
10 Alternative 4A would not have substantial effects on spawning and egg incubation habitat for Pacific
11 lamprey. There would be no biologically meaningful differences in flow reductions that increase
12 redd dewatering risk between the NAA_ELT and H3_ELT at all locations evaluated. Also, there would
13 be increases and decreases in exposure risk of eggs to elevated temperatures but would not have a
14 biologically meaningful effect due to their small absolute values relative to total egg cohort sizes.
15 These modeling results are consistent between H3_ELT and H4_ELT.

16 *CEQA Conclusion:* Collectively, the results of the Impact AQUA-166 CEQA analysis show that there
17 would be no effect of Alternative 4A on Pacific lamprey spawning and egg incubation habitat relative
18 to the CEQA baseline.

19 H3_ELT/ESO_ELT

20 Effects of H3_ELT on month-over-month flow reduction compared to Existing Conditions consist of
21 negligible effects (<5% difference) in the Trinity River, a decrease in egg cohorts exposed to flow
22 reductions (-17%) in the Feather River, and moderate to substantial increases in exposures in the
23 Sacramento River and American River (Table 11-4A-116). Changes would be most substantial for
24 the American River (increased risk of dewatering exposure to 27 cohorts or 32% at Nimbus Dam,
25 and 31 cohorts or 33% at the confluence). In the Sacramento River, there would be increased
26 exposure to flow reductions for 13 cohorts or 24% at Keswick, and to 15 cohorts or 28% at Red
27 Bluff. These results indicate that effects of Alternative 4A on flow would not negatively affect Pacific
28 lamprey redd dewatering risk in the Feather River and Trinity River. Further, an increase of 13 to 31
29 cohorts out of 656 cohorts would represent fewer than 5 percent of total redd cohorts. Therefore,
30 Alternative 4A would not affect dewatering risk in the Sacramento River or the American River.

31 The number of egg cohorts exposed to 22°C (71.6°F) under H3_ELT would be greater than that
32 under Existing Conditions in at least one location in all rivers, except the Trinity River (Table 11-4A-
33 117). In the American River, the difference in the number of cohorts exposed would represent 6 to
34 15 percent of total cohorts.

1 H4_ELT/HOS

2 Flows during January through August under H4_ELT would generally be similar to or greater than
3 flows under H3_ELT in all rivers except the Feather River. As a result, the redd dewatering risk
4 analysis was not conducted for H4_ELT in these rivers and results for H4_ELT would be the same as
5 those for H3_ELT.

6 In the Feather River at Thermalito Afterbay, there would be 14 fewer cohorts (9%) exposed to a
7 50% month over month drop in flow rate under H1 relative to NAA_ELT (Table 11-4A-118).
8 Although relatively large, this value represents <5% of the population of ammocoetes. Therefore, it
9 is not expected that this decrease in exposure would have a biologically meaningful effect to the
10 population.

11 Water temperatures under H4_ELT would be similar to those under H3_ELT for all rivers examined.
12 Therefore, no additional cohort temperature exposure analyses were conducted for H4_ELT. Overall,
13 results for H4_ELT would be similar to those for H3_ELT.

14 Summary of CEQA Conclusion

15 Collectively, these modeling results indicate that the impacts to Pacific lamprey spawning and egg
16 incubation conditions would be less than significant. There would be no increases in exposure to
17 redd dewatering that would affect more than 5 percent of the population in all rivers. Temperature
18 exposure in the American River at the Sacramento River confluence would affect 15 percent more
19 cohorts under H3_ELT, but there would be no other differences that would have a biologically
20 meaningful effect to Pacific lamprey in any of the other 9 locations evaluated. Therefore, the impact
21 is less than significant and no mitigation is required.

22 Impact AQUA-167: Effects of Water Operations on Rearing Habitat for Pacific Lamprey

23 In general, the effect of Alternative 4A on Pacific lamprey rearing habitat would be negligible
24 relative to the NAA_ELT.

25 H3_ELT/ESO_ELT

26 Flow-related impacts to Pacific lamprey rearing habitat were evaluated by estimating of the
27 frequency of rapid flow reductions in ammocoete rearing areas. Rapid reductions in flow can strand
28 ammocoetes, leading to mortality. Comparisons of effects were made for ammocoete cohorts in the
29 Sacramento River at Keswick and Red Bluff, the Trinity River, Feather River, and the American River
30 at Nimbus Dam and at the confluence with the Sacramento River. An ammocoete remains relatively
31 immobile in the sediment in the same location for 5 to 7 years, after which it migrates downstream.
32 During the upstream rearing period there is potential for ammocoete stranding from rapid
33 reductions in flow.

34 The analysis of ammocoete stranding was conducted by analyzing a range of month-over-month
35 flow reductions from CALSIM II outputs, using the range of 50%–90% in 5% increments. A cohort of
36 ammocoetes was assumed to be born every month during their spawning period (January through
37 August) and spend 7 years rearing upstream. Therefore, a cohort was considered stranded if at least
38 one month-over-month flow reduction was greater than a given flow reduction (50%–90% in 5%
39 increments) at any time during the seven-year period.

1 Comparisons of month-over-month flow reductions for the Sacramento River at Keswick (Table 11-
2 4A-119) indicate that H3_ELT would have either no effect (0%) or negligible effects (<5%) on cohort
3 exposures to all flow reductions. These results indicate that there would be no difference in Pacific
4 lamprey stranding risk between H3_ELT and NAA_ELT in the Sacramento River at Keswick.

5 Table 11-4A-119. Percent Difference between Model Scenarios in the Number of Pacific Lamprey
6 Ammocoete Cohorts Exposed to Month-over-Month Flow Reductions, Sacramento River at
7 Keswick

Percent Flow Reduction	Percent Difference ^a	
	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
-50%	0	0
-55%	0	0
-60%	4	4
-65%	1	-2
-70%	0	-3
-75%	3	2
-80%	4	0
-85%	104	0
-90%	NA	NA

NA = could not be calculated because the denominator was 0.

^a Negative values indicate reduced cohort exposure, a benefit of H3_ELT.

8
9 Results of comparisons for the Sacramento River at Red Bluff (Table 11-4A-120) indicate that there
10 would be no or negligible changes in flow reductions. These results indicate that there would no
11 effect of H3_ELT on Pacific lamprey ammocoete exposure to flow reductions in the Sacramento
12 River at Red Bluff.

13 Table 11-4A-120. Percent Difference between Model Scenarios in the Number of Pacific Lamprey
14 Ammocoete Cohorts Exposed to Month-over-Month Flow Reductions, Sacramento River at Red
15 Bluff

Percent Flow Reduction	Percent Difference ^a	
	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
-50%	0	0
-55%	4	4
-60%	1	-1
-65%	-1	-2
-70%	3	0
-75%	10	0
-80%	23	0
-85%	0	0
-90%	NA	NA

NA = could not be calculated because the denominator was 0.

^a Negative values indicate reduced cohort exposure, a benefit of H3_ELT.

16

1 Comparisons for the Trinity River indicate that there would be no or small (5%) differences in
 2 cohort exposure between NAA_ELT and H3_ELT for all flow reductions evaluated (Table 11-4A-
 3 121). These results indicate that there would be no biologically meaningful effects of H3_ELT on
 4 Pacific lamprey stranding risk in the Trinity River.

5 Table 11-4A-121. Percent Difference between Model Scenarios in the Number of Pacific Lamprey
 6 Ammocoete Cohorts Exposed to Month-over-Month Flow Reductions, Trinity River at Lewiston

Percent Flow Reduction	Percent Difference ^a	
	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
-50%	0	0
-55%	0	0
-60%	0	0
-65%	0	0
-70%	0	0
-75%	22	1
-80%	20	1
-85%	20	1
-90%	34	5

^a Negative values indicate reduced cohort exposure, a benefit of H3_ELT.

7
 8 In the Feather River at Thermalito Afterbay, there would be no difference in ammocoete cohort
 9 exposure at the 50% through 75% flow reductions (Table 11-4A-122). For the 80% through 90%
 10 flow reductions, ammocoete exposure would be 1% to 64% lower, which would have a beneficial
 11 effect on ammocoete rearing. These results indicate that there will be beneficial effects of H3_ELT on
 12 Pacific lamprey ammocoete rearing in the Feather River.

13 Table 11-4A-122. Percent Difference between Model Scenarios in the Number of Pacific Lamprey
 14 Ammocoete Cohorts Exposed to Month-over-Month Flow Reductions, Feather River at Thermalito
 15 Afterbay

Percent Flow Reduction	Percent Difference ^a	
	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
-50%	0	0
-55%	0	0
-60%	0	0
-65%	0	0
-70%	0	0
-75%	0	0
-80%	-3	-1
-85%	-19	-30
-90%	-64	-64

^a Negative values indicate reduced cohort exposure, a benefit of H3_ELT.

16

1 Comparisons for the American River at Nimbus Dam (Table 11-4A-123) and at the confluence with
2 the Sacramento River (Table 11-4A-124) have similar results. There would be no or negligible
3 differences in cohort exposure between NAA_ELT and H3_ELT for the 50% to 70% flow reductions
4 range and the 85% to 90% flow reductions range. There would be higher cohort exposure under
5 H3_ELT relative to NAA_ELT at Nimbus Dam at the 75% flow reduction (7% higher) and at the
6 confluence with the Sacramento River at the 75% (12% higher) and 80% (23% higher) flow
7 reductions. At the confluence with the Sacramento River, there would be no differences in cohort
8 exposure for all flow reduction levels except the 85% level, at which exposure would be 33% greater
9 under H3_ELT. These results indicate that there would generally be no effect of H3_ELT on stranding
10 risk in the American River with few small exceptions that would be infrequent and would therefore
11 not result in biologically meaningful effects.

12 Table 11-4A-123. Percent Difference between Model Scenarios in the Number of Pacific Lamprey
13 Ammocoete Cohorts Exposed to Month-over-Month Flow Reductions, American River at Nimbus
14 Dam

Percent Flow Reduction	Percent Difference ^a	
	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
-50%	0	0
-55%	0	0
-60%	1	0
-65%	1	-1
-70%	34	4
-75%	85	12
-80%	238	23
-85%	104	0
-90%	-100	0

^a Negative values indicate reduced cohort exposure, a benefit of H3_ELT.

15

16 Table 11-4A-124. Percent Difference between Model Scenarios in the Number of Pacific Lamprey
17 Ammocoete Cohorts Exposed to Month-over-Month Flow Reductions, American River at the
18 Confluence with the Sacramento River

Percent Flow Reduction	Percent Difference ^a	
	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
-50%	0	0
-55%	0	0
-60%	1	0
-65%	1	1
-70%	7	1
-75%	22	4
-80%	192	4
-85%	223	33
-90%	104	0

^a Negative values indicate reduced cohort exposure, a benefit of H3_ELT.

19

To evaluate water temperature-related effects of H3_ELT on Pacific lamprey ammocoetes, we examined the predicted number of ammocoete “cohorts” that experience water temperatures greater than 71.6°F for at least one day in the Sacramento River (because daily water temperature data are available) or for at least one month in the Feather, American, Stanislaus, and Trinity rivers over a 7 year period, the maximum likely duration of the ammocoete life stage (Moyle 2002). Each individual day or month starts a new “cohort” such that there are 18,244 cohorts for the Sacramento River, corresponding to 82 years of ammocoetes being “born” every day each year from January 1 through August 31, and 593 cohorts for the other rivers using monthly data over the same period.

The number of ammocoete cohorts exposed to temperatures greater than 71.6°F would be similar between NAA_ELT and H3_ELT in most of the rivers (Table 11-1A-125). Ammocoetes in the Feather River at Thermalito Afterbay would experience a 15% increase in exposure to temperatures greater than 71.6°F, although there would be no difference relative to the NAA at the fish dam. Overall, the effects would be minimal to the Pacific lamprey population.

Table 11-4A-125. Differences (Percent Differences) between Model Scenarios in Pacific Lamprey Ammocoete Cohorts Exposed to Temperatures Greater than 71.6°F in at Least One Day or Month

Location	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
Sacramento River at Keswick ^b	0 (NA)	0 (NA)
Sacramento River at Hamilton City ^b	7,721 (NA)	476 (7%)
Trinity River at Lewiston	56 (NA)	0 (0%)
Trinity River at North Fork	56 (NA)	0 (0%)
Feather River at Fish Barrier Dam	0 (NA)	0 (NA)
Feather River below Thermalito Afterbay	164 (43%)	70 (15%)
American River at Nimbus	265 (137%)	-14 (-3%)
American River at Sacramento River Confluence	151 (35%)	9 (2%)
Stanislaus River at Knights Ferry	0 (NA)	0 (NA)
Stanislaus River at Riverbank	283 (505%)	0 (0%)

NA = could not be calculated because the denominator was 0.

^a Positive values indicate a higher value in H3_ELT than in EXISTING CONDITIONS or NAA_ELT.

^b Based on daily data; all other locations use monthly data; 1922–2003.

H4_ELT/HOS

There would be generally no differences in mean flows year-round between H4_ELT and H3_ELT in the Sacramento, Trinity, and American rivers. Therefore, ammocoete stranding risk analysis was conducted only for the Feather River.

In the Feather River at Thermalito Afterbay, there would be no or a negligible difference in ammocoete cohort exposure between NAA_ELT and H4_ELT at the 50% through 80% flow reductions (Table 11-4A-126). For the 85% and 90% flow reductions, ammocoete exposure under H4_ELT would be 9 and 53% higher, respectively. The 85% and 90% flow reductions would occur rarely: 19 and 7 times under NAA_ELT and 22 and 10 times, respectively under H4_ELT throughout the 985 total months evaluated. Therefore, these reductions would affect a small proportion of the population. As a result, these results indicate that there would be no biologically meaningful effect of H4_ELT on stranding risk.

1 Table 11-4A-126. Percent Difference between Baselines and H4_ELT Model Scenarios in the
2 Number of Pacific Lamprey Ammocoete Cohorts Exposed to Month-over-Month Flow Reductions,
3 Feather River at Thermalito Afterbay

Percent Flow Reduction	Percent Difference ^a	
	EXISTING CONDITIONS vs. H4_ELT	NAA_ELT vs. H4_ELT
-50%	0	0
-55%	0	0
-60%	0	0
-65%	0	0
-70%	0	0
-75%	0	0
-80%	0	2
-85%	25	9
-90%	53	53

^a Negative values indicate reduced cohort exposure under H4_ELT.

4
5 There would generally be no differences in mean water temperatures year-round between H4_ELT
6 and H3_ELT in any river examined. As a result, no additional ammocoete cohort exposure analyses
7 were conducted for H4_ELT. Results of these analyses for H4_ELT would be the same as those for
8 H3_ELT.

9 Overall, these results indicate that results for H4_ELT would generally be similar to those under
10 H3_ELT except for an increase in ammocoete stranding risk exposure in the Feather River at 85%
11 and 90% flow reductions under H4_ELT.

12 *NEPA Effects:* Collectively, these modeling results indicate that the effect is not adverse because it
13 would not substantially reduce rearing habitat or substantially reduce the number of fish as a result
14 of ammocoete mortality. There would generally be negligible effects or beneficial effects of H3_ELT
15 on Pacific lamprey ammocoete stranding risk in all rivers evaluated. There would be minimal
16 differences in exposure risk of ammocoetes to elevated temperatures within each river evaluated.

17 *CEQA Conclusion:* In general, Alternative 4A would reduce the quantity and quality of rearing
18 habitat for Pacific lamprey relative to Existing Conditions. However, as further described below in
19 **the Summary of CEQA Conclusion, reviewing the alternative’s impacts in relation to the NAA_ELT** is
20 a better approach because it isolates the effect of the alternative from those of sea level rise, climate
21 change, and future water demand. Informed by the NAA_ELT comparison, Alternative 4A would not
22 affect the quantity and quality of rearing habitat for Pacific lamprey relative to NAA_ELT.

23 H3_ELT/ESO_ELT

24 Comparisons of H3_ELT to Existing Conditions for the Sacramento River at Keswick indicate
25 negligible changes (<5%) in occurrence of flow reductions for all flow reduction categories, with the
26 exception of a 104% increase in occurrence of month-over-month flow reductions of 85% (Table
27 11-4A-119). Comparisons for the Sacramento River at Red Bluff indicate no effect (0%) or negligible
28 effects (<5%) for all flow reduction categories with the exception of 10% and 23% increases in
29 exposure for the 75% and 80% flow reduction events, respectively (Table 11-4A-120). Based on the
30 fact that increases in exposure would only be substantial for one or two flow reduction categories

1 depending on location, H3_ELT would not be expected to have biologically meaningful negative
2 effects on spawning success in the Sacramento River but would contribute incrementally to regional
3 effects.

4 Increases from Existing Conditions to H3_ELT of 20–34% are predicted for egg cohort exposed to
5 flow reductions from 75% to 90% for the Trinity River (Table 11-4A-121); the percentages
6 correspond generally to increased occurrences from approximately 350 events for Existing
7 Conditions to approximately 450 events for H3_ELT. Despite the prevalence of increased exposure
8 risk to the higher flow reduction events, the percentage of cohorts exposed to stranding risk is
9 relatively small compared to the total number of cohorts and therefore effects on rearing success in
10 the Trinity River would not be biologically meaningful but would contribute incrementally to
11 regional effects.

12 Comparisons for the Feather River at Thermalito Afterbay (Table 11-4A-122) indicate that there
13 would be negligible (<5%) differences in exposure of Pacific lamprey ammocoete cohorts to all flow
14 reductions except the 85% and 90% reductions, in which exposure would be 19% and 64% lower
15 under H3_ELT. This suggests that flow conditions would improve for Pacific lamprey ammocoetes
16 under H3_ELT.

17 Comparisons for the American River at Nimbus Dam (Table 11-4A-123) and at the confluence with
18 the Sacramento River (Table 11-4A-124) indicate an increase in exposure risk to stranding between
19 70% and 85% or 90% for H3_ELT compared to Existing Conditions; predicted increases ranged
20 from 34 to 238% for Nimbus Dam and from 7 to 223% for the confluence. These persistent and
21 substantial increases in exposures to larger flow reduction events would have biologically
22 meaningful effects on Pacific lamprey ammocoete cohort stranding and therefore spawning success
23 in the American River.

24 The number of ammocoete cohorts exposed to 71.6°F under H3_ELT would be higher than those
25 under Existing Conditions in most locations examined, except in the Sacramento River at Keswick, in
26 the Feather River at the Fish Barrier Dam, and the Stanislaus River at Knights Ferry (Table 11-4A-
27 125).

28 H4_ELT/HOS

29 There would be generally no differences in mean flows year-round between H4_ELT and H3_ELT in
30 the Sacramento, Trinity, and American rivers. Therefore, ammocoete stranding risk analysis was
31 conducted only for the Feather River.

32 In the Feather River at Thermalito Afterbay, there would be no or a negligible difference in
33 ammocoete cohort exposure between Existing Conditions and H4_ELT at the 50% through 80% flow
34 reductions (Table 11-4A-126). For the 85% and 90% flow reductions, ammocoete exposure under
35 H4_ELT would be 25% and 53% higher, respectively. These results indicate that there would
36 generally be no effect of H4_ELT on stranding risk with exceptions that very high flow reductions
37 that would not be common enough to have biologically meaningful effects.

38 There would generally be no differences in mean water temperatures year-round between H4_ELT
39 and H3_ELT in any river examined. As a result, no additional ammocoete cohort exposure analyses
40 were conducted for H4_ELT. Results of these analyses for H4_ELT would be the same as those for
41 H3_ELT.

1 Overall, these results indicate that results for H4_ELT would generally be similar to those under
2 H3_ELT.

3 Summary of CEQA Conclusion

4 Under Alternative 4A, the risk of redd dewatering would increase to some degree under some flow
5 reductions in the Sacramento and Trinity rivers, and substantially in the American River at Nimbus
6 Dam (increases from 34% to 238%). Flow reductions would increase the risk of ammocoete
7 stranding and desiccation in these rivers. There would be a beneficial effect from decreased
8 occurrence of flow reduction events (=reduced ammocoete stranding risk) in the Feather River (-
9 19% to -64% for the 85% and 90% flow reduction categories) but this effect would not offset the
10 more substantial reductions in the other locations. There would be an increase in exposure to
11 critical water temperatures in most locations examined. Increased exposure to higher water
12 temperatures would increase stress and mortality of ammocoetes. Contrary to the NEPA conclusion
13 set forth above, these modeling results indicate that the difference between Existing Conditions and
14 Alternative 4A could be significant because the alternative could substantially reduce rearing habitat
15 and substantially reduce the number of Pacific lamprey as a result of fry and juvenile mortality.

16 However, this interpretation of the biological modeling results is likely attributable to different
17 modeling assumptions for four factors: sea level rise, climate change, future water demands, and
18 implementation of the alternative. As discussed in Section 11.3.3, because of differences between the
19 CEQA and NEPA baselines, it is sometimes possible for CEQA and NEPA significance conclusions to
20 vary between one another under the same impact discussion. The baseline for the CEQA analysis is
21 Existing Conditions at the time the NOP was prepared. Both the action alternative and the NEPA
22 baseline (NAA_ELT) models anticipated future conditions that would occur in 2025 (ELT
23 implementation period), including the projected effects of climate change (precipitation patterns),
24 sea level rise and future water demands, as well as implementation of required actions under the
25 2008 USFWS BiOp and the 2009 NMFS BiOp. Because the action alternative modeling does not
26 partition the effects of implementation of the alternative from the effects of sea level rise, climate
27 change, and future water demands, the comparison to Existing Conditions may not offer a clear
28 understanding of the impact of the alternative on the environment. This suggests that the
29 comparison of the results between the alternative and NAA_ELT is a better approach because it
30 isolates the effect of the alternative from those of sea level rise, climate change, and future water
31 demands.

32 When compared to NAA_ELT and informed by the NEPA analysis above, there would generally be
33 negligible effects or beneficial effects of Alternative 4A on Pacific lamprey ammocoete stranding risk
34 in all rivers evaluated. There would be increase and decreases in exposure risk of ammocoetes to
35 elevated temperatures within each river evaluated that would balance out such that there would be
36 no net effect on Pacific lamprey ammocoetes. These modeling results represent the increment of
37 change attributable to the alternative, demonstrating the similarities in flows and water
38 temperatures under Alternative 4A and the NAA_ELT, and addressing the limitations of the CEQA
39 baseline (Existing Conditions).

40 Impact AQUA-168: Effects of Water Operations on Migration Conditions for Pacific Lamprey

41 In general, the effect of Alternative 4A on Pacific lamprey migration conditions would be negligible
42 relative to the NAA_ELT.

1 H3_ELT/ESO_ELT

2 After 5 to 7 years, Pacific lamprey ammocoetes migrate downstream and become macrophthalmia
3 (juveniles) once they reach the Delta. Migration generally is associated with large flow pulses in
4 winter months (December through March) (USFWS unpublished data) meaning alterations in flow
5 have the potential to affect downstream migration conditions. The effects of H3_ELT water
6 operations on seasonal migration flows for Pacific lamprey macrophthalmia were assessed using
7 CALSIM II flow output. Flow rates along the likely migration pathways of Pacific lamprey during the
8 likely macrophthalmia migration period (December through May) were examined for the Sacramento
9 River at Rio Vista and Red Bluff, the Feather River at the confluence with the Sacramento River, and
10 the American River at the confluence with the Sacramento River.

11 The adult Pacific lamprey upstream migration period occurs between January and June. CALSIM II
12 flow outputs were examined during these periods for each model scenario.

13 *Sacramento River*

14 *Macrophthalmia*

15 Flows the Sacramento River at Rio Vista (Appendix 11C, *CALSIM II Model Results utilized in the Fish*
16 *Analysis*) were examined during the December to May macrophthalmia migration period. Flows
17 under H3_ELT would generally be lower by up to 24% under H3_ELT relative to NAA_ELT. Based on
18 the prevalence of moderate decreases in flow in drier water years for much of migration period,
19 H3_ELT would affect Pacific lamprey macrophthalmia migration conditions at this location. In the
20 Sacramento River upstream of Red Bluff (Appendix 11C, *CALSIM II Model Results utilized in the Fish*
21 *Analysis*), flows under H3_ELT during December through May would be similar to or up to 9%
22 greater than flows under NAA_ELT.

23 *Adults*

24 Flows in the Sacramento River at Red Bluff (Appendix 11C, *CALSIM II Model Results utilized in the*
25 *Fish Analysis*) were examined during the January to June adult migration period. Flows under
26 H3_ELT would be similar to or up to 9% greater than flows under NAA_ELT. These results indicate
27 that H3_ELT would generally not affect adult migration conditions in the Sacramento River.

28 *Feather River*

29 *Macrophthalmia*

30 Flows in the Feather River at the confluence with the Sacramento River (Appendix 11C, *CALSIM II*
31 *Model Results utilized in the Fish Analysis*) were examined during the December to May
32 macrophthalmia migration period. Flows under H3_ELT during would generally be similar to or
33 greater (up to 12% greater) than flows under NAA_ELT. These results indicate that effects of
34 H3_ELT on macrophthalmia migration flows in the Feather River would generally be negligible.

35 *Adults*

36 Flows in the Feather River at the confluence with the Sacramento River (Appendix 11C, *CALSIM II*
37 *Model Results utilized in the Fish Analysis*) were examined during the January through June adult
38 migration period. Flows under H3_ELT would generally be similar to flows under NAA_ELT during
39 January through May and greater by up to 77% during June. These results indicate that H3_ELT
40 would have no effect or a beneficial effect on adult migration conditions in the Feather River.

1 *American River*

2 *Macrophthalmia*

3 Flows in the American River at the confluence with the Sacramento River (Appendix 11C, *CALSIM II*
4 *Model Results utilized in the Fish Analysis*) were examined during the December through May
5 macrophthalmia migration period. Flows under H3_ELT would generally be similar to flows under
6 NAA_ELT with few small exceptions. These results indicate that H3_ELT would not have negative
7 effects on macrophthalmia migration conditions in the American River.

8 *Adults*

9 Flows in the American River at the confluence with the Sacramento River (Appendix 11C, *CALSIM II*
10 *Model Results utilized in the Fish Analysis*) were examined during the January to June adult migration
11 period. Flows under H3_ELT during January through May would generally be similar to flows under
12 NAA_ELT with few small exceptions. Flows under H3_ELT during June would generally be greater by
13 up to 25% than flows under NAA_ELT. These results indicate that H3_ELT would have no effect or a
14 beneficial effect on adult migration conditions in the American River.

15 H4_ELT/HOS

16 Flows at Rio Vista would be up to 12% lower under H4_ELT relative to NAA_ELT during December
17 through April and there would be no differences during May. Flows in the Sacramento River
18 upstream of Red Bluff under H4_ELT during the December through May macrophthalmia migration
19 period would generally be similar to flows under NAA_ELT (Appendix 11C, *CALSIM II Model Results*
20 *utilized in the Fish Analysis*), indicating that migration conditions for macrophthalmia in this reach
21 would be unaffected under. Flows in the Sacramento River at Red Bluff under H4_ELT during the
22 January through June migration period would generally be similar to flows under NAA_ELT. Overall,
23 flows at Rio Vista under H4_ELT would be slightly lower on average than flows under NAA_ELT and
24 flows would not differ between NAA_ELT and H4_ELT at Red Bluff.

25 Flows in the Feather River at the confluence with the Sacramento River under H4_ELT during the
26 December through May macrophthalmia migration period would generally be similar to or greater
27 than (up to 119% greater) flows under H3_ELT (Appendix 11C, *CALSIM II Model Results utilized in*
28 *the Fish Analysis*), indicating that migration conditions for macrophthalmia would be improved under
29 H4_ELT relative to NAA_ELT in the Feather River. Flows under H4_ELT during the January through
30 June adult migration period would generally be similar to or greater than (up to 119% greater)
31 flows under H3_ELT, indicating that migration conditions for adults would also be improved under
32 H4_ELT relative to NAA_ELT in the Feather River.

33 Flows in the American River at the confluence with the Sacramento River under H4_ELT during the
34 December through May macrophthalmia migration period and the January through June adult
35 migration period would generally be similar to or greater than flows under NAA_ELT (Appendix
36 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

37 These results indicate that there would be small negative effects of Alternative 4A on lamprey
38 migration flows in the Sacramento River, moderately large benefits in the Feather River, and no
39 effect in the American River.

40 *NEPA Effects:* Collectively, these modeling results indicate that the effect is not adverse because it
41 would not substantially reduce or degrade migration habitat or substantially reduce the number of

1 fish as a result of mortality. There would be small to moderate negative effects of Alternative 4A on
2 lamprey migration flows in the Sacramento River at Rio Vista, no effect (under H3_ELT) or
3 moderately large benefits (under H4_ELT) in the Feather River, and no effect in the Sacramento
4 River at Red Bluff and in the American River. Combined, these effects would not result in adverse
5 effects on migration conditions for Pacific lamprey.

6 *CEQA Conclusion:* In general, Alternative 4A would not reduce the quantity and quality of migration
7 habitat for Pacific lamprey relative to Existing Conditions.

8 H3_ELT/ESO_ELT

9 *Sacramento River*

10 *Macrophthalmia*

11 Comparisons of mean monthly flow rates for H3_ELT to Existing Conditions in the Sacramento River
12 at Rio Vista (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*) for December to
13 May indicate that flows would be up to 47% lower under H3_ELT compared to Existing Conditions.

14 Comparisons for the Sacramento River at Red Bluff (Appendix 11C, *CALSIM II Model Results utilized*
15 *in the Fish Analysis*) for December to May indicate negligible effects (<5%) or small increases or
16 decreases in flow (up to 10%) under H3_ELT that would not have biologically meaningful effects on
17 migration conditions relative to Existing Conditions.

18 *Adults*

19 Comparisons of mean monthly flow for the Sacramento River at Red Bluff (Appendix 11C, *CALSIM II*
20 *Model Results utilized in the Fish Analysis*) for January through June for H3_ELT relative to Existing
21 Conditions indicate that for most months and water year types, flows under H3_ELT would be
22 similar to (<5% difference) or greater than flows under Existing Conditions, with some increases
23 and decreases in mean monthly flow that would not have biologically meaningful effects on
24 migration.

25 *Feather River*

26 *Macrophthalmia*

27 Comparisons for the Feather River at the confluence with the Sacramento River (Appendix 11C,
28 *CALSIM II Model Results utilized in the Fish Analysis*) for December to May indicate variable effects of
29 H3_ELT relative to Existing Conditions by month and water year type, with negligible effects (<5%),
30 moderate increases in flow (to 18%) that would be beneficial for migration conditions, with
31 occasional occurrences of moderate decreases in flow to -19%. These results indicate that the effects
32 of H3_ELT on flows would not have negative effects on macrophthalmia migration in the Feather
33 River.

34 *Adults*

35 Comparisons of mean monthly flow for the Feather River at the confluence with the Sacramento
36 River (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*) for January to June
37 indicate variable effects of H3_ELT relative to Existing Conditions depending on the month and
38 water year type, with primarily negligible effects (<5%), small to substantial increases in flow (to
39 71%) that would have a beneficial effect on migration conditions, and occasional small to moderate

1 decreases in flow (up to 19%). Based on the prevalence of negligible effects and increases in flow
2 which would have a beneficial effect on migration conditions, and only occasional reductions in flow
3 of small to moderate magnitude, these results indicate that effects of H3_ELT on flow would not have
4 biologically meaningful negative effects on adult migration conditions in the Feather River.

5 *American River*

6 *Macrophthalmia*

7 Comparisons for the American River at the confluence with the Sacramento River (Appendix 11C,
8 *CALSIM II Model Results utilized in the Fish Analysis*) for December to May indicate variable effects of
9 H3_ELT relative to Existing Conditions, with negligible effects (<5%) during April, increases (up to
10 15%) during February and March that would be beneficial on migration conditions, and decreases
11 (up to -18%) during January and May. Due to the low magnitude and frequency of increases and
12 decreases in flow, these differences would not have biologically meaningful positive or negative
13 effects on macrophthalmia migration conditions in the American River.

14 *Adults*

15 Comparisons of mean monthly flow for the American River at the confluence with the Sacramento
16 River (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*) for January to June
17 indicate variable effects of H3_ELT relative to Existing Conditions, with negligible effects (<5%),
18 increases (up to 15%) that would be beneficial on migration conditions, and decreases (to -35%).
19 Based on the balance of increases and decreases in flows, these results indicate that effects of
20 H3_ELT on flow would not have biologically meaningful negative effects on adult migration
21 conditions in the American River.

22 H4_ELT/HOS

23 Flows in the Sacramento River at Rio Vista during the December through May macrophthalmia
24 migration period under H4_ELT would be mostly lower by up to 17% than flows under Existing
25 Conditions. Flows upstream of Red Bluff under H4_ELT during December through May would
26 generally be similar to or greater than (up to 9% greater) flows under NAA_ELT (Appendix 11C,
27 *CALSIM II Model Results utilized in the Fish Analysis*), indicating that migration conditions for Pacific
28 lamprey macrophthalmia would be largely unaffected by H4_ELT. Flows in the Sacramento River at
29 Red Bluff under H4_ELT during the January through June migration period would generally be
30 similar to or greater than (up to 9% greater) flows under NAA_ELT, indicating that migration
31 conditions for adults would be largely unaffected by H4_ELT.

32 Flows in the Feather River at the confluence with the Sacramento River under H4_ELT during the
33 December through May macrophthalmia migration period would generally be similar to or greater
34 than (up to 112% greater) flows under Existing Conditions (Appendix 11C, *CALSIM II Model Results*
35 *utilized in the Fish Analysis*), indicating that migration conditions for macrophthalmia would be
36 similar to or improved under H4_ELT. Flows in the Feather River at the confluence with the
37 Sacramento River under H4_ELT during the January through June migration period would generally
38 be similar to or greater than (up to 112% greater) flows under Existing Conditions, except during
39 June in which flows under H4_ELT would be up to 28% lower. Overall, flows in the Feather River
40 would be higher under H4_ELT than those under Existing Conditions during the adult migration
41 period.

1 Differences in flows in the American River at the confluence with the Sacramento River under
2 H4_ELT during the December through May macrophthalmia migration period and the January
3 through June adult migration period would generally be similar. Flows under H4_ELT would be
4 similar to those under Existing Conditions during December, March, and April, higher during
5 January, February, and March, and lower during May and June (*Appendix 11C, CALSIM II Model*
6 *Results utilized in the Fish Analysis*). Due to the wide variation in results, it is concluded that the
7 effects will not be negative.

8 These results indicate that the effects of H4_ELT on Pacific lamprey migration conditions would
9 generally be similar to those under Existing Conditions.

10 Summary of CEQA Conclusion

11 Collectively, these modeling results indicate that the effect is less than significant because it would
12 not substantially reduce or degrade migration habitat or substantially reduce the number of fish as a
13 result of mortality. There would be small to moderate negative effects of Alternative 4A on lamprey
14 migration flows in the Sacramento River at Rio Vista, no effect (under H3_ELT) or moderately large
15 benefits (under H4_ELT) in the Feather River, and no effect in the Sacramento River at Red Bluff and
16 in the American River. Combined, these effects would not have a population level effect on Pacific
17 lamprey. Therefore, the impact is less than significant and no mitigation is required.

18 Restoration Measures (Environmental Commitments 4, Environmental Commitment 6, 19 Environmental Commitment 7, and Environmental Commitment 10)

20 As described for other covered fishes, Alternative 4A includes a greatly reduced extent of restoration
21 measures relative to Alternative 4 and Alternative 1A. The mechanisms of impacts of habitat
22 restoration discussed for other covered species such as winter-run Chinook salmon generally would
23 be similar for Pacific lamprey. Pacific lamprey would have the potential to encounter restoration-
24 related effects. However, because the extent of restoration is limited to offsetting losses from
25 construction of the water conveyance facilities, any such effects would be greatly limited compared
26 to Alternative 1A and 4, for example.

27 Impact AQUA-169: Effects of Construction of Restoration Measures on Pacific Lamprey

28 **As noted for Alternative 1A's discussion of Impact AQUA-133**, in-water and shoreline construction
29 activities (e.g., riprap removal and levee breaching; shoreline excavation and recontouring) could
30 increase turbidity, but Pacific lamprey are tolerant to such increases and implementation of the
31 environmental commitments described under Impact AQUA-1 for delta smelt and in Appendix 3B,
32 *Environmental Commitments* (Environmental Training; Stormwater Pollution Prevention Plan;
33 Erosion and Sediment Control Plan; Hazardous Materials Management Plan; Spill Prevention,
34 Containment, and Countermeasure Plan; and Disposal of Spoils, Reusable Tunnel Material, and
35 Dredged Material), would minimize or eliminate effects on Pacific lamprey.

36 *NEPA Effects:* The effects of short-term construction activities would not be adverse to Pacific
37 lamprey because environmental commitments would limit the potential for construction-related
38 effects.

39 *CEQA Conclusion:* As discussed for Alternative 1A, habitat restoration activities could result in
40 short-term effects on Pacific lamprey but would be localized, sporadic, and of low magnitude; such
41 effects would be avoided by limiting the frequency, duration, and spatial extent of in-water work
42 and with implementation of environmental commitments (see Appendix 3B, *Environmental*

1 *Commitments*). The potential impact of habitat restoration activities is considered less than
2 significant because it would not substantially reduce Pacific lamprey habitat, restrict its range, or
3 interfere with its movement. No additional mitigation would be required.

4 Impact AQUA-170: Effects of Contaminants Associated with Restoration Measures on Pacific
5 Lamprey

6 The factors influencing the potential effects of contaminants from restored areas on Pacific lamprey
7 are discussed in the analysis of Impact AQUA-170 under Alternative 1A. Because the extent of
8 habitat restoration under Alternative 4A is considerably reduced relative to Alternative 1A, any
9 effects from contaminants also would be considerably reduced.

10 *NEPA Effects:* As noted for other covered fishes, while Alternative 4A habitat restoration actions
11 may result in a very small increase production, mobilization, and bioavailability of methylmercury,
12 selenium, copper, and pesticides in the aquatic system, any such releases would be short-term and
13 localized, and would be unlikely to result in measurable increases in the bioaccumulation of these
14 contaminants in Pacific lamprey. Overall, the effects of contaminants associated with restoration
15 measures would not be adverse for Pacific lamprey.

16 *CEQA Conclusion:* As noted for other covered fishes, habitat restoration under Alternative 4A may
17 result in increased production, mobilization, and bioavailability of contaminants in the aquatic
18 system, but these would be short-term and localized, and would be unlikely to result in measurable
19 increases in the bioaccumulation in Pacific lamprey. For methylmercury, implementation of
20 *Environmental Commitment 12 Methylmercury Management* would help to minimize the increased
21 mobilization of methylmercury in the limited restoration areas. Therefore, the impact of
22 contaminants is considered less than significant because it would not substantially affect Pacific
23 lamprey either directly or through habitat modifications. Consequently, no mitigation would be
24 required.

25 Impact AQUA-171: Effects of Restored Habitat Conditions on Pacific Lamprey

26 Restored habitat under *Environmental Commitment 4 Tidal Natural Communities Restoration* and
27 *Environmental Commitment 6 Channel Margin Enhancement* is intended to offset habitat
28 loss/modification caused by construction and operation of the water facilities proposed under
29 Alternative 4A.

30 *NEPA Effects:* The effects of restored habitat conditions on Pacific lamprey would not be adverse
31 restoration could provide habitat benefits for lamprey.

32 *CEQA Conclusion:* As described above, habitat restoration would be undertaken to offset
33 loss/modification of habitat from water facility construction and operation. The effects of restored
34 habitat conditions on Pacific lamprey would be less than significant. Consequently, no mitigation
35 would be required.

36 Other Environmental Commitments (Environmental Commitment 12, Environmental Commitment
37 15, and Environmental Commitment 16)

38 As noted for other covered species, Alternative 4A includes three other conservation measures,
39 which are reduced in their extent relative to other Alternatives (e.g., Alternative 1A and Alternative
40 4). While the extent of these measures is reduced compared to these alternatives, the nature of the
41 mechanisms for Pacific lamprey remains the same.

1 Impact AQUA-172: Effects of Methylmercury Management on Pacific Lamprey
2 (Environmental Commitment 12)

3 The impact discussion for winter-run Chinook salmon (Impact AQUA-46) is also applicable to Pacific
4 lamprey.

5 *NEPA Effects:* The effects of methylmercury management on Pacific lamprey would not be adverse
6 because it is expected to reduce overall methylmercury levels resulting from habitat restoration.

7 *CEQA Conclusion:* As noted for winter-run Chinook salmon, effects of *Environmental Commitment 12*
8 *Methylmercury Management* within the areas restored under Alternative 4A are expected to reduce
9 overall methylmercury levels resulting from habitat restoration. Because it is designed to improve
10 water quality and habitat conditions, impacts on Pacific lamprey would be less than significant.
11 Consequently, no mitigation is required.

12 Impact AQUA-175: Effects of Localized Reduction of Predatory Fish on Pacific Lamprey
13 (Environmental Commitment 15)

14 It is possible, but not assured, that there would be some reduction in predation losses of Pacific
15 lamprey under *Environmental Commitment 15 Localized Reduction of Predatory Fish*; for Alternative
16 4A, such efforts would be focused at the NDD and at the south Delta export facilities. There is
17 uncertainty in the potential efficacy of Environmental Commitment 15 and also uncertainty in the
18 importance of predation to Pacific lamprey. Due to these uncertainties, there would be no
19 demonstrable effect of this conservation measure on Pacific lamprey.

20 *NEPA Effects:* Consistent with the analysis for Alternative 1A and reflecting the above discussion,
21 the overall effect would not be adverse.

22 *CEQA Conclusion:* Consistent with the analysis for Alternative 1A and reflecting the above
23 discussion, the impact is considered less than significant. Consequently, no mitigation would be
24 required.

25 Impact AQUA-176: Effects of Nonphysical Fish Barriers on Pacific Lamprey (Environmental
26 Commitment 16)

27 As described for winter-run Chinook salmon, under Alternative 4A, an NPB at the divergence of
28 Georgiana Slough from the Sacramento River would be implemented to guide juvenile salmonids
29 away from Georgiana Slough and the interior Delta, wherein survival is relatively low compared to
30 the Sacramento River (Perry et al. 2010). As described in the *BDCP Effects Analysis*, the effects of an
31 NPB at this location would be expected to have little to no effect on Pacific lamprey because of their
32 **physiology (limited hearing ability in the range employed by the NPB's acoustic deterrence stimuli;**
33 **see section 5C.5.3.9 in *BDCP Effects Analysis Appendix 5.C* and section 5.B.6.1.11.1 *BDCP Effects***
34 ***Analysis Appendix 5.B, both hereby incorporated by reference***). As noted in the discussion of Impact
35 AQUA-180 for Alternative 1A, the NPB may attract piscivorous predators but the additional
36 predation on Pacific lamprey is expected to be low.

37 *NEPA Effects:* The overall effect of the NPB on Pacific lamprey would not be adverse because of their
38 **limited hearing ability in the range employed by the NPB's acoustic deterrence stimuli.**

39 *CEQA Conclusion:* Consistent with the analysis for Alternative 1A and reflecting the above
40 discussion, the impact of the NPB on Pacific lamprey is considered less than significant because of

1 **their limited hearing ability in the range employed by the NPB's acoustic deterrence stimuli.**
2 Consequently, no mitigation would be required.

3 River Lamprey

4 Construction and Maintenance of Water Conveyance Facilities

5 Impact AQUA-181: Effects of Construction of Water Conveyance Facilities on River Lamprey

6 The potential effects of construction of water conveyance facilities on river lamprey would be the
7 same as those described for Alternative 4 Impact AQUA-181. This section provides additional detail
8 on underwater noise impacts which are also applicable to Impact AQUA-181 in Alternative 4.

9 Table 11-8 presents the life stages of river lamprey and months of their potential presence in the
10 north, east, and south Delta during the proposed in-water construction window (June 1–October
11 31). Little is known about the distribution and abundance of river lamprey, but salvage records at
12 the south Delta export facilities indicate that they could be present in the Delta during this period. It
13 is assumed that the discussion above for Pacific lamprey generally applies to river lamprey. Thus,
14 underwater construction noise could adversely affect small numbers of river lamprey but would not
15 result in significant population-level effects.

16 *NEPA Effects:* As concluded for Alternative 4, Impact AQUA-181, the effect would not be adverse for
17 river lamprey. Implementation of the measures described in Appendix 3B, *Environmental*
18 *Commitments*, such as *Environmental Training; Stormwater Pollution Prevention Plan; Erosion and*
19 *Sediment Control Plan; Hazardous Materials Management Plan; Spill Prevention, Containment, and*
20 *Countermeasure Plan; Disposal of Spoils, Reusable Tunnel Material, and Dredged Material; Fish Rescue*
21 *and Salvage Plan; and Barge Operations Plan* would guide rapid and effective response in the case of
22 inadvertent spills of hazardous materials. This **species' natural tolerance to turbidity** would likely
23 avoid the risk of any adverse turbidity effects resulting from project construction. Construction
24 would not be expected to increase predation rates relative to baseline conditions. Construction will
25 result in both temporary and permanent alteration of rearing and migratory habitats used by river
26 lamprey. However, Alternative 4A includes Environmental Commitment 4 to restore tidal habitat.
27 The direct effects of underwater construction noise on river lamprey that may be present could be
28 adverse if river lamprey are exposed. However, implementation of Mitigation Measures AQUA-1a
29 and AQUA-1b, combined with the in-water work window that would minimize exposure, would
30 reduce the potential for effects from underwater noise and this effect would not be adverse.

31 *CEQA Conclusion:* As described in Alternative 4, Impact AQUA-181, the impact of the construction of
32 water conveyance facilities on river lamprey would not be significant except for construction noise
33 associated with pile driving. Construction of Alternative 4A involves several elements with the
34 potential to affect river lamprey. However, these turbidity and hazardous material spill effects will
35 be effectively avoided and/or minimized through implementation of environmental commitments
36 (see Impact AQUA-1 and Appendix 3B, *Environmental Commitments: Environmental Training;*
37 *Stormwater Pollution Prevention Plan; Erosion and Sediment Control Plan; Hazardous Materials*
38 *Management Plan; Spill Prevention, Containment, and Countermeasure Plan; Disposal of Spoils,*
39 *Reusable Tunnel Material, and Dredged Material; Fish Rescue and Salvage Plan; and Barge Operations*
40 *Plan*). Implementation of Mitigation Measures AQUA-1a and AQUA-1b would reduce that noise
41 impact to less than significant.

1 Mitigation Measure AQUA-1a: Minimize the Use of Impact Pile Driving to Address Effects
2 of Pile Driving and Other Construction-Related Underwater Noise

3 Mitigation Measure AQUA-1b: Monitor Underwater Noise and if Necessary, Use an
4 Attenuation Device to Reduce Effects of Pile Driving and Other Construction-Related
5 Underwater Noise

6 Impact AQUA-182: Effects of Maintenance of Water Conveyance Facilities on River Lamprey

7 The potential effects of the maintenance of water conveyance facilities under Alternative 4 would be
8 the same as those described for Alternative 1A (see Impact AQUA-182) except that only three
9 intakes would need to be maintained under Alternative 4 rather than five under Alternative 1A,
10 resulting in less impacts. As concluded in Alternative 1A, Impact AQUA-182, the impact would not be
11 adverse for river lamprey.

12 *CEQA Conclusion:* As described in Alternative 1A, Impact AQUA-182, the impact of the maintenance
13 of water conveyance facilities on river lamprey would be less than significant and no mitigation is
14 required.

15 Operations of Water Conveyance Facilities

16 Impact AQUA-183: Effects of Water Operations on Entrainment of River Lamprey

17 *Water Exports*

18 The impact on entrainment of river lamprey at water operations facilities in the south and north
19 Delta is expected to be the same as described for Pacific lamprey (see Impact AQUA-165).
20 Entrainment losses at the south Delta facilities would be reduced for both flow scenarios under
21 Alternative 4A compared to NAA_ELT. The potential impacts at the proposed new north Delta
22 intakes are unknown since little is known about the river lamprey life history in the Delta.

23 *Predation Associated with Entrainment*

24 Entrainment-related predation loss of lamprey at the south Delta facilities would not be greater
25 under this Alternative compared to the NAA_ELT and may be lower due to a reduction in
26 entrainment loss. Conditions under Scenario H4_ELT would decrease predation loss relative to
27 NAA_ELT and Scenario H3_ELT. Predation at the north Delta would be increased due to the
28 installation of the proposed water export facilities on the Sacramento River. The effect on lamprey
29 from predation loss at the north Delta facilities is unknown because of the lack of knowledge about
30 their distribution and population abundances in the Delta.

31 *NEPA Effects:* Overall, the effect of entrainment and entrainment-related predation would not be
32 adverse because entrainment, and predation associated with entrainment, would be reduced under
33 Alternative 4A.

34 *CEQA Conclusion:* As described above for Pacific lamprey (which is assumed to have the same
35 entrainment effects as river lamprey), annual entrainment losses of lamprey would be substantially
36 reduced under both flow scenarios for Alternative 4A relative to existing biological conditions.
37 Lamprey predation loss at the south Delta facilities would not be increased relative to Existing
38 Conditions and may be decreased due to reduction entrainment losses. The impact of predation loss
39 at the north Delta is unknown, since there is little available knowledge on the distribution and

1 abundance in the Delta, especially in the vicinity of the proposed new north Delta intakes. Overall,
2 the impacts of Alternative 4A water operations to river lamprey are considered less than significant
3 because they would reduce entrainment and potentially entrainment-related predation. No
4 mitigation would be required.

5 Impact AQUA-184: Effects of Water Operations on Spawning and Egg Incubation Habitat for
6 River Lamprey

7 In general, the effect of Alternative 4A would be negligible relative to the NAA_ELT.

8 H3_ELT/ESO_ELT

9 Flow-related impacts to river lamprey spawning habitat were evaluated by estimating effects of flow
10 alterations on redd dewatering risk as described for Pacific lamprey with appropriate time-frames
11 for river lamprey incorporated into the analysis. The same locations were analyzed as for Pacific
12 lamprey: the Sacramento River at Keswick and Red Bluff, Trinity River downstream of Lewiston,
13 Feather River at Thermalito Afterbay, and the American River at Nimbus Dam and at the confluence
14 with the Sacramento River. River lamprey spawn in these rivers between February and June so flow
15 reductions during those months have the potential to dewater redds, which could result in
16 incomplete development of the eggs to ammocoetes (the larval stage).

17 Dewatering risk to redd cohorts was characterized by the number of cohorts experiencing a month-
18 over-month reduction in flows (using CALSIM II outputs) of greater than 50%. Small-scale spawning
19 location suitability characteristics (e.g., depth, velocity, and substrate) of river lamprey are not
20 adequately described to employ a more formal analysis such as a weighted usable area analysis.
21 Therefore, as described for Pacific lamprey, there is uncertainty that these values represent actual
22 redd dewatering events, and results should be treated as rough estimates of flow fluctuations under
23 each model scenario. Results were expressed as the number of cohorts exposed to dewatering risk
24 and as a percentage of the total number of cohorts anticipated in the river based on the applicable
25 time-frame, February to June.

26 There would be negligible differences between H3_ELT and NAA_ELT in exposure to flow reductions
27 in all rivers except for a small decrease (8% lower) in the American River at Nimbus Dam (Table 11-
28 4A-127). These results indicate that H3_ELT would not have biologically meaningful effects on river
29 lamprey redd cohorts predicted to experience a month-over-month change in flow of greater than
30 50% in all locations analyzed.

1 Table 11-4A-127. Differences between Model Scenarios in Dewatering Risk of River Lamprey Redd
2 Cohorts^a

Location	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
Sacramento River at Keswick	3 (9%)	0 (0%)
Sacramento River at Red Bluff	4 (11%)	1 (3%)
Trinity River downstream of Lewiston	-2 (-3%)	0 (0%)
Feather River below Thermalito Afterbay	-3 (-4%)	-3 (-4%)
American River at Nimbus	4 (7%)	-5 (-8%)
American River at Sacramento River confluence	12 (20%)	0 (0%)

^a Difference and percent difference between model scenarios in the number of river lamprey redd cohorts experiencing a month-over-month reduction in flows of greater than 50%. Positive values indicate a higher value in H3_ELT than in Existing Conditions or NAA_ELT.

3

4 River lamprey generally spawn between February and June (Beamish 1980; Moyle 2002). Using
5 Pacific lamprey as a surrogate, eggs are assumed to hatch in 18-49 days depending on water
6 temperature (Brumo 2006) and are, therefore, assumed to be present during roughly the same
7 period and locations as spawners. Moyle et al. (1995) indicate that river lamprey “adults need...
8 **temperatures [that] do not exceed 25°C,” although there is no mention of thermal requirements for**
9 eggs in this or any existing literature. Meeuwig et al. (2005) reported that, for Pacific lamprey eggs,
10 significant reductions in survival were observed at 22°C (71.6°F). Therefore, for this analysis, both
11 temperatures, 22°C (71.6°F) and 25°C (77°F), were used as upper thresholds of river lamprey eggs.
12 The analysis predicted the number of consecutive 49 day periods for the entire 82-year CALSIM
13 period during which at least one day exceeds 22°C (71.6°F) or 25°C (77°F) using daily data from
14 USRWQM. For other rivers, the analysis predicted the number of consecutive two-month periods
15 during which at least one month exceeds 22°C (71.6°F) or 25°C (77°F) using monthly averaged data
16 **from the Bureau’s temperature model. Each individual day or month starts a new “egg cohort” such**
17 that there are 12.320 cohorts for the Sacramento River, corresponding to 82 years of eggs being laid
18 every day each year from February 1 through June 30, and 405 cohorts for the other rivers using
19 monthly data over the same period. The incubation periods used in this analysis are conservative
20 and represent the extreme long end of the egg incubation period (Brumo 2006). Also, the utility of
21 the monthly average time step is limited because the extreme temperatures are masked; however,
22 no better analytical tools are currently available for this analysis. Spawning locations of river
23 lamprey are not well defined. Therefore, this analysis uses the widest range in which the species is
24 thought to spawn in each river.

25 For both thresholds, there would be few differences in egg cohort exposure between NAA_ELT and
26 H3_ELT among all sites (Table 11-4A-128). In most cases, absolute differences account for <5% of
27 the total number of cohorts. The two exceptions are for the 71.6 °F threshold in the Feather River at
28 Thermalito Afterbay (7% absolute increase) and for the 77 °F threshold in American River at the
29 Sacramento River Confluence (11% absolute decrease). However, due to the low magnitude and
30 frequency, there would be no population level effects of this increase and decrease in temperature
31 exposure to river lamprey eggs.

1 Table 11-4A-128. Differences (Percent Differences) between Model Scenarios in River Lamprey Egg
2 Cohort Temperature Exposure^a

Location	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
Temperatures above 71.6°F		
Sacramento River at Keswick	0 (NA)	0 (NA)
Sacramento River at Hamilton City	100 (NA)	-1 (-1%)
Trinity River at Lewiston	0 (NA)	0 (NA)
Trinity River at North Fork	1 (NA)	0 (0%)
Feather River at Fish Barrier Dam	0 (NA)	0 (NA)
Feather River below Thermalito Afterbay	11 (122%)	7 (54%)
American River at Nimbus	12 (240%)	-2 (-11%)
American River at Sacramento River Confluence	18 (64%)	-11 (-19%)
Stanislaus River at Knights Ferry	0 (NA)	0 (NA)
Stanislaus River at Riverbank	11 (1100%)	0 (0%)
Temperatures above 77°F		
Sacramento River at Keswick	0 (NA)	0 (NA)
Sacramento River at Hamilton City	0 (NA)	0 (NA)
Trinity River at Lewiston	0 (NA)	0 (NA)
Trinity River at North Fork	0 (NA)	0 (NA)
Feather River at Fish Barrier Dam	0 (NA)	0 (NA)
Feather River below Thermalito Afterbay	2 (NA)	2 (NA)
American River at Nimbus	1 (NA)	0 (0%)
American River at Sacramento River Confluence	3 (NA)	0 (0%)
Stanislaus River at Knights Ferry	0 (NA)	0 (NA)
Stanislaus River at Riverbank	0 (NA)	0 (NA)

NA = could not be calculated because the denominator was 0.

^a Difference and percent difference between model scenarios in the number of river lamprey egg cohorts experiencing water temperatures above 71.6°F and 77°F during February through June on at least one day during a 49-day incubation period in the Sacramento River or for at least one month during a 2-month incubation period in other rivers for each model scenario. Positive values indicate a higher value in H3_ELT than in EXISTING CONDITIONS or NAA_ELT.

3

4 H4_ELT/HOS

5 Flows during January through August under H4_ELT would generally be similar to or greater than
6 flows under H3_ELT in all rivers except the Feather River. As a result, the redd dewatering risk
7 analysis was not conducted for H4_ELT in these rivers and results for H4_ELT would be the same as
8 those for H3_ELT.

9 In the Feather River at Thermalito Afterbay, there would be 23 more cohorts (20%) exposed to a
10 50% month over month drop in flow rate under H4_ELT relative to NAA_ELT (Table 11-4A-129).
11 This change of 23 cohorts out of 410 cohorts equated to ~6% of all cohorts, which is not considered
12 substantial to the population.

1 Table 11-4A-129. Differences between Model Scenarios in Dewatering Risk of River Lamprey Redd
2 Cohorts^a

Location	EXISTING CONDITIONS vs. H4_ELT	NAA_ELT vs. H4_ELT
Feather River at Thermalito Afterbay	-14 (-9%)	23 (20%)

^a Difference and percent difference between model scenarios in the number of river lamprey redd cohorts experiencing a month-over-month reduction in flows of greater than 50%. Positive values indicate a higher value in H1 or H4_ELT than in Existing Conditions or NAA_ELT.

3
4 Water temperatures would not differ between H4_ELT and H3_ELT and, therefore, no egg cohort
5 temperature analyses were conducted. Overall, results for H4_ELT would be similar to those for
6 H3_ELT.

7 *NEPA Effects:* Collectively, these modeling results indicate that the effect is not adverse because it
8 would not substantially reduce suitable spawning habitat or substantially reduce the number of fish
9 as a result of egg mortality. Effects of Alternative 4A on river lamprey redd dewatering risk and
10 exposure risk of eggs to elevated water temperatures would be small or negligible for all locations
11 analyzed.

12 *CEQA Conclusion:* Collectively, the results of the Impact AQUA-166 CEQA analysis show that the
13 difference between the CEQA baseline and Alternative 4A is less than significant.

14 H3_ELT/ESO_ELT

15 Dewatering risk during the river lamprey spawning period from February to June would generally
16 be similar to slightly higher under H3_ELT relative to Existing Conditions (Table 11-4A-127). The
17 largest difference would be in the American River at the Sacramento River confluence (12 cohorts,
18 or 20% increase). An increase in 12 cohorts of the 410 total cohorts would represent <3% of total
19 cohorts. As a result, it is concluded that this increase would not represent a biological meaningful
20 effect to river lamprey.

21 Egg cohort temperature exposure results are reported in Table 11-4A-128. There would be either
22 negligible differences or an increase in exposure of egg cohorts (11 to 18 cohorts, or 64% to
23 1,100%) under H3_ELT relative to Existing Conditions to temperatures above 71.6°F in the Feather
24 River, American River, and Stanislaus River and an increase of up to 100 cohorts in the Sacramento
25 River. However, none of these increases would compose more than 5% of the 410 total ammocoete
26 cohort count and, therefore, would not be biologically relevant to the species. There would be
27 negligible differences in the number of cohorts exposed to temperatures above 77°F under H3_ELT
28 relative to Existing Conditions.

29 H4_ELT/HOS

30 Flows during February through June under H4_ELT would generally be similar to or greater than
31 flows under H3_ELT in all rivers except the Feather River. As a result, the redd dewatering risk
32 analysis was not conducted for H4_ELT in these rivers and results for H4_ELT would be the same as
33 those for H3_ELT.

34 In the Feather River at Thermalito Afterbay, there would be 14 (9%) more cohorts (Table 11-4A-
35 129). This increase would be too small to have a biologically meaningful effect on river lamprey.

1 Water temperatures under H4_ELT would be similar to those under H3_ELT for all rivers examined.
2 Therefore, no additional cohort temperature exposure analyses were conducted for H4_ELT.

3 Overall, results for H4_ELT would be similar to those for H3_ELT.

4 Summary of CEQA Conclusion

5 Collectively, these modeling results indicate that the effect is less than significant because it would
6 not substantially reduce suitable spawning habitat or substantially reduce the number of fish as a
7 result of egg mortality. Effects of Alternative 4A on river lamprey redd dewatering risk and exposure
8 risk of eggs to elevated water temperatures would be small or negligible for all locations analyzed.
9 No mitigation is necessary.

10 Impact AQUA-185: Effects of Water Operations on Rearing Habitat for River Lamprey

11 In general, the effect of Alternative 4A would be negligible relative to the NAA_ELT.

12 H3_ELT/ESO_ELT

13 Flow-related impacts to river lamprey rearing habitat were evaluated by estimating of the frequency
14 of rapid flow reductions in ammocoete rearing areas. Rapid reductions in flow can strand
15 ammocoetes, leading to mortality. Comparisons of effects were made for ammocoete cohorts, as
16 described for Pacific lamprey, in the Sacramento River at Keswick and Red Bluff, the Trinity River,
17 Feather River, and the American River at Nimbus Dam and at the confluence with the Sacramento
18 River.

19 As for Pacific lamprey, the analysis of river lamprey ammocoete stranding was conducted by
20 analyzing a range of month-over-month flow reductions from CALSIM II outputs, using the range of
21 50%–90% in 5% increments. A cohort of ammocoetes was assumed to be born every month during
22 their spawning period (February through June) and spend 5 years rearing upstream. Therefore, a
23 cohort was considered stranded if at least one month-over-month flow reduction was greater than
24 the flow reduction at any time during the period.

25 Comparisons of H3_ELT to NAA_ELT for the Sacramento River at Keswick (Table 11-4A-130)
26 indicate that there would be no effect (0%) or negligible effects ($\leq 5\%$) attributable to H3_ELT in all
27 flow reduction categories.

1 Table 11-4A-130. Percent Difference between Model Scenarios in the Number of River Lamprey
2 Ammocoete Cohorts Exposed to Month-over-Month Flow Reductions, Sacramento River at
3 Keswick

Percent Flow Reduction	Percent Difference ^a	
	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
-50%	0	0
-55%	2	0
-60%	6	5
-65%	1	-4
-70%	0	-5
-75%	4	3
-80%	7	0
-85%	111	0
-90%	NA	NA

NA = could not be calculated because the denominator was 0.

^a Negative values indicate reduced cohort exposure, a benefit of H3_ELT.

4

5 Results of comparisons for the Sacramento River at Red Bluff indicates that H3_ELT would have
6 negligible effects (<5%) in all but the 55% flow increase category, which would cause a 6% increase
7 in cohort exposure (Table 11-4A-131). Overall, this indicates that there would be minimal effect on
8 ammocoete exposure.

9 Table 11-4A-131. Percent Difference between Model Scenarios in the Number of River Lamprey
10 Ammocoete Cohorts Exposed to Month-over-Month Flow Reductions, Sacramento River at Red
11 Bluff

Percent Flow Reduction	Percent Difference ^a	
	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
-50%	0	2
-55%	6	6
-60%	4	-2
-65%	-2	-3
-70%	2	0
-75%	19	0
-80%	23	0
-85%	0	0
-90%	NA	NA

NA = could not be calculated because the denominator was 0.

^a Negative values indicate reduced cohort exposure, a benefit of H3_ELT.

12

13 Comparisons for the Trinity River indicate that there would be no or negligible differences in
14 ammocoete cohorts exposed flow reductions between H3_ELT and NAA_ELT for all flow reduction
15 categories except 80-90%, which would be 5 to 11% higher under H3_ELT (Table 11-4A-132).

1 Table 11-4A-132. Percent Difference between Model Scenarios in the Number of River Lamprey
2 Ammocoete Cohorts Exposed to Month-over-Month Flow Reductions, Trinity River at Lewiston

Percent Flow Reduction	Percent Difference ^a	
	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
-50%	0	0
-55%	0	0
-60%	0	0
-65%	0	0
-70%	0	0
-75%	27	0
-80%	30	5
-85%	33	6
-90%	49	11

^a Negative values indicate reduced cohort exposure, a benefit of H3_ELT.

3

4 In the Feather River at Thermalito Afterbay, there would be no difference in ammocoete cohort
5 exposure at the 50% through 75% flow reductions (Table 11-4A-133). For the 80% through 90%
6 flow reductions, ammocoete exposure would be 5% to 64% lower, which due to the low frequency
7 with which 85% and 90% reductions in flow would occur, would not be frequent enough to have a
8 biologically meaningful effect on river lamprey ammocoete rearing. These results indicate that there
9 will be no effects of H3_ELT on river lamprey ammocoete rearing in the Feather River.

10 Table 11-4A-133. Percent Difference between Model Scenarios in the Number of River Lamprey
11 Ammocoete Cohorts Exposed to Month-over-Month Flow Reductions, Feather River at Thermalito
12 Afterbay

Percent Flow Reduction	Percent Difference ^a	
	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
-50%	0	0
-55%	0	0
-60%	0	0
-65%	0	0
-70%	0	0
-75%	-1	-1
-80%	-7	-5
-85%	-27	-32
-90%	-61	-64

^a Negative values indicate reduced cohort exposure, a benefit of H3_ELT.

13

14 Comparisons for the American River at Nimbus Dam (Table 11-4A-134) and at the confluence with
15 the Sacramento River (Table 11-4A-135) have similar results. There would be no or negligible
16 differences in cohort exposure between NAA_ELT and H3_ELT for most flow reduction categories.
17 There would be higher cohort exposure under H3_ELT relative to NAA_ELT at Nimbus Dam at the
18 75% and 80% flow reductions (19% and 22% higher, respectively) and at the confluence with the

1 Sacramento River at the 80% and 85% flow reductions (9% and 32% higher, respectively) flow
2 reductions. These results indicate that there would generally be no effect of H3_ELT on stranding
3 risk in the American River with few small exceptions that would not be common enough to have
4 biologically meaningful effects.

5 Table 11-4A-134. Percent Difference between Model Scenarios in the Number of River Lamprey
6 Ammocoete Cohorts Exposed to Month-over-Month Flow Reductions, American River at Nimbus
7 Dam

Percent Flow Reduction	Percent Difference ^a	
	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
-50%	0	0
-55%	-1	-1
-60%	2	-1
-65%	5	0
-70%	45	4
-75%	119	19
-80%	292	22
-85%	100	0
-90%	-100	NA

NA = could not be calculated because the denominator was 0.

^a Negative values indicate reduced cohort exposure, a benefit of H3_ELT.

8

9 Table 11-4A-135. Relative Difference between Model Scenarios in the Number of River Lamprey
10 Ammocoete Cohorts Exposed to Month-over-Month Flow Reductions, American River at the
11 Confluence with the Sacramento River

Percent Flow Reduction	Percent Difference ^a	
	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
-50%	0	0
-55%	0	0
-60%	3	1
-65%	3	2
-70%	20	4
-75%	33	2
-80%	235	9
-85%	270	32
-90%	100	0

^a Negative values indicate reduced cohort exposure, a benefit of H3_ELT.

12

13 Because the thermal tolerance of river lamprey ammocoetes is unknown, the thermal tolerance of
14 Pacific lamprey ammocoetes of 22°C (71.6°F) and of river lamprey adults of 25°C (77°F) (Moyle et al.
15 1995) was used. River lamprey ammocoetes rear upstream for 3–5 years (Moyle 2002). To be
16 conservative, this analysis assumed a maximum ammocoete duration of 5 years. Each individual day
17 or month starts a new “cohort” such that there are 18,730 cohorts for the Sacramento River,

1 corresponding to 82 years of ammocoetes being “born” every day each year from January 1 through
2 August 31, and 380 cohorts for the other rivers using monthly data over the same period.

3 There would be differences in the number of ammocoete cohorts exposed to temperatures greater
4 than the thresholds in most of the rivers, particularly for the 77°F threshold (Table 11-4A-136).
5 However, each river with an increase in exposure would also have a site with a decrease in exposure
6 of similar magnitude, except in the Feather River for the 77°F threshold. Overall, the increases and
7 decreases are expected to balance out within rivers such that there would be no overall effect on
8 river lamprey ammocoetes.

9 Table 11-4A-136. Differences (Percent Differences) between Model Scenarios in River Lamprey
10 Ammocoete Cohorts Exposed to Temperatures in the Feather River Greater than 71.6°F and 77°F
11 in at Least One Month

Location	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
71.6°F Threshold		
Sacramento River at Keswick ^b	0 (NA)	0 (NA)
Sacramento River at Hamilton City ^b	5775 (NA)	-11 (-0.2%)
Trinity River at Lewiston	25 (NA)	0 (0%)
Trinity River at North Fork	25 (NA)	0 (0%)
Feather River at Fish Barrier Dam	0 (NA)	0 (NA)
Feather River below Thermalito Afterbay	135 (71%)	65 (25%)
American River at Nimbus	180 (200%)	0 (0%)
American River at Sacramento River Confluence	120 (49%)	5 (1%)
Stanislaus River at Knights Ferry	0 (NA)	0 (NA)
Stanislaus River at Riverbank	155 (620%)	0 (0%)
77°F Threshold		
Sacramento River at Keswick ^b	0 (0%)	0 (NA)
Sacramento River at Hamilton City ^b	0 (0%)	4404 (NA)
Trinity River at Lewiston	0 (NA)	0 (NA)
Trinity River at North Fork	0 (NA)	0 (NA)
Feather River at Fish Barrier Dam	0 (NA)	0 (NA)
Feather River below Thermalito Afterbay	50 (NA)	25 (100%)
American River at Nimbus	75 (NA)	25 (50%)
American River at Sacramento River Confluence	80 (NA)	-25 (-24%)
Stanislaus River at Knights Ferry	0 (NA)	0 (NA)
Stanislaus River at Riverbank	0 (NA)	0 (NA)

NA = could not be calculated because the denominator was 0.

^a Positive values indicate a higher value in H3_ELT than in EXISTING CONDITIONS or NAA_ELT.

^b Based on daily data; all other locations use monthly data; 1922–2003.

12

1 H4_ELT/HOS

2 There would be generally no differences in mean flows year-round between H4_ELT and H3_ELT in
3 the Sacramento, Trinity, and American rivers. Therefore, ammocoete stranding risk analysis was
4 conducted only for the Feather River.

5 In the Feather River at Thermalito Afterbay, there would be no or a negligible difference in
6 ammocoete cohort exposure between NAA_ELT and H4_ELT at the 50% through 80% flow
7 reductions (Table 11-4A-137). For the 85% and 90% flow reductions, ammocoete exposure under
8 H4_ELT would be 14% and 47% higher, respectively.

9 Table 11-4A-137. Percent Difference between Baselines and H4_ELT Model Scenarios in the
10 Number of River Lamprey Ammocoete Cohorts Exposed to Month-over-Month Flow Reductions,
11 Feather River at Thermalito Afterbay

Percent Flow Reduction	Percent Difference ^a	
	EXISTING CONDITIONS vs. H4_ELT	NAA_ELT vs. H4_ELT
-50%	0	0
-55%	0	0
-60%	0	0
-65%	0	0
-70%	0	0
-75%	0	0
-80%	2	5
-85%	22	14
-90%	57	47

^a Negative values indicate reduced cohort exposure under H4_ELT.

12

13 There would generally be no differences in mean water temperatures year-round between H4_ELT
14 and H3_ELT in any river examined. As a result, no additional ammocoete cohort exposure analyses
15 were conducted for H4_ELT. Results of these analyses for H4_ELT would be the same as those for
16 H3_ELT.

17 Overall, these results indicate that results for H4_ELT would generally be similar to those under
18 H3_ELT except for an increase in ammocoete stranding risk exposure in the Feather River at 85%
19 and 90% flow reductions under H4_ELT. The 85% and 90% flow reductions would occur rarely—19
20 and 7 times under NAA_ELT and 22 and 10 times, respectively—under H4_ELT, throughout the 985
21 months evaluated. Therefore, these reductions would affect a small proportion of the population.
22 These results indicate that there would be no biologically meaningful effect of H4_ELT on stranding
23 risk.

24 *NEPA Effects:* These modeling results indicate the effect would not be adverse because it would not
25 substantially reduce rearing habitat or substantially reduce the number of fish through ammocoete
26 mortality. Project-related effects on flow reductions and effects on water temperatures in all
27 locations analyzed would be negligible and would not affect river lamprey ammocoete stranding
28 risk and rearing success because the changes would not be large enough or frequent enough to be
29 biologically meaningful.

1 *CEQA Conclusion:* In general, Alternative 4A would reduce the quantity and quality of rearing
2 habitat for river lamprey relative to Existing Conditions. However, as further described below in the
3 **Summary of CEQA Conclusion, reviewing the alternative's impacts in relation to the NAA_ELT** is a
4 better approach because it isolates the effect of the alternative from those of sea level rise, climate
5 change, and future water demand. Informed by the NAA_ELT comparison, Alternative 4A would not
6 affect the quantity and quality of rearing habitat for river lamprey relative to NAA_ELT.

7 H3_ELT/ESO_ELT

8 Comparisons of H3_ELT to Existing Conditions for the Sacramento River at Keswick indicate
9 negligible effects (<5%) or small increases (to 7%) for ammocoete cohort exposures to flow
10 reductions from 50% to 80% and 90%, and a more substantial increase in exposure (111%) to 85%
11 flow reduction events (Table 11-4A-130). Comparisons for the Sacramento River at Red Bluff
12 indicate similar results with negligible effects (<5%) or small increases in exposure (to 6%) for 50%
13 to 70% and 85% to 90% flow reduction categories, and a more substantial increases in exposure
14 (19% to 23%) in the 80% and 85% flow reduction categories, respectively (Table 11-4A-131).
15 Based on the prevalence of small and negligible effects, the effects of a more substantial increase in
16 flow reductions in a single flow reduction category would not be considered biologically meaningful
17 to river lamprey in the Sacramento River.

18 Comparisons for the Trinity River between H3_ELT and Existing Conditions indicated no effect (0%)
19 for the lower flow reduction categories up to 70%, and increases in occurrence ranging from 27% to
20 49% for the 75% through 90% flow reduction categories (Table 11-4A-132). The prevalence of
21 increased occurrence of higher-magnitude flow reductions would affect river lamprey ammocoete
22 stranding in the Trinity River.

23 Comparisons for the Feather River between H3_ELT and Existing Conditions indicated no effect
24 (0%) or reductions in frequency of occurrence for all flow reduction categories, with 7% to 61%
25 reductions in cohorts exposed to 80% to 90% flow reduction events (Table 11-4A-133). Due to the
26 low frequency with which 85% and 90% reductions in flow would occur, would not be frequent
27 enough to have a biologically meaningful effect on river lamprey ammocoete rearing.

28 Comparisons for the American River at Nimbus Dam (Table 11-4A-134) and at the confluence with
29 the Sacramento River (Table 11-4A-135) between H3_ELT and Existing Conditions indicate a 45% to
30 292% increased chance of occurrence of flow reductions between 70 and 85% under H3_ELT
31 compared to NAA_ELT at Nimbus Dam and a 20% to 270% increased chance of occurrence of flows
32 reductions between 70% and 85% at the confluence with the Sacramento River. The prevalence of
33 increased occurrence of higher-magnitude flow reductions would constitute a biologically
34 meaningful effect on river lamprey ammocoete stranding in the American River.

35 The number of ammocoete cohorts exposed to 71.6°F under H3_ELT (including climate change)
36 would be up to 620% higher than those under Existing Conditions in most locations examined
37 (Table 11-A1-136). The number of ammocoete cohorts exposed to 77°F would be similar between
38 Existing Conditions and H3_ELT in the Sacramento, Trinity, and Stanislaus Rivers, but 50 to 80
39 cohorts higher in the Feather and American Rivers (percent differences could not be calculated
40 because there would be 0 cohorts under Existing Conditions).

1 H4_ELT/HOS

2 There would be generally no differences in mean flows year-round between H4_ELT and H3_ELT in
3 the Sacramento, Trinity, and American rivers. Therefore, ammocoete stranding risk analysis was
4 conducted only for the Feather River.

5 In the Feather River at Thermalito Afterbay, there would be no or a negligible difference in
6 ammocoete cohort exposure between Existing Conditions and H4_ELT at the 50% through 80% flow
7 reductions (Table 11-4A-137). There would be 22% and 57% more cohorts exposed to 85% and
8 90% flow reductions, respectively, under H3_ELT relative to Existing Conditions.

9 There would generally be no differences in mean water temperatures year-round between H4_ELT
10 and H3_ELT in any river examined. As a result, no additional ammocoete temperature cohort
11 exposure analyses were conducted for H4_ELT. Results of these analyses for H4_ELT would be the
12 same as those for H3_ELT.

13 Overall, these results indicate that results for H4_ELT would generally be similar to those under
14 H3_ELT.

15 Summary of CEQA Conclusion

16 Under Alternative 4A, there would be moderate to substantial persistent increases in occurrence of
17 flow reduction events for Alternative 4A with respect to Existing Conditions for the Trinity River (up
18 to 49%) and the American River at Nimbus Dam (up to 292%) and at the confluence with the
19 Sacramento River (up to 270%) that would increase river lamprey ammocoete stranding risk and
20 therefore rearing success for these locations. There would be a beneficial effect from reduced
21 occurrence of flow reductions in the Feather River (up to 61% reduction) but this effect would not
22 be sufficient to offset the negative effects from increased occurrence of flow reductions at the other
23 locations. Further, stranding risk under H4_ELT in the Feather River would be higher than those
24 under H3_ELT, such that the benefits under H3_ELT would not occur under these H4_ELT. There
25 would also be increases under Alternative 4A in ammocoete cohort exposure to critical water
26 temperatures in the Feather and American rivers that would have effects on rearing success through
27 ammocoete mortality. Contrary to the NEPA conclusion set forth above, these modeling results
28 indicate that the difference between Existing Conditions and Alternative 4A could be significant
29 because the alternative could substantially reduce rearing habitat and substantially reduce the
30 number of river lamprey as a result of fry and juvenile mortality.

31 However, this interpretation of the biological modeling results is likely attributable to different
32 modeling assumptions for four factors: sea level rise, climate change, future water demands, and
33 implementation of the alternative. As discussed in Section 11.3.3, because of differences between the
34 CEQA and NEPA baselines, it is sometimes possible for CEQA and NEPA significance conclusions to
35 vary between one another under the same impact discussion. The baseline for the CEQA analysis is
36 Existing Conditions at the time the NOP was prepared. Both the action alternative and the NEPA
37 baseline (NAA_ELT) models anticipated future conditions that would occur at 2025 (ELT
38 implementation period), including the projected effects of climate change (precipitation patterns),
39 sea level rise and future water demands, as well as implementation of required actions under the
40 2008 USFWS BiOp and the 2009 NMFS BiOp. Because the action alternative modeling does not
41 partition the effects of implementation of the alternative from the effects of sea level rise, climate
42 change, and future water demands, the comparison to Existing Conditions may not offer a clear
43 understanding of the impact of the alternative on the environment. This suggests that the

1 comparison of the results between the alternative and NAA_ELT is a better approach because it
2 isolates the effect of the alternative from those of sea level rise, climate change, and future water
3 demands.

4 When compared to NAA_ELT and informed by the NEPA analysis above, project-related effects on
5 flow reductions and effects on water temperatures in all locations analyzed would be negligible and
6 would not affect river lamprey ammocoete stranding risk and rearing success. These modeling
7 results represent the increment of change attributable to the alternative, demonstrating the
8 similarities in flows and water temperatures under Alternative 4A and the NAA_ELT, and addressing
9 the limitations of the CEQA baseline (Existing Conditions). Therefore, the impact is less than
10 significant and no mitigation is required.

11 Impact AQUA-186: Effects of Water Operations on Migration Conditions for River Lamprey

12 In general, the effect of Alternative 4A on river lamprey migration conditions would be negligible
13 relative to the NAA_ELT.

14 H3_ELT/ESO_ELT

15 After 3 to 5 years, river lamprey ammocoetes migrate downstream and become macrophthalmia once
16 they reach the Delta. River lamprey migration generally occurs September through November
17 (USFWS unpublished data). The effects of H3_ELT on seasonal migration flows for river lamprey
18 macrophthalmia were assessed using CALSIM II flow output. Flow rates along the likely migration
19 pathways of river lamprey during the likely migration period (September through November) were
20 examined to predict how H3_ELT may affect migration flows for outmigrating macrophthalmia.
21 Analyses were conducted for the Sacramento River at Red Bluff, Feather River at the confluence with
22 the Sacramento River, and the American River at the confluence with the Sacramento River.

23 The adult river lamprey upstream migration period also occurs between September and June.
24 Therefore, results presented below represent effects to the migration of both macrophthalmia and
25 adult river lamprey. CALSIM II flow outputs were examined during these periods for each model
26 scenario.

27 *Sacramento River*

28 Mean monthly flow rates for the Sacramento River at Red Bluff (Appendix 11C, *CALSIM II Model*
29 *Results utilized in the Fish Analysis*) were examined during the September to November river
30 lamprey macrophthalmia and adult migration periods. Flows under H3_ELT would generally be
31 similar to or up to 18% lower than flows under NAA_ELT during September and November and
32 similar to flows under NAA_ELT during October. Because of the relatively small magnitude, reduced
33 flows during November are not likely to cause biologically meaningful effects on river lamprey
34 migration.

35 *Feather River*

36 Flows in the Feather River at the confluence with the Sacramento River (Appendix 11C, *CALSIM II*
37 *Model Results utilized in the Fish Analysis*) were examined during the September to November river
38 lamprey macrophthalmia and adult migration periods. Flows under H3_ELT would generally be up to
39 27% lower than flows under NAA_ELT during September, up to 17% higher than flows under
40 NAA_ELT during October, and similar to flows under NAA_ELT during November. Based on
41 occurrence of negligible effects or increases in flow that would have a beneficial effect on migration

1 conditions, with decreases predicted for wetter water years when effects on migration conditions
2 would not be as critical, these results indicate that effects of NAA_ELT on flows would not have
3 biologically meaningful negative effects on migration conditions in the Feather River.

4 *American River*

5 Flows in the American River at the confluence with the Sacramento River (Appendix 11C, *CALSIM II*
6 *Model Results utilized in the Fish Analysis*) were examined during the September through November
7 macrophthalmia and adult migration periods. Flows under H3_ELT would be lower than flows under
8 NAA_ELT during September and November and similar to flows during October. These results
9 indicate that project-related effects would include small to moderate decreases in flow under
10 H3_ELT for some months and water year types.

11 H4_ELT/HOS

12 Flows under H4_ELT in the Sacramento River at Red Bluff would be similar to flows under NAA_ELT
13 during September and October and up to 15% lower during November (Appendix 11C, *CALSIM II*
14 *Model Results utilized in the Fish Analysis*). Flows under H4_ELT in the Feather River at the
15 confluence with the Sacramento River would generally be up to 38% lower than flows under
16 H3_ELT in September and mixed (higher, lower, and similar) during October and November. Flows
17 under H4_ELT in the American River at the confluence with the Sacramento River would generally
18 be lower than those under NAA_ELT but up to 22% during September and November and similar
19 during October. These results indicate that project-related effects would include small to moderate
20 decreases in flow under H4_ELT for some months and water year types.

21 *NEPA Effects:* Collectively, these modeling results indicate that the effect is not adverse because it
22 would not substantially reduce the amount of suitable habitat or substantially interfere with the
23 movement of fish. H3_ELT would primarily have negligible effects (<5%), small increases or
24 decreases in flow, or decreases in wetter water year types and/or during a limited portion of the
25 migration period that would not have negative effects on migration conditions. There would be
26 beneficial effects from moderate increases in flow for some months and water year types in the
27 Feather River (to 34%) and American River (to 24%); however, the beneficial effect would be
28 partially offset by flow reductions during other months of the migration periods. Flows under
29 H4_ELT would be similar to those under H3_ELT.

30 *CEQA Conclusion:* In general, Alternative 4A would reduce the quantity and quality of migration
31 habitat for river lamprey relative to Existing Conditions. However, as further described below in the
32 **Summary of CEQA Conclusion, reviewing the alternative's impacts in relation to the NAA_ELT is a**
33 **better approach because it isolates the effect of the alternative from those of sea level rise, climate**
34 **change, and future water demand. Informed by the NAA_ELT comparison, Alternative 4A would not**
35 **affect the quantity and quality of migration habitat for river lamprey.**

36 H3_ELT/ESO_ELT

37 For the Sacramento River at Red Bluff, comparisons of mean monthly flow rate for H3_ELT to
38 Existing Conditions (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*) indicate that
39 flows under H3_ELT would be up to 22% lower than those under Existing Conditions during October
40 and November. During September, flows would be higher in wetter years and lower in drier years.

41 Comparisons for the Feather River at the confluence with the Sacramento River indicate (Appendix
42 11C, *CALSIM II Model Results utilized in the Fish Analysis*) indicate highly variable effects of H3_ELT

1 relative to Existing Conditions depending on month and water year type. Combining all water year
2 types, flows would be 28% higher during September, 8% lower during October, and 5% lower
3 during November.

4 Comparisons for the American River at the confluence with the Sacramento River (Appendix 11C,
5 *CALSIM II Model Results utilized in the Fish Analysis*) for September through November indicate
6 reductions in flows in September and November of up to 47% and variable changes of 11% lower to
7 15% higher during October depending on water year type. Overall, these results show that flows
8 would be reduced in the American River during this period relative to Existing Conditions.

9 H4_ELT/HOS

10 Flows under H4_ELT in the Sacramento River at Red Bluff would be similar to or greater than flows
11 under Existing Conditions during September through November, although highly variable during
12 September (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flows under
13 H4_ELT in the Feather River at the confluence with the Sacramento River would be higher and lower
14 than flows under Existing Conditions depending on month and water year type, but lower overall.
15 Flows under H4_ELT in the American River at the confluence with the Sacramento River would
16 generally be up to 47% lower than flows under Existing Conditions. Overall, migration conditions
17 for river lamprey under H4_ELT would be less favorable than conditions under Existing Conditions.

18 Summary of CEQA Conclusion

19 Under Alternative 4A, there would be moderate and persistent flow reductions for substantial
20 portions of the river lamprey macropthalmia migration period in the American River, and less
21 persistent and smaller magnitude flow reductions in the Sacramento River and Feather River. These
22 flow reductions would affect juvenile migration success, increase straying, and delay access to the
23 ocean. If in fact, lamprey use these cues to find natal spawning grounds, these flow reductions may
24 also affect adult migration success, including a reduction in the ability for adults to sense olfactory
25 cues. There would be beneficial effects from increases in flow for some months and water year types
26 in each location. However, this effect would not be sufficient to offset the negative effects of flow
27 reductions for the remainder of the migration period and/or in other water year types, particularly
28 drier water year types when effects of flow reductions would be more critical. Flows under H4_ELT
29 would be less favorable than those under H3_ELT. Contrary to the NEPA conclusion set forth above,
30 these modeling results indicate that the difference between Existing Conditions and Alternative 4A
31 could be significant because the alternative could substantially reduce migration conditions for river
32 lamprey.

33 However, this interpretation of the biological modeling is likely attributable to different modeling
34 assumptions for four factors: sea level rise, climate change, future water demands, and
35 implementation of the alternative. As discussed in Section 11.3.3, because of differences between the
36 CEQA and NEPA baselines, it is sometimes possible for CEQA and NEPA significance conclusions to
37 vary between one another under the same impact discussion. The baseline for the CEQA analysis is
38 Existing Conditions at the time the NOP was prepared. Both the action alternative and the NEPA
39 baseline (NAA_ELT) models anticipated future conditions that would occur at 2025 (ELT
40 implementation period), including the projected effects of climate change (precipitation patterns),
41 sea level rise and future water demands, as well as implementation of required actions under the
42 2008 USFWS BiOp and the 2009 NMFS BiOp. Because the action alternative modeling does not
43 partition the effects of implementation of the alternative from the effects of sea level rise, climate
44 change, and future water demands, the comparison to Existing Conditions may not offer a clear

1 understanding of the impact of the alternative on the environment. This suggests that the
2 comparison in results between the alternative and NAA_ELT, is a better approach because it isolates
3 the effect of the alternative from those of sea level rise, climate change, and future water demands.

4 When compared to NAA_ELT and informed by the NEPA analysis above, there would generally be
5 negligible effects on mean monthly flow and water temperatures for river lamprey migration
6 periods at all locations analyzed. Therefore, this impact is less than significant and no mitigation is
7 required,

8 Restoration Measures (Environmental Commitment Environmental Commitment 4, Environmental
9 Commitment 6, Environmental Commitment 7, and Environmental Commitment 10)

10 The discussion of the effects of restoration measures for Pacific lamprey is also applicable to river
11 lamprey.

12 Impact AQUA-187: Effects of Construction of Restoration Measures on River Lamprey

13 Refer to Impact AQUA-169 under Pacific lamprey for a discussion of the effects of construction of
14 restoration measures on river lamprey.

15 *NEPA Effects:* The effects of short-term construction activities would not be adverse to river
16 lamprey because environmental commitments would limit the potential for construction-related
17 effects.

18 *CEQA Conclusion:* As discussed for Alternative 1A, habitat restoration activities could result in
19 short-term effects on river lamprey but would be localized, sporadic, and of low magnitude; such
20 effects would be avoided by limiting the frequency, duration, and spatial extent of in-water work
21 and with implementation of environmental commitments (see Appendix 3B, *Environmental*
22 *Commitments*). The potential impact of habitat restoration activities is considered less than
23 significant because it would not substantially reduce river lamprey habitat, restrict its range, or
24 interfere with its movement. No additional mitigation would be required.

25 Impact AQUA-188: Effects of Contaminants Associated with Restoration Measures on River 26 Lamprey

27 Refer to Impact AQUA-169 under Pacific lamprey for a discussion of the effects of contaminants
28 associated with restoration measures on river lamprey, which are assumed to have similar potential
29 for exposure and effects of exposure for contaminant-related effects.

30 *NEPA Effects:* As noted for other covered fishes, while Alternative 4A habitat restoration actions
31 may result in a very small increase production, mobilization, and bioavailability of methylmercury,
32 selenium, copper, and pesticides in the aquatic system, any such releases would be short-term and
33 localized, and would be unlikely to result in measurable increases in the bioaccumulation of these
34 contaminants in river lamprey. Overall, the effects of contaminants associated with restoration
35 measures would not be adverse for river lamprey.

36 *CEQA Conclusion:* As noted for other covered fishes, habitat restoration under Alternative 4A may
37 result in increased production, mobilization, and bioavailability of contaminants in the aquatic
38 system, but these would be short-term and localized, and would be unlikely to result in measurable
39 increases in the bioaccumulation in river lamprey. For methylmercury, implementation of
40 *Environmental Commitment 12 Methylmercury Management* would help to minimize the increased

1 mobilization of methylmercury in the limited restoration areas. Therefore, the impact of
2 contaminants is considered less than significant because it would not substantially affect river
3 lamprey either directly or through habitat modifications. Consequently, no mitigation would be
4 required.

5 Impact AQUA-189: Effects of Restored Habitat Conditions on River Lamprey

6 Refer to Impact AQUA-170 under Pacific lamprey for a discussion of the effects of restored habitat
7 conditions on river lamprey.

8 *NEPA Effects:* The effects of restored habitat conditions on river lamprey would not be adverse
9 because restoration could provide habitat benefits for lamprey.

10 *CEQA Conclusion:* As described in the discussion for Pacific lamprey, habitat restoration would be
11 undertaken to offset loss/modification of habitat from water facility construction and operation. The
12 effects of restored habitat conditions on river lamprey would be less than significant. Consequently,
13 no mitigation would be required.

14 Other Environmental Commitments (Environmental Commitment 12, Environmental Commitment
15 15, and Environmental Commitment 16)

16 The discussion of the effects of other conservation measures for Pacific lamprey is also applicable to
17 river lamprey.

18 Impact AQUA-190: Effects of Methylmercury Management on River Lamprey (Environmental
19 Commitment 12)

20 Refer to Impact AQUA-46 under winter-run Chinook salmon for a discussion of the effects of
21 methylmercury management on river lamprey.

22 *NEPA Effects:* The effects of methylmercury management on river lamprey would not be adverse
23 because it is expected to reduce overall methylmercury levels resulting from habitat restoration.

24 *CEQA Conclusion:* As noted for winter-run Chinook salmon, effects of *Environmental Commitment 12*
25 *Methylmercury Management* within the areas restored under Alternative 4A are expected to reduce
26 overall methylmercury levels resulting from habitat restoration. Because it is designed to improve
27 water quality and habitat conditions, impacts on river lamprey would be less than significant.
28 Consequently, no mitigation is required.

29 Impact AQUA-193: Effects of Localized Reduction of Predatory Fish on River Lamprey
30 (Environmental Commitment 15)

31 Refer to Impact AQUA-175 under Pacific lamprey for a discussion of the effects of predator
32 management on river lamprey.

33 *NEPA Effects:* Consistent with the analysis for Alternative 1A and reflecting the above discussion for
34 Pacific lamprey, which is expected to have similar predators, the overall effect would not be adverse.

35 *CEQA Conclusion:* Consistent with the analysis for Alternative 1A and reflecting the discussion for
36 Pacific lamprey, the impact is considered less than significant. Consequently, no mitigation would be
37 required.

1 Impact AQUA-194: Effects of Nonphysical Fish Barriers on River Lamprey (Environmental
2 Commitment 16)

3 Refer to Impact AQUA-176 under Pacific lamprey for a discussion of the effects of nonphysical fish
4 barriers on river lamprey.

5 *NEPA Effects:* The overall effect of the NPB on Pacific lamprey would not be adverse because of their
6 **limited hearing ability in the range employed by the NPB's acoustic deterrence stimuli.**

7 *CEQA Conclusion:* Consistent with the analysis for Alternative 1A and reflecting the above
8 discussion, the impact of the NPB on Pacific lamprey is considered less than significant because of
9 **their limited hearing ability in the range employed by the NPB's acoustic deterrence stimuli.**

10 Consequently, no mitigation would be required.

11 Non-Covered Aquatic Species of Primary Management Concern

12 Construction and Maintenance of Water Conveyance Facilities

13 The effects of construction and maintenance of the water conveyance facilities under Alternative 4A
14 would be similar in nature for all non-covered species; therefore, the analysis below is combined for
15 all non-covered species instead of analyzed by individual species.

16 Impact AQUA-199: Effects of Construction of Water Conveyance Facilities on Non-Covered 17 Aquatic Species of Primary Management Concern

18 *NEPA Effects:* Refer to Impact AQUA-1 under delta smelt for a discussion of the types of effects of
19 construction of water conveyance facilities that are relevant to non-covered species of primary
20 management concern. That discussion under delta smelt addresses the type, magnitude and range of
21 impact mechanisms that are relevant to the aquatic environment and aquatic species. The potential
22 effects of the construction of water conveyance facilities under Alternative 4A would be the same as
23 those for Alternative 4. Implementation of the measures described in Appendix 3B, *Environmental*
24 *Commitments*, such as *Environmental Training*; *Stormwater Pollution Prevention Plan*; *Erosion and*
25 *Sediment Control Plan*; *Hazardous Materials Management Plan*; *Spill Prevention, Containment, and*
26 *Countermeasure Plan*; *Disposal of Spoils, Reusable Tunnel Material, and Dredged Material*; *Fish Rescue*
27 *and Salvage Plan*; and *Barge Operations Plan* would guide rapid and effective response in the case of
28 inadvertent spills of hazardous materials. Construction would not be expected to increase predation
29 rates relative to baseline conditions. Construction will result in both temporary and permanent
30 alteration of rearing and migratory habitats. However, Alternative 4A includes Environmental
31 Commitment 4 to restore tidal habitat and Environmental Commitment 6 to restore channel margin
32 habitat. The direct effects of underwater construction noise on species that may be present could be
33 adverse if they are exposed. However, implementation of Mitigation Measures AQUA-1a and AQUA-
34 1b, combined with the in-water work window that would minimize exposure, would reduce the
35 potential for effects from underwater noise and this effect would not be adverse.

36 Consistent with the conclusion for Alternative 4, Impact AQUA-1, environmental commitments and
37 mitigation measures would be available to avoid and minimize potential effects, and the effect would
38 not be adverse for non-covered aquatic species of primary management concern.

39 *CEQA Conclusion:* Consistent with the conclusion for Alternative 4, Impacts AQUA-1 and AQUA-199,
40 the impact of the construction of the water conveyance facilities on non-covered aquatic species of
41 primary management concern would not be significant except for construction noise associated with

1 pile driving. Construction of Alternative 4A involves several elements with the potential to affect
2 these fish species. However, these turbidity and hazardous material spill effects will be effectively
3 avoided and/or minimized through implementation of environmental commitments (see Impact
4 AQUA-1 and Appendix 3B, *Environmental Commitments: Environmental Training; Stormwater*
5 *Pollution Prevention Plan; Erosion and Sediment Control Plan; Hazardous Materials Management*
6 *Plan; Spill Prevention, Containment, and Countermeasure Plan; Disposal of Spoils, Reusable Tunnel*
7 *Material, and Dredged Material; Fish Rescue and Salvage Plan; and Barge Operations Plan).*

8 Implementation of Mitigation Measures AQUA-1a and AQUA-1b would reduce that noise impact to
9 less than significant.

10 Mitigation Measure AQUA-1a: Minimize the Use of Impact Pile Driving to Address Effects
11 of Pile Driving and Other Construction-Related Underwater Noise

12 Mitigation Measure AQUA-1b: Monitor Underwater Noise and if Necessary, Use an
13 Attenuation Device to Reduce Effects of Pile Driving and Other Construction-Related
14 Underwater Noise

15 Impact AQUA-200: Effects of Maintenance of Water Conveyance Facilities on Non-Covered
16 Aquatic Species of Primary Management Concern

17 *NEPA Effects:* The potential effects of the maintenance of water conveyance facilities under
18 Alternative 4A would be the same as those described for Alternative 4 (which draws on the analysis
19 of Alternative 1A, Impact AQUA-2). California bay shrimp would not be affected because they do not
20 occur in the vicinity and Sacramento-San Joaquin roach and hardhead are unlikely to be affected
21 because their primary distributions are upstream. Consequently, the effects would not be adverse.

22 *CEQA Conclusion:* Consistent with the conclusion for Alternative 4, Impact AQUA-2 and Impact
23 AQUA-200, the impact of the maintenance of water conveyance facilities on non-covered species of
24 primary management concern would be less than significant and no mitigation is required.

25 Operations of Water Conveyance Facilities

26 The effects of water operations of the water conveyance facilities under Alternative 4A include a
27 detailed analysis of the following species.

- 28 ● Striped bass
- 29 ● American shad
- 30 ● Threadfin shad
- 31 ● Largemouth bass
- 32 ● Sacramento tule perch
- 33 ● Sacramento-San Joaquin roach – California species of special concern
- 34 ● Hardhead – California species of special concern

1 Impact AQUA-201: Effects of Water Operations on Entrainment of Non-Covered Aquatic
2 Species of Primary Management Concern

3 A revised analysis of Impact AQUA-201 for all alternatives, including Alternative 4A, is provided in
4 Chapter 11, Section 11.3.5, in Appendix A. The analysis below for Alternative 4A draws on that
5 analysis.

6 *Striped Bass*

7 *NEPA Effects:* Under Existing Conditions, striped bass are observed in salvage operations of the
8 south Delta facilities throughout the year, with the majority of juvenile striped bass entrainment
9 occurring during the summer (May through July). As described in Chapter 11, Section 11.3.5, in
10 Appendix A, operation of the north Delta intakes under Alternative 4A would be expected to reduce
11 overall entrainment of screenable life stages (i.e., early juveniles and older, around 20 mm long)
12 because of the reduction in use of the south Delta facilities, which do not have the state of the art fish
13 screens proposed for the north Delta intakes. Differences in potential entrainment as a function of
14 exports that were provided for juvenile Sacramento splittail under Impact AQUA-111 are
15 representative of the late spring/early summer reductions in entrainment that could occur for
16 juvenile striped bass. As described in Chapter 11, Section 11.3.5, in Appendix A, eggs and larval
17 striped bass are susceptible to entrainment at the proposed north Delta intakes. Particle tracking
18 modeling results for ten monthly periods during March-June suggested that overall entrainment of
19 eggs and larvae of striped bass originating in the Sacramento River upstream of the Delta and
20 moving downstream into the Delta would increase relative to NAA_ELT (see Table 11-mult-5 in
21 Chapter 11, Section 11.3.5, in Appendix A of this RDEIR/SDEIS). For Alternative 4A, scenario
22 H3_ELT, the mean entrainment was increased from 6.5% of particles to 21% of particles, a 220%
23 increase. Note that entrainment of the early life stages of striped bass at the north Delta intakes may
24 be moderated by real-time operational adjustments being made under Alternative 4A during the
25 spring to benefit covered fishes such as spring-run Chinook salmon, and that the results presented
26 in Table 11-mult-5 in Chapter 11, Section 11.3.5, in Appendix A of this RDEIR/SDEIS for Alternative
27 4A reflect the H3_ELT scenario, whereas spring entrainment under the H4_ELT scenario would be
28 somewhat less. Note also that although the north Delta intake screens are estimated to include
29 larvae or juvenile fish of around 20-22 mm and larger, they may also exclude smaller fish to some
30 extent, based on observations from other fish screens in the Delta (Nobriga et al. 2004). As
31 described in Chapter 11, Section 11.3.5, in Appendix A of this RDEIR/SDEIS, density-dependence
32 during the juvenile stages of the striped bass life cycle means that losses of early life stages do not
33 necessarily translate into proportional reductions in abundance of older individuals, and
34 entrainment has not recently been identified as a significant driver of juvenile abundance (Mac Nally
35 et al. 2010; Thomson et al. 2010). Therefore it is concluded with some uncertainty that there would
36 be an adverse effect on striped bass.

37 *CEQA Conclusion:* The impact of water operations on entrainment of striped bass would be similar
38 to the effects described immediately above. Relative to Existing Conditions, particle tracking
39 modeling for Alternative 4A scenario H3_ELT showed mean entrainment was increased by around
40 160% (from 8% to 21%; Table 11-mult-5 in Chapter 11, Section 11.3.5, in Appendix A of this
41 RDEIR/SDEIS). As described in the NEPA Effects section above, increased losses of striped bass eggs
42 and larvae need not necessarily translate into reductions in abundance of later life stages.
43 Nevertheless, there is no feasible mitigation that would reduce this potential impact. Thus, this
44 impact is significant and unavoidable.

1 *American Shad*

2 As described for Alternative 4, American shad eggs and larvae would be vulnerable to entrainment
3 at the proposed north SWP/CVP Delta intakes as these life stages are passively transported
4 downstream to the north Delta. Most American shad spawning though takes place well upstream of
5 the Delta and juveniles may rear to sufficiently large size to avoid entrainment as state-of-the-art
6 fish screens on the proposed north Delta intakes would exclude juvenile and adult American shad.

7 *NEPA Effects:* Differences in potential entrainment as a function of exports that were provided for
8 juvenile Sacramento splittail under Impact AQUA-111 are representative of the late spring/early
9 summer reductions in entrainment that could occur for juvenile American shad. As described in
10 Chapter 11, Section 11.3.5, in Appendix A, eggs and larval American shad are susceptible to
11 entrainment at the proposed north Delta intakes. Particle tracking modeling results for ten monthly
12 periods during March-June suggested that overall entrainment of eggs and larvae of American shad
13 originating in the Sacramento River upstream of the Delta and moving downstream into the Delta
14 would increase relative to NAA_ELT (see Table 11-mult-5 in Chapter 11, Section 11.3.5, in Appendix
15 A of this RDEIR/SDEIS). For Alternative 4A, scenario H3_ELT, and as discussed above for striped
16 bass, the mean entrainment was increased from 6.5% of particles to 21% of particles, a 220%
17 increase. As noted for striped bass, entrainment of the early life stages of American shad at the north
18 Delta intakes may be moderated by real-time operational adjustments being made under Alternative
19 4A during the spring to benefit covered fishes such as spring-run Chinook salmon; in addition, the
20 results presented in Table 11-mult-5 in Chapter 11, Section 11.3.5, in Appendix A of this
21 RDEIR/SDEIS for Alternative 4A reflect the H3_ELT scenario, whereas spring entrainment under the
22 H4_ELT scenario would be somewhat less. Note also that although the north Delta intake screens are
23 estimated to include larvae or juvenile fish of around 20-22 mm and larger, they may also exclude
24 smaller fish to some extent, based on observations from other fish screens in the Delta (Nobriga et
25 al. 2004). As described in Chapter 11, Section 11.3.5, in Appendix A, although American shad early
26 life stages may rear to sufficiently large size above the Delta to avoid entrainment, they could also be
27 entrained in appreciably greater magnitude than currently occurs and therefore it is also concluded
28 that the effects of entrainment on American shad would be adverse.

29 *CEQA Conclusion:* The impact of water operations on entrainment of American shad would be
30 similar to the effects described immediately above. Relative to Existing Conditions and as described
31 above for striped bass, particle tracking modeling for Alternative 4A scenario H3_ELT showed mean
32 entrainment was increased by around 160% (from 8% to 21%; Table 11-mult-5 in Chapter 11,
33 Section 11.3.5, in Appendix A of this RDEIR/SDEIS). As described in the NEPA Effects section above,
34 American shad early life stages may rear to sufficiently large size above the Delta to avoid
35 entrainment. Nevertheless, there is no feasible mitigation that would reduce this potential impact.
36 Thus, this impact is significant and unavoidable to American shad.

37 *Threadfin Shad*

38 *NEPA Effects:* The impact and conclusion would be the same as discussed for Alternative 1A (Impact
39 AQUA-201 for Threadfin Shad). Entrainment at the south delta would be reduced due to overall
40 decreased exports from the SWP/CVP south Delta facilities. Entrainment losses would be further
41 reduced under Scenario H4 compared to the other flow scenarios for Alternative 4A. There would be
42 potential entrainment of threadfin shad eggs and larvae to the north Delta intakes, although this risk
43 is minimal because threadfin shad are most abundant in the south Delta (Baxter et al. 2010; see also
44 discussion in Chapter 11, Section 11.3.5, in Appendix A). Overall, threadfin shad entrainment would

1 be reduced because they are most abundant in the southern Delta and would particularly benefit
2 from reduced south Delta exports. The effect would not be adverse.

3 *CEQA Conclusion:* The impact of water operations on entrainment of threadfin shad would be
4 similar to the effects described immediately above in the NEPA Effects section. The impact would be
5 less than significant and no mitigation would be required.

6 *Largemouth Bass*

7 *NEPA Effects:* Please refer to the discussion in Chapter 11, Section 11.3.5, in Appendix A. The effect
8 would not be adverse.

9 *CEQA Conclusion:* Please refer to the discussion in Chapter 11, Section 11.3.5, in Appendix A. The
10 impact would be less than significant and no mitigation would be required.

11 *Sacramento Tule Perch*

12 *NEPA Effects:* Please refer to the discussion in Chapter 11, Section 11.3.5, in Appendix A. The effect
13 would not be adverse.

14 *CEQA Conclusion:* Please refer to the discussion in Chapter 11, Section 11.3.5, in Appendix A. The
15 impact would be less than significant and no mitigation would be required.

16 *Sacramento-San Joaquin Roach*

17 *NEPA Effects:* Please refer to the discussion in Chapter 11, Section 11.3.5, in Appendix A. The effect
18 would not be adverse.

19 *CEQA Conclusion:* Please refer to the discussion in Chapter 11, Section 11.3.5, in Appendix A. The
20 impact would be less than significant and no mitigation would be required.

21 *Hardhead*

22 *NEPA Effects:* Please refer to the discussion in Chapter 11, Section 11.3.5, in Appendix A. The effect
23 would not be adverse.

24 *CEQA Conclusion:* Please refer to the discussion in Chapter 11, Section 11.3.5, in Appendix A. The
25 impact would be less than significant and no mitigation would be required.

26 *California Bay Shrimp*

27 *NEPA Effects:* Please refer to the discussion in Chapter 11, Section 11.3.5, in Appendix A. The effect
28 would not be adverse.

29 *CEQA Conclusion:* Please refer to the discussion in Chapter 11, Section 11.3.5, in Appendix A. The
30 impact would be less than significant and no mitigation would be required.

31 Impact AQUA-202: Effects of Water Operations on Spawning and Egg Incubation Habitat for
32 Non-Covered Aquatic Species of Primary Management Concern

33 See Alternative 1A, Impact AQUA-202 for additional background information relevant to non-
34 covered species of primary management concern.

1 *Striped Bass*

2 In general, the effects of Alternative 4A on the quality and quantity of spawning, egg incubation, and
3 initial rearing habitat conditions for striped bass would not be adverse relative to the NAA_ELT.

4 *H3_ELT/ESO_ELT*

5 *Flows*

6 Flow rates in the Sacramento, Trinity, Feather, American, San Joaquin, and Stanislaus Rivers and in
7 Clear Creek were examined during the April through June striped bass spawning, embryo
8 incubation, and initial rearing period. Lower flows could reduce the quantity and quality of instream
9 habitat available for spawning, egg incubation, and rearing.

10 In the Sacramento River upstream of Red Bluff, flows under H3_ELT would generally be similar to or
11 slightly greater than flows under NAA_ELT during April through June (Appendix 11C, *CALSIM II*
12 *Model Results utilized in the Fish Analysis*).

13 In the Trinity River below Lewiston Reservoir, flows under H3_ELT would generally be similar to
14 flows under NAA_ELT during April through June, except in above normal years during April (17%
15 lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

16 In Clear Creek at Whiskeytown Dam, flows under H3_ELT would be similar to flows under NAA_ELT
17 during April through June regardless of water year type (Appendix 11C, *CALSIM II Model Results*
18 *utilized in the Fish Analysis*).

19 In the Feather River at Thermalito Afterbay, flows under H3_ELT would generally be moderately to
20 substantially greater than flows under NAA_ELT during April through June, except in critical years
21 during May (10% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

22 In the American River at Nimbus Dam, flows under H3_ELT would be similar to or greater than flows
23 under NAA_ELT during April through June (Appendix 11C, *CALSIM II Model Results utilized in the*
24 *Fish Analysis*).

25 In the San Joaquin River at Vernalis, flows under H3_ELT would be similar to those under NAA_ELT
26 during April through June, regardless of water year type.

27 In the Stanislaus River at the confluence with the San Joaquin River, flows under H3_ELT would be
28 similar to those under NAA_ELT during April through June, regardless of water year type.

29 *Water Temperature*

30 The percentage of months outside of the 59°F to 68°F suitable water temperature range for striped
31 bass spawning, embryo incubation, and initial rearing during April through June was examined in
32 the Sacramento, Trinity, Feather, American, and Stanislaus Rivers. Water temperatures outside this
33 range could lead to reduced spawning success and increased egg and larval stress and mortality.
34 Water temperatures were not modeled in the San Joaquin River or Clear Creek.

35 Because water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under
36 H3_ELT would generally be the same as those under NAA_ELT, this analysis was not conducted and
37 it was concluded that there would be no temperature related effects in these rivers. In the Feather
38 River below Thermalito Afterbay, the percentage of months under H3_ELT outside the range would

1 be similar to or lower than the percentage under NAA_ELT in all water year types (Table 11-4A-
2 138).

3 Table 11-4A-138. Difference and Percent Difference in the Percentage of Months during April–
4 June in Which Water Temperatures in the Feather River below Thermalito Afterbay are outside
5 the 59°F to 68°F Water Temperature Range for Striped Bass Spawning, Embryo Incubation, and
6 Initial Rearing^a

Water Year Type	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
Wet	0 (0%)	-5 (-10%)
Above Normal	-3 (-7%)	-13 (-24%)
Below Normal	-14 (-33%)	-16 (-36%)
Dry	0 (0%)	-10 (-18%)
Critical	8 (21%)	-3 (-6%)
All	-2 (-5%)	-9 (-18%)

^a A negative value indicates a benefit (reduction in percentage of months outside suitable range) of the alternative.

7

8 *H4_ELT/HOS_ELT*

9 Flows under H4_ELT in the Sacramento River upstream of Red Bluff during the April through June
10 striped bass spawning, embryo incubation, and initial rearing period would generally be similar to
11 flows under NAA_ELT (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

12 Flows under H4_ELT in the Feather River at Thermalito Afterbay would generally be similar to or up
13 to 548% greater than flows under NAA_ELT during April through June, except in June of wet and
14 critical water years, when the flow would be 12% and 10% lower, respectively, than flow under
15 NAA_ELT.

16 Flows under H4_ELT in the American River below Nimbus Dam would generally be similar to flows
17 under NAA_ELT during April through June, except for 10% higher flow during April of critical water
18 years, 14% lower flow for May of critical years, and 10% lower flow for June of dry years.

19 Flows under H4_ELT in the Trinity River below Lewiston would generally be similar to flows under
20 NAA_ELT during April through June, except for 17% lower flow during April of above normal water
21 years.

22 Flows under H4_ELT in the San Joaquin and Stanislaus Rivers and in Clear Creek would be similar to
23 flows under NAA_ELT throughout the period.

24 The percentage of months under H4_ELT with mean water temperatures outside the 59°F to 68°F
25 suitable water temperature range in the Feather River below Thermalito Afterbay would be 10%
26 higher than the percentage under NAA_ELT in wet years, 11% and 7% lower than the percentage
27 under NAA_ELT in below normal and dry water years, respectively, and would be the same as the
28 percentage under NAA_ELT in above normal and critical water years (Table 11-4A-139). Because
29 water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under H4_ELT
30 would generally be the same as those under NAA_ELT, this analysis was not conducted and it was
31 concluded that there would be no temperature related effects in these rivers. Water temperature
32 modeling was not conducted in Clear Creek or the San Joaquin River.

1 Table 11-4A-139. Difference and Percent Difference between the Baseline Scenarios and H4_ELT in
 2 the Percentage of Months during April–June in which Water Temperatures in the Feather River
 3 below Thermalito Afterbay are Outside the 59°F to 68°F Water Temperature Range for Striped
 4 Bass Spawning, Embryo Incubation, and Initial Rearing^a

Water Year Type	EXISTING CONDITIONS vs. H4_ELT	NAA_ELT vs. H4_ELT
Wet	10 (23%)	5 (10%)
Above Normal	10 (22%)	0 (0%)
Below Normal	-3 (-7%)	-5 (-11%)
Dry	6 (13%)	-4 (-7%)
Critical	11 (28%)	0 (0%)
All	7 (16%)	0 (0%)

^a A negative value indicates a reduction in percentage of months outside suitable range for H4_ELT.

5
 6 *NEPA Effects:* Collectively, these modeling results indicate that the effect would not be adverse
 7 because Alternative 4A would not cause a substantial reduction in striped bass spawning,
 8 incubation, or initial rearing habitat. Flows in all rivers examined during the April through June
 9 spawning, incubation, and initial rearing period under Alternative 4A would generally be similar to
 10 or greater than flows under the NAA_ELT. There would be no substantial temperature effects under
 11 Alternative 4A in any river examined. Flow and water temperature conditions under H4_ELT would
 12 be less favorable than those under H3_ELT, but would be similar to those under NAA_ELT.

13 *CEQA Conclusion:* In general, Alternative 4A would not affect the quality and quantity of upstream
 14 habitat conditions for striped bass relative to Existing Conditions.

15 *H3_ELT/ESO_ELT*

16 *Flows*

17 Flow rates in the Sacramento, Trinity, Feather, American, San Joaquin, and Stanislaus Rivers and in
 18 Clear Creek were examined during the April through June striped bass spawning, embryo
 19 incubation, and initial rearing period. Lower flows could reduce the quantity and quality of instream
 20 habitat available for spawning, egg incubation, and rearing.

21 In the Sacramento River upstream of Red Bluff, flows under H3_ELT would generally be similar to or
 22 greater than flows under Existing Conditions during April through June, except in wet years during
 23 May (10% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

24 In the Trinity River below Lewiston Reservoir, flows under H3_ELT would generally be similar to or
 25 greater than flows under Existing Conditions during April through June, except in critical years
 26 during May (6% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

27 In Clear Creek at Whiskeytown Dam, flows under H3_ELT would be similar to or greater than flows
 28 under Existing Conditions during April through June (Appendix 11C, *CALSIM II Model Results utilized*
 29 *in the Fish Analysis*).

30 In the Feather River at Thermalito Afterbay, flows under H3_ELT would be greater than flows under
 31 Existing Conditions during April through June, except in below normal years in April (6% lower) and

1 wet years during May (15% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish*
2 *Analysis*).

3 In the American River at Nimbus Dam, flows under H3_ELT would generally be similar to flows
4 under Existing Conditions during April and June, but lower during May (16% lower) (Appendix 11C,
5 *CALSIM II Model Results utilized in the Fish Analysis*).

6 In the San Joaquin River at Vernalis, flows under H3_ELT would generally be similar to or slightly
7 lower than those under Existing Conditions during April through June, with few exceptions.

8 In the Stanislaus River at the confluence with the San Joaquin River, flows under H3_ELT would
9 generally be up to 14% lower than to those under Existing Conditions during April through June,
10 except during wet years, in which flow would range from 0.3% lower in April to 11% greater in June.

11 *Water Temperature*

12 The percentage of months outside of the 59°F to 68°F suitable water temperature range for striped
13 bass spawning, embryo incubation, and initial rearing during April through June was examined in
14 the Sacramento, Trinity, Feather, American, and Stanislaus Rivers.

15 Water temperatures outside this range could lead to reduced spawning success and increased egg
16 and larval stress and mortality. Water temperatures were not modeled in the San Joaquin River or
17 Clear Creek.

18 Because water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under
19 H3_ELT would generally be the same as those under Existing Conditions, this analysis was not
20 conducted and it was concluded that there would be no temperature related effects in these rivers.

21 In the Feather River below Thermalito Afterbay, the percentage of months under H3_ELT outside of
22 the 59°F to 68°F suitable water temperature range for striped bass spawning, embryo incubation,
23 and initial rearing during April through June would be the same as or lower than the percentage
24 under Existing Conditions in all water years except critical years (21% higher on a relative scale; 8%
25 higher on an absolute scale) (Table 11-4A-138). This is a relatively small effect that would not have
26 biologically meaningful negative effects on the striped bass population because it only occurs in one
27 water year type.

28 *H4_ELT/HOS_ELT*

29 Flows under H4_ELT in the Sacramento River upstream of Red Bluff during the April through June
30 striped bass spawning, embryo incubation, and initial rearing period would generally be similar to
31 flows under Existing Conditions, except during May of wet years when flows would be 11% lower
32 under H4_ELT (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

33 Flows under H4_ELT in the Feather River at Thermalito Afterbay would generally be up to 509%
34 greater than flows under Existing Conditions during April through June, except during June of wet
35 and critical water years, when flow under H4_ELT would be 37% lower and 6% lower, respectively.

36 Flows under H4_ELT in the American River below Nimbus Dam would generally be similar to flows
37 under Existing Conditions during April, and generally up to 27% lower than flows under Existing
38 Conditions during May and June.

1 Flows under H4_ELT in the San Joaquin River at Vernalis would generally be similar to or slightly
2 lower than those under Existing Conditions during April through June, except for June of wet and
3 dry water years, when flows under H3_ELT would be 16% and 12% lower, respectively.

4 Flows under H4_ELT in the Stanislaus River at the confluence with the San Joaquin River would
5 generally be up to 14% lower than to those under Existing Conditions during April through June,
6 except during wet years, in which flow would range from 0.3% lower in April to 11% greater in June.

7 Flows under H4_ELT in the Trinity River and Clear Creek would be similar to flows under Existing
8 Conditions throughout the period, with minor exceptions.

9 The percentage of months under H4_ELT with mean water temperatures outside the 59°F to 68°F
10 suitable water temperature range in the Feather River below Thermalito Afterbay would be similar
11 or up to 28% higher than the percentage under Existing Conditions depending on water year type
12 (Table 11-4A-139). Because water temperatures in the Sacramento, Trinity, American, and
13 Stanislaus Rivers under H4_ELT would generally be the same as those under Existing Conditions,
14 this analysis was not conducted and it was concluded that there would be no temperature related
15 effects in these rivers.

16 *Summary of CEQA Conclusion*

17 Collectively, these modeling results indicate that the impact would not be significant because
18 Alternative 4A would not cause a substantial reduction in spawning, incubation, and initial rearing
19 habitat of striped bass relative to Existing Conditions. Therefore, no mitigation is necessary. Flows in
20 all rivers except the San Joaquin and Stanislaus Rivers during the April through June spawning,
21 incubation, or initial rearing period under Alternative 4A would generally be similar to or greater
22 than flows under Existing Conditions. There would be isolated and/or small-magnitude flow
23 reductions for some months and water year types in the San Joaquin and Stanislaus Rivers that
24 would not have biologically meaningful negative effects to striped bass. There would be no
25 substantial temperature effects under Alternative 4A on striped bass. Flow and water temperature
26 conditions under H4_ELT would be less favorable than those under H3_ELT, but would be similar to
27 those under Existing Conditions.

28 *American Shad*

29 In general, the effects of Alternative 4A on the quality and quantity of spawning and egg incubation
30 habitat conditions for American shad would not be adverse relative to the NAA_ELT.

31 *H3_ELT/ESO_ELT*

32 *Flows*

33 Flow rates in the Sacramento, Trinity, Feather, American, San Joaquin, and Stanislaus Rivers and in
34 Clear Creek were examined during the April through June American shad adult migration and
35 spawning period. Lower flows could reduce migration ability and instream habitat quantity and
36 quality for spawning.

37 In the Sacramento River upstream of Red Bluff, flows under H3_ELT would generally be similar to or
38 greater than flows under NAA_ELT during April through June (Appendix 11C, *CALSIM II Model*
39 *Results utilized in the Fish Analysis*).

1 In the Trinity River below Lewiston Reservoir, flows under H3_ELT would generally be similar to
2 flows under NAA_ELT during April through June, except in above normal years during April (17%
3 lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

4 In Clear Creek at Whiskeytown Dam, flows under H3_ELT would be similar to flows under NAA_ELT
5 during April through June, regardless of water year type (Appendix 11C, *CALSIM II Model Results*
6 *utilized in the Fish Analysis*).

7 In the Feather River at Thermalito Afterbay, flows under H3 would generally be moderately to
8 substantially greater than flows under NAA during April through June, except in critical years during
9 May (10% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

10 In the American River at Nimbus Dam, flows under H3_ELT would be similar to or greater than flows
11 under NAA_ELT during April through June (Appendix 11C, *CALSIM II Model Results utilized in the*
12 *Fish Analysis*).

13 In the San Joaquin River at Vernalis, flows under H3_ELT would be similar to those under NAA_ELT
14 during April through June, regardless of water year type.

15 In the Stanislaus River at the confluence with the San Joaquin River flows under H3_ELT would be
16 similar to those under NAA_ELT during April through June, regardless of water year type.

17 *Water Temperature*

18 The percentage of months outside of the 60°F to 70°F water temperature range for American shad
19 adult migration and spawning during April through June was examined in the Sacramento, Trinity,
20 Feather, American, and Stanislaus Rivers. Water temperatures outside this range could lead to
21 reduced spawning success and increased adult migrant stress and mortality. Water temperatures
22 were not modeled in the San Joaquin River or Clear Creek.

23 Because water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under
24 H3_ELT would generally be the same as those under NAA_ELT, this analysis was not conducted and
25 it was concluded that there would be no temperature related effects in these rivers. In the Feather
26 River below Thermalito Afterbay, the percentage of months under H3_ELT outside the 60°F to 70°F
27 water temperature range would be lower than the percentage under NAA_ELT regardless of water
28 year type (Table 11-4A-140).

29 Table 11-4A-140. Difference and Percent Difference in the Percentage of Months during April–
30 June in Which Water Temperatures in the Feather River below Thermalito Afterbay Are outside
31 the 60°F to 70°F Water Temperature Range for American Shad Adult Migration and Spawning^a

Water Year Type	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
Wet	-6 (-13%)	-2 (-5%)
Above Normal	-3 (-8%)	-15 (-31%)
Below Normal	-2 (-6%)	-7 (-19%)
Dry	-2 (-5%)	-4 (-10%)
Critical	-3 (-8%)	-6 (-15%)
All	-4 (-10%)	-6 (-15%)

^a A negative value indicates a benefit (reduction in percentage of months outside suitable range) of the alternative.

1 *H4_ELT/HOS_ELT*

2 Flows under H4_ELT in the Sacramento River upstream of Red Bluff during the April through June
3 American Shad migration and spawning period would generally be similar to flows under NAA_ELT
4 (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

5 Flows under H4_ELT in the Feather River at Thermalito Afterbay would generally be similar to or up
6 to 548% greater than flows under NAA_ELT during April through June, except in June of wet and
7 critical water years, when the flow would be 12% and 10% lower, respectively, than flows under
8 NAA_ELT.

9 Flows under H4_ELT in the American River below Nimbus Dam would generally be similar to flows
10 under NAA_ELT during April through June, except for 10% higher flow during April of critical water
11 years, 14% lower flow for May of critical years, and 10% lower flows for June of dry years.

12 Flows under H4_ELT in the Trinity River below Lewiston would generally be similar to flows under
13 NAA_ELT during April through June, except for 17% lower flow during April of above normal water
14 years.

15 Flows under H4_ELT in the San Joaquin and Stanislaus Rivers and in Clear Creek would be similar to
16 flows under NAA_ELT throughout the period.

17 The percentage of months under H4_ELT with mean water temperatures outside the 60°F to 70°F
18 suitable water temperature range in the Feather River below Thermalito Afterbay would be up to
19 10% higher and up to 8% lower on a relative scale than the percentage under NAA_ELT, in
20 depending on water year type (Table 11-4A-141). On an absolute scale, these differences would be
21 **very small (≤4%) and, therefore, would not be biologically meaningful to American shad.**

22 Table 11-4A-141. Difference and Percent Difference between the Baseline Scenarios and H4_ELT in
23 the Percentage of Months during April–June in Which Water Temperatures in the Feather River
24 below Thermalito Afterbay Are outside the 60°F to 70°F Water Temperature Range for American
25 Shad Adult Migration and Spawning^a

Water Year Type	EXISTING CONDITIONS vs. H4_ELT	NAA_ELT vs. H4_ELT
Wet	0 (0%)	4 (10%)
Above Normal	16 (44%)	4 (8%)
Below Normal	2 (6%)	-3 (-8%)
Dry	2 (5%)	0 (0%)
Critical	0 (0%)	-3 (-8%)
All	3 (8%)	1 (2%)

^a A negative value indicates a reduction in percentage of months outside suitable range for H4_ELT.

26
27 *NEPA Effects:* Collectively, these modeling results indicate that the effect would not be adverse
28 because Alternative 4A would not cause a substantial reduction in American shad spawning or adult
29 migration. Flows in all rivers examined during the April through June adult migration and spawning
30 period under Alternative 4A would generally be similar to or greater than flows under the NAA_ELT.
31 There would be no substantial temperature effects under Alternative 4A in any river examined. Flow
32 and water temperature conditions under H4_ELT would be less favorable than those under H3_ELT,
33 but would be similar to those under NAA_ELT.

1 *CEQA Conclusion:* In general, Alternative 4A would not affect the quality and quantity of upstream
2 habitat conditions for American shad relative to Existing Conditions.

3 *H3_ELT/ESO_ELT*

4 *Flows*

5 Flow rates in the Sacramento, Trinity, Feather, American, San Joaquin, and Stanislaus Rivers and in
6 Clear Creek were examined during the April through June American shad adult migration and
7 spawning period. Lower flows could reduce migration ability and instream habitat quantity and
8 quality for spawning.

9 In the Sacramento River upstream of Red Bluff, flows under H3_ELT would generally be similar to or
10 greater than flows under Existing Conditions during April through June, except in wet years during
11 May (10% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

12 In the Trinity River below Lewiston Reservoir, flows under H3_ELT would generally be similar to or
13 greater than flows under Existing Conditions during April through June, except in critical years
14 during May (6% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

15 In Clear Creek at Whiskeytown Dam, flows under H3_ELT would be similar to or greater than flows
16 under Existing Conditions during April through June (Appendix 11C, *CALSIM II Model Results utilized*
17 *in the Fish Analysis*).

18 In the Feather River at Thermalito Afterbay, flows under H3_ELT would be greater than flows under
19 Existing Conditions during April through June, except in below normal years in April (6% lower) and
20 wet years during May (15% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish*
21 *Analysis*).

22 In the American River at Nimbus Dam, flows under H3_ELT would generally be similar to flows
23 under Existing Conditions during April and June, but lower during May (16% lower) (Appendix 11C,
24 *CALSIM II Model Results utilized in the Fish Analysis*). In the San Joaquin River at Vernalis, flows
25 under H3_ELT would generally be similar to or slightly lower than those under Existing Conditions
26 during April through June.

27 In the Stanislaus River at the confluence with the San Joaquin River, flows under H3_ELT would
28 generally be up to 14% lower than to those under Existing Conditions during April through June,
29 except during wet years, in which flow would range from 0.3% lower in April to 11% greater in June.

30 *Water Temperature*

31 The percentage of months outside of the 60°F to 70°F water temperature range for American shad
32 adult migration and spawning during April through June was examined in the Sacramento, Trinity,
33 Feather, American, and Stanislaus Rivers. Water temperatures outside this range could lead to
34 reduced spawning success and increased adult migrant stress and mortality. Water temperatures
35 were not modeled in the San Joaquin River or Clear Creek.

36 Because water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under
37 H3_ELT would generally be the same as those under NAA_ELT, this analysis was not conducted and
38 it was concluded that there would be no temperature related effects in these rivers. In the Feather
39 River below Thermalito Afterbay, the percentage of months under H3_ELT outside of the 60°F to

1 70°F water temperature range would be lower than the percentage under Existing Conditions in all
2 water year types (Table 11-4A-140).

3 *H4_ELT /HOS_ELT*

4 Flows under H4_ELT in the Sacramento River upstream of Red Bluff during the April through June
5 American Shad migration and spawning period would generally be similar to flows under Existing
6 Conditions, except during May of wet years when flows would be 11% lower under H4_ELT
7 (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

8 Flows under H4_ELT in the Feather River at Thermalito Afterbay would generally be up to 509%
9 greater than flows under Existing Conditions during April through June, except during June of wet
10 and critical water years, when flow under H4_ELT would be 37% lower and 6% lower, respectively.

11 Flows under H4_ELT in the American River below Nimbus Dam would generally be similar to flows
12 under Existing Conditions during April, and up to 27% lower than flows under Existing Conditions
13 during May and June.

14 Flows under H4_ELT in the San Joaquin River at Vernalis would generally be similar to or slightly
15 lower than those under Existing Conditions during April through June, except for June of wet and
16 dry water years, when flows under H4_ELT would be 16% and 12% lower, respectively.

17 Flows under H4_ELT in the Stanislaus River at the confluence with the San Joaquin River would
18 generally be up to 14% lower than to those under Existing Conditions during April through June,
19 except during wet years, in which flow would range from 0.3% lower in April to 11% greater in June.

20 Flows under H4_ELT in the Trinity River and Clear Creek would be similar to flows under Existing
21 Conditions throughout the period, with minor exceptions. The percentage of months under H4_ELT
22 with mean water temperatures outside the 60°F to 70°F suitable water temperature range in the
23 Feather River below Thermalito Afterbay would be similar to the percentage under Existing
24 Conditions in all water types except above normal water years, for which the percentage under
25 H4_ELT would be 44% higher (Table 11-4A-141). Because water temperatures in the Sacramento,
26 Trinity, American, and Stanislaus Rivers under H3_ELT would generally be the same as those under
27 NAA_ELT, this analysis was not conducted and it was concluded that there would be no temperature
28 related effects in these rivers.

29 *Summary of CEQA Conclusion*

30 Collectively, these modeling results indicate that the impact would not be significant because
31 Alternative 4A would not cause a substantial reduction in American shad adult migration and
32 spawning habitat relative to Existing Conditions, and no mitigation is necessary. Flows in all rivers
33 examined except the San Joaquin and Stanislaus Rivers during the April through June adult
34 migration and spawning period under Alternative 4A would generally be similar to or greater than
35 flows under Existing Conditions. There would be isolated and/or small-magnitude flow reductions
36 for some months and water year types in the San Joaquin and Stanislaus Rivers that would not have
37 biologically meaningful negative effects. There would be no temperature related effects of
38 Alternative 4A on American shad. Flow and water temperature conditions under H4_ELT would be
39 less favorable than those under H3_ELT, but would be similar to those under Existing conditions.

1 *Threadfin Shad*

2 In general, the effects of Alternative 4A on the quality and quantity of spawning habitat conditions
3 for threadfin shad would not be adverse relative to the NAA_ELT.

4 *H3_ELT/ESO_ELT*

5 *Flows*

6 Flow rates in the Sacramento, Trinity, Feather, American, San Joaquin, and Stanislaus Rivers and in
7 Clear Creek were examined during April through August threadfin shad spawning period. Lower
8 flows could reduce the quantity and quality of instream habitat available for spawning.

9 In the Sacramento River upstream of Red Bluff, flows under H3_ELT would generally be similar to or
10 greater than flows under NAA_ELT during April through August, except in dry years during August
11 (10% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

12 In the Trinity River below Lewiston Reservoir, flows under H3_ELT would generally be similar to
13 flows under NAA_ELT during April through August, except in above normal years during April (17%
14 lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

15 In Clear Creek at Whiskeytown Dam, flows under H3_ELT would be similar to flows under NAA_ELT
16 during April through August, except in critical years during July (14% lower) and in critical years
17 during August (11% greater) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

18 In the Feather River at Thermalito Afterbay, flows under H3_ELT would be moderately to
19 substantially greater than flows under NAA_ELT during April through June (to 106% greater),
20 except during critical years in May (10% lower) and June (8% lower), and moderately to
21 substantially lower than flows under NAA_ELT during July and August (to 48% lower), except
22 during critical years in August (23% greater) (Appendix 11C, *CALSIM II Model Results utilized in the
23 Fish Analysis*). Based on occurrence late in the spawning period, these flow reductions are not
24 expected to have biologically meaningful effects.

25 In the American River below Nimbus Dam, flows under H3_ELT would be similar to or greater than
26 flows under NAA_ELT during April through July and lower than flows under NAA_ELT during August
27 (to 21% lower) regardless of water year type (Appendix 11C, *CALSIM II Model Results utilized in the
28 Fish Analysis*). These flow reductions are small to moderate in magnitude and limited to late in the
29 spawning period and, therefore, would not have biologically meaningful negative effects.

30 In the San Joaquin River at Vernalis, flows under H3_ELT would be similar to those under NAA_ELT
31 during April through August, regardless of water year type.

32 In the Stanislaus River at the confluence with the San Joaquin River, flows under H3_ELT would be
33 similar to those under NAA_ELT during April through August, regardless of water year type.

34 *Water Temperature*

35 The percentage of months below 68°F water temperature threshold for the April through August
36 adult threadfin shad spawning period was examined in the Sacramento, Trinity, Feather, American,
37 and Stanislaus Rivers. Water temperatures below this threshold could delay or prevent successful
38 spawning in these areas. Water temperatures were not modeled in the San Joaquin River or Clear
39 Creek.

1 Because water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under
2 H3_ELT would generally be the same as those under NAA_ELT, this analysis was not conducted and
3 it was concluded that In the Feather River below Thermalito Afterbay, the percentage of months
4 under H3_ELT below 68°F would be greater than those under NAA_ELT (4% to 25% greater) in all
5 but dry and critical years (Table 11-4A-142). On an absolute scale, these are small increases ($\leq 4\%$)
6 that would not have biologically meaningful effects, except in below normal water years (14%
7 increase).

8 Table 11-4A-142. Difference and Percent Difference in the Percentage of Months during April–
9 August in Which Water Temperatures in the Feather River below Thermalito Afterbay fall below
10 the 68°F Water Temperature Threshold for Threadfin Shad Spawning^a

Water Year Type	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
Wet	1 (1%)	2 (4%)
Above Normal	-9 (-12%)	4 (6%)
Below Normal	1 (2%)	14 (25%)
Dry	-26 (-34%)	-2 (-4%)
Critical	-22 (-33%)	-2 (-4%)
All	-10 (-14%)	3 (5%)

^a A negative value indicates a benefit (reduction in percentage of months outside suitable range) of the alternative.

11

12 *H4_ELT/HOS_ELT*

13 Flows under H4_ELT in the Sacramento River upstream of Red Bluff during the April through August
14 threadfin shad spawning period would generally be similar to flows under NAA_ELT (Appendix 11C,
15 *CALSIM II Model Results utilized in the Fish Analysis*).

16 Flows under H4_ELT in the Trinity River below Lewiston would generally be similar to flows under
17 NAA_ELT during April through August, except for 17% lower flow during April of above normal
18 water years.

19 Flows under H4_ELT in Clear Creek below Whiskeytown would generally be similar to flows under
20 NAA_ELT during April through August, except for 14% lower flow during July of critical water years
21 and 11% higher flow in August of critical years.

22 Flows under H4_ELT in the Feather River at Thermalito Afterbay would generally be up to 548%
23 greater than flows under NAA_ELT during April through June, except for 10% lower and 12% lower
24 flows during June of critical and wet years, respectively, and would be up to 46% lower than flows
25 under NAA_ELT during July and August, except for 48% higher flows in August of critical water
26 years. Based on occurrence late in the spawning period, these flow reductions are not expected to
27 have biologically meaningful effects.

28 Flows under H4_ELT in the American River below Nimbus Dam would generally be similar to flows
29 under NAA_ELT during April through August, except for 14% lower flow in May of critical water
30 years, 28% lower flow in August of critical years, and 18% greater flow in August of below normal
31 water years.

1 Flows under H4_ELT in the San Joaquin and Stanislaus Rivers would be similar to flows under
2 NAA_ELT throughout the period.

3 The percentage of months under H4_ELT with mean water temperatures below the 68°F
4 temperature threshold in the Feather River below Thermalito Afterbay would be similar to or lower
5 than the percentage under NAA_ELT in all water years (Table 11-4A-143). Because water
6 temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under H4_ELT would
7 generally be the same as those under NAA_ELT, this analysis was not conducted and it was
8 concluded that there would be no temperature related effects in these rivers. Water temperature
9 modeling was not conducted in Clear Creek or the San Joaquin River.

10 Table 11-4A-143. Difference and Percent Difference between the Baseline Scenarios and H4_ELT in
11 the Percentage of Months during April–June in Which Water Temperatures in the Feather River
12 below Thermalito Afterbay fall below the 68°F Water Temperature Threshold for Threadfin Shad
13 Spawning^a

Water Year Type	EXISTING CONDITIONS vs. H4_ELT	NAA_ELT vs. H4_ELT
Wet	-7 (-11%)	-5 (-9%)
Above Normal	-27 (-36%)	-15 (-23%)
Below Normal	-13 (-18%)	0 (0%)
Dry	-29 (-39%)	-6 (-11%)
Critical	-22 (-33%)	-2 (-4%)
All	-18 (-26%)	-5 (-9%)

^a A negative value indicates a reduction in percentage of months outside suitable range H4_ELT.

14

15 *NEPA Effects:* Collectively, these modeling results indicate that the effect would not be adverse
16 because Alternative 4A would not cause a substantial reduction in threadfin shad spawning habitat.
17 Flows in all rivers examined during the April through August spawning period under Alternative 4A
18 would generally be similar to or greater than flows under the NAA_ELT. Some flow reductions would
19 occur late in the spawning season in the Feather River and would be too small in magnitude or
20 frequency to have a biologically meaningful effect on threadfin shad. The percentage of years below
21 the spawning temperature threshold would be similar or lower under Alternative 4A relative to the
22 NAA_ELT, except in below normal years, but this increase is not expected to have a biologically
23 meaningful effect on the threadfin shad population because it occurs in only one water year type and
24 is isolated to the Feather River. Flow conditions in the Feather River under H4_ELT would be less
25 favorable than those under H3_ELT, but would be similar to those under NAA_ELT.

26 *CEQA Conclusion:* In general, Alternative 4A would not affect the quality and quantity of upstream
27 habitat conditions for threadfin shad relative to Existing Conditions.

28 *H3_ELT/ESO_ELT*

29 *Flows*

30 Flow rates in the Sacramento, Trinity, Feather, American, San Joaquin, and Stanislaus Rivers and in
31 Clear Creek were examined during April through August spawning period. Lower flows could reduce
32 the quantity and quality of instream habitat available for spawning.

1 In the Sacramento River upstream of Red Bluff, flows under H3_ELT would generally be similar to or
2 greater than flows under Existing Conditions during April through August, except in wet years
3 during May (10% lower) and in dry and critical years during August (11% and 13% lower,
4 respectively) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). These are
5 relatively small-magnitude and infrequent flow reductions and would not have biologically
6 meaningful effects.

7 In the Trinity River below Lewiston Reservoir, flows under H3_ELT would generally be similar to or
8 greater than flows under Existing Conditions during April through August, except in critical years
9 during May and August (6% and 8% lower, respectively) and in wet years during July (10% lower)
10 (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

11 In Clear Creek at Whiskeytown Dam, flows under H3_ELT would be similar to or greater than flows
12 under Existing Conditions during April through August (Appendix 11C, *CALSIM II Model Results*
13 *utilized in the Fish Analysis*).

14 In the Feather River at Thermalito Afterbay, flows under H3_ELT would be greater than flows under
15 Existing Conditions during April through June, except in below normal years during April (6%
16 lower) and in wet years during May (15% lower), and would be lower than flows under Existing
17 Conditions in dry and critical years during July (22% and 52% lower, respectively) and in below
18 normal and dry years during August (7% and 45% lower, respectively) (Appendix 11C, *CALSIM II*
19 *Model Results utilized in the Fish Analysis*).

20 In the American River at Nimbus Dam, flows under H3_ELT would generally be similar to flows
21 under Existing Conditions during April and lower than flows under Existing Conditions during May
22 through August (up to 46% lower) respectively) (Appendix 11C, *CALSIM II Model Results utilized in*
23 *the Fish Analysis*).

24 In the San Joaquin River at Vernalis, flows under H3_ELT would generally be similar to or slightly
25 lower than those under Existing Conditions during April and May, and would be up to 23% lower
26 than flows under Existing Conditions during June through August.

27 In the Stanislaus River at the confluence with the San Joaquin River, flows under H3_ELT would be
28 similar to or up to 14% lower than to those under Existing Conditions during April through August,
29 except for 11% greater flow during June of wet years.

30 *Water Temperature*

31 The percentage of months below 68°F water temperature threshold for the April through August
32 adult threadfin shad spawning period was examined in the Sacramento, Trinity, Feather, American,
33 and Stanislaus Rivers. Water temperatures below this threshold could delay or prevent successful
34 spawning in these areas. Water temperatures were not modeled in the San Joaquin River or Clear
35 Creek.

36 Because water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under
37 H3_ELT would generally be the same as those under NAA_ELT, this analysis was not conducted and
38 it was concluded that there would be no temperature related effects in these rivers. In the Feather
39 River below Thermalito Afterbay, the percentage of months below the 68°F water temperature
40 threshold for threadfin shad spawning under H3_ELT would be similar to or 12% to 34% lower than
41 the percentage under Existing Conditions, depending on water year type (Table 11-4A-142).

1 *H4_ELT/HOS_ELT*

2 Flows under H4_ELT in the Sacramento River upstream of Red Bluff during the April through August
3 threadfin shad spawning period would generally be similar to flows under Existing Conditions
4 except during May of wet years, when flow would be 11% lower (Appendix 11C, *CALSIM II Model*
5 *Results utilized in the Fish Analysis*).

6 Flows under H4_ELT in the Feather River at Thermalito Afterbay would generally be up to 509%
7 greater than flows under Existing Conditions during April through June, except for 38% and 6%
8 lower flows during June of wet and critical water years, respectively, and would generally be up to
9 54% lower than flows under Existing Conditions during July and August, except for 26% higher
10 flows in August of critical water years.

11 Flows under H4_ELT in the American River below Nimbus Dam would generally be similar to flows
12 under Existing Conditions during April, and similar to or up to 37% lower than flows under Existing
13 Conditions during May through August, except during August of below normal years (9% greater
14 flow)

15 Flows in the Trinity River below Lewiston Reservoir and in Clear Creek at Whiskeytown Dam
16 H4_ELT would generally be similar to flows under Existing Conditions during April through August,
17 with minor exceptions.

18 Flows in the San Joaquin River at Vernalis under H4_ELT would generally be similar to or slightly
19 lower than those under Existing Conditions during April and May, and would be up to 23% lower
20 than flows under Existing Conditions during June through August.

21 Flows in the Stanislaus River at the confluence with the San Joaquin River under H4_ELT would
22 generally be similar to or up to 14% lower than to those under Existing Conditions during April
23 through August, except for 11% greater flow during June of wet years.

24 The percentage of months under H4_ELT with mean water temperatures below the 68°F
25 temperature threshold in the Feather River below Thermalito Afterbay would be lower than the
26 percentage under Existing Conditions in all water years (Table 11-4A-143). Because water
27 temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under H3_ELT would
28 generally be the same as those under NAA_ELT, this analysis was not conducted and it was
29 concluded that there would be no temperature related effects in these rivers. Collectively, flows
30 would be lower under Alternative 4A during the threadfin shad spawning period relative to Existing
31 Conditions. Flows would be moderately to substantially lower in the Feather, American, Stanislaus,
32 and San Joaquin rivers during substantial portions of the spawning period. Therefore, these
33 modeling results indicate that the difference between Existing Conditions and Alternative 4A could
34 be significant because the alternative could substantially reduce suitable spawning habitat as a
35 result of flow reductions.

36 *Summary of CEQA Conclusion*

37 As discussed in Section 11.3.3, because of differences between the CEQA and NEPA baselines, it is
38 sometimes possible for CEQA and NEPA significance conclusions to vary between one another under
39 the same impact discussion. The baseline for the CEQA analysis is Existing Conditions at the time the
40 NOP was prepared. Both the action alternative and the NEPA baseline (NAA_ELT) models
41 anticipated future conditions that would occur at 2025 (ELT implementation period), including the
42 projected effects of climate change (precipitation patterns), sea level rise and future water demands,

1 as well as implementation of required actions under the 2008 USFWS BiOp and the 2009 NMFS
2 BiOp. Because the action alternative modeling does not partition the effects of implementation of the
3 alternative from the effects of sea level rise, climate change, and future water demands, the
4 comparison to Existing Conditions may not offer a clear understanding of the impact of the
5 alternative on the environment. The comparison to the NAA_ELT is a better approach because it
6 isolates the effect of the alternative from those of sea level rise, climate change, and future water
7 demands.

8 When compared to NAA_ELT and informed by the NEPA analysis above, flows and water
9 temperatures in all rivers would generally be similar between NAA_ELT and Alternative 4A. These
10 modeling results represent the increment of change attributable to the alternative, demonstrating
11 the general similarities in flows and water temperature under Alternative 4A and the NAA_ELT, and
12 addressing the limitations of the CEQA baseline (Existing Conditions). Therefore, this impact is
13 found to be less than significant and no mitigation is required.

14 *Largemouth Bass*

15 In general, Alternative 4A would not affect the quality and quantity of upstream habitat conditions
16 for largemouth bass relative to the NAA_ELT.

17 *H3_ELT/ESO_ELT*

18 *Flows*

19 Flow rates in the Sacramento, Trinity, Feather, American, San Joaquin, and Stanislaus Rivers and in
20 Clear Creek were examined during the March through June largemouth bass spawning period.
21 Lower flows could reduce the quantity and quality of instream spawning habitat.

22 In the Sacramento River upstream of Red Bluff, flows under H3_ELT would generally be similar to or
23 greater than flows under NAA_ELT during March through June (Appendix 11C, *CALSIM II Model*
24 *Results utilized in the Fish Analysis*).

25 In the Trinity River below Lewiston Reservoir, flows under H3_ELT would generally be similar to or
26 greater than flows under NAA_ELT during March through June, except in above normal years during
27 April (17% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

28 In Clear Creek at Whiskeytown Dam, flows under H3_ELT would be similar to flows under NAA_ELT
29 during March through June (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

30 In the Feather River at Thermalito Afterbay, flows under H3_ELT would generally be moderately to
31 substantially greater than flows under NAA_ELT during March through June, except in below normal
32 years during March (13% lower) and in critical years during May and June (10% and 8% lower,
33 respectively) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

34 In the American River at Nimbus Dam, flows under H3_ELT would be similar to or greater than flows
35 under NAA_ELT during March through June (Appendix 11C, *CALSIM II Model Results utilized in the*
36 *Fish Analysis*).

37 In the San Joaquin River at Vernalis, flows under H3_ELT would be similar to those under NAA_ELT
38 during March through June, regardless of water year type.

1 In the Stanislaus River at the confluence with the San Joaquin River, flows under H3_ELT would be
2 similar to those under NAA_ELT during March through June, regardless of water year type.

3 *Water Temperature*

4 The percentage of months outside of the 59°F to 75°F suitable water temperature range for
5 largemouth bass spawning during March through June was examined in the Sacramento, Trinity,
6 Feather, American, and Stanislaus Rivers. Water temperatures outside this range could lead to
7 reduced spawning success. Water temperatures were not modeled in the San Joaquin River or Clear
8 Creek.

9 Because water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under
10 H3_ELT would generally be the same as those under NAA_ELT, this analysis was not conducted and
11 it was concluded that In the Feather River below Thermalito Afterbay, the percentage of months
12 under H3_ELT outside the 59°F to 75°F water temperature range would be similar to or lower than
13 the percentage under NAA_ELT in all water year types (Table 11-4A-144).

14 Table 11-4A-144. Difference and Percent Difference in the Percentage of Months during March–
15 June in Which Water Temperatures in the Feather River below Thermalito Afterbay Would Be
16 outside the 59°F to 75°F Water Temperature Range for Largemouth Bass Spawning^a

Water Year Type	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
Wet	-2 (-4%)	0 (0%)
Above Normal	-2 (-4%)	0 (0%)
Below Normal	0 (0%)	0 (0%)
Dry	-5 (-11%)	0 (0%)
Critical	-9 (-20%)	-3 (-8%)
All	-3 (-6%)	0 (0%)

^a A negative value indicates a benefit (reduction in percentage of months outside suitable range) of the alternative.

17

18 *H4_ELT/HOS_ELT*

19 Flows under H4_ELT in the Sacramento River upstream of Red Bluff during the March through June
20 largemouth bass spawning period would generally be similar to flows under NAA_ELT (Appendix
21 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

22 Flows under H4_ELT in the Feather River at Thermalito Afterbay would generally be similar to or up
23 to 548% greater than flows under NAA_ELT during March through June, except in June of wet and
24 critical water years, when the flow would be 12% and 10% lower, respectively, than flow under
25 NAA_ELT.

26 Flows under H4_ELT in the American River below Nimbus Dam would generally be similar to flows
27 under NAA_ELT during March through June, except for 10% higher flow during April of critical
28 water years, 14% lower flow for May of critical years, and 10% lower flows for June of dry years.

29 Flows under H4_ELT in the Trinity River below Lewiston would generally be similar to flows under
30 NAA_ELT during March through June, except for 17% lower flow during April of above normal water
31 years.

1 Flows under H4_ELT in Clear Creek at Whiskeytown Dam would generally be similar to flows under
2 NAA_ELT during March through June, except for 12% greater flow during March of below normal
3 water years.

4 Flows under H4_ELT in the San Joaquin and Stanislaus Rivers would be similar to flows under
5 NAA_ELT throughout the period.

6 The percentage of months under H4_ELT with mean water temperatures outside the 59°F to 75°F
7 water temperature range in the Feather River below Thermalito Afterbay would be similar to or
8 greater than the percentage under NAA_ELT in all water year types although these small increases
9 **on an absolute scale (≤5%)** would not have biologically meaningful effects on largemouth bass
10 spawning habitat conditions (Table 11-4A-145). Because water temperatures in the Sacramento,
11 Trinity, American, and Stanislaus Rivers under H4_ELT would generally be the same as those under
12 NAA_ELT, this analysis was not conducted and it was concluded that there would be no temperature
13 related effects in these rivers. Water temperature modeling was not conducted in Clear Creek or the
14 San Joaquin River.

15 Table 11-4A-145. Difference and Percent Difference between the Baseline Scenarios and H4_ELT in
16 the Percentage of Months during April–June in Which Water Temperatures in the Feather River
17 below Thermalito Afterbay Would Be outside the 59°F to 75°F Water Temperature Range for
18 Largemouth Bass Spawning^a

Water Year Type	EXISTING CONDITIONS vs. H4_ELT	NAA_ELT vs. H4_ELT
Wet	3 (5%)	5 (9%)
Above Normal	0 (0%)	2 (4%)
Below Normal	1 (2%)	1 (2%)
Dry	-5 (-11%)	0 (0%)
Critical	-6 (-14%)	0 (0%)
All	-1 (-2%)	2 (4%)

^a A negative value indicates a reduction in percentage of months outside suitable range for H4_ELT.

19

20 *NEPA Effects:* Collectively, these modeling results indicate that the effect would not be adverse
21 because Alternative 4A would not cause a substantial reduction in largemouth bass spawning
22 habitat. Flows in all rivers examined during the March through June spawning period under
23 Alternative 4A would generally be similar to or greater than flows under the NAA_ELT. There would
24 be no substantial temperature effects under Alternative 4A in any river examined. Flow and water
25 temperature conditions under H4_ELT would be less favorable than those under H3_ELT, but would
26 be similar to those under NAA_ELT.

27 *CEQA Conclusion:* In general, Alternative 4A would not reduce the quality and quantity of upstream
28 habitat conditions for largemouth bass relative to Existing Conditions.

29 *H3_ELT/ESO_ELT*

30 *Flows*

31 Flow rates in the Sacramento, Trinity, Feather, American, San Joaquin, and Stanislaus Rivers and in
32 Clear Creek were examined during the March through June largemouth bass spawning period.
33 Lower flows could reduce the quantity and quality of instream spawning habitat.

1 In the Sacramento River upstream of Red Bluff, flows under H3_ELT would generally be similar to or
2 greater than flows under Existing Conditions during March through June, except in below normal
3 years during March (8% lower) and in wet years during May (10% lower) (Appendix 11C, *CALSIM II*
4 *Model Results utilized in the Fish Analysis*).

5 In the Trinity River below Lewiston Reservoir, flows under H3_ELT would generally be similar to or
6 greater than flows under Existing Conditions during March through June, except in below normal
7 years during March (6% lower) and in critical years during May (6% lower) (Appendix 11C, *CALSIM*
8 *II Model Results utilized in the Fish Analysis*).

9 In Clear Creek at Whiskeytown Dam, flows under H3_ELT would be similar to or greater than flows
10 under Existing Conditions during March through June (Appendix 11C, *CALSIM II Model Results*
11 *utilized in the Fish Analysis*).

12 In the Feather River at Thermalito Afterbay, flows under H3_ELT would be greater than flows under
13 Existing Conditions during March through June, except in below normal and dry years during March
14 (39% and 17% lower, respectively), in below normal years during April (6% lower), and in wet
15 years during May (15% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

16 In the American River at Nimbus Dam, flows under H3_ELT would generally be similar to or greater
17 than flows under Existing Conditions during March, April and June, except in critical years during
18 March (8% lower), above normal years during April (5% lower), and in wet and critical years during
19 June (21% and 29% lower, respectively) (Appendix 11C, *CALSIM II Model Results utilized in the Fish*
20 *Analysis*). Flows under H3_ELT would generally be lower than flows under Existing Conditions
21 during May (to 16% lower) except in critical years (13% greater) (Appendix 11C, *CALSIM II Model*
22 *Results utilized in the Fish Analysis*). Flow reductions in drier water year types, when effects on
23 habitat conditions would be more critical, would be inconsistent and/or of small magnitude
24 throughout the spawning period and would not have biologically meaningful negative effects.

25 In the San Joaquin River at Vernalis, flows under H3_ELT would generally be similar to or slightly
26 lower than those under Existing Conditions during March through June.

27 In the Stanislaus River at the confluence with the San Joaquin River, flows under H3_ELT would
28 generally be up to 23% lower than to those under Existing Conditions during March through June,
29 except during these four months in wet years, in which flows under H3_ELT would range from 0.3%
30 lower to 11% greater.

31 *Water Temperature*

32 The percentage of months outside of the 59°F to 75°F suitable water temperature range for
33 largemouth bass spawning during March through June was examined in the Sacramento, Trinity,
34 Feather, American, and Stanislaus Rivers. Water temperatures outside this range could lead to
35 reduced spawning success. Water temperatures were not modeled in the San Joaquin River or Clear
36 Creek.

37 Because water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under
38 H3_ELT would generally be the same as those under Existing Conditions, this analysis was not
39 conducted and it was concluded that there would be no temperature related effects in these rivers.

1 In the Feather River below Thermalito Afterbay, the percentage of months under H3_ELT outside of
2 the 59°F to 75°F water temperature range for largemouth bass spawning would be the same or
3 lower than the percentage under Existing Conditions in all water year types (Table 11-4A-144).

4 *H4_ELT/HOS_ELT*

5 Flows under H4_ELT in the Sacramento River upstream of Red Bluff during the March through June
6 largemouth bass spawning period would generally be similar to or slightly lower than flows under
7 Existing Conditions, except during May of wet years when flows would be 11% lower under H4_ELT
8 (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

9 Flows under H4_ELT in the Feather River at Thermalito Afterbay would generally be similar or up to
10 509% greater than flows under Existing Conditions during March through June, except during
11 March of below normal and dry water years, when flows under H4_ELT would be 22% and 11%
12 lower, respectively, and during June of wet and critical water years, when flow under H4_ELT would
13 be 37% lower and 6% lower, respectively.

14 Flows under H4_ELT in the American River below Nimbus Dam would generally be similar to flows
15 under Existing Conditions during March and April, and generally up to 27% lower than flows under
16 Existing Conditions during May and June.

17 Flows under H4_ELT in the Trinity River at Lewiston would generally be similar to those under
18 Existing Conditions during March through June, except during March of wet years, in which flow
19 under H4_ELT would be 14% greater than flow under Existing Conditions.

20 Flows under H4_ELT in Clear Creek at Whiskeytown Dam would generally be similar to those under
21 Existing Conditions during March through June, except during March of below normal and critical
22 water years, in which flow under H4_ELT would be 13% and 10% greater, respectively, than flow
23 under Existing Conditions.

24 Flows under H4_ELT in the San Joaquin River at Vernalis would generally be similar to or slightly
25 lower than those under Existing Conditions during March through June, except during March of
26 below normal and dry water years, when flow under H4_ELT would be 11% and 12% lower,
27 respectively, and during June of wet and dry water years, when flows would be 16% and 12% lower,
28 respectively.

29 Flows under H4_ELT in the Stanislaus River at the confluence with the San Joaquin River would
30 generally be up to 23% lower than to those under Existing Conditions during March through June,
31 except during wet years, in which flow under H4_ELT would range from 0.3% lower to 11% greater
32 than flow under Existing Conditions.

33 The percentage of months under H4_ELT with mean water temperatures below outside the 59°F to
34 75°F water temperature range in the Feather River below Thermalito Afterbay would be similar to
35 the percentage under Existing Conditions in wet, above normal, and below normal water year types
36 and would be lower than the percentage under Existing Conditions in dry and critical water year
37 types (Table 11-4A-143). The reductions would not be large enough to have biologically meaningful
38 effects on largemouth bass spawning habitat conditions. Because water temperatures in the
39 Sacramento, Trinity, American, and Stanislaus Rivers under H4_ELT would generally be the same as
40 those under Existing Conditions, this analysis was not conducted and it was concluded that there
41 would be no temperature related effects in these rivers.

1 *Summary of CEQA Conclusion*

2 Collectively, these modeling results indicate that the impact would not be significant because
3 Alternative 4A would not cause a substantial reduction in largemouth bass spawning habitat relative
4 to Existing Conditions, and no mitigation is necessary. Flows in all rivers examined except the San
5 Joaquin and Stanislaus Rivers during the March through June spawning period under Alternative 4A
6 would generally be similar to or greater than flows under Existing Conditions. There would be
7 isolated and/or small-magnitude flow reductions for some months and water year types in the San
8 Joaquin and Stanislaus Rivers that would not have biologically meaningful negative effects to
9 largemouth bass. There would be no substantial temperature effects under Alternative 4A on
10 largemouth bass. Flow and water temperature conditions under H4_ELT would be less favorable
11 than those under H3_ELT, but would be similar to those under Existing Conditions.

12 *Sacramento Tule Perch*

13 *NEPA Effects:* The effects of water operations on spawning habitat for Sacramento tule perch under
14 Alternative 4A would be similar to that described for Alternative 1A due to similarities in hydrology.
15 For a detailed discussion, please see Alternative 1A, Impact AQUA-202. The effects would not be
16 adverse.

17 *CEQA Conclusion:* As described under Alternative 1A, Impact AQUA-202 the impacts on Sacramento
18 tule perch spawning would be not be significant and no mitigation is required.

19 *Sacramento-San Joaquin Roach – California species of special concern*

20 In general, Alternative 4A would not affect the quality and quantity of upstream habitat conditions
21 for Sacramento-San Joaquin roach relative to the NAA_ELT.

22 *H3_ELT/ESO_ELT*

23 *Flows*

24 Flow rates in the Sacramento, Trinity, Feather, American, San Joaquin, and Stanislaus Rivers and in
25 Clear Creek were examined during the March through June Sacramento-San Joaquin roach spawning
26 period. Lower flows could reduce the quantity and quality of instream habitat available for
27 spawning.

28 In the Sacramento River upstream of Red Bluff, flows under H3_ELT would generally be similar to or
29 greater than flows under NAA_ELT during March through June (Appendix 11C, *CALSIM II Model*
30 *Results utilized in the Fish Analysis*).

31 In the Trinity River below Lewiston Reservoir, flows under H3_ELT would generally be similar to or
32 greater than flows under NAA_ELT during March through June, except in above normal years during
33 April (17% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

34 In Clear Creek at Whiskeytown Dam, flows under H3_ELT would be similar to flows under NAA_ELT
35 during March through June (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

36 In the Feather River at Thermalito Afterbay, flows under H3_ELT would generally be moderately to
37 substantially greater than flows under NAA_ELT during March through June, except in below normal
38 years during March (13% lower) and in critical years during May and June (10% and 8% lower,
39 respectively) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

1 In the American River at Nimbus Dam, flows under H3_ELT would be similar to or greater than flows
2 under NAA_ELT during March through June (Appendix 11C, *CALSIM II Model Results utilized in the*
3 *Fish Analysis*).

4 In the San Joaquin River at Vernalis, flows under H3_ELT would be similar to those under NAA_ELT
5 during March through June, regardless of water year type (Appendix 11C, *CALSIM II Model Results*
6 *utilized in the Fish Analysis*).

7 In the Stanislaus River at the confluence with the San Joaquin River flows under H3_ELT would be
8 similar to those under NAA_ELT during March through June, regardless of water year type
9 (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

10 *Water Temperature*

11 The percentage of months below the 60.8°F water temperature threshold for Sacramento-San
12 Joaquin roach spawning initiation during March through June was examined in the Sacramento,
13 Trinity, Feather, American, and Stanislaus Rivers. Water temperatures below this threshold could
14 delay or prevent spawning initiation. Water temperatures were not modeled in the San Joaquin
15 River or Clear Creek.

16 Because water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under
17 H3_ELT would generally be the same as those under NAA_ELT, this analysis was not conducted and
18 it was concluded that there would be no temperature related effects in these rivers. In the Feather
19 River below Thermalito Afterbay, the percentage of months in which temperatures would be below
20 the 60.8°F water temperature threshold for roach spawning initiation under H3_ELT would be
21 similar to or lower than the percentage under NAA_ELT in all water year types (Table 11-4A-146).

22 Table 11-4A-146. Difference and Percent Difference in the Percentage of Months during March–
23 June in Which Water Temperatures in the Feather River below Thermalito Afterbay Fall below the
24 60.8°F Water Temperature Threshold for the Initiation of Sacramento-San Joaquin Roach
25 Spawning^a

Water Year Type	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
Wet	-8 (-11%)	0 (0%)
Above Normal	-5 (-8%)	0 (0%)
Below Normal	-2 (-4%)	0 (0%)
Dry	-8 (-15%)	-3 (-6%)
Critical	-6 (-11%)	2 (4%)
All	-6 (-11%)	0 (-1%)

^a A negative value indicates a benefit (reduction in percentage of months outside suitable range) of the alternative.

26

27 *H4_ELT /HOS_ELT*

28 Flows under H4_ELT in the Sacramento River upstream of Red Bluff during the March through June
29 Sacramento-San Joaquin roach spawning period would generally be similar to flows under NAA_ELT
30 (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

31 Flows under H4_ELT in the Feather River at Thermalito Afterbay would generally be similar to or up
32 to 548% greater than flows under NAA_ELT during March through June, except in June of wet and

1 critical water years, when the flow would be 12% and 10% lower, respectively, than flow under
2 NAA_ELT.

3 Flows under H4_ELT in the American River below Nimbus Dam would generally be similar to flows
4 under NAA_ELT during March through June, except for 10% higher flow during April of critical
5 water years, 14% lower flow for May of critical years, and 10% lower flows for June of dry years.

6 Flows under H4_ELT in the Trinity River below Lewiston would generally be similar to flows under
7 NAA_ELT during March through June, except for 17% lower flow during April of above normal water
8 years.

9 Flows under H4_ELT in Clear Creek at Whiskeytown Dam would generally be similar to flows under
10 NAA_ELT during March through June, except for 12% greater flow during March of below normal
11 water years.

12 Flows under H4_ELT in the San Joaquin and Stanislaus Rivers would be similar to flows under
13 NAA_ELT throughout the period. The percentage of months under H4_ELT with mean water
14 temperatures below the 60.8°F water temperature range in the Feather River below Thermalito
15 Afterbay would be similar to or up to 18% greater than the percentage under NAA_ELT, although
16 **these small increases on an absolute scale ($\leq 9\%$) would not have biologically meaningful effects on**
17 **roach spawning habitat conditions.** (Table 11-4A-147). Because water temperatures in the
18 Sacramento, Trinity, American, and Stanislaus Rivers under H4_ELT would generally be the same as
19 those under NAA_ELT, this analysis was not conducted and it was concluded that there would be no
20 temperature related effects in these rivers. Water temperature modeling was not conducted in Clear
21 Creek or the San Joaquin River.

22 Table 11-4A-147. Difference and Percent Difference between the Baseline Scenarios and H4_ELT in
23 the Percentage of Months during March–June in Which Water Temperatures in the Feather River
24 below Thermalito Afterbay Would Fall below the 60.8°F Water Temperature Threshold for
25 Sacramento-San Joaquin Roach Spawning^a

Water Year Type	EXISTING CONDITIONS vs. H4_ELT	NAA_ELT vs. H4_ELT
Wet	-4 (-6%)	4 (6%)
Above Normal	5 (8%)	9 (18%)
Below Normal	4 (7%)	5 (11%)
Dry	-4 (-8%)	1 (3%)
Critical	-11 (-19%)	-2 (-4%)
All	-3 (-4%)	3 (6%)

^a A negative value indicates a reduction in percentage of months outside suitable range for H4_ELT.

26

27 *NEPA Effects:* Collectively, these modeling results indicate that the effect would not be adverse
28 because Alternative 4A would not cause a substantial reduction in roach spawning habitat. Flows in
29 all rivers examined during the March through June spawning period under Alternative 4A would
30 generally be similar to or greater than flows under the NAA_ELT. The occurrence of flow reductions
31 would not be of sufficient magnitude or frequency to have a biologically meaningful effect on roach.
32 There would be no substantial temperature effects under Alternative 4A in any river examined. Flow
33 and water temperature conditions under H4_ELT would be less favorable than those under H3_ELT,
34 but would be similar to those under NAA_ELT.

1 *CEQA Conclusion:* In general, Alternative 4A would not affect the quality and quantity of upstream
2 habitat conditions for Sacramento-San Joaquin Roach relative to Existing Conditions.

3 *H3_ELT/ESO_ELT*

4 *Flows*

5 Flow rates in the Sacramento, Trinity, Feather, American, San Joaquin, and Stanislaus Rivers and in
6 Clear Creek were examined during the March through June Sacramento-San Joaquin roach spawning
7 period. Lower flows could reduce the quantity and quality of instream habitat available for
8 spawning.

9 In the Sacramento River upstream of Red Bluff, flows under H3_ELT would generally be similar to or
10 greater than flows under Existing Conditions during March through June, except in below normal
11 years during March (8% lower) and in wet years during May (10% lower) (Appendix 11C, *CALSIM II*
12 *Model Results utilized in the Fish Analysis*).

13 In the Trinity River below Lewiston Reservoir, flows under H3_ELT would generally be similar to or
14 greater than flows under Existing Conditions during March through June, except in below normal
15 years during March (6% lower) and in critical years during May (6% lower) (Appendix 11C, *CALSIM II*
16 *Model Results utilized in the Fish Analysis*).

17 In Clear Creek at Whiskeytown Dam, flows under H3_ELT would be similar to or greater than flows
18 under Existing Conditions during March through June (Appendix 11C, *CALSIM II Model Results*
19 *utilized in the Fish Analysis*).

20 In the Feather River at Thermalito Afterbay, flows under H3_ELT would be greater than flows under
21 Existing Conditions during March through June, except in below normal and dry years during March
22 (39% and 17% lower, respectively), in below normal years during April (6% lower), and in wet
23 years during May (15% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

24 In the American River at Nimbus Dam, flows under H3_ELT would generally be similar to or greater
25 than flows under Existing Conditions during March, April and June, except in critical years during
26 March (8% lower), above normal years during April (75% lower), and in wet and critical years
27 during June (21% and 29% lower, respectively) (Appendix 11C, *CALSIM II Model Results utilized in*
28 *the Fish Analysis*). Flows under H3_ELT would generally be lower than flows under Existing
29 Conditions during May (to 16% lower), except in critical years (13% greater) (Appendix 11C,
30 *CALSIM II Model Results utilized in the Fish Analysis*). Flow reductions in drier water year types, when
31 effects on habitat conditions would be more critical, would be inconsistent and/or of small
32 magnitude throughout the spawning period and would not have biologically meaningful negative
33 effects.

34 In the San Joaquin River at Vernalis, flows under H3_ELT would generally be similar to or slightly
35 lower than those under Existing Conditions during March through June, except during March of
36 below normal and dry water years, when flow under H3_ELT would be 11% and 12% lower,
37 respectively, and during June of wet and dry water years, when flows would be 16% and 11% lower,
38 respectively.

39 In the San Joaquin River at Vernalis, flows under H3_ELT would generally be similar to or slightly
40 lower than those under Existing Conditions during March through June.

1 In the Stanislaus River at the confluence with the San Joaquin River, flows under H3_ELT would
2 generally be up to 23% lower than to those under Existing Conditions during March through June,
3 except during these four months in wet years, in which flows under H3_ELT would range from 0.3%
4 lower to 11% greater.

5 *Water Temperature*

6 The percentage of months below the 60.8°F water temperature threshold for Sacramento-San
7 Joaquin roach spawning initiation during March through June was examined in the Sacramento,
8 Trinity, Feather, American, and Stanislaus Rivers. Water temperatures below this threshold could
9 delay or prevent spawning initiation. Water temperatures were not modeled in the San Joaquin
10 River or Clear Creek.

11 Because water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under
12 H3_ELT would generally be the same as those under Existing Conditions, this analysis was not
13 conducted and it was concluded that there would be no temperature related effects in these rivers.

14 In the Feather River below Thermalito Afterbay, the percentage of months under H3_ELT in which
15 temperatures would be below the 60.8°F water temperature threshold for roach spawning initiation
16 would be lower than the percentage under Existing Conditions in all water year types (Table 11-4A-
17 146).

18 *H4_ELT/HOS_ELT*

19 Flows under H4_ELT in the Sacramento River upstream of Red Bluff during the March through June
20 Sacramento-San Joaquin roach spawning period would generally be similar to or slightly lower than
21 flows under Existing Conditions, except during May of wet years when flows would be 11% lower
22 under H4_ELT (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

23 Flows under H4_ELT in the Feather River at Thermalito Afterbay would generally be similar or up to
24 509% greater than flows under Existing Conditions during March through June, except during
25 March of below normal and dry water years, when flows under H4_ELT would be 22% and 11%
26 lower, respectively, and during June of wet and critical water years, when flow under H4_ELT would
27 be 37% lower and 6% lower, respectively.

28 Flows under H4_ELT in the American River below Nimbus Dam would generally be similar to flows
29 under Existing Conditions during March and April, and generally up to 27% lower than flows under
30 Existing Conditions during May and June.

31 Flows under H4_ELT in the Trinity River at Lewiston would generally be similar to those under
32 Existing Conditions during March through June, except during March of wet years, in which flow
33 under H4_ELT would be 14% greater than flow under Existing Conditions.

34 Flows under H4_ELT in Clear Creek at Whiskeytown Dam would generally be similar to those under
35 Existing Conditions during March through June, except during March of below normal and critical
36 water years, in which flow under H4_ELT would be 13% and 10% greater, respectively, than flow
37 under Existing Conditions.

38 Flows under H4_ELT in the San Joaquin River at Vernalis would generally be similar to or slightly
39 lower than those under Existing Conditions during March through June, except during March of
40 below normal and dry water years, when flow under H4_ELT would be 11% and 12% lower,

1 respectively, and during June of wet and dry water years, when flows would be 16% and 12% lower,
2 respectively.

3 Flows under H4_ELT in the Stanislaus River at the confluence with the San Joaquin River would
4 generally be up to 23% lower than to those under Existing Conditions during March through June,
5 except during wet years, in which flow under H4_ELT would range from 0.3% lower to 11% greater
6 than flow under Existing Conditions.

7 The percentage of months under H4_ELT with mean water temperatures below the 60.8°F water
8 temperature range in the Feather River below Thermalito Afterbay would be up to 7% and 8%
9 higher than the percentage under Existing Conditions in above normal and below normal water
10 years, respectively, and would be up to 19% lower than the percentage under Existing Conditions in
11 the other three water year types (Table 11-4A-147). Because water temperatures in the Sacramento,
12 Trinity, American, and Stanislaus Rivers under H4_ELT would generally be the same as those under
13 Existing Conditions, this analysis was not conducted and it was concluded that there would be no
14 temperature related effects in these rivers.

15 *Summary of CEQA Conclusion*

16 Collectively, these modeling results indicate that the impact would not be significant because
17 Alternative 4A would not cause a substantial reduction in Sacramento-San Joaquin roach spawning
18 habitat relative to Existing Conditions, and no mitigation is necessary. Flows in all rivers examined
19 except the San Joaquin and Stanislaus Rivers during the March through June spawning period under
20 Alternative 4A would generally be similar to or greater than flows under Existing Conditions. There
21 would be isolated and/or small-magnitude flow reductions for some months and water year types in
22 the San Joaquin and Stanislaus Rivers that would not have biologically meaningful negative effects to
23 Sacramento-San Joaquin roach. There would be no substantial temperature effects under
24 Alternative 4A on Sacramento-San Joaquin roach. Flow and water temperature conditions under
25 H4_ELT would be less favorable than those under H3_ELT, but would be similar to those under
26 Existing Conditions.

27 *Hardhead – California species of special concern*

28 In general, Alternative 4A would not affect the quality and quantity of upstream habitat conditions
29 for hardhead relative to the NAA_ELT.

30 *H3_ELT/ESO_ELT*

31 *Flows*

32 Flow rates in the Sacramento, Trinity, Feather, American, San Joaquin, and Stanislaus Rivers and in
33 Clear Creek were examined during the April through May hardhead spawning period. Lower flows
34 could reduce the quantity and quality of instream habitat available for spawning.

35 In the Sacramento River upstream of Red Bluff, flows under H3_ELT would generally be similar to or
36 greater than flows under NAA_ELT during April and May) (Appendix 11C, *CALSIM II Model Results*
37 *utilized in the Fish Analysis*).

38 In the Trinity River below Lewiston Reservoir, flows under H3_ELT would generally be similar to
39 flows under NAA_ELT during April and May, except in above normal years during April (17% lower)
40 (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

- 1 In Clear Creek at Whiskeytown Dam, flows under H3_ELT would be similar to flows under NAA_ELT
2 during April and May (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).
- 3 In the Feather River at Thermalito Afterbay, flows under H3_ELT would generally be similar to
4 moderately greater than flows under NAA_ELT during April and May, except in critical years in May
5 (10% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).
- 6 In the American River at Nimbus Dam, flows under H3_ELT would be similar to or greater than flows
7 under NAA_ELT during April and May (Appendix 11C, *CALSIM II Model Results utilized in the Fish*
8 *Analysis*).
- 9 In the San Joaquin River at Vernalis, flows under H3_ELT would be similar to those under NAA_ELT
10 during April and May, regardless of water year type.
- 11 In the Stanislaus River at the confluence with the San Joaquin River flows under H3_ELT would be
12 similar to those under NAA_ELT during April and May, regardless of water year type.

13 *Water Temperature*

14 The percentage of years outside of the 59°F to 64°F suitable water temperature range for hardhead
15 spawning during April through May was examined in the Sacramento, Trinity, Feather, American,
16 and Stanislaus Rivers. Water temperatures outside this range could lead to reduced spawning
17 success and increased egg and larval stress and mortality. Water temperatures were not modeled in
18 the San Joaquin River or Clear Creek.

19 Because water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under
20 H3_ELT would generally be the same as those under NAA_ELT, this analysis was not conducted and
21 it was concluded that there would be no temperature-related effects in these rivers. In the Feather
22 River below Thermalito Afterbay, the percentage of years under H3_ELT outside the 59°F to 64°F
23 suitable water temperature range would be similar to or lower than the percentage under NAA_ELT
24 in all water year types (Table 11-4A-148).

25 Table 11-4A-148. Difference and Percent Difference in the Percentage of Months during April–May
26 in Which Water Temperatures in the Feather River below Thermalito Afterbay Would Be outside
27 the 59°F to 64°F Water Temperature Range for Hardhead Spawning^a

Water Year Type	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
Wet	1 (2%)	0 (0%)
Above Normal	4 (6%)	-5 (-7%)
Below Normal	18 (42%)	4 (7%)
Dry	5 (9%)	-6 (-9%)
Critical	-8 (-15%)	-8 (-15%)
All	4 (7%)	-3 (-5%)

^a A negative value indicates a benefit (reduction in percentage of months outside suitable range) of the alternative.

1 *H4_ELT /HOS_ELT*

2 Flows under H4_ELT in the Sacramento River upstream of Red Bluff during the April through May
3 period would generally be similar to flows under NAA_ELT (Appendix 11C, *CALSIM II Model Results*
4 *utilized in the Fish Analysis*).

5 Flows under H4_ELT in the Feather River at Thermalito Afterbay would be similar to or up to 548%
6 greater than flows under NAA_ELT during April and May.

7 Flows under H4_ELT in the American River below Nimbus Dam would generally be similar to flows
8 under NAA_ELT during April and May, except for 10% higher flow during April of critical water
9 years and 14% lower flow for May of critical years.

10 Flows under H4_ELT in the Trinity River below Lewiston would generally be similar to flows under
11 NAA_ELT during April and May, except for 17% lower flow during April of above normal water
12 years.

13 Flows under H4_ELT in the San Joaquin and Stanislaus Rivers and in Clear Creek would be similar to
14 flows under NAA_ELT in both April and May.

15 The percentage of months under H4_ELT with mean water temperatures outside the 59°F to 64°F
16 suitable water temperature range in the Feather River below Thermalito Afterbay would be similar
17 to or up to 19% lower than the percentage under NAA_ELT in all water years, except wet years
18 (10% greater) (Table 11-4A-149). Because water temperatures in the Sacramento, Trinity,
19 American, and Stanislaus Rivers under H4_ELT would generally be the same as those under
20 NAA_ELT, this analysis was not conducted and it was concluded that there would be no temperature
21 related effects in these rivers. Water temperature modeling was not conducted in Clear Creek or the
22 San Joaquin River.

23 Table 11-4A-149. Difference and Percent Difference between the Baseline Scenarios and H4_ELT in
24 the Percentage of Months during April–May in Which Water Temperatures in the Feather River
25 below Thermalito Afterbay Would Fall outside the 59°F to 64°F Water Temperature Range for
26 Hardhead Spawning^a

Water Year Type	EXISTING CONDITIONS vs. H4_ELT	NAA_ELT vs. H4_ELT
Wet	7 (11%)	6 (10%)
Above Normal	-5 (-8%)	-14 (-19%)
Below Normal	14 (33%)	0 (0%)
Dry	5 (9%)	-6 (-9%)
Critical	-4 (-7%)	-4 (-7%)
All	5 (9%)	-2 (-3%)

^a A negative value indicates a reduction in percentage of months outside suitable range for H4_ELT.

27
28 *NEPA Effects:* Collectively, these modeling results indicate that the effect would not be adverse
29 because Alternative 4A would not cause a substantial reduction in hardhead spawning habitat.
30 Flows in all rivers examined during the April through May spawning period under Alternative 4A
31 would generally be similar to or greater than flows under the NAA_ELT. There would be no
32 substantial temperature effects under Alternative 4A in any river examined. Flow and water
33 temperature conditions under H4_ELT would be less favorable than those under H3_ELT, but would
34 be similar to those under NAA_ELT.

1 *CEQA Conclusion:* In general, Alternative 4A would not affect the quality and quantity of upstream
2 habitat conditions for hardhead relative to Existing Conditions.

3 *H3_ELT/ESO_ELT*

4 *Flows*

5 Flow rates in the Sacramento, Trinity, Feather, American, San Joaquin, and Stanislaus Rivers and in
6 Clear Creek were examined during the April through May hardhead spawning period. Lower flows
7 could reduce the quantity and quality of instream habitat available for spawning.

8 In the Sacramento River upstream of Red Bluff, flows under H3_ELT would generally be similar to
9 flows under Existing Conditions during April through May, except in wet years during May (10%
10 lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

11 In the Trinity River below Lewiston Reservoir, flows under H3_ELT would generally be similar to or
12 greater than flows under Existing Conditions during April through May, except in critical years
13 during May (6% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

14 In Clear Creek at Whiskeytown Dam, flows under H3_ELT would be similar to flows under Existing
15 Conditions during April through May, except in critical years during May (6% lower) (Appendix 11C,
16 *CALSIM II Model Results utilized in the Fish Analysis*).

17 In the Feather River at Thermalito Afterbay, flows under H3_ELT would be greater than flows under
18 Existing Conditions during April through May, except in below normal years during April (6%
19 lower) and in wet years during May (15% lower) (Appendix 11C, *CALSIM II Model Results utilized in*
20 *the Fish Analysis*).

21 In the American River at Nimbus Dam, flows under H3_ELT would generally be similar to or greater
22 than flows under Existing Conditions during April, except in above normal years (5% lower), but
23 generally lower than flows under Existing Conditions during May, except in critical years (13%
24 greater) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). These few flow
25 reductions are relatively small in magnitude and, therefore would not have biologically meaningful
26 negative effects.

27 In the San Joaquin River at Vernalis, flows under H3_ELT would generally be similar to or slightly
28 lower than those under Existing Conditions during April and May.

29 In the Stanislaus River at the confluence with the San Joaquin River, flows under H3_ELT would
30 generally be similar to or up to 12% lower than to those under Existing Conditions during April and
31 May.

32 *Water Temperature*

33 The percentage of months outside of the 59°F to 64°F suitable water temperature range for
34 hardhead spawning during April through May was examined in the Sacramento, Trinity, Feather,
35 American, and Stanislaus Rivers. Water temperatures outside this range could lead to reduced
36 spawning success and increased egg and larval stress and mortality. Water temperatures were not
37 modeled in the San Joaquin River or Clear Creek.

38 Because water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under
39 H3_ELT would generally be the same as those under Existing Conditions, this analysis was not

1 conducted and it was concluded that there would be no temperature related effects in these rivers.
2 In the Feather River below Thermalito Afterbay, the percentage of months under H3_ELT outside of
3 the 59°F to 64°F water temperature range for hardhead spawning would be greater than the
4 percentage under Existing Conditions in all water years types, except critical years (15% lower)
5 (Table 11-4A-148).

6 *H4_ELT/HOS_ELT*

7 Flows under H4_ELT in the Sacramento River upstream of Red Bluff during the April through May
8 period would generally be similar to or up to 11% lower (May of wet years) than flows under
9 Existing Conditions (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

10 Flows under H4_ELT in the Feather River at Thermalito Afterbay would generally be up to 509%
11 greater than flows under Existing Conditions during April and May.

12 Flows under H4_ELT in the American River below Nimbus Dam would generally be similar to flows
13 under Existing Conditions during April, and up to 18% lower than flows under Existing Conditions
14 during May.

15 Flows under H4_ELT in the San Joaquin River at Vernalis would generally be similar to or slightly
16 lower than those under Existing Conditions during April and May.

17 Flows under H4_ELT in the Stanislaus River at the confluence with the San Joaquin River would
18 generally be similar to or up to 13% lower than to those under Existing Conditions during April and
19 May.

20 Flows under H4_ELT in the Trinity River and Clear Creek would be similar to flows under Existing
21 Conditions in both months, except for 10% higher flows in Clear Creek during April of critical water
22 years.

23 The percentage of months under H4_ELT with mean water temperatures outside the 59°F to 64°F
24 suitable water temperature range in the Feather River below Thermalito Afterbay would be slightly
25 lower than the percentage under Existing Conditions in above normal and critical water years and
26 would be up to 33% higher than the percentage under Existing Conditions in wet, below normal and
27 dry water years (Table 11-4A-149). Because water temperatures in the Sacramento, Trinity,
28 American, and Stanislaus Rivers under H4_ELT would generally be the same as those under Existing
29 Conditions, this analysis was not conducted and it was concluded that there would be no
30 temperature related effects in these rivers.

31 *Summary of CEQA Conclusion*

32 Collectively, these modeling results indicate that the effect would be less than significant because
33 Alternative 4A would not cause a substantial reduction in roach spawning habitat, and no mitigation
34 is necessary. Flows in most rivers examined during the April through May spawning period under
35 Alternative 4A would generally be similar to or greater than flows under Existing Conditions. Flows
36 in the San Joaquin and Stanislaus Rivers would be lower under Alternative 4A, although these
37 reductions would not have population-level effects on hardhead. There would be no substantial
38 temperature effects under Alternative 4A on roach. Therefore, the impact would be less than
39 significant and no mitigation is required.

1 *California Bay Shrimp*

2 *NEPA Effects:* The effect of water operations on spawning habitat of California bay shrimp under
3 Alternative 4A would be similar to that described for Alternative 1A (see Alternative 1A, Impact
4 AQUA-202) due to similarities in hydrology. For a detailed discussion, please see Alternative 1A,
5 Impact AQUA-202. The effects would not be adverse.

6 *CEQA Conclusion:* The impact of water operations on spawning habitat of California bay shrimp
7 would be the same as described immediately above. The impact would be less than significant and
8 no mitigation would be required.

9 Impact AQUA-203: Effects of Water Operations on Rearing Habitat for Non-Covered Aquatic
10 Species of Primary Management Concern

11 See Alternative 1A, Impact AQUA-203 for additional background information relevant to non-
12 covered species of primary management concern. The analysis for striped bass, American shad, and
13 bay shrimp includes new analysis across all alternatives that is described in detail in Chapter 11,
14 Section 11.3.5, in Appendix A. The analysis below for Alternative 4A draws on that analysis.

15 *Striped Bass*

16 *NEPA Effects:* The discussion under Alternative 4A, Impact AQUA-202 for striped bass also
17 addressed the embryo incubation and initial rearing period. That analysis indicates that there is no
18 adverse effect on striped bass rearing during that period. As discussed further in Chapter 11, Section
19 11.3.5, in Appendix A, water operations have the potential to affect striped bass juvenile abundance
20 through changes in the extent of rearing habitat in the Plan Area as indexed by X2 (Kimmerer et al.
21 2009). Several X2-abundance index or X2-survival index relationships from Kimmerer et al. (2009)
22 were applied to striped bass in order to assess the potential effects on abundance or survival
23 through changes in rearing habitat. Application of these relationships suggested that, in relation to
24 NAA_ELT, there generally would be only a small change in mean abundance index (<5%) as a result
25 of change in rearing habitat under Alternative 4A scenarios H3_ELT and H4_ELT (See Table 11-
26 mult-6, Table 11-mult-7, Table 11-mult-8, Table 11-mult-9, and Table 11-mult-10 in Chapter 11,
27 Section 11.3.5, in Appendix A of this RDEIR/SDEIS). The exceptions were the mean bay midwater
28 trawl abundance index (7% reduction; Table 11-mult-9) and the mean summer townet survival
29 index (6% reduction; Table 11-mult-6). These results indicate that the operational effects would not
30 be adverse, because they would not result in a substantial reduction in the rearing habitat for
31 striped bass.

32 *CEQA Conclusion:* The analysis of potential water operations-related rearing habitat effects
33 illustrated that in relation to Existing Conditions (see Table 11-mult-6, Table 11-mult-7, Table 11-
34 mult-8, Table 11-mult-9, and Table 11-mult-10 in Chapter 11, Section 11.3.5, in Appendix A of this
35 RDEIR/SDEIS), there could be significant impacts of the Alternative 4A on survival or abundance of
36 striped bass, in contrast to the conclusion presented above in the NEPA Effects section. As described
37 in Chapter 11, Section 11.3.5, in Appendix A of this RDEIR/SDEIS, because of differences between
38 the CEQA and NEPA baselines, it is sometimes possible for CEQA and NEPA significance conclusions
39 to vary between one another under the same impact discussion. The baseline for the CEQA analysis
40 is Existing Conditions at the time the NOP was prepared. Both Alternative 4A and the NEPA baseline
41 (NAA_ELT) models anticipated future conditions that would occur in the ELT, including the
42 projected effects of climate change (precipitation patterns), sea level rise and future water demands.
43 Because Alternative 4A modeling does not partition the effects of implementation of the alternative

1 from the effects of sea level rise, climate change, and future water demands, the comparison to
2 Existing Conditions may not offer a clear understanding of the impact of the alternative on the
3 environment. The comparison to the NAA_ELT is a better approach because it isolates the effect of
4 the alternative from those of sea level rise, climate change, and future water demands. In the case of
5 the X2-related analyses of rearing habitat for striped bass, the effect of sea level rise in particular
6 confounds the interpretation of the effects of the alternatives. When compared to NAA_ELT and
7 informed by the NEPA analysis above, the change in rearing habitat would be less than significant.
8 No mitigation would be necessary.

9 *American Shad*

10 *NEPA Effects:* As discussed further in Chapter 11, Section 11.3.5, in Appendix A, water operations
11 have the potential to affect American shad juvenile abundance through changes in the extent of
12 rearing habitat in the Plan Area as indexed by X2 (Kimmerer et al. 2009). Two X2-abundance index
13 relationships from Kimmerer et al. (2009) were applied to American shad in order to assess the
14 potential effects on abundance through changes in rearing habitat. Application of these relationships
15 suggested that, in relation to NAA_ELT, there would be only a small change in mean abundance
16 index (<5%) as a result of change in rearing habitat under Alternative 4A scenarios H3_ELT and
17 H4_ELT (See Table 11-mult-11, Table 11-mult-12 in Chapter 11, Section 11.3.5, in Appendix A of this
18 RDEIR/SDEIS). These modeling results indicate that the operational effects would not be adverse,
19 because they would not result in a substantial reduction in the rearing habitat for American shad.

20 *CEQA Conclusion:* Similar to striped bass, the analysis of potential water operations-related rearing
21 habitat effects illustrated that in relation to Existing Conditions, there could be a greater impact of
22 Alternative 4A on abundance of American shad (Table 11-mult-11, Table 11-mult-12 in Chapter 11,
23 Section 11.3.5, in Appendix A of this RDEIR/SDEIS), than found in the NEPA Effects section. As noted
24 for striped bass, the comparison to the NAA_ELT is a better approach than comparison to Existing
25 Conditions because it isolates the effect of the alternative from those of sea level rise, climate
26 change, and future water demands. In the case of the X2-related analyses of rearing habitat for
27 American shad, the effect of sea level rise in particular confounds the interpretation of the effects of
28 the alternatives. Based on the discussion presented above for the NEPA Effects, the change in
29 rearing habitat would be less than significant. No mitigation would necessary.

30 *Threadfin Shad*

31 *NEPA Effects:* The effects of water operations on rearing habitat for threadfin shad under
32 Alternative 4A would be similar to that described for Alternative 1A (see Alternative 1A, Impact
33 AQUA-203) due to similarities in hydrology. For a detailed discussion, please see Alternative 1A,
34 Impact AQUA-203. The effects would not be adverse.

35 *CEQA Conclusion:* As described above the impacts on threadfin shad rearing habitat would be less
36 than significant and no mitigation would be required.

1 *Largemouth Bass*

2 *H3_ELT/ESO_ELT*

3 *Juveniles*

4 *Flows*

5 Flow rates in the Sacramento, Trinity, Feather, American, San Joaquin, and Stanislaus Rivers and in
6 Clear Creek were examined during the April through November juvenile largemouth bass rearing
7 period. Lower flows could reduce the quantity and quality of instream habitat available for juvenile
8 rearing.

9 In the Sacramento River upstream of Red Bluff, flows under H3_ELT would generally be similar to or
10 greater than flows under NAA_ELT during April through October with some exceptions (to 14%
11 lower), and would be lower in all water year types during November (to 18% lower) (Appendix 11C,
12 *CALSIM II Model Results utilized in the Fish Analysis*). Flow reductions in drier water years, when
13 effects on habitat conditions would be more critical, would be inconsistent and/or of small
14 magnitude for all months during the rearing period and would not have biologically meaningful
15 negative effects.

16 In the Trinity River below Lewiston Reservoir, flows under H3_ELT would generally be similar to
17 flows under NAA_ELT with isolated exceptions, including flow reduction in above normal years
18 during April (to 17% lower) and small flow reductions in above normal years during October (7%
19 lower) and in wet years during November (10% lower) (Appendix 11C, *CALSIM II Model Results*
20 *utilized in the Fish Analysis*).

21 In Clear Creek at Whiskeytown Dam, flows under H3_ELT would be similar to flows under NAA_ELT
22 during April through November, except in critical years during August (11% greater) and in critical
23 years during July, September, and October (to 14% lower) (Appendix 11C, *CALSIM II Model Results*
24 *utilized in the Fish Analysis*).

25 In the Feather River at Thermalito Afterbay, flows under H3_ELT would generally be moderately to
26 substantially greater than flows under NAA during April through June (to 106% greater), except in
27 critical years during May and June (to 10% lower); moderately to substantially lower than flows
28 under NAA during July through September (to 48% lower), except in critical years during August
29 and September (to 25% greater); and similar to or greater than flows under NAA_ELT during
30 October and November (to 19% greater) (Appendix 11C, *CALSIM II Model Results utilized in the Fish*
31 *Analysis*). Flow reductions during July through September would be partially offset by increases in
32 flow in the adjoining months.

33 In the American River at Nimbus Dam, flows under H3_ELT would be similar to or greater than flows
34 under NAA during April through July and October, except in wet years during October (6% lower),
35 and would be similar to or lower than flows under NAA_ELT during August, September, and
36 November (to 22% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flow
37 reductions would be offset by increases in some months and/or not persistent within a single water
38 year type. Effects would not be biologically meaningful.

39 In the San Joaquin River at Vernalis, flows under H3_ELT would be similar to those under NAA_ELT
40 during April through November, regardless of water year type.

1 In the Stanislaus River at the confluence with the San Joaquin River flows under H3_ELT would be
2 similar to those under NAA_ELT during April through November, regardless of water year type.

3 *Water Temperature*

4 The percentage of months above the 88°F water temperature threshold for juvenile largemouth bass
5 rearing during April through November was examined in the Sacramento, Trinity, Feather,
6 American, and Stanislaus Rivers. Elevated water temperatures could lead to reduced quantity and
7 quality of instream habitat available for juvenile rearing and increased stress and mortality. Water
8 temperatures were not modeled in the San Joaquin River or Clear Creek.

9 Water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under H3_ELT
10 would generally be the same as those under NAA_ELT. Therefore, there would be no temperature
11 related effects of H3_ELT in these rivers during the April through November period.

12 In the Feather River below Thermalito Afterbay, water temperatures would not exceed 88°F under
13 NAA_ELT or H3_ELT. As a result, there would be no difference between NAA_ELT and H3_ELT in the
14 percentage of months in which the 88°F water temperature threshold is exceeded (Table 11-4A-
15 150).

16 Table 11-4A-150. Difference and Percent Difference in the Percentage of Months during April–
17 November in Which Water Temperatures in the Feather River below Thermalito Afterbay Exceed
18 the 88°F Water Temperature Threshold for Juvenile Largemouth Bass Rearing^a

Water Year Type	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
Wet	0 (NA)	0 (NA)
Above Normal	0 (NA)	0 (NA)
Below Normal	0 (NA)	0 (NA)
Dry	0 (NA)	0 (NA)
Critical	0 (NA)	0 (NA)
All	0 (NA)	0 (NA)

NA = could not be calculated because the denominator was 0.

^a A negative value indicates a benefit (reduction in percentage of months outside suitable range) of the alternative.

19 *Adults*

20 *Flows*

21 Flow rates in the Sacramento, Trinity, Feather, American, San Joaquin, and Stanislaus Rivers and in
22 Clear Creek were examined during year-round adult largemouth bass residency period. Lower flows
23 could reduce the quantity and quality of instream habitat available for adults.
24

25 In the Sacramento River upstream of Red Bluff, flows under H3_ELT would generally be similar to or
26 greater than flows under NAA_ELT throughout the year with some exceptions (up to 14% lower),
27 and would be lower in all water year types during November (up to 18% lower) (Appendix 11C,
28 *CALSIM II Model Results utilized in the Fish Analysis*). Flow reductions in drier water years, when
29 effects on habitat conditions would be more critical, would be inconsistent and/or of small
30 magnitude for all months during the rearing period and, therefore, would not have biologically
31 meaningful negative effects.

1 In the Trinity River below Lewiston Reservoir, flows under H3_ELT would generally be similar to or
2 greater than flows under NAA_ELT during the period, except in above normal years in April and
3 October (17% and 8% lower, respectively), and in wet years during November (10% lower)
4 (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

5 In Clear Creek at Whiskeytown Dam, flows under H3_ELT would be similar to flows under NAA_ELT
6 throughout the year, except in critical years during July (14% lower), August (11% greater),
7 September (10% lower), and October (7% lower) (Appendix 11C, *CALSIM II Model Results utilized in*
8 *the Fish Analysis*).

9 In the Feather River at Thermalito Afterbay, flows under H3_ELT would generally be lower than
10 flows under NAA_ELT during January and July through September, except in critical years in August
11 and September (23% and 25% greater, respectively); would generally be similar to or greater than
12 flows under NAA during February through June, except for below normal years during February and
13 March (11% and 13% lower, respectively) and in critical years during May and June (10% and 8%
14 lower, respectively); and would generally be similar to or greater than flows under NAA_ELT during
15 November and December, except in wet years during December (5% lower) (Appendix 11C, *CALSIM*
16 *II Model Results utilized in the Fish Analysis*). Flows would be more persistently lower under H3_ELT
17 relative to NAA_ELT (up to 48% lower) during July, August, and in all water year types except
18 critical years during September. Flow reductions would be partially offset by increases in flow in the
19 adjoining months.

20 In the American River at Nimbus Dam, flows under H3_ELT would be similar to or greater than flows
21 under NAA_ELT during January through July and December, except in below normal years during
22 January (11% lower), and would be similar to or lower than flows under NAA_ELT (up to 22%
23 lower) during August through November, except in below normal and critical years during October
24 (16% and 22% greater, respectively) (Appendix 11C, *CALSIM II Model Results utilized in the Fish*
25 *Analysis*). Flow reductions would be offset by increases in some months and/or not persistent
26 within a single water year type. Effects would not be biologically meaningful.

27 In the San Joaquin River at Vernalis, flows under H3_ELT would be similar to those under NAA_ELT
28 throughout the year, regardless of water year type.

29 In the Stanislaus River at the confluence with the San Joaquin River flows under H3_ELT would be
30 similar to those under NAA_ELT throughout the year, regardless of water year type.

31 The analysis for Alternative 1A indicates that there would be no differences in flows between H3
32 and NAA_ELT.

33 *Water Temperature*

34 The percentage of months above the 86°F water temperature threshold for year-round adult
35 largemouth bass residency period was examined in the Sacramento, Trinity, Feather, American, and
36 Stanislaus Rivers. Elevated water temperatures could lead to reduced quantity and quality of habitat
37 and increased stress and mortality for adults. Water temperatures were not modeled in the San
38 Joaquin River or Clear Creek.

39 Water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under H3_ELT
40 would generally be the same as those under NAA_ELT. Therefore, there would be no temperature
41 related effects of H3_ELT in these rivers during any month.

1 In the Feather River below Thermalito Afterbay, water temperatures would not exceed 86°F under
 2 NAA_ELT and H3_ELT (Table 11-4A-151). As a result, there would be no difference in the percentage
 3 of months in which the 86°F water temperature threshold is exceeded between NAA_ELT and
 4 H3_ELT.

5 Table 11-4A-151. Difference and Percent Difference in the Percentage of Months Year-Round in
 6 Which Water Temperatures in the Feather River below Thermalito Afterbay Exceed the 86°F
 7 Water Temperature Threshold for Adult Largemouth Bass Survival^a

Water Year Type	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
Wet	0 (NA)	0 (NA)
Above Normal	0 (NA)	0 (NA)
Below Normal	0 (NA)	0 (NA)
Dry	0 (NA)	0 (NA)
Critical	0 (NA)	0 (NA)
All	0 (NA)	0 (NA)

NA = could not be calculated because the denominator was 0.

^a A negative value indicates a benefit (reduction in percentage of months outside suitable range) of the alternative.

8

9 *H4_ELT /HOS_ELT*

10 *Juveniles*

11 Flows under H4_ELT in the Sacramento River upstream of Red Bluff during the April through
 12 November juvenile largemouth bass rearing period would generally be similar to flows under
 13 NAA_ELT, except during November of all water year types, when flows would be up to 15% lower
 14 (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flows under H4_ELT in the
 15 Feather River at Thermalito Afterbay would generally be up to 548% greater than flows under
 16 NAA_ELT during April through June, except for 12% and 10% lower flows during June of wet and
 17 critical water years, respectively, and would generally be similar to or up to 60% lower than flows
 18 under NAA_ELT during July through November, except in August through November of critical
 19 water years, when flows under NAA_ELT would range from 11% to 52% higher. Flows under
 20 H4_ELT in the American River below Nimbus Dam would generally be similar to flows under
 21 NAA_ELT during April through November, except for 14% lower flow in May of critical water years,
 22 28% lower flow in August of critical years, 20% lower flows in September of below normal years,
 23 18% greater flow in August of below normal years, and 15% and 21% greater flows in October of
 24 below normal and critical water years, respectively. Flows under H4_ELT in the Trinity River below
 25 Lewiston would generally be similar to flows under NAA_ELT, during April through November,
 26 except for 17% lower flow during April of above normal water years, 16% greater flow in
 27 September of critical years, and 11% greater flow during October of above normal water years.
 28 Flows under H4_ELT in Clear Creek below Whiskeytown would generally be similar to flows under
 29 NAA_ELT during April through November, except for 14% lower flow and 11% higher flow during
 30 July and August, respectively, of critical water years. Flows under H4_ELT in the San Joaquin and
 31 Stanislaus Rivers would be similar to flows under NAA_ELT throughout the period.

1 Water temperatures in the Feather River below Thermalito Afterbay during the April through
2 November juvenile largemouth bass rearing period would not exceed the 88°F water temperature
3 threshold in H4_ELT or NAA_ELT. As a result, there would be no difference between H4_ELT and
4 NAA_ELT in the percentage of months in which the 88°F water temperature threshold is exceeded
5 (Table 11-4A-152).

6 Table 11-4A-152. Difference and Percent Difference between the Baseline Scenarios and H4_ELT in
7 the Percentage of Months during April–November in Which Water Temperatures in the Feather
8 River below Thermalito Afterbay Exceed the 88°F Water Temperature Threshold for Juvenile
9 Largemouth Bass Rearing^a

Water Year Type	EXISTING CONDITIONS vs. H4_ELT	NAA_ELT vs. H4_ELT
Wet	0 (NA)	0 (NA)
Above Normal	0 (NA)	0 (NA)
Below Normal	0 (NA)	0 (NA)
Dry	0 (NA)	0 (NA)
Critical	0 (NA)	0 (NA)
All	0 (NA)	0 (NA)

NA = could not be calculated because the denominator was 0.

^a A negative value indicates a reduction in percentage of months outside suitable range for H4_ELT.

10

11 *Adults*

12 Flows under H4_ELT in the Sacramento River upstream of Red Bluff during the year-round adult
13 largemouth bass residency period would generally be similar to flows under NAA_ELT, except for
14 10% lower flow during September of below normal water years and except during November of all
15 water year types, when flows would be up to 15% lower (Appendix 11C, *CALSIM II Model Results*
16 *utilized in the Fish Analysis*). Flows under H4_ELT in the Feather River at Thermalito Afterbay would
17 generally be up to 548% greater than flows under NAA_ELT during April through June, except for
18 12% and 10% lower flows during June of wet and critical water years, respectively. The Feather
19 River flows under H4_ELT would generally be similar to or up to 60% lower than flows under
20 NAA_ELT during July through November, except in August through November of critical water years,
21 when flows under NAA_ELT would range from 11% to 52% higher, and the flows would generally be
22 similar to or up to 40% higher under NAA_ELT during December through March. Flows under
23 H4_ELT in the American River below Nimbus Dam would generally be similar to flows under
24 NAA_ELT throughout the year, except for 14% lower flow in May of critical water years, 28% lower
25 flow in August of critical years, 20% lower flows in September of below normal years, 18% greater
26 flow in August of below normal years, and 15% and 21% greater flows in October of below normal
27 and critical water years, respectively. Flows under H4_ELT in the Trinity River below Lewiston
28 would generally be similar to flows under NAA_ELT throughout the year, except for 10% higher flow
29 during February of wet years, 17% lower flow during April of above normal water years, 16%
30 greater flow during September of critical years, and 11% greater flow during October of above
31 normal water years. Flows under H4_ELT in Clear Creek below Whiskeytown would generally be
32 similar to flows under NAA_ELT throughout the year, except for 12% higher flow in March of below
33 normal water years, and 14% lower flow and 11% higher flow during July and August, respectively,
34 of critical water years. Flows under H4_ELT in the San Joaquin and Stanislaus Rivers would be
35 similar to flows under NAA_ELT throughout the year.

1 Water temperatures in the Feather River below Thermalito Afterbay during the year-round adult
2 largemouth bass residency period would not exceed the 86°F water temperature threshold in
3 H4_ELT or NAA_ELT. As a result, there would be no difference between H4_ELT and NAA_ELT in the
4 percentage of months in which the 86°F water temperature threshold is exceeded (Table 11-4A-
5 153).

6 Table 11-4A-153. Difference and Percent Difference between the Baseline Scenarios and H4_ELT in
7 the Percentage of Months Year-Round in Which Water Temperatures in the Feather River below
8 Thermalito Afterbay Exceed the 86°F Water Temperature Threshold for Adult Largemouth Bass
9 Survival^a

Water Year Type	EXISTING CONDITIONS vs. H4_ELT	NAA_ELT vs. H4_ELT
Wet	0 (NA)	0 (NA)
Above Normal	0 (NA)	0 (NA)
Below Normal	0 (NA)	0 (NA)
Dry	0 (NA)	0 (NA)
Critical	0 (NA)	0 (NA)
All	0 (NA)	0 (NA)

NA = could not be calculated because the denominator was 0.

^a A negative value indicates a reduction in percentage of months outside suitable range for H4_ELT.

10

11 *NEPA Effects:* Collectively, these modeling results indicate that the effect would not be adverse
12 because Alternative 4A would not cause a substantial reduction in juvenile rearing and adult
13 spawning habitat. Flows in all rivers examined during the year under Alternative 4A are generally
14 similar to or greater than flows under the NAA_ELT in most months. Flows in July or August through
15 November are more likely to be lower for some water year types in some of the locations analyzed,
16 however they are generally of small magnitude, not consistent from month to month within a
17 specific water year type, and/or would be offset by increases in flow in the adjoining months.
18 Therefore, the flow reductions are not expected to have biologically meaningful negative effects on
19 the largemouth bass population. Flow-related habitat conditions for both juvenile and adult
20 largemouth bass under H4_ELT would be less favorable than those under H3_ELT although not
21 different from NAA_ELT. There are no temperature-related effects in any other rivers examined.

22 *CEQA Conclusion:* In general, Alternative 4 would not reduce the quality and quantity of upstream
23 habitat conditions for largemouth bass relative to Existing Conditions.

24 *H3_ELT/ESO_ELT*

25 *Juveniles*

26 *Flows*

27 Flow rates in the Sacramento, Trinity, Feather, American, San Joaquin, and Stanislaus Rivers and in
28 Clear Creek were examined during the April through November juvenile largemouth bass rearing
29 period. Lower flows could reduce the quantity and quality of instream habitat available for juvenile
30 rearing.

31 In the Sacramento River upstream of Red Bluff, flows under H3_ELT would generally be similar to or
32 greater than flows under Existing Conditions during April through July, except in wet years during

1 May (10% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flows would
2 generally be similar to or lower than flows under Existing Conditions during August through
3 November (to 22% lower), except in above normal and below normal years during August (to 7%
4 greater) and in wet and above normal years during September (to 32% greater) (Appendix 11C,
5 *CALSIM II Model Results utilized in the Fish Analysis*). There would be primarily small flow reductions
6 in some drier water year types for some months, but not persistent enough and of a magnitude that
7 would not be expected to have biologically meaningful negative effects.

8 In the Trinity River below Lewiston Reservoir, flows under H3_ELT would generally be similar to or
9 greater than flows under Existing Conditions during April through July, except in critical years
10 during May (6% lower) and in wet years during July (10% lower), and similar to or lower than flows
11 under Existing Conditions during August through November (to 17% lower) (Appendix 11C, *CALSIM
12 II Model Results utilized in the Fish Analysis*). The persistent, small to moderate flow reductions years
13 during August through November would have a localized effect on rearing conditions.

14 In Clear Creek at Whiskeytown Dam, flows under H3_ELT would be similar to or greater than flows
15 under Existing Conditions during April through November, except in critical years during September
16 (19% lower) and in below normal years during October (6% lower) (Appendix 11C, *CALSIM II Model
17 Results utilized in the Fish Analysis*). This flow reduction is a relatively small, isolated effect limited to
18 a single water year type and would not be expected to have biologically meaningful negative effects.

19 In the Feather River at Thermalito Afterbay, flows under H3_ELT would be greater than flows under
20 Existing Conditions during April through June, September, and October, with a few isolated
21 exceptions (to 50% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).
22 Flows under H3_ELT would generally be moderately to substantially lower than flows under
23 Existing Conditions during July, August, and November (to 52% lower), except in wet and above
24 normal years during July and August (to 50% greater) and in above normal years during November
25 (5% greater).

26 In the American River at Nimbus Dam, flows under H3_ELT would generally be similar to or greater
27 than flows under Existing Conditions during April, except in above normal years (5% lower), but
28 generally lower, by up to 46%, during May through November (Appendix 11C, *CALSIM II Model
29 Results utilized in the Fish Analysis*). There would be moderate flow reductions in drier water year
30 types, when effects would be most critical for habitat conditions, for some months/water year types
31 from May through November that would affect rearing conditions at this location.

32 In the San Joaquin River at Vernalis, flows under H3_ELT would generally be similar to or slightly
33 lower than those under Existing Conditions during April and May and September through
34 November, and would be similar to or up to 23% lower than flows under Existing Conditions during
35 June through August.

36 In the Stanislaus River at the confluence with the San Joaquin River, flows under H3_ELT would
37 generally be similar to or up to 14% lower than to those under Existing Conditions during April
38 through July, except for 11% greater flow during June of wet years, and would be similar to or
39 slightly lower than flows under Existing Conditions during August through November.

40 *Water Temperature*

41 The percentage of months above the 88°F water temperature threshold for juvenile largemouth bass
42 rearing during April through November was examined in the Sacramento, Trinity, Feather,
43 American, and Stanislaus Rivers. Elevated water temperatures could lead to reduced quantity and

1 quality of instream habitat available for juvenile rearing and increased stress and mortality. Water
2 temperatures were not modeled in the San Joaquin River or Clear Creek.

3 Water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under H3_ELT
4 would generally be the same as those under Existing Conditions. Therefore, there would be no
5 temperature related effects of H3_ELT in these rivers during the April through November period.

6 In the Feather River below Thermalito Afterbay, water temperatures would not exceed the 88°F
7 water temperature threshold for juvenile largemouth bass during the April through November
8 rearing period under Existing Conditions or H3_ELT (Table 11-4A-150). As a result, there would be
9 no difference in the percentage of months in which the 88°F water temperature threshold is
10 exceeded between H3_ELT and Existing Conditions.

11 *Adults*

12 *Flows*

13 Flow rates in the Sacramento, Trinity, Feather, American, San Joaquin, and Stanislaus Rivers and in
14 Clear Creek were examined during the year-round adult largemouth bass residency period. Lower
15 flows could reduce the quantity and quality of instream habitat available for adults.

16 In the Sacramento River upstream of Red Bluff, flows under H3_ELT would generally be similar to or
17 greater than flows under Existing Conditions during January through April and December, except in
18 drier years during January (to 13% lower), in dry and critical years during February (8% and 6%
19 lower, respectively), in critical years during March (8% lower), in above normal years in April (5%
20 lower), and in dry and critical years during December (8% and 5% lower, respectively) (Appendix
21 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flows would generally be similar to or
22 lower than flows under Existing Conditions during May through November (to 46% lower), except
23 in critical years during May (13% greater), in below normal and dry years during June (8% and 25%
24 greater, respectively), and in below normal and critical years during October (10% and 15% greater,
25 respectively) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). There would be
26 primarily small flow reductions in some water year types for some months, but not persistent
27 enough and of a magnitude that would not be expected to have biologically meaningful negative
28 effects.

29 In the Trinity River below Lewiston Reservoir, flows under H3_ELT would generally be similar to or
30 greater than flows under Existing Conditions during January through June and December, except in
31 below normal years during January (16% lower), in below normal years during March (6% lower),
32 and in critical years during May (6% lower), but would generally be similar to or lower than flows
33 under Existing Conditions during July through November, except in below normal years during July
34 (5% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). The persistent,
35 small to moderate flow reductions in critical years would have a localized effect on conditions for
36 adults in that water year type.

37 In Clear Creek at Whiskeytown Dam, flows under H3_ELT would be similar to or greater than flows
38 under Existing Conditions throughout the year, except in critical years during September and in
39 below normal years during October (19% and 6% lower, respectively) (Appendix 11C, *CALSIM II*
40 *Model Results utilized in the Fish Analysis*). This flow reduction is a relatively isolated effect limited to
41 a single water year type in each month and would not be expected to have biologically meaningful
42 negative effects.

1 In the Feather River at Thermalito Afterbay, flows under H3_ELT would be greater than flows under
2 Existing Conditions during February through June, September, and October, except in drier years
3 during February (to 48% lower), in below normal and dry years during March (39% and 17% lower,
4 respectively), in below normal years during April (6% lower), in wet years during May (15% lower),
5 in below normal and critical years during September (26% and 50% lower, respectively), and in wet
6 and critical years during October (6% and 7% lower, respectively) (Appendix 11C, *CALSIM II Model
7 Results utilized in the Fish Analysis*). Flows under H3_ELT would generally be moderately to
8 substantially lower than flows under Existing Conditions in January, July, August, November, and
9 December, except in wet and above normal years during July (15% and 9% greater, respectively), in
10 below normal and dry years during August (7% and 45% greater, respectively), in above normal
11 years during November (5% greater), and in above normal years during December (18% greater).

12 In the American River at Nimbus Dam, flows under H3_ELT would generally be similar to or greater
13 than flows under Existing Conditions in wetter years during January, in wet and below normal years
14 during December, and in most water year types during February through April, except in dry and
15 critical years during February (8% and 6% lower, respectively), in critical years during March (7%
16 lower), and in above normal years during April (5% lower) (Appendix 11C, *CALSIM II Model Results
17 utilized in the Fish Analysis*). Flows under H3_ELT would generally be similar to or lower than flows
18 under Existing Conditions during May through November, except in critical years during May (13%
19 greater), in below normal and dry years during June (8% and 25% greater, respectively), and in
20 below normal and critical years during October (10% and 15% greater, respectively). There would
21 be persistent small to substantial flow reductions that would affect conditions for adults at this
22 location.

23 In the San Joaquin River at Vernalis, flows under H3_ELT would generally be similar to or slightly
24 lower than those under Existing Conditions during April, May and September through November,
25 would be similar to or up to 23% lower than flows under Existing Conditions during February,
26 March, and June through August, and would be similar to or up to 11% greater than flows under
27 Existing Conditions during December and January.

28 In the Stanislaus River at the confluence with the San Joaquin River, flows under H3_ELT would
29 generally be similar to or up to 29% lower than to those under Existing Conditions during January
30 through July, except for 17% and 11% greater flow in wet years during February and June,
31 respectively, and would be similar to or slightly lower than flows under Existing Conditions during
32 August through December.

33 *Water Temperature*

34 The percentage of months above the 86°F water temperature threshold for year-round adult
35 largemouth bass residency period was examined in the Sacramento, Trinity, Feather, American, and
36 Stanislaus Rivers. Elevated water temperatures could lead to reduced quantity and quality of habitat
37 for adults and increased stress and mortality of adults. Water temperatures were not modeled in the
38 San Joaquin River or Clear Creek.

39 Water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under H3_ELT
40 would generally be the same as those under Existing Conditions. Therefore, there would be no
41 temperature related effects of H3_ELT in these rivers during any month.

42 In the Feather River below Thermalito Afterbay, water temperatures would not exceed the 86°F
43 water temperature threshold for adult largemouth bass under Existing Conditions or H3_ELT (Table

1 11-4A-151). As a result, there would be no difference in the percentage of months in which the 86°F
2 water temperature threshold is exceeded between H3_ELT and Existing Conditions.

3 *H4_ELT/HOS_ELT*

4 *Juveniles*

5 Flows under H4_ELT in the Sacramento River upstream of Red Bluff during the April through July
6 juvenile largemouth bass rearing period would generally be similar to flows under Existing
7 Conditions (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flows under in the
8 Feather River at Thermalito Afterbay would be greater (up to 509%) than those under Existing
9 Conditions June, with few exceptions. Flows under H4_ELT in the American River at Nimbus Dam
10 would generally be similar to flows under Existing Conditions during April, but up to 27% lower
11 than flows under Existing Conditions during May and June. Flows under H4_ELT in the Trinity River
12 would generally be similar to flows under Existing Conditions with minor exceptions. Flows under
13 H4_ELT in Clear Creek would be similar to flows under Existing Conditions. Flows under H4_ELT in
14 the San Joaquin River at Vernalis would generally be lower (up to 16% lower) than those under
15 Existing Conditions. Flows under H4_ELT in the Stanislaus River at the confluence with the San
16 Joaquin River would generally be up to 14% lower than to those under Existing Conditions.

17 Based on these flow reductions, juvenile rearing habitat conditions would generally be less
18 favorable under H4 relative to NAA_ELT in the Feather River.

19 *Adults*

20 Flows under H4_ELT in the Sacramento River upstream of Red Bluff during the year-round adult
21 largemouth bass residency period would generally be similar to or up to 18% lower than flows
22 under Existing Conditions throughout the year, except during September, when flows would be for
23 27% and 49% in wet and above normal, respectively (Appendix 11C, *CALSIM II Model Results utilized*
24 *in the Fish Analysis*). Differences in flows between H4_ELT and Existing Conditions in the Feather
25 River at Thermalito Afterbay would be highly variable, with flows under H4_ELT up to 509% greater
26 than those under Existing Conditions during April through June and September, except for 37% and
27 6% lower flows during June of wet and critical water years, respectively, and 49% and 47% lower
28 flows during September of below normal and dry years, respectively. The Feather River flows under
29 H4_ELT would generally be similar to or up to 54% lower than flows under Existing Conditions
30 during July, August, and October through March, except in August through November of critical
31 water years, when flows under H4_ELT would range up to 55% higher. Flows under H4_ELT in the
32 American River at Nimbus Dam would generally be similar to or up to 38% lower than flows under
33 Existing Conditions throughout the year, except for 15% greater flow in January of wet years, 12%
34 to 14% greater flow in February of wet, above normal and below normal water years, and 14%
35 greater flow in October of critical water years. Flows under H4_ELT in the Trinity River would
36 generally be similar to flows under Existing Conditions throughout the year, but would range from
37 10% to 29% higher during December through March of wet years, would be 22% higher in February
38 of above normal years, would be 16% lower in January of below normal years, and would be 10%
39 lower in July of wet years. Flows under H4_ELT in Clear Creek would generally be similar to flows
40 under Existing Conditions throughout the year, but would be 40% and 13% greater in January and
41 February, respectively, of wet years, would be 10% higher in December through April of critical
42 water years, 11% higher in October of critical years, 13% higher in March of below normal years.
43 Flows under H4_ELT in the San Joaquin River at Vernalis would generally be similar to or slightly
44 lower than those under Existing Conditions during January, April, May and September through

1 November, would be similar to or up to 23% lower than flows under Existing Conditions during
2 February, March, and June through August, and would be similar to or 12% higher (wet years) in
3 December. Flows under H4_ELT in the Stanislaus River at the confluence with the San Joaquin River
4 would generally be similar to or up to 29% lower than to those under Existing Conditions during
5 January through July, except for 17% and 11% greater flow during February and June, respectively,
6 of wet years, and would be similar to or slightly lower than flows under Existing Conditions during
7 August through December.

8 Water temperatures in the Feather River below Thermalito Afterbay would not exceed the 86°F
9 water temperature threshold for adult largemouth bass under H4_ELT or Existing Conditions. As a
10 result, there would be no difference between H4_ELT and Existing Conditions in the percentage of
11 months in which the 86°F water temperature threshold is exceeded (Table 11-4A-153).

12 *Summary of CEQA Conclusion*

13 Collectively, flows would be lower under Alternative 4A during the adult largemouth bass residency
14 period relative to Existing Conditions. Flows would be persistently and moderately to substantially
15 lower in several rivers during substantial portions of the period. Therefore, these modeling results
16 indicate that the difference between Existing Conditions and Alternative 4A could be significant
17 because the alternative could substantially reduce the quantity and quality of habitat for adults as a
18 result of flow reductions.

19 As discussed in Section 11.3.3, because of differences between the CEQA and NEPA baselines, it is
20 sometimes possible for CEQA and NEPA significance conclusions to vary between one another under
21 the same impact discussion. The baseline for the CEQA analysis is Existing Conditions at the time the
22 NOP was prepared. Both the action alternative and the NEPA baseline (NAA_ELT) models
23 anticipated future conditions that would occur at 2025 (ELT implementation period), including the
24 projected effects of climate change (precipitation patterns), sea level rise and future water demands,
25 as well as implementation of required actions under the 2008 USFWS BiOp and the 2009 NMFS
26 BiOp. Because the action alternative modeling does not partition the effects of implementation of the
27 alternative from the effects of sea level rise, climate change, and future water demands, the
28 comparison to Existing Conditions may not offer a clear understanding of the impact of the
29 alternative on the environment. The comparison to the NAA_ELT is a better approach because it
30 isolates the effect of the alternative from those of sea level rise, climate change, and future water
31 demands.

32 When compared to NAA_ELT and informed by the NEPA analysis above, flows and water
33 temperatures in all rivers would generally be similar between NAA_ELT and Alternative 4A. These
34 modeling results represent the increment of change attributable to the alternative, demonstrating
35 the general similarities in flows and water temperature under Alternative 4A and the NAA_ELT, and
36 addressing the limitations of the CEQA baseline (Existing Conditions). Therefore, this impact is
37 found to be less than significant and no mitigation is required.

38 *Sacramento Tule Perch*

39 In general, Alternative 4A would not affect the quality and quantity of upstream habitat conditions
40 for Sacramento tule perch relative to the NAA_ELT.

1 H3_ELT/ESO_ELT

2 Flows

3 Flow rates in the Sacramento, Trinity, Feather, American, San Joaquin, and Stanislaus Rivers and in
4 Clear Creek were examined during year-round juvenile and adult Sacramento tule perch occurrence
5 period. Lower flows could reduce the quantity and quality of instream habitat available for rearing.

6 In the Sacramento River upstream of Red Bluff, flows under H3_ELT would generally be similar to or
7 greater than flows under NAA_ELT throughout the year with some exceptions (up to 14% lower),
8 and would be lower in all water year types during November (up to 18% lower) (Appendix 11C,
9 *CALSIM II Model Results utilized in the Fish Analysis*). Flow reductions in drier water years, when
10 effects on habitat conditions would be more critical, would be inconsistent and/or of small
11 magnitude for all months during the rearing period and, therefore, would not have biologically
12 meaningful negative effects.

13 In the Trinity River below Lewiston Reservoir, flows under H3_ELT would generally be similar to or
14 greater than flows under NAA_ELT during the period, except in above normal years in April and
15 October (17% and 8% lower, respectively), and in wet years during November (10% lower)
16 (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

17 In Clear Creek at Whiskeytown Dam, flows under H3_ELT would be similar to flows under NAA_ELT
18 throughout the year, except in critical years during July (14% lower), August (11% greater),
19 September (10% lower), and October (7% lower) (Appendix 11C, *CALSIM II Model Results utilized in*
20 *the Fish Analysis*).

21 In the Feather River at Thermalito Afterbay, flows under H3_ELT would generally be lower than
22 flows under NAA during January and July through September, except in critical years in August and
23 September (23% and 25% greater, respectively); would generally be similar to or greater than flows
24 under NAA_ELT during February through June, except for below normal years during February and
25 March (11% and 13% lower, respectively) and in critical years during May and June (10% and 8%
26 lower, respectively); and would generally be similar to or greater than flows under NAA_ELT during
27 November and December, except in wet years during December (5% lower) (Appendix 11C, *CALSIM*
28 *II Model Results utilized in the Fish Analysis*). Flows would be more persistently lower under H3_ELT
29 relative to NAA_ELT (up to 48% lower) during July, August, and in all water year types except
30 critical years during September (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).
31 Flow reductions would be partially offset by increases in flow in the adjoining months. In the
32 American River at Nimbus Dam, flows under H3_ELT would be similar to or greater than flows
33 under NAA_ELT during January through July and December, except in below normal and critical
34 years during October (11% lower), and would be similar to or lower than flows under NAA_ELT (up
35 to 22% lower) during August through November, except in below normal and critical years during
36 October (16% and 22% greater, respectively) (Appendix 11C, *CALSIM II Model Results utilized in the*
37 *Fish Analysis*).

38 Flow reductions would be offset by increases in some months and/or not persistent within a single
39 water year type. Effects would not be biologically meaningful.

40 In the San Joaquin River at Vernalis, flows under H3_ELT would be similar to those under NAA_ELT
41 throughout the year, regardless of water year type.

1 In the Stanislaus River at the confluence with the San Joaquin River flows under H3_ELT would be
2 similar to those under NAA_ELT throughout the year, regardless of water year type.

3 The analysis for Alternative 4A indicates that there would be no biologically meaningful differences
4 in flows between H3 and NAA_ELT because flows would not be reduced enough or frequently
5 enough to affect habitat conditions.

6 *Water Temperature*

7 The percentage of months exceeding water temperature thresholds of 72°F and 75°F for the year-
8 round juvenile and adult Sacramento tule perch occurrence period was examined in the Sacramento,
9 Trinity, Feather, American, and Stanislaus Rivers. Water temperatures exceeding these thresholds
10 could lead to reduced rearing habitat quantity and quality and increased stress and mortality. Water
11 temperatures were not modeled in the San Joaquin River or Clear Creek.

12 Water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under H3_ELT
13 would generally be the same as those under NAA_ELT. Therefore, there would be no temperature
14 related effects of H3_ELT in these rivers during any month. In the Feather River below Thermalito
15 Afterbay, the percentage of years under H3_ELT exceeding the 72°F threshold would be higher than
16 the percentage under NAA_ELT by up to 164% depending on water year type (Table 11-4A-154).
17 Although relative differences are large due to small values in the divisor, the absolute differences in
18 percent exceedance are **negligible** ($\leq 2\%$) and, therefore, do not represent biologically meaningful
19 effects to Sacramento tule perch.

20 The percentage of months under H3_ELT exceeding the 75°F threshold would be similar to or up to
21 29% lower than the percentage under NAA_ELT (Table 11-4A-154). As with the 72°F threshold,
22 although relative differences are large due to small values in the divisor, the absolute differences in
23 percent exceedance are **negligible** ($\leq 1\%$) and, therefore, do not represent biologically meaningful
24 effects to Sacramento tule perch.

25 Table 11-4A-154. Difference and Percent Difference in the Percentage of Months Year-Round in
26 Which Water Temperatures in the Feather River below Thermalito Afterbay Exceed 72°F and 75°F
27 Water Temperature Thresholds for Sacramento Tule Perch Occurrence^a

Water Year Type	EXISTING CONDITIONS vs. H3_ELT	NAA vs. H3_ELT
72°F Threshold		
Wet	1 (59%)	2 (84%)
Above Normal	0 (NA)	0 (NA)
Below Normal	2 (NA)	2 (NA)
Dry	4 (NA)	2 (164%)
Critical	5 (114%)	1 (18%)
All	2 (185%)	2 (76%)
75°F Threshold		
Wet	0 (NA)	0 (0%)
Above Normal	0 (NA)	0 (NA)
Below Normal	0 (NA)	0 (NA)
Dry	0 (NA)	0 (NA)
Critical	3 (400%)	-1 (-29%)
All	1 (500%)	0 (-25%)

NA = could not be calculated because the denominator was 0.

^a A negative value indicates a benefit (reduction in percentage of months outside suitable range) of the alternative.

1 *H4_ELT/HOS_ELT*

2 Flows under H4_ELT in the Sacramento River upstream of Red Bluff during the year-round juvenile
3 and adult Sacramento tule perch occurrence period would generally be similar to flows under
4 NAA_ELT, except for 10% lower flow during September of below normal water years and except
5 during November of all water year types, when flows would be up to 15% lower (Appendix 11C,
6 *CALSIM II Model Results utilized in the Fish Analysis*).

7 Flows under H4_ELT in the Feather River at Thermalito Afterbay would generally be up to 548%
8 greater than flows under NAA_ELT during April through June, except for 12% and 10% lower flows
9 during June of wet and critical water years, respectively. The Feather River flows under H4_ELT
10 would generally be similar to or up to 60% lower than flows under NAA_ELT during July through
11 November, except in August through November of critical water years, when flows under NAA_ELT
12 would range from 11% to 52% higher, and the flows would generally be similar to or up to 40%
13 higher under NAA_ELT during December through March.

14 Flows under H4_ELT in the American River below Nimbus Dam would generally be similar to flows
15 under NAA_ELT throughout the year, except for 14% lower flow in May of critical water years, 28%
16 lower flow in August of critical years, 20% lower flows in September of below normal years, 18%
17 greater flow in August of below normal years, and 15% and 21% greater flows in October of below
18 normal and critical water years, respectively.

19 Flows under H4_ELT in the Trinity River below Lewiston would generally be similar to flows under
20 NAA_ELT throughout the year, except for 10% higher flow during February of wet years, 17% lower
21 flow during April of above normal water years, 16% greater flow during September of critical years,
22 and 11% greater flow during October of above normal water years.

23 Flows under H4_ELT in Clear Creek below Whiskeytown would generally be similar to flows under
24 NAA_ELT throughout the year, except for 12% higher flow in March of below normal water years,
25 and 14% lower flow and 11% higher flow during July and August, respectively, of critical water
26 years.

27 Flows under H4_ELT in the San Joaquin and Stanislaus Rivers would be similar to flows under
28 NAA_ELT throughout the year.

29 The percentage of months under H4_ELT exceeding the 72°F and 75°F water temperature
30 thresholds in the Feather River below Thermalito Afterbay during the year-round juvenile and adult
31 Sacramento tule perch occurrence period would generally be higher than the percentage under
32 **NAA_ELT, but absolute differences would be small ($\leq 4\%$) and, therefore, would not represent a**
33 **biologically meaningful effect to Sacramento tule perch (Table 11-4A-155).**

1 Table 11-4A-155. Difference and Percent Difference between the Baseline Scenarios and H4_ELT in
2 the Percentage of Months Year-Round in Which Water Temperatures in the Feather River below
3 Thermalito Afterbay Exceed 72°F and 75°F Water Temperature Thresholds for Sacramento Tule
4 Perch Occurrence^a

Water Year Type	EXISTING CONDITIONS vs. H4_ELT	NAA_ELT vs. H4_ELT
72°F Threshold		
Wet	3 (145%)	4 (184%)
Above Normal	2 (NA)	2 (NA)
Below Normal	2 (NA)	2 (NA)
Dry	5 (NA)	3 (229%)
Critical	7 (164%)	4 (46%)
All	4 (292%)	3 (143%)
75°F Threshold		
Wet	1 (NA)	1 (233%)
Above Normal	0 (NA)	0 (NA)
Below Normal	0 (NA)	0 (NA)
Dry	1 (NA)	1 (NA)
Critical	2 (300%)	-2 (-43%)
All	1 (700%)	0 (0%)

NA = could not be calculated because the denominator was 0.

^a A negative value indicates a reduction in percentage of months outside suitable range under H4_ELT.

5
6 *NEPA Effects:* Collectively, these modeling results indicate that the effect would not be adverse
7 because Alternative 4A would not cause a substantial reduction in the quantity or quality of
8 Sacramento tule perch habitat. Flows in all rivers examined during the year under Alternative 4A
9 are generally similar to or greater than flows under the NAA_ELT in most months. Flows in July or
10 August through November are more likely to be lower for some water year types in some of the
11 locations analyzed, however they are generally of small magnitude, not consistent from month to
12 month within a specific water year type, and/or would be offset by increases in flow in the adjoining
13 months. Therefore, the flow reductions are not expected to have biologically meaningful negative
14 effects on the Sacramento tule perch population. There would be no substantial differences in water
15 temperature between Alternative 4A and NAA_ELT in any river examined that would cause a
16 biologically meaningful effect to Sacramento tule perch.

17 *CEQA Conclusion:* In general, Alternative 4A would not affect the quality and quantity of upstream
18 habitat conditions for Sacramento tule perch relative to Existing Conditions.

19 *H3_ELT/ESO_ELT*

20 *Flows*

21 Flow rates in the Sacramento, Trinity, Feather, American, San Joaquin, and Stanislaus Rivers and in
22 Clear Creek were examined during year-round juvenile and adult Sacramento tule perch occurrence
23 period. Lower flows could reduce the quantity and quality of instream habitat available for tule
24 perch.

1 In the Sacramento River upstream of Red Bluff, flows under H3_ELT would generally be similar to or
2 greater than flows under Existing Conditions during January through April and December, except in
3 drier years during January (to 13% lower), in dry and critical years during February (8% and 6%
4 lower, respectively), in critical years during March (8% lower), in above normal years in April (5%
5 lower), and in dry and critical years during December (8% and 5% lower, respectively) (Appendix
6 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flows would generally be similar to or
7 lower than flows under Existing Conditions during May through November (to 46% lower), except
8 in critical years during May (13% greater), in below normal and dry years during June (8% and 25%
9 greater, respectively), and in below normal and critical years during October (10% and 15% greater,
10 respectively) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). There would be
11 primarily small flow reductions in some water year types for some months, but not persistent
12 enough and of a magnitude that would not be expected to have biologically meaningful negative
13 effects.

14 In the Trinity River below Lewiston Reservoir, flows under H3_ELT would generally be similar to or
15 greater than flows under Existing Conditions during January through June and December, except in
16 below normal years during January (16% lower), in below normal years during March (6% lower),
17 and in critical years during May (6% lower), but would generally be similar to or lower than flows
18 under Existing Conditions during July through November, except in below normal years during July
19 (5% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). The persistent,
20 small to moderate flow reductions would have a localized effect on habitat conditions in that water
21 year type.

22 In Clear Creek at Whiskeytown Dam, flows under H3_ELT would be similar to or greater than flows
23 under Existing Conditions throughout the year, except in critical years during September and in
24 below normal years during October (19% and 6% lower, respectively) (Appendix 11C, *CALSIM II*
25 *Model Results utilized in the Fish Analysis*). This flow reduction is a relatively isolated effect limited to
26 a single water year type in each month and would not be expected to have biologically meaningful
27 negative effects.

28 In the Feather River at Thermalito Afterbay, flows under H3_ELT would be greater than flows under
29 Existing Conditions during February through June, September, and October, except in drier years
30 during February (to 48% lower), in below normal and dry years during March (39% and 17% lower,
31 respectively), in below normal years during April (6% lower), in wet years during May (15% lower),
32 in below normal and critical years during September (26% and 50% lower, respectively), and in wet
33 and critical years during October (6% and 7% lower, respectively) (Appendix 11C, *CALSIM II Model*
34 *Results utilized in the Fish Analysis*). Flows under H3_ELT would generally be moderately to
35 substantially lower than flows under Existing Conditions in January, July, August, November, and
36 December, except in wet and above normal years during July (15% and 9% greater, respectively), in
37 below normal and dry years during August (7% and 45% greater, respectively), in above normal
38 years during November (5% greater), and in above normal years during December (18% greater)
39 (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

40 In the American River at Nimbus Dam, flows under H3_ELT would generally be similar to or greater
41 than flows under Existing Conditions in wetter years during January, in wet and below normal years
42 during December, and in most water year types during February through April, except in dry and
43 critical years during February (8% and 6% lower, respectively), in critical years during March (7%
44 lower), and in above normal years during April (5% lower) (Appendix 11C, *CALSIM II Model Results*
45 *utilized in the Fish Analysis*). Flows under H3_ELT would generally be similar to or lower than flows

1 under Existing Conditions during May through November, except in critical years during May (13%
2 greater), in below normal and dry years during June (8% and 25% greater, respectively), and in
3 below normal and critical years during October (10% and 15% greater, respectively). There would
4 be persistent small to substantial flow reductions that would affect habitat conditions at this
5 location.

6 In the San Joaquin River at Vernalis, flows under H3_ELT would generally be similar to or slightly
7 lower than those under Existing Conditions during April, May and September through November,
8 would be similar to or up to 23% lower than flows under Existing Conditions during February,
9 March, and June through August, and would be similar to or up to 11% greater than flows under
10 Existing Conditions during December and January.

11 In the Stanislaus River at the confluence with the San Joaquin River, flows under H3_ELT would
12 generally be similar to or up to 29% lower than to those under Existing Conditions during January
13 through July, except for 17% and 11% greater flow in wet years during February and June,
14 respectively, and would be similar to or slightly lower than flows under Existing Conditions during
15 August through December.

16 *Water Temperature*

17 The percentage of months exceeding water temperatures of 72°F and 75°F for the year-round
18 juvenile and adult Sacramento tule perch occurrence period was examined in the Sacramento,
19 Trinity, Feather, American, and Stanislaus Rivers. Water temperatures exceeding these thresholds
20 could lead to reduced habitat quality and increased stress and mortality. Water temperatures were
21 not modeled in Clear Creek or the San Joaquin River.

22 Water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under H3_ELT
23 would generally be the same as those under Existing Conditions. Therefore, there would be no
24 temperature related effects of H3_ELT in these rivers during any month. In the Feather River below
25 Thermalito Afterbay, the percentage of months under H3_ELT exceeding 72°F relative to the
26 percentage under Existing Conditions would be similar to or greater, by up to 114% (Table 11-4A-
27 154). However, these relative increases correspond to small absolute increases ($\leq 5\%$) that are not
28 expected to have biologically meaningful effects.

29 The percentage of years under H3_ELT exceeding 75°F would be similar to the percentage under
30 Existing Conditions in all water years except critical years (400% higher) (Table 11-4A-154). As
31 with the 72°F threshold, this increase corresponds to a small absolute increase (3%) that is not
32 expected to have biologically meaningful negative effects.

33 *H4_ELT/HOS_ELT*

34 Flows under H4_ELT in the Sacramento River upstream of Red Bluff during the year-round juvenile
35 and adult Sacramento tule perch occurrence period would generally be similar to or up to 18%
36 lower than flows under Existing Conditions throughout the year, except during September, when
37 flows would be for 27% and 49% in wet and above normal, respectively (Appendix 11C, *CALSIM II*
38 *Model Results utilized in the Fish Analysis*). Differences in flows between H4_ELT and Existing
39 Conditions in the Feather River at Thermalito Afterbay would be highly variable, with flows under
40 H4_ELT up to 509% greater than those under Existing Conditions during April through June and
41 September, except for 37% and 6% lower flows during June of wet and critical water years,
42 respectively, and 49% and 47% lower flows during September of below normal and dry years,

1 respectively. The Feather River flows under H4_ELT would generally be similar to or up to 54%
2 lower than flows under Existing Conditions during July, August, and October through March, except
3 in August through November of critical water years, when flows under H4_ELT would range up to
4 55% higher. Flows under H4_ELT in the American River at Nimbus Dam would generally be similar
5 to or up to 38% lower than flows under Existing Conditions throughout the year, except for 15%
6 greater flow in January of wet years, 12% to 14% greater flow in February of wet, above normal and
7 below normal water years, and 14% greater flow in October of critical water years. Flows under
8 H4_ELT in the Trinity River would generally be similar to flows under Existing Conditions
9 throughout the year, but would range from 10% to 29% higher during December through March of
10 wet years, would be 22% higher in February of above normal years, would be 16% lower in January
11 of below normal years, and would be 10% lower in July of wet years. Flows under H4_ELT in Clear
12 Creek would generally be similar to flows under Existing Conditions throughout the year, but would
13 be 40% and 13% greater in January and February, respectively, of wet years, would be 10% higher
14 in December through April of critical water years, 11% higher in October of critical years, 13%
15 higher in March of below normal years. Flows under H4_ELT in the San Joaquin River at Vernalis
16 would generally be similar to or slightly lower than those under Existing Conditions during January,
17 April, May and September through November, would be similar to or up to 23% lower than flows
18 under Existing Conditions during February, March, and June through August, and would be similar
19 to or 12% higher (wet years) in December. Flows under H4_ELT in the Stanislaus River at the
20 confluence with the San Joaquin River would generally be similar to or up to 29% lower than to
21 those under Existing Conditions during January through July, except for 17% and 11% greater flow
22 during February and June, respectively, of wet years, and would be similar to or slightly lower than
23 flows under Existing Conditions during August through December.

24 The percentage of months under H4_ELT exceeding the 72°F and 75°F water temperature
25 thresholds in the Feather River below Thermalito Afterbay during the year-round juvenile and adult
26 Sacramento tule perch occurrence period would generally be similar to those under Existing
27 Conditions, except in wet and critical years for the 72°F threshold and in critical years for the 75°F
28 threshold. Although these relative differences would be large, the absolute differences would be
29 **small** ($\leq 7\%$) and, therefore, would not have a biologically meaningful effect on the quantity or
30 quality of habitat for Sacramento tule perch (Table 11-4A-155).

31 *Summary of CEQA Conclusion*

32 Collectively, flows would be lower under Alternative 4A during the juvenile and adult Sacramento
33 tule perch occurrence period relative to Existing Conditions. Flows would be persistently and
34 moderately to substantially lower in several rivers during substantial portions of the period.
35 Therefore, these modeling results indicate that the difference between Existing Conditions and
36 Alternative 4A could be significant because the alternative could substantially reduce suitable
37 rearing habitat as a result of flow reductions.

38 As discussed in Section 11.3.3, because of differences between the CEQA and NEPA baselines, it is
39 sometimes possible for CEQA and NEPA significance conclusions to vary between one another under
40 the same impact discussion. The baseline for the CEQA analysis is Existing Conditions at the time the
41 NOP was prepared. Both the action alternative and the NEPA baseline (NAA_ELT) models
42 anticipated future conditions that would occur at 2025 (ELT implementation period), including the
43 projected effects of climate change (precipitation patterns), sea level rise and future water demands,
44 as well as implementation of required actions under the 2008 USFWS BiOp and the 2009 NMFS
45 BiOp. Because the action alternative modeling does not partition the effects of implementation of the

1 alternative from the effects of sea level rise, climate change, and future water demands, the
2 comparison to Existing Conditions may not offer a clear understanding of the impact of the
3 alternative on the environment. The comparison to the NAA_ELT is a better approach because it
4 isolates the effect of the alternative from those of sea level rise, climate change, and future water
5 demands.

6 When compared to NAA_ELT and informed by the NEPA analysis above, flows and water
7 temperatures in all rivers would generally be similar between NAA_ELT and Alternative 4A. These
8 modeling results represent the increment of change attributable to the alternative, demonstrating
9 the general similarities in flows and water temperature under Alternative 4A and the NAA_ELT, and
10 addressing the limitations of the CEQA baseline (Existing Conditions). Therefore, this impact is
11 found to be less than significant and no mitigation is required.

12 *Sacramento-San Joaquin Roach*

13 In general, Alternative 4A would not affect the quality and quantity of upstream habitat conditions
14 for Sacramento-San Joaquin roach relative to the NAA_ELT.

15 *Flows*

16 Flow rates in the Sacramento, Trinity, Feather, American, San Joaquin, and Stanislaus Rivers and in
17 Clear Creek were examined during the year-round juvenile and adult Sacramento-San Joaquin roach
18 occurrence period. Lower flows could reduce the quantity and quality of instream habitat for
19 juvenile and adult Sacramento-San Joaquin roach.

20 In the Sacramento River upstream of Red Bluff, flows under H3_ELT would generally be similar to or
21 greater than flows under NAA_ELT throughout the year with some exceptions (up to 14% lower),
22 and would be lower in all water year types during November (up to 18% lower) (Appendix 11C,
23 *CALSIM II Model Results utilized in the Fish Analysis*). Flow reductions in drier water years, when
24 effects on habitat conditions would be more critical, would be inconsistent and/or of small
25 magnitude for all months during the rearing period and, therefore, would not have biologically
26 meaningful negative effects.

27 In the Trinity River below Lewiston Reservoir, flows under H3_ELT would generally be similar to or
28 greater than flows under NAA_ELT during the period, except in above normal years in April and
29 October (17% and 8% lower, respectively), and in wet years during November (10%
30 lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

31 In Clear Creek at Whiskeytown Dam, flows under H3_ELT would be similar to flows under NAA_ELT
32 throughout the year, except in critical years during July (14% lower), August (11% greater),
33 September (10% lower), and October (7% lower) (Appendix 11C, *CALSIM II Model Results utilized in*
34 *the Fish Analysis*).

35 In the Feather River at Thermalito Afterbay, flows under H3_ELT would generally be lower than
36 flows under NAA_ELT during January and July through September, except in critical years in August
37 and September (23% and 25% greater, respectively); would generally be similar to or greater than
38 flows under NAA_ELT during February through June, except for below normal years during
39 February and March (11% and 13% lower, respectively) and in critical years during May and June
40 (10% and 8% lower, respectively); and would generally be similar to or greater than flows under
41 NAA_ELT during November and December, except in wet years during December (5% lower)
42 (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flows would be more

1 persistently lower under H3_ELT relative to NAA_ELT (up to 48% lower) during July, August, and in
2 all water year types except critical years during September. Flow reductions would be partially
3 offset by increases in flow in the adjoining months.

4 In the American River at Nimbus Dam, flows under H3_ELT would be similar to or greater than flows
5 under NAA_ELT during January through July and December, except in below normal and critical
6 years during October (11% lower), and would be similar to or lower than flows under NAA_ELT (up
7 to 22% lower) during August through November, except in below normal and critical years during
8 October (16% and 22% greater, respectively) (Appendix 11C, *CALSIM II Model Results utilized in the*
9 *Fish Analysis*). Flow reductions would be offset by increases in some months and/or not persistent
10 within a single water year type. Effects would not be biologically meaningful.

11 In the San Joaquin River at Vernalis, flows under H3_ELT would be similar to those under NAA_ELT
12 throughout the year, regardless of water year type.

13 In the Stanislaus River at the confluence with the San Joaquin River flows under H3_ELT would be
14 similar to those under NAA_ELT throughout the year, regardless of water year type.

15 *Water Temperature*

16 The percentage of months above the 86°F water temperature threshold for year-round juvenile and
17 adult Sacramento-San Joaquin roach occurrence period was examined in the Sacramento, Trinity,
18 Feather, American, and Stanislaus Rivers. Elevated water temperatures could lead to reduced
19 rearing habitat quality and increased stress and mortality. Water temperatures were not modeled in
20 the San Joaquin River or Clear Creek.

21 Water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under H3_ELT
22 would generally be the same as those under NAA_ELT. Therefore, there would be no temperature
23 related effects of H3_ELT in these rivers during any month.

24 In the Feather River below Thermalito Afterbay, water temperatures would not exceed 86°F under
25 NAA_ELT or H3_ELT (Table 11-4A-156). As a result, there would be no difference in the percentage
26 of months in which the 86°F water temperature threshold is exceeded between NAA_ELT and
27 H3_ELT.

28 Table 11-4A-156. Difference and Percent Difference in the Percentage of Months Year-Round in
29 Which Water Temperatures in the Feather River below Thermalito Afterbay Exceed the 86°F
30 Water Temperature Threshold for Sacramento-San Joaquin Roach Survival^a

Water Year Type	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
Wet	0 (NA)	0 (NA)
Above Normal	0 (NA)	0 (NA)
Below Normal	0 (NA)	0 (NA)
Dry	0 (NA)	0 (NA)
Critical	0 (NA)	0 (NA)
All	0 (NA)	0 (NA)

NA = could not be calculated because the denominator was 0.

^a A negative value indicates a benefit (reduction in percentage of months outside suitable range) of the alternative.

31

H4_ELT/HOS_ELT

Flows under H4_ELT in the Sacramento River upstream of Red Bluff during the year-round Sacramento-San Joaquin roach occurrence period would generally be similar to flows under NAA_ELT, except for 10% lower flow during September of below normal water years and except during November of all water year types, when flows would be up to 15% lower (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flows under H4_ELT in the Feather River at Thermalito Afterbay would generally be up to 548% greater than flows under NAA_ELT during April through June, except for 12% and 10% lower flows during June of wet and critical water years, respectively. The Feather River flows under H4_ELT would generally be similar to or up to 60% lower than flows under NAA_ELT during July through November, except in August through November of critical water years, when flows under NAA_ELT would range from 11% to 52% higher, and the flows would generally be similar to or up to 40% higher under NAA_ELT during December through March. Flows under H4_ELT in the American River below Nimbus Dam would generally be similar to flows under NAA_ELT throughout the year, except for 14% lower flow in May of critical water years, 28% lower flow in August of critical years, 20% lower flows in September of below normal years, 18% greater flow in August of below normal years, and 15% and 21% greater flows in October of below normal and critical water years, respectively. Flows under H4_ELT in the Trinity River below Lewiston would generally be similar to flows under NAA_ELT throughout the year, except for 10% higher flow during February of wet years, 17% lower flow during April of above normal water years, 16% greater flow during September of critical years, and 11% greater flow during October of above normal water years. Flows under H4_ELT in Clear Creek below Whiskeytown would generally be similar to flows under NAA_ELT throughout the year, except for 12% higher flow in March of below normal water years, and 14% lower flow and 11% higher flow during July and August, respectively, of critical water years. Flows under H4_ELT in the San Joaquin and Stanislaus Rivers would be similar to flows under NAA_ELT throughout the year.

Water temperatures in the Feather River below Thermalito Afterbay during the year-round Sacramento-San Joaquin roach occurrence period would not exceed the 86°F water temperature threshold in H4_ELT or NAA_ELT. As a result, there would be no difference between H4_ELT and NAA_ELT in the percentage of months in which the 86°F water temperature threshold is exceeded (Table 11-4A-157).

Table 11-4A-157. Difference and Percent Difference between the Baseline Scenarios and H4_ELT in the Percentage of Months Year-Round in Which Water Temperatures in the Feather River below Thermalito Afterbay Exceed the 86°F Water Temperature Threshold for Sacramento-San Joaquin Roach Survival^a

Water Year Type	EXISTING CONDITIONS vs. H4_ELT	NAA_ELT vs. H4_ELT
Wet	0 (NA)	0 (NA)
Above Normal	0 (NA)	0 (NA)
Below Normal	0 (NA)	0 (NA)
Dry	0 (NA)	0 (NA)
Critical	0 (NA)	0 (NA)
All	0 (NA)	0 (NA)

NA = could not be calculated because the denominator was 0.

^a A negative value indicates a reduction in percentage of months outside suitable range for H4_ELT.

1 *NEPA Effects:* Collectively, these modeling results indicate that the effect would not be adverse
2 because Alternative 4A would not cause a substantial reduction in quantity and quality of habitat for
3 juvenile and adult Sacramento-San Joaquin roach rearing habitat. Flows in all rivers examined
4 during the year under Alternative 4A are generally similar to or greater than flows under the
5 NAA_ELT in most months. Flows in July or August through November are more likely to be lower for
6 some water year types in some of the locations analyzed, however they are generally of small
7 magnitude, not consistent from month to month within a specific water year type, and/or would be
8 offset by increases in flow in the adjoining months. Therefore, the flow reductions are not expected
9 to have biologically meaningful negative effects on the Sacramento-San Joaquin roach population.
10 Flow-related habitat conditions for roach under H4_ELT would be less favorable than those under
11 H3_ELT although not different from NAA_ELT. There are no temperature-related effects in any other
12 rivers examined.

13 *CEQA Conclusion:* In general, Alternative 4A would not affect the quality and quantity of upstream
14 habitat conditions for Sacramento-San Joaquin roach relative to Existing Conditions.

15 *Flows*

16 Flow rates in the Sacramento, Trinity, Feather, American, San Joaquin, and Stanislaus Rivers and in
17 Clear Creek were examined during the year-round juvenile and adult Sacramento-San Joaquin roach
18 occurrence period. Lower flows could reduce the quantity and quality of instream habitat for
19 juvenile and adult Sacramento-San Joaquin roach.

20 In the Sacramento River upstream of Red Bluff, flows under H4_ELT would generally be similar to or
21 greater than flows under Existing Conditions during January through April and December, except in
22 drier years during January (to 13% lower), in dry and critical years during February (8% and 6%
23 lower, respectively), in critical years during March (8% lower), in above normal years in April (5%
24 lower), and in dry and critical years during December (8% and 5% lower, respectively) (Appendix
25 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flows would generally be similar to or
26 lower than flows under Existing Conditions during May through November (to 46% lower), except
27 in critical years during May (13% greater), in below normal and dry years during June (8% and 25%
28 greater, respectively), and in below normal and critical years during October (10% and 15% greater,
29 respectively). There would be primarily small flow reductions in some drier water year types for
30 some months, but not persistent enough and of a magnitude that would not be expected to have
31 biologically meaningful negative effects.

32 In the Trinity River below Lewiston Reservoir, flows under H3_ELT would generally be similar to or
33 greater than flows under Existing Conditions during January through June and December, except in
34 below normal years during January (16% lower), in below normal years during March (6% lower),
35 and in critical years during May (6% lower), but would generally be similar to or lower than flows
36 under Existing Conditions during July through November, except in below normal years during July
37 (5% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). The persistent,
38 small to moderate flow reductions in critical years would have a localized effect on habitat
39 conditions in that water year type.

40 In Clear Creek at Whiskeytown Dam, flows under H3_ELT would be similar to or greater than flows
41 under Existing Conditions throughout the year, except in critical years during September and in
42 below normal years during October (19% and 6% lower, respectively) (Appendix 11C, *CALSIM II*
43 *Model Results utilized in the Fish Analysis*). This flow reduction is a relatively isolated effect limited to

1 a single water year type in each month and would not be expected to have biologically meaningful
2 negative effects.

3 In the Feather River at Thermalito Afterbay, flows under H3_ELT would be greater than flows under
4 Existing Conditions during February through June, September, and October, except in drier years
5 during February (to 48% lower), in below normal and dry years during March (39% and 17% lower,
6 respectively), in below normal years during April (6% lower), in wet years during May (15% lower),
7 in below normal and critical years during September (26% and 50% lower, respectively), and in wet
8 and critical years during October (6% and 7% lower, respectively) (Appendix 11C, *CALSIM II Model
9 Results utilized in the Fish Analysis*). Flows under H3_ELT would generally be moderately to
10 substantially lower than flows under Existing Conditions in January, July, August, November, and
11 December, except in wet and above normal years during July (15% and 9% greater, respectively), in
12 below normal and dry years during August (7% and 45% greater, respectively), in above normal
13 years during November (5% greater), and in above normal years during December (18% greater).

14 In the American River at Nimbus Dam, flows under H3_ELT would generally be similar to or greater
15 than flows under Existing Conditions in wetter years during January, in wet and below normal years
16 during December, and in most water year types during February through April, except in dry and
17 critical years during February (8% and 6% lower, respectively), in critical years during March (7%
18 lower), and in above normal years during April (5% lower) (Appendix 11C, *CALSIM II Model Results
19 utilized in the Fish Analysis*). Flows under H3_ELT would generally be similar to or lower than flows
20 under Existing Conditions during May through November, except in critical years during May (13%
21 greater), in below normal and dry years during June (8% and 25% greater, respectively), and in
22 below normal and critical years during October (10% and 15% greater, respectively). There would
23 be moderate flow reductions in drier water year types, when effects would be most critical for
24 habitat conditions, for some months/water year types from May through November that would
25 affect rearing conditions at this location. There would be persistent small to substantial flow
26 reductions that would affect habitat conditions at this location.

27 In the San Joaquin River at Vernalis, flows under H3_ELT would generally be similar to or slightly
28 lower than those under Existing Conditions during April, May and September through November,
29 would be similar to or up to 23% lower than flows under Existing Conditions during February,
30 March, and June through August, and would be similar to or up to 11% greater than flows under
31 Existing Conditions during December and January.

32 In the Stanislaus River at the confluence with the San Joaquin River, flows under H3_ELT would
33 generally be similar to or up to 29% lower than to those under Existing Conditions during January
34 through July, except for 17% and 11% greater flow in wet years during February and June,
35 respectively, and would be similar to or slightly lower than flows under Existing Conditions during
36 August through December.

37 *Water Temperature*

38 The percentage of months above the 86°F water temperature threshold for year-round juvenile and
39 adult Sacramento-San Joaquin roach occurrence period was examined in the Sacramento, Trinity,
40 Feather, American, and Stanislaus Rivers. Elevated water temperatures could lead to reduced
41 quantity and quality of habitat and increased stress and mortality for juvenile and adult
42 Sacramento-San Joaquin roach. Water temperatures were not modeled in the San Joaquin River or
43 Clear Creek.

1 Water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under H3_ELT
2 would generally be the same as those under NAA_ELT. Therefore, there would be no temperature
3 related effects of H3_ELT in these rivers during any month.

4 In the Feather River below Thermalito Afterbay, water temperatures would not exceed the 86°F
5 water temperature threshold for Sacramento-San Joaquin roach under Existing Conditions or
6 H3_ELT (Table 11-4A-156). As a result, there would be no difference in the percentage of months in
7 which the 86°F water temperature threshold is exceeded between H3_ELT and Existing Conditions.

8 *H4_ELT/HOS_ELT*

9 Flows under H4_ELT in the Sacramento River upstream of Red Bluff during the year-round juvenile
10 and adult Sacramento-San Joaquin roach occurrence period would generally be similar to or up to
11 18% lower than flows under Existing Conditions throughout the year, except during September,
12 when flows would be for 27% and 49% in wet and above normal, respectively (Appendix 11C,
13 *CALSIM II Model Results utilized in the Fish Analysis*). Differences in flows between H4_ELT and
14 Existing Conditions in the Feather River at Thermalito Afterbay would be highly variable, with flows
15 under H4_ELT up to 509% greater than those under Existing Conditions during April through June
16 and September, except for 37% and 6% lower flows during June of wet and critical water years,
17 respectively, and 49% and 47% lower flows during September of below normal and dry years,
18 respectively. The Feather River flows under H4_ELT would generally be similar to or up to 54%
19 lower than flows under Existing Conditions during July, August, and October through March, except
20 in August through November of critical water years, when flows under H4_ELT would range up to
21 55% higher. Flows under H4_ELT in the American River at Nimbus Dam would generally be similar
22 to or up to 38% lower than flows under Existing Conditions throughout the year, except for 15%
23 greater flow in January of wet years, 12% to 14% greater flow in February of wet, above normal and
24 below normal water years, and 14% greater flow in October of critical water years. Flows under
25 H4_ELT in the Trinity River would generally be similar to flows under Existing Conditions
26 throughout the year, but would range from 10% to 29% higher during December through March of
27 wet years, would be 22% higher in February of above normal years, would be 16% lower in January
28 of below normal years, and would be 10% lower in July of wet years. Flows under H4_ELT in Clear
29 Creek would generally be similar to flows under Existing Conditions throughout the year, but would
30 be 40% and 13% greater in January and February, respectively, of wet years, would be 10% higher
31 in December through April of critical water years, 11% higher in October of critical years, 13%
32 higher in March of below normal years. Flows under H4_ELT in the San Joaquin River at Vernalis
33 would generally be similar to or slightly lower than those under Existing Conditions during January,
34 April, May and September through November, would be similar to or up to 23% lower than flows
35 under Existing Conditions during February, March, and June through August, and would be similar
36 to or 12% higher (wet years) in December. Flows under H4_ELT in the Stanislaus River at the
37 confluence with the San Joaquin River would generally be similar to or up to 29% lower than to
38 those under Existing Conditions during January through July, except for 17% and 11% greater flow
39 during February and June, respectively, of wet years, and would be similar to or slightly lower than
40 flows under Existing Conditions during August through December.

41 Water temperatures in the Feather River below Thermalito Afterbay during the year-round juvenile
42 and adult Sacramento-San Joaquin roach occurrence period would not exceed the 86°F water
43 temperature threshold in H4_ELT or Existing Conditions. As a result, there would be no difference
44 between H4_ELT and Existing Conditions in the percentage of months in which the 86°F water
45 temperature threshold is exceeded (Table 11-4A-157).

1 *Summary of CEQA Conclusion*

2 Collectively, flows would be lower under Alternative 4A during the year-round juvenile and adult
3 Sacramento-San Joaquin roach occurrence period relative to Existing Conditions. Flows would be
4 persistently and moderately to substantially lower in several rivers during substantial portions of
5 the rearing period. Therefore, these modeling results indicate that the difference between Existing
6 Conditions and Alternative 4A could be significant because the alternative could substantially
7 reduce suitable rearing habitat as a result of flow reductions.

8 As discussed in Section 11.3.3, because of differences between the CEQA and NEPA baselines, it is
9 sometimes possible for CEQA and NEPA significance conclusions to vary between one another under
10 the same impact discussion. The baseline for the CEQA analysis is Existing Conditions at the time the
11 NOP was prepared. Both the action alternative and the NEPA baseline (NAA_ELT) models
12 anticipated future conditions that would occur at 2025 (ELT implementation period), including the
13 projected effects of climate change (precipitation patterns), sea level rise and future water demands,
14 as well as implementation of required actions under the 2008 USFWS BiOp and the 2009 NMFS
15 BiOp. Because the action alternative modeling does not partition the effects of implementation of the
16 alternative from the effects of sea level rise, climate change, and future water demands, the
17 comparison to Existing Conditions may not offer a clear understanding of the impact of the
18 alternative on the environment. The comparison to the NAA_ELT is a better approach because it
19 isolates the effect of the alternative from those of sea level rise, climate change, and future water
20 demands.

21 When compared to NAA_ELT and informed by the NEPA analysis above, flows and water
22 temperatures in all rivers would generally be similar between NAA_ELT and Alternative 4A. These
23 modeling results represent the increment of change attributable to the alternative, demonstrating
24 the general similarities in flows and water temperature under Alternative 4A and the NAA_ELT, and
25 addressing the limitations of the CEQA baseline (Existing Conditions). Therefore, this impact is
26 found to be less than significant and no mitigation is required.

27 *Hardhead*

28 In general, Alternative 4A would not affect the quality and quantity of upstream habitat conditions
29 for hardhead relative to the NAA.

30 *Flows*

31 Flow rates in the Sacramento, Trinity, Feather, American, San Joaquin, and Stanislaus Rivers and in
32 Clear Creek were examined during the year-round juvenile and adult hardhead occurrence period.
33 Lower flows could reduce the quantity and quality of instream habitat available for juvenile and
34 adult hardhead.

35 In the Sacramento River upstream of Red Bluff, flows under H3_ELT would generally be similar to or
36 greater than flows under NAA_ELT throughout the year with some exceptions (up to 14% lower),
37 and would be lower in all water year types during November (up to 18% lower) (Appendix 11C,
38 *CALSIM II Model Results utilized in the Fish Analysis*). Flow reductions in drier water years, when
39 effects on habitat conditions would be more critical, would be inconsistent and/or of small
40 magnitude for all months during the rearing period and, therefore, would not have biologically
41 meaningful negative effects.

1 In the Trinity River below Lewiston Reservoir, flows under H3_ELT would generally be similar to or
2 greater than flows under NAA_ELT during the period, except in above normal years in April and
3 October (17% and 8% lower, respectively), and in wet years during November (10% lower)
4 (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

5 In Clear Creek at Whiskeytown Dam, flows under H3_ELT would be similar to flows under NAA_ELT
6 throughout the year except in critical years during July (14% lower), August (11% greater),
7 September (10% lower), and October (7% lower) (Appendix 11C, *CALSIM II Model Results utilized in*
8 *the Fish Analysis*).

9 In the Feather River at Thermalito Afterbay, flows under H3_ELT would generally be lower than
10 flows under NAA_ELT during January and July through September, except in critical years during
11 August and September (23% and 25% greater, respectively); would generally be similar to or
12 greater than flows under NAA_ELT during February through June, except for below normal years
13 during February and March (11% and 13% lower, respectively) and in critical years during May and
14 June (10% and 8% lower, respectively); and would generally be similar to or greater than flows
15 under NAA_ELT during November and December, except in wet years during December (5% lower)
16 (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flows would be more
17 persistently lower under H3_ELT relative to NAA_ELT (up to 48% lower) during July, August, and in
18 all water year types except critical years during September (Appendix 11C, *CALSIM II Model Results*
19 *utilized in the Fish Analysis*). Flow reductions would be partially offset by increases in flow in the
20 adjoining months.

21 In the American River at Nimbus Dam, flows under H3_ELT would be similar to or greater than flows
22 under NAA_ELT during January through July and December, except in below normal years during
23 January (to 11% lower), and would be similar to or lower than flows under NAA_ELT (up to 22%
24 lower) during August through November, except in below normal and critical years during October
25 (16% and 22% greater, respectively) (Appendix 11C, *CALSIM II Model Results utilized in the Fish*
26 *Analysis*). Flow reductions would be offset by increases in some months and/or not persistent
27 within a single water year type. Effects would not be biologically meaningful.

28 In the San Joaquin River at Vernalis, flows under H3_ELT would be similar to those under NAA_ELT
29 throughout the year, regardless of water year type.

30 In the Stanislaus River at the confluence with the San Joaquin River flows under H3_ELT would be
31 similar to those under NAA_ELT throughout the year, regardless of water year type.

32 *Water Temperature*

33 The percentage of months outside of the 65°F to 82.4°F suitable water temperature range for
34 juvenile and adult hardhead was examined in the Sacramento, Trinity, Feather, American, and
35 Stanislaus Rivers. Water temperatures outside this range could lead to reduced rearing habitat
36 quality and increased stress and mortality for juvenile and adult hardhead. Water temperatures
37 were not modeled in the San Joaquin River or Clear Creek.

38 Water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under H3_ELT
39 would generally be the same as those under NAA_ELT. Therefore, there would be no temperature
40 related effects of H3_ELT in these rivers during any month.

1 In the Feather River below Thermalito Afterbay, the percentage of months under H3_ELT outside
2 the range would be similar to or lower than the percentage under NAA_ELT in all water year except
3 below normal years (6% greater) (Table 11-4A-158).

4 Table 11-4A-158. Difference and Percent Difference in the Percentage of Months Year-Round in
5 Which Water Temperatures in the Feather River below Thermalito Afterbay Are outside the 65°F
6 to 82.4°F Water Temperature Range for Juvenile and Adult Hardhead Occurrence^a

Water Year Type	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
Wet	0 (0%)	1 (1%)
Above Normal	-3 (-4%)	-3 (-4%)
Below Normal	0 (0%)	4 (6%)
Dry	-1 (-1%)	0 (0%)
Critical	-4 (-6%)	-2 (-3%)
All	0 (0%)	1 (1%)

^a A negative value indicates a benefit (reduction in percentage of months outside suitable range) of the alternative.

7

8 *H4_ELT/HOS_ELT*

9 Flows under H4_ELT in the Sacramento River upstream of Red Bluff during the year-round juvenile
10 and adult hardhead occurrence period would generally be similar to flows under NAA_ELT, except
11 for 10% lower flow during September of below normal water years and except during November of
12 all water year types, when flows would be up to 15% lower (Appendix 11C, *CALSIM II Model Results*
13 *utilized in the Fish Analysis*). Flows under H4_ELT in the Feather River at Thermalito Afterbay would
14 generally be up to 548% greater than flows under NAA_ELT during April through June, except for
15 12% and 10% lower flows during June of wet and critical water years, respectively. The Feather
16 River flows under H4_ELT would generally be similar to or up to 60% lower than flows under
17 NAA_ELT during July through November, except in August through November of critical water years,
18 when flows under NAA_ELT would range from 11% to 52% higher, and the flows would generally be
19 similar to or up to 40% higher under NAA_ELT during December through March. Flows under
20 H4_ELT in the American River below Nimbus Dam would generally be similar to flows under
21 NAA_ELT throughout the year, except for 14% lower flow in May of critical water years, 28% lower
22 flow in August of critical years, 20% lower flows in September of below normal years, 18% greater
23 flow in August of below normal years, and 15% and 21% greater flows in October of below normal
24 and critical water years, respectively. Flows under H4_ELT in the Trinity River below Lewiston
25 would generally be similar to flows under NAA_ELT throughout the year, except for 10% higher flow
26 during February of wet years, 17% lower flow during April of above normal water years, 16%
27 greater flow during September of critical years, and 11% greater flow during October of above
28 normal water years. Flows under H4_ELT in Clear Creek below Whiskeytown would generally be
29 similar to flows under NAA_ELT throughout the year, except for 12% higher flow in March of below
30 normal water years, and 14% lower flow and 11% higher flow during July and August, respectively,
31 of critical water years. Flows under H4_ELT in the San Joaquin and Stanislaus Rivers would be
32 similar to flows under NAA_ELT throughout the year.

33 The percentage of months under H4_ELT outside the 65°F to 82.4°F water temperature range in the
34 Feather River below Thermalito Afterbay during the year-round juvenile and adult hardhead

1 occurrence period would be similar to or lower than the percentage under Existing Conditions in all
2 water year types (Table 11-4A-159).

3 Table 11-4A-159. Difference and Percent Difference between the Baseline Scenarios and H4_ELT in
4 the Percentage of Months Year-Round in Which Water Temperatures in the Feather River below
5 Thermalito Afterbay Are outside the 65°F to 82.4°F Water Temperature Range for Juvenile and
6 Adult Hardhead Occurrence^a

Water Year Type	EXISTING CONDITIONS	NAA_ELT vs. H4_ELT
Wet	-2 (-3%)	-1 (-1%)
Above Normal	0 (0%)	0 (0%)
Below Normal	-4 (-6%)	0 (0%)
Dry	-1 (-1%)	0 (0%)
Critical	-4 (-6%)	-2 (-3%)
All	-2 (-3%)	-1 (-1%)

^a A negative value indicates a reduction in percentage of months outside suitable range for H4_ELT.

7

8 *NEPA Effects:* Collectively, these modeling results indicate that the effect would not be adverse
9 because Alternative 4A would not cause a substantial reduction in the quantity or quality of habitat
10 for juvenile and adult hardhead. Flows in all rivers examined during the year under Alternative 4A
11 are generally similar to or greater than flows under the NAA_ELT in most months. Flows in July or
12 August through November are more likely to be lower for some water year types in some of the
13 locations analyzed, however they are generally of small magnitude, not consistent from month to
14 month within a specific water year type, and/or would be offset by increases in flow in the adjoining
15 months. Therefore, the flow reductions are not expected to have biologically meaningful negative
16 effects on hardhead. Flow-related habitat conditions for hardhead under H4_ELT would be less
17 favorable than those under H3_ELT although not different from NAA_ELT. There are no
18 temperature-related effects in any other rivers examined.

19 *CEQA Conclusion:* In general, Alternative 4A would not affect the quality and quantity of upstream
20 habitat conditions for juvenile and adult hardhead relative to Existing Conditions.

21 *Flows*

22 Flow rates in the Sacramento, Trinity, Feather, American, San Joaquin, and Stanislaus Rivers and in
23 Clear Creek were examined during the year-round juvenile and adult hardhead occurrence period.
24 Lower flows could reduce the quantity and quality of instream habitat for juvenile and adult
25 hardhead.

26 In the Sacramento River upstream of Red Bluff, flows under H3_ELT would generally be similar to or
27 greater than flows under Existing Conditions during January through April and December, except in
28 drier years during January (to 13% lower), in dry and critical years during February (8% and 6%
29 lower, respectively), in critical years during March (8% lower), in above normal years in April (5%
30 lower), and in dry and critical years during December (8% and 5% lower, respectively) (Appendix
31 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flows would generally be similar to or
32 lower than flows under Existing Conditions during May through November (to 46% lower), except
33 in critical years during May (13% greater), in below normal and dry years during June (8% and 25%
34 greater, respectively), and in below normal and critical years during October (10% and 15% greater,

1 respectively). There would be primarily small flow reductions in some drier water year types for
2 some months, but not persistent enough and of a magnitude that would not be expected to have
3 biologically meaningful negative effects.

4 In the Trinity River below Lewiston Reservoir, flows under H3_ELT would generally be similar to or
5 greater than flows under Existing Conditions during January through June and December, except in
6 below normal years during January (16% lower), in below normal years during March (6% lower),
7 and in critical years during May (6% lower), but would generally be similar to or lower than flows
8 under Existing Conditions during July through November, except in below normal years during July
9 (5% lower) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). The persistent,
10 small to moderate flow reductions in critical years would have a localized effect on rearing
11 conditions in that water year type. In Clear Creek at Whiskeytown Dam, flows under H3_ELT would
12 be similar to or greater than flows under Existing Conditions throughout the year, except in critical
13 years during September and in below normal years during October (19% and 6% lower,
14 respectively) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). This flow
15 reduction is a relatively isolated effect limited to a single water year type in each month and would
16 not be expected to have biologically meaningful negative effects.

17 In the Feather River at Thermalito Afterbay, flows under H3_ELT would be greater than flows under
18 Existing Conditions during February through June, September, and October, except in drier years
19 during February (to 48%), in below normal and dry years during March (39% and 17% lower,
20 respectively), in below normal years during April (6% lower), in wet years during May (15% lower),
21 in below normal and critical years during September (26% and 50% lower, respectively), and in wet
22 and critical years during October (6% and 7% lower, respectively) (Appendix 11C, *CALSIM II Model
23 Results utilized in the Fish Analysis*). Flows under H3_ELT would generally be moderately to
24 substantially lower than flows under Existing Conditions in January, July, August, November, and
25 December, except in wet and above normal years during July (15% and 9% greater, respectively), in
26 below normal and dry years during August (7% and 45% greater, respectively), in above normal
27 years during November (5% greater), and in above normal years during December (18% greater).

28 In the American River at Nimbus Dam, flows under H3_ELT would generally be similar to or greater
29 than flows under Existing Conditions in wetter years during January, in wet and below normal years
30 during December, and in most water year types during February through April, except in dry and
31 critical years during February (8% and 6% lower, respectively), in critical years during March (7%
32 lower), and in above normal years during April (5% lower) (Appendix 11C, *CALSIM II Model Results
33 utilized in the Fish Analysis*). Flows under H3_ELT would generally be similar to or lower than flows
34 under Existing Conditions during May through November, except in critical years during May (13%
35 greater), in below normal and dry years during June (8% and 25% greater, respectively), and in
36 below normal and critical years during October (10% and 15% greater, respectively). The
37 persistent, small to moderate flow reductions in critical years would have a localized effect on
38 habitat conditions in that water year type.

39 In the San Joaquin River at Vernalis, flows under H3_ELT would generally be similar to or slightly
40 lower than those under Existing Conditions during April, May and September through November,
41 would be similar to or up to 23% lower than flows under Existing Conditions during February,
42 March, and June through August, and would be similar to or up to 11% greater than flows under
43 Existing Conditions during December and January.

1 In the Stanislaus River at the confluence with the San Joaquin River, flows under H3_ELT would
2 generally be similar to or up to 29% lower than to those under Existing Conditions during January
3 through July, except for 17% and 11% greater flow in wet years during February and June,
4 respectively, and would be similar to or slightly lower than flows under Existing Conditions during
5 August through December.

6 *Water Temperature*

7 The percentage of months in which year-round in-stream temperatures would be outside of the
8 65°F to 82.4°F suitable water temperature range for juvenile and adult hardhead was examined in
9 the Sacramento, Trinity, Feather, American, and Stanislaus Rivers. Water temperatures outside this
10 range could lead to reduced rearing habitat quality and increased stress and mortality for juvenile
11 and adult hardhead. Water temperatures were not modeled in the San Joaquin River or Clear Creek.

12 Water temperatures in the Sacramento, Trinity, American, and Stanislaus Rivers under H3_ELT
13 would generally be the same as those under Existing Conditions. Therefore, there would be no
14 temperature related effects of H3_ELT in these rivers during any month.

15 In the Feather River below Thermalito Afterbay, the percentage of months under H3_ELT outside of
16 the 65°F to 82.4°F suitable water temperature range for juvenile and adult hardhead would be
17 similar to or lower than the percentage under Existing Conditions in all water years (Table 11-4A-
18 158).

19 *H4_ELT/HOS_ELT*

20 Flows under H4_ELT in the Sacramento River upstream of Red Bluff during the year-round juvenile
21 and adult hardhead occurrence period would generally be similar to or up to 18% lower than flows
22 under Existing Conditions throughout the year, except during September, when flows would be for
23 27% and 49% in wet and above normal, respectively (Appendix 11C, *CALSIM II Model Results utilized*
24 *in the Fish Analysis*). Differences in flows between H4_ELT and Existing Conditions in the Feather
25 River at Thermalito Afterbay would be highly variable, with flows under H4_ELT up to 509% greater
26 than those under Existing Conditions during April through June and September, except for 37% and
27 6% lower flows during June of wet and critical water years, respectively, and 49% and 47% lower
28 flows during September of below normal and dry years, respectively. The Feather River flows under
29 H4_ELT would generally be similar to or up to 54% lower than flows under Existing Conditions
30 during July, August, and October through March, except in August through November of critical
31 water years, when flows under H4_ELT would range up to 55% higher. Flows under H4_ELT in the
32 American River at Nimbus Dam would generally be similar to or up to 38% lower than flows under
33 Existing Conditions throughout the year, except for 15% greater flow in January of wet years, 12%
34 to 14% greater flow in February of wet, above normal and below normal water years, and 14%
35 greater flow in October of critical water years. Flows under H4_ELT in the Trinity River would
36 generally be similar to flows under Existing Conditions throughout the year, but would range from
37 10% to 29% higher during December through March of wet years, would be 22% higher in February
38 of above normal years, would be 16% lower in January of below normal years, and would be 10%
39 lower in July of wet years. Flows under H4_ELT in Clear Creek would generally be similar to flows
40 under Existing Conditions throughout the year, but would be 40% and 13% greater in January and
41 February, respectively, of wet years, would be 10% higher in December through April of critical
42 water years, 11% higher in October of critical years, 13% higher in March of below normal years.
43 Flows under H4_ELT in the San Joaquin River at Vernalis would generally be similar to or slightly
44 lower than those under Existing Conditions during January, April, May and September through

1 November, would be similar to or up to 23% lower than flows under Existing Conditions during
2 February, March, and June through August, and would be similar to or 12% higher (wet years) in
3 December. Flows under H4_ELT in the Stanislaus River at the confluence with the San Joaquin River
4 would generally be similar to or up to 29% lower than to those under Existing Conditions during
5 January through July, except for 17% and 11% greater flow during February and June, respectively,
6 of wet years, and would be similar to or slightly lower than flows under Existing Conditions during
7 August through December.

8 The percentage of months under H4_ELT outside the 65°F to 82.4°F water temperature range in the
9 Feather River below Thermalito Afterbay during the year-round juvenile and adult hardhead
10 occurrence period would be similar to or less than the percentage under Existing Conditions in all
11 water year types (Table 11-4A-159).

12 *Summary of CEQA Conclusion*

13 Collectively, flows would be lower under Alternative 4A during the juvenile and adult hardhead
14 occurrence period relative to Existing Conditions. Flows would be persistently and moderately to
15 substantially lower in several rivers during substantial portions of the rearing period. Therefore,
16 these modeling results indicate that the difference between Existing Conditions and Alternative 4A
17 could be significant because the alternative could substantially reduce habitat for juvenile and adult
18 hardhead as a result of flow reductions.

19 As discussed in Section 11.3.3, because of differences between the CEQA and NEPA baselines, it is
20 sometimes possible for CEQA and NEPA significance conclusions to vary between one another under
21 the same impact discussion. The baseline for the CEQA analysis is Existing Conditions at the time the
22 NOP was prepared. Both the action alternative and the NEPA baseline (NAA_ELT) models
23 anticipated future conditions that would occur at 2025 (ELT implementation period), including the
24 projected effects of climate change (precipitation patterns), sea level rise and future water demands,
25 as well as implementation of required actions under the 2008 USFWS BiOp and the 2009 NMFS
26 BiOp. Because the action alternative modeling does not partition the effects of implementation of the
27 alternative from the effects of sea level rise, climate change, and future water demands, the
28 comparison to Existing Conditions may not offer a clear understanding of the impact of the
29 alternative on the environment. The comparison to the NAA_ELT is a better approach because it
30 isolates the effect of the alternative from those of sea level rise, climate change, and future water
31 demands.

32 When compared to NAA_ELT and informed by the NEPA analysis above, flows and water
33 temperatures in all rivers would generally be similar between NAA_ELT and Alternative 4A. These
34 modeling results represent the increment of change attributable to the alternative, demonstrating
35 the general similarities in flows and water temperature under Alternative 4A and the NAA_ELT, and
36 addressing the limitations of the CEQA baseline (Existing Conditions). Therefore, this impact is
37 found to be less than significant and no mitigation is required.

38 *California Bay Shrimp*

39 *NEPA Effects:* As discussed further in Chapter 11, Section 11.3.5, in Appendix A, water operations
40 have the potential to affect California bay shrimp juvenile abundance through because of an increase
41 in residual circulation in the estuary with increasing outflow (as indexed by X2) that could translate
42 to more rapid or more complete entrainment into the estuary, or more rapid transport to rearing
43 grounds, both of which presumably could increase survival from hatching to settlement (Kimmerer

1 et al. 2009). An X2-abundance index relationship from Kimmerer et al. (2009) was applied to bay
2 shrimp in order to assess the potential effects on abundance through changes in rearing habitat.
3 Application of these relationships suggested that, in relation to NAA_ELT, there would be only a
4 small change in mean abundance index (<5%) as a result of change in rearing habitat under
5 Alternative 4A scenarios H3_ELT and H4_ELT (See Table 11-mult-13 in Chapter 11, Section 11.3.5, in
6 Appendix A of this RDEIR/SDEIS). These modeling results indicate that the operational effects
7 would not be adverse, because they would not result in a substantial reduction in the rearing habitat
8 for California bay shrimp.

9 *CEQA Conclusion:* Similar to striped bass and American shad, the analysis of potential water
10 operations-related rearing habitat effects illustrated that in relation to Existing Conditions, there
11 could be a greater impact of Alternative 4A on abundance of California bay shrimp (Table 11-mult-
12 13 in Chapter 11, Section 11.3.5, in Appendix A of this RDEIR/SDEIS), than found in the NEPA Effects
13 section. As noted for striped bass and American shad, the comparison to the NAA_ELT is a better
14 approach than comparison to Existing Conditions because it isolates the effect of the alternative
15 from those of sea level rise, climate change, and future water demands. In the case of the X2-related
16 analyses of rearing habitat for California bay shrimp and as noted for striped bass and American
17 shad, the effect of sea level rise in particular confounds the interpretation of the effects of the
18 alternatives. Based on the discussion presented above for the NEPA Effects, the change in rearing
19 habitat would be less than significant. No mitigation would necessary.

20 Impact AQUA-204: Effects of Water Operations on Migration Conditions for Non-Covered 21 Aquatic Species of Primary Management Concern

22 See Alternative 1A, Impact AQUA-204 for additional background information relevant to non-
23 covered species of primary management concern.

24 *Striped Bass*

25 *NEPA Effects:* Under Alternative 4A Scenario H3_ELT, average spring (March–May) monthly flows in
26 the Sacramento River downstream of the north Delta intake would be reduced 18–22% during the
27 adult striped bass migration compared to baseline (NAA_ELT). The reduction would be less (4–
28 18%) for the H4_ELT scenario. Sacramento River flows are highly variable inter-annually, but
29 striped bass are still able to migrate upstream the Sacramento River during years of lower flows.
30 The effect of reduced Sacramento flows under Alternative 4A would not be adverse.

31 *CEQA Conclusion:* Impacts would be as described immediately above and would be less than
32 significant because the changes in spring flow under Scenarios H3_ELT (21–23% lower compared to
33 Existing Conditions) and H4_ELT (10–18% lower compared to Existing Conditions) would not
34 interfere substantially with movement of pre-spawning striped bass through the Delta. No
35 mitigation would be required.

36 *American Shad*

37 *NEPA Effects:* Flows in the Sacramento River below the north Delta diversion facilities under
38 Scenarios H3_ELT and H4_ELT would be reduced 18–22% and 4–18%, respectively, relative to the
39 NEPA point of comparison (NAA_ELT) during March–May, as described above for striped bass. River
40 flows are highly variable inter-annually, and American shad are still able to migrate upstream the
41 Sacramento River during lower flow years. Overall, the impact to American shad migration habitat
42 conditions would not be adverse under Alternative 4A.

1 *CEQA Conclusion:* Impacts would be as described immediately above and would be less than
2 significant because, as described above for striped bass, the changes in flow under Scenario H3_ELT
3 (21–23% lower compared to Existing Conditions) and H4_ELT (10–18% lower compared to Existing
4 Conditions) would not interfere substantially with movement of American shad from the Delta to
5 upstream spawning habitat. No mitigation would be required.

6 *Threadfin Shad*

7 *NEPA Effects:* Threadfin shad are semi-anadromous, moving between freshwater and brackish
8 water habitats. Threadfin shad found in the Delta do not actively migrate upstream to spawn.
9 Therefore there is no effect on migration habitat conditions.

10 *CEQA Conclusion:* Impacts would be as described immediately above and would be less than
11 significant because flow changes in the Delta under Alternative 4 would not alter movement
12 patterns for threadfin shad. No mitigation would be required.

13 *Largemouth Bass*

14 *NEPA Effects:* Largemouth bass are non-migratory fish within the Delta. Therefore they do not use
15 the Delta as a migration habitat corridor. There would be no effect.

16 *CEQA Conclusion:* As described immediately above, flow changes under Alternative 4 would not
17 affect largemouth movements within the Delta. Therefore, the impact is less than significant. No
18 mitigation would be required.

19 *Sacramento Tule Perch*

20 *NEPA Effects:* Similar with largemouth bass, Sacramento tule perch are a non-migratory species and
21 do not use the Delta as a migration corridor as they are a resident Delta species. There would be no
22 effect.

23 *CEQA Conclusion:* As described immediately above, flow changes would not affect Sacramento tule
24 perch movements within the Delta. Therefore, the impact is less than significant. No mitigation
25 would be required.

26 *Sacramento-San Joaquin Roach*

27 *NEPA Effects:* For Sacramento-San Joaquin roach, the overall flows and temperature in upstream
28 rivers during migration to their spawning grounds would be similar to those described under
29 Alternative 4, Impact AQUA-202 for spawning. As described there, the flows would slightly improve
30 the upstream conditions relative to the NAA_ELT. These conditions would not be adverse.

31 *CEQA Conclusion:* As described in Alternative 4, Impact AQUA-202, the impacts of water operations
32 on migration conditions for Sacramento-San Joaquin roach would be less than significant and no
33 mitigation would be required.

34 *Hardhead*

35 *NEPA Effects:* For hardhead the overall flows and temperature in upstream rivers during migration
36 to their spawning grounds would be similar to those described under Alternative 4, Impact AQUA-
37 202 for spawning due to similar flows and temperatures. As described there, the flows would

1 slightly improve the upstream conditions relative to the NAA_ELT. These conditions would not be
2 adverse.

3 *CEQA Conclusion:* As described immediately above, the impacts of water operations on migration
4 conditions for hardhead would be less than significant and no mitigation would be required.

5 *California Bay Shrimp*

6 *NEPA Effects:* The effect of water operations on migration conditions of California bay shrimp under
7 Alternative 4A would be similar to that described for Alternative 1A (see Alternative 1A, Impact
8 AQUA-204) due to similar flows and temperatures. For a detailed discussion, please see Alternative
9 1A, Impact AQUA-204. The effects would not be adverse.

10 *CEQA Conclusion:* As described above the impacts on California bay shrimp migration conditions
11 would be less than significant and no mitigation would be required.

12 Restoration Measures (Environmental Commitment Environmental Commitment 4, Environmental
13 Commitment 6, Environmental Commitment 7, and Environmental Commitment 10)

14 As noted previously, Alternative 4A includes a greatly reduced extent of restoration measures
15 relative to Alternative 4 and Alternative 1A, upon which the discussion of impacts for Alternative 4
16 is based. In particular, *Environmental Commitment 4 Tidal Natural Communities Restoration* is
17 reduced from 65,000 acres to 59 acres, so that any impacts would be extremely small. The effects of
18 restoration measures under Alternative 4A would be similar for all non-covered species; therefore,
19 the analysis below is combined for all non-covered species instead of analyzed by individual species.

20 Impact AQUA-205: Effects of Construction of Restoration Measures on Non-Covered Aquatic
21 Species of Primary Management Concern

22 *NEPA Effects:* Refer to Impact AQUA-7 under delta smelt for a discussion of the effects of
23 construction of restoration measures on non-covered species of primary management concern
24 because effects would be avoided by limiting the frequency, duration, and spatial extent of in-water
25 work and implementing the commitments described in detail under Impact AQUA-1 and in
26 Appendix 3B, *Environmental Commitments*. The potential effects of the construction of restoration
27 measures under Alternative 4A would be similar to those described for Alternative 1A (see
28 Alternative 1A, Impact AQUA-7). For a detailed discussion, please see Alternative 1A, Impact AQUA-
29 7. The effects would not be adverse.

30 *CEQA Conclusion:* As described immediately above, the impacts of the construction of restoration
31 measures would be less than significant and no mitigation would be required.

32 Impact AQUA-206: Effects of Contaminants Associated with Restoration Measures on Non-
33 Covered Aquatic Species of Primary Management Concern

34 *NEPA Effects:* Refer to Impact AQUA-8 under delta smelt for a discussion of the effects of
35 contaminants associated with restoration measures on non-covered species of primary
36 management concern. The potential effects of contaminants associated with restoration measures
37 under Alternative 4A would be similar to those described for Alternative 1A (see Alternative 1A,
38 Impact AQUA-8), although would be greatly reduced in extent. For a detailed discussion, please see
39 Alternative 1A, Impact AQUA-8. The effects would not be adverse.

1 *CEQA Conclusion:* As described immediately above, the impacts of the contaminants associated with
2 restoration measures would be less than significant and no mitigation would be required.

3 Impact AQUA-207: Effects of Restored Habitat Conditions on Non-Covered Aquatic Species of
4 Primary Management Concern

5 *NEPA Effects:* Refer to Impact AQUA-9 under delta smelt for a general discussion of the effects of
6 restored habitat conditions on non-covered species of primary management concern. Although
7 there are minor differences, the effects are similar because restoration would provide new habitat
8 areas for those species that occur in the areas that are restored. The effect of restoration activities
9 under Alternative 4A relative to NAA_ELT would not be adverse.

10 *CEQA Conclusion:* The impacts of restored habitat conditions would range from slightly beneficial to
11 beneficial, depending on where the restoration occurs and how it is designed. No mitigation would
12 be required.

13 Other Environmental Commitments (Environmental Commitment 12, Environmental Commitment
14 15, and Environmental Commitment 16)

15 The effects of other Environmental Commitments under Alternative 4A would be similar for all non-
16 covered species; therefore, the analysis below is combined for all non-covered species instead of
17 analyzed by individual species.

18 Impact AQUA-208: Effects of Methylmercury Management on Non-Covered Aquatic Species of
19 Primary Management Concern (Environmental Commitment 12)

20 *NEPA Effects:* Refer to Impact AQUA-10 under delta smelt for a discussion of the effects of
21 methylmercury management on non-covered species of primary management concern. The
22 potential effects of methylmercury management under Alternative 4A would be similar to those
23 described for Alternative 1A (see Alternative 1A, Impact AQUA-10). For a detailed discussion, please
24 see Alternative 1A, Impact AQUA-10. The effects would not be adverse because it is expected to
25 reduce overall methylmercury levels resulting from habitat restoration.

26 *CEQA Conclusion:* As described immediately above, the impacts of methylmercury management
27 would be less than significant and no mitigation would be required.

28 Impact AQUA-211: Effects of Localized Reduction of Predatory Fish on Non-Covered Aquatic
29 Species of Primary Management Concern (Environmental Commitment 15)

30 *NEPA Effects:* Refer to Alternative 1A, Impact AQUA-13 under delta smelt for a discussion of the
31 effects of predatory fish (striped bass and largemouth bass) and predator management on non-
32 predatory fish. The purpose of predatory fish management is to reduce predation pressure at
33 predation hotspots and not to reduce the overall populations of these species. This management will
34 have localized negative effects on predatory fish; under Alternative 4A, the efforts will be focused
35 solely at the south Delta export facilities and the proposed north Delta intakes. Given that the
36 numbers of predatory fish are high and the extent of the habitats in which they occur is extensive,
37 the effects of Environmental Commitment 15 will not be adverse.

38 *CEQA Conclusion:* Refer to Alternative 1A, Impact AQUA-13 under delta smelt for a discussion of the
39 effects of predatory fish and predator management on non-predatory fish. The purpose of predatory
40 fish management is to reduce predation pressure at predation hotspots and not to reduce the overall

1 populations of these species. This management will have localized negative effects on predatory fish;
2 under Alternative 4A, the efforts will be focused solely at the south Delta export facilities and the
3 proposed north Delta intakes. Given that the numbers of predatory fish are high and the extent of
4 the habitats in which they occur is extensive, the effects of Environmental Commitment 15 will be
5 less than significant. No mitigation is necessary.

6 Impact AQUA-212: Effects of Nonphysical Fish Barriers on Non-Covered Aquatic Species of
7 Primary Management Concern (Environmental Commitment 16)

8 *NEPA Effects:* As described for Alternative 1A, nonphysical barriers (NPBs) are designed to alter
9 juvenile salmon migration routes using sound, light, and bubbles and are not intended for other
10 species. Alternative 4A proposes only one location for a NPB, at the divergence of Georgiana Slough
11 from the Sacramento River. The in-water structures associated with this barriers may attract fish
12 predators (including the non-covered aquatic species striped bass and largemouth bass), increasing
13 localized predation risk for smaller individuals of the noncovered aquatic species migrating past the
14 barriers, but the extent of this effect is highly uncertain. The general potential effects of nonphysical
15 fish barriers under Alternative 4A would be similar to those described for Alternative 1A (see
16 Alternative 1A, Impact AQUA-14). For a detailed discussion, please see Alternative 1A, Impact
17 AQUA-14. Whereas striped bass, American shad, threadfin shad, and largemouth bass could
18 encounter the proposed barrier, Sacramento-San Joaquin roach and hardhead are unlikely to be
19 present in the vicinity of the nonphysical barrier, and California bay shrimp do not occur in these
20 habitats so there would be no effect. The effects on non-covered aquatic species of primary
21 management concern would not be adverse.

22 *CEQA Conclusion:* As described immediately above, the impacts of a nonphysical fish barrier would
23 be less than significant and no mitigation would be required.

24 Upstream Reservoirs

25 Impact AQUA-217: Effects of Water Operations on Reservoir Coldwater Fish Habitat

26 *NEPA Effects:* As discussed in Alternative 1A, Impact AQUA-217 and reported in Table 11-1A-102,
27 this effect would not be adverse because coldwater fish habitat in the CVP and SWP upstream
28 reservoirs under Alternative 4A would not be substantially reduced when compared to the No
29 Action Alternative. Carryover storage thresholds for all CVP and SWP reservoirs would be similar
30 between the No Action Alternative and Alternative 4A.

31 *CEQA Conclusion:* As discussed in Alternative 1A, Impact AQUA-217 and reported in Table 11-1A-
32 102, Alternative 4A would reduce the quantity of coldwater fish habitat in the CVP and SWP relative
33 to Existing Conditions. There would be There would be 5 and 7 fewer years (7% and 9% lower,
34 respectively) that exceed the 250 TAF carryover storage threshold in Folsom Reservoir under
35 H3_ELT and H4_ELT, respectively, relative to Existing Conditions, which could result in a significant
36 impact.

37 However, this interpretation of the biological modeling results is likely attributable to different
38 modeling assumptions for four factors: sea level rise, climate change, future water demands, and
39 implementation of the alternative. As discussed in Section 11.3.3, because of differences between the
40 CEQA and NEPA baselines, it is sometimes possible for CEQA and NEPA significance conclusions to
41 vary between one another under the same impact discussion. The baseline for the CEQA analysis is
42 Existing Conditions at the time the NOP was prepared. Both the action alternative and the NEPA

1 baseline (NAA_ELT) models anticipated future conditions that would occur at 2025 (ELT
2 implementation period), including the projected effects of climate change (precipitation patterns),
3 sea level rise and future water demands, as well as implementation of required actions under the
4 2008 USFWS BiOp and the 2009 NMFS BiOp. Because the action alternative modeling does not
5 partition the effects of implementation of the alternative from the effects of sea level rise, climate
6 change, and future water demands, the comparison to Existing Conditions may not offer a clear
7 understanding of the impact of the alternative on the environment. This suggests that the
8 comparison of results between the alternative and NAA is a better approach because it isolates the
9 effect of the alternative from those of sea level rise, climate change, and future water demands.

10 When compared to NAA and informed by the NEPA analysis above, there would be negligible effects
11 on mean monthly reservoir storage. These modeling results represent the increment of change
12 attributable to the alternative, demonstrating the similarities in reservoir storage under Alternative
13 4A and the NAA_ELT, and addressing the limitations of the CEQA baseline (Existing Conditions).
14 Therefore, this impact is found to be less than significant and no mitigation is required.