

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

6 Impact AQUA-67: Effects of Localized Reduction of Predatory Fish on Chinook Salmon
7 (Spring-Run ESU) (Environmental Commitment 15)

8 As noted above, the impact discussion for winter-run Chinook salmon (Impact AQUA-49) is also
9 applicable to spring-run Chinook salmon.

10 *NEPA Effects:* As noted for winter-run Chinook salmon, Environmental Commitment 15 would not
11 have adverse impacts and could benefit spring-run Chinook salmon. Due to the uncertainty in the
12 effectiveness of Environmental Commitment 15, however, it is concluded that there would be no
13 demonstrable effect of this conservation measure on spring-run Chinook salmon.

14 *CEQA Conclusion:* As noted for winter-run Chinook salmon, Environmental Commitment 15 would
15 not have a significant impact and could benefit spring-run Chinook salmon. Due to the uncertainties
16 associated with this Environmental Commitment, however, it is concluded that there would be no
17 demonstrable effect on spring-run Chinook salmon. Consequently, no mitigation would be required.

18 Impact AQUA-68: Effects of Nonphysical Fish Barriers on Chinook Salmon (Spring-Run ESU)
19 (Environmental Commitment 16)

20 As noted above, the impact discussion for winter-run Chinook salmon (Impact AQUA-50) is also
21 applicable to spring-run Chinook salmon.

22 *NEPA Effects:* The effects of the NPB would not be adverse because it is intended to improve
23 migratory conditions for juvenile Sacramento River salmon.

24 *CEQA Conclusion:* As concluded for winter-run Chinook salmon, the impacts of *Environmental*
25 *Commitment 16 Nonphysical Fish Barriers* are expected to be less than significant because it is
26 intended to improve migratory conditions for juvenile Sacramento River salmon. Consequently, no
27 mitigation would be required.

28 Fall-/Late Fall–Run Chinook Salmon

29 Construction and Maintenance of Water Conveyance Facilities

30 The discussion of potential effects to delta smelt from construction and maintenance of Water
31 Conveyance Facilities under Alternative 4A is also relevant to fall-run/late fall-run Chinook salmon.
32 Adult and juvenile fall-run/late fall-run Chinook salmon would have the potential to overlap
33 construction and maintenance to a minor degree (Table 11-8).

34 Impact AQUA-73: Effects of Construction of Water Conveyance Facilities on Chinook Salmon
35 (Fall-/Late Fall–Run ESU)

36 The potential effects of construction of the water conveyance facilities on fall-run/late fall-run
37 Chinook salmon would be the same as those described for Alternative 4, Impact AQUA-73.

1 *NEPA Effects:* As concluded for Alternative 4, Impact AQUA-73, the effect would not be adverse for
2 fall-run/late fall-run Chinook salmon.

3 *CEQA Conclusion:* As described in Alternative 4, Impact AQUA-73, the impact of construction of the
4 water conveyance facilities on fall-run/late fall-run Chinook salmon would not be significant except
5 for construction noise associated with pile driving. Implementation of Mitigation Measures AQUA-1a
6 and AQUA-1b would reduce that noise impact to less than significant.

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

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

12 Impact AQUA-74: Effects of Maintenance of Water Conveyance Facilities on Chinook Salmon
13 (Fall-/Late Fall-Run ESU)

14 *NEPA Effects:* Once constructed, Alternative 4A structures and facilities will require ongoing
15 periodic maintenance that includes in-water work activities with the potential to affect Chinook
16 salmon. These activities include periodic cleaning and replacement of screens, trash racks, and
17 associated machinery and dredging to maintain intake capacity. These activities will produce
18 disturbance and underwater noise, and may generate turbidity or other water quality effects. In
19 general, the likelihood of adverse effects on Chinook salmon from maintenance activities would be
20 avoided and minimized through the same methods and rationale described for Impact AQUA-1. The
21 potential effects of the maintenance of the water conveyance facilities under Alternative 4A would
22 be the same as those described for Alternative 4, Impact AQUA-74. The impact would not be adverse
23 for fall-run/late fall-run Chinook salmon.

24 *CEQA Conclusion:* Once constructed, Alternative 4A structures and facilities will require ongoing
25 periodic maintenance that includes in-water work activities with the potential to affect Chinook
26 salmon. These activities include periodic cleaning and replacement of screens, trash racks, and
27 associated machinery and dredging to maintain intake capacity. These activities will produce
28 disturbance and underwater noise, and may generate turbidity or other water quality effects. In
29 general, the likelihood of adverse effects on Chinook salmon from maintenance activities would be
30 avoided and minimized through the same methods and rationale described for Impact AQUA-1. As
31 described in Alternative 4, Impact AQUA-74, the impact of maintenance of the water conveyance
32 facilities on fall-run/late fall-run Chinook salmon would be less than significant and no mitigation is
33 required.

34 Operations of Water Conveyance Facilities

35 Impact AQUA-75: Effects of Water Operations on Entrainment of Chinook Salmon (Fall-/Late
36 Fall-Run ESU)

37 Overall entrainment under Alternative 4A at the south Delta export facilities would be reduced for
38 all water year types (Table 11-4A-53). Under Scenario H3_ELT, average entrainment across all years
39 would be reduced 42% (~24,000 fish) for fall-run Chinook salmon and reduced 33% (643 fish) for
40 late fall-run Chinook salmon compared to NAA_ELT.

1 Table 11-4A-53. Juvenile Fall-Run and Late Fall-Run Chinook Salmon Annual Entrainment Index^a at
2 the SWP and CVP Salvage Facilities—Differences between Model Scenarios for Alternative 4A
3 (Scenario H3_ELT)

Water Year	Absolute Difference (Percent Difference)	
	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
Fall-run Chinook Salmon		
Wet	-79,680 (-62%)	-85,155 (-64%)
Above Normal	-13,483 (-41%)	-14,279 (-42%)
Below Normal	-4,120 (-30%)	-3,951 (-29%)
Dry	933 (5%)	-760 (-4%)
Critical	-13,262 (-32%)	-11,208 (-29%)
All Years	-22,380 (-41%)	-23,707 (-42%)
Late fall-run Chinook Salmon		
Wet	-2,724 (-46%)	-2,895 (-47%)
Above Normal	-225 (-39%)	-223 (-39%)
Below Normal	-24 (-43%)	-26 (-45%)
Dry	-39 (-28%)	-30 (-23%)
Critical	-35 (-22%)	-25 (-16%)
All Years	-622 (-32%)	-643 (-33%)

Shading indicates 10% or greater increased entrainment.

Note: Estimated annual number of fish lost, based on normalized data.

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

4
5 The annual juvenile population that approaches the Delta is assumed to be 23 million fall-run
6 Chinook salmon and 1 million late fall-run Chinook salmon (juvenile index of abundance). The
7 proportion of juvenile index of abundance lost at the south Delta facilities is very low for both runs
8 under NAA_ELT (fall-run 0.24%, late fall-run 0.20% averaged for all years), and under Scenario
9 H3_ELT decreases to negligible levels (fall-run 0.14%; late fall-run 0.13%).

10 Lower south Delta export pumping during the spring under Scenario H4_ELT would result in lower
11 entrainment during this period than under Scenario H3_ELT.

12 *Water Exports from SWP/CVP North Delta Intake Facilities*

13 The impact would be similar in type to Alternative 1A, but the degree would be less because
14 Alternative 4A would have fewer intakes. Thus under Alternative 4A there would be about a 40%
15 reduction in impingement and predation risk relative to Alternative 1A (Impact AQUA-75).

16 *Predation Associated with Entrainment*

17 Entrainment-related predation loss at the south Delta facilities would be no greater and may be
18 lower than NAA_ELT, due to a reduction in entrainment loss. Scenario H3_ELT entrainment-related
19 predation losses are expected to decrease under Scenario H4_ELT.

20 Predation at the north Delta would be increased due to the installation of the proposed SWP/CVP
21 North Delta intake facilities on the Sacramento River, although the magnitude of this increase is

1 uncertain. Bioenergetics modeling with a median predator density predicts a predation loss under
2 Alternative 4A of less than 0.6% of the annual juvenile production (155,000 fall-run juveniles, 0.24%
3 annual production; 25,000 late fall-run juveniles, 0.57% annual production) (Table 11-4A-54). Note
4 that this estimate does not provide context to the level of predation in this reach that would occur
5 without implementation of Alternative 4A. See additional discussion under Impact AQUA-78.

6 Table 11-4A-54. Fall-Run and Late Fall-Run Chinook Salmon Juvenile Predation Loss at the
7 Proposed North Delta Diversion (NDD) Intakes for Alternative 4A (Three Intakes)

Striped Bass at NDD (Three Intakes)			Fall-Run Chinook		Late Fall-Run Chinook	
Density	Bass per 1,000 Feet of Intake	Total Number of Bass	Number Consumed	Percentage of Annual Production Entering the Delta ¹	Number Consumed	Percentage of Annual Production Entering the Delta ¹
Low	18	86	22,025	0.04%	3,703	0.09%
Median	119	571	145,610	0.24%	24,483	0.57%
High	219	1,051	267,971	0.44%	45,056	1.05%

Note: Based on bioenergetics modeling of Chinook salmon consumption by striped bass (Appendix 5F Biological Stressors).

¹ Estimated as 61.6 million for fall-run and 4.3 million for late fall-run. See Section 5.F.3.2.1 in *BDCP Effects Analysis*, Appendix 5F Biological Stressors, hereby incorporated by reference.

8

9 *NEPA Effects:* In conclusion, Alternative 4A would reduce overall entrainment and associated
10 predation losses of juvenile fall-run Chinook salmon and late fall-run Chinook salmon relative to
11 NAA_ELT. The population benefit would be minor because entrainment losses affect a small
12 proportion of the total juvenile population. Conditions under Scenario H4_ELT would further reduce
13 entrainment losses compared to Scenario H3_ELT. The effect of Alternative 4A would not be
14 adverse.

15 *CEQA Conclusion:* Scenario H3_ELT would substantially reduce entrainment at the south Delta
16 facilities for fall-run (41% less) and late fall-run Chinook salmon (32% less) compared to Existing
17 Conditions. Proportional losses of the juvenile population (juvenile index of abundance) would be
18 slightly reduced from already-low levels (less than 0.25% on average). Under Scenario H4_ELT,
19 entrainment losses are expected to further decrease relative to Existing Conditions. Overall, impacts
20 to fall-run and late fall-run Chinook salmon under Alternative 4A would be less than significant. No
21 mitigation would be required.

22 Impact AQUA-76: Effects of Water Operations on Spawning and Egg Incubation Habitat for
23 Chinook Salmon (Fall-/Late Fall-Run ESU)

24 In general, Alternative 4A would not affect the quantity and quality of spawning and egg incubation
25 habitat for fall-/late fall-run Chinook salmon relative to the NAA_ELT.

1 H3_ELT/ESO_ELT

2 *Sacramento River*

3 *Fall-Run*

4 Sacramento River flows upstream of Red Bluff were examined for the October through January fall-
5 run Chinook salmon spawning and egg incubation period (Appendix 11C, *CALSIM II Model Results*
6 *utilized in the Fish Analysis*). Mean flows under H3_ELT would generally be similar to NAA_ELT
7 during October through January, except for November, in which flow would be up to 18% lower.

8 Shasta Reservoir storage at the end of September would affect flows during the fall-run spawning
9 and egg incubation period. As reported in Impact AQUA-58, mean end of September Shasta
10 Reservoir storage under H3_ELT would be similar to storage under NAA_ELT in all water year types
11 (Table 11-4A-27).

12 Mean water temperatures in the Sacramento River at Red Bluff were examined during the October
13 through January fall-run Chinook salmon spawning and egg incubation period (Appendix 11D,
14 *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the*
15 *Fish Analysis*). There would be no differences (<5%) in mean monthly water temperature between
16 NAA_ELT and H3_ELT in any month or water year type throughout the period.

17 The number of days at Red Bluff on which temperature exceeded 56°F by >0.5°F to >5°F in 0.5°F
18 increments was determined for each month, during October through April, and year of the 82-year
19 modeling period (Table 11-4A-13). The combination of number of days and degrees above the 56°F
20 **threshold were further assigned a “level of concern”, as defined in Table 11-4A-14.** Differences
21 between baselines and H3_ELT in the highest level of concern across all months and all 82 modeled
22 years are presented in Table 11-4A-28. There would be 1 (5%) more years **with a “red” level of**
23 **concern** under H3_ELT relative to NAA_ELT. This difference would not be biologically meaningful to
24 fall-run Chinook salmon spawners and eggs.

25 Total degree-days exceeding 56°F were summed by month and water year type at Red Bluff during
26 October through April. Total degree-days under H3_ELT would be 11 degree-days (19% higher)
27 than those under NAA_ELT during March, but were similar during the remaining months (Table 11-
28 4A-29). This total degree-day difference during March across 82 years would correspond to a
29 negligible difference per day. Therefore, this would not result in a negative effect on fall-run Chinook
30 salmon spawning and egg incubation.

31 The Reclamation egg mortality model predicts that fall-run Chinook salmon egg mortality in the
32 Sacramento River under H3_ELT would be similar to mortality under NAA_ELT in all water year
33 types except below normal years, for which mortality under H3_ELT would be 11% higher (Table
34 11-4A-55). However, the corresponding absolute increase would be 2% of the fall-run population,
35 which is not substantial. (Therefore, these results indicate that H3_ELT would have negligible effects
36 on fall-run Chinook salmon egg mortality.

1 Table 11-4A-55. Difference and Percent Difference in Percent Mortality of Fall-Run Chinook
2 Salmon Eggs in the Sacramento River (Egg Mortality Model)

Water Year Type	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
Wet	4 (40%)	0.2 (1%)
Above Normal	5 (46%)	1 (7%)
Below Normal	7 (62%)	2 (11%)
Dry	7 (47%)	-0.4 (-2%)
Critical	5 (18%)	-0.3 (-1%)
All	5 (39%)	0.4 (2%)

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

3
4 SacEFT predicts that there would be a 33% increase in the percentage of years with good spawning
5 habitat availability for fall-run Chinook salmon, measured as weighted usable area, under H3_ELT
6 relative to NAA_ELT (Table 11-4A-56). SacEFT predicts that there would be a 12% reduction in the
7 percentage of years with good (lower) redd scour risk under H3_ELT relative to NAA_ELT. SacEFT
8 predicts that there would be no difference in the number of years with good egg incubation
9 conditions between H3_ELT and NAA_ELT. SacEFT predicts that there would be a 7% decrease in
10 the number of years with good redd dewatering risk conditions under H3_ELT relative to NAA_ELT.

11 Table 11-4A-56. **Difference and Percent Difference in Percentage of Years with “Good” Conditions**
12 for Fall-Run Chinook Salmon Habitat Metrics in the Upper Sacramento River (from SacEFT)

Metric	EXISTING CONDITIONS vs. H3_ELT	NAA vs. H3_ELT
Spawning WUA	9 (19%)	14 (33%)
Redd Scour Risk	-3 (-5%)	-8 (-12%)
Egg Incubation	-5 (-5%)	0 (0%)
Redd Dewatering Risk	0 (0%)	-2 (-7%)
Juvenile Rearing WUA	1 (3%)	-4 (-11%)
Juvenile Stranding Risk	-8 (-26%)	0 (0%)

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

WUA = Weighted Usable Area.

13
14 *Late Fall-Run*
15 Sacramento River flows upstream of Red Bluff were examined for the February through May late
16 fall-run Chinook salmon spawning and egg incubation period (Appendix 11C, *CALSIM II Model*
17 *Results utilized in the Fish Analysis*). Mean flows under H3_ELT would be similar to flows under
18 NAA_ELT during February through May.
19 Shasta Reservoir storage at the end of September would affect flows during the fall-run spawning
20 and egg incubation period. As reported in Impact AQUA-58, end of September Shasta Reservoir
21 storage under H3_ELT would be similar to storage under NAA_ELT in all water year types (Table 11-
22 4A-27).

1 The Reclamation egg mortality model predicts that late fall-run Chinook salmon egg mortality in the
2 Sacramento River under H3_ELT would be similar to or lower than mortality under NAA_ELT in all
3 water years (Table 11-4A-57).

4 Table 11-4A-57. Difference and Percent Difference in Percent Mortality of Late Fall-Run Chinook
5 Salmon Eggs in the Sacramento River (Egg Mortality Model)

Water Year Type	EXISTING CONDITIONS vs. H3_ELT	NAA vs. H3_ELT
Wet	2 (80%)	-0.1 (-3%)
Above Normal	1 (48%)	-1 (-14%)
Below Normal	2 (120%)	0.1 (3%)
Dry	2 (69%)	-0.1 (-2%)
Critical	1 (60%)	0 (0%)
All	2 (76%)	-0.1 (-3%)

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

6
7 Mean monthly water temperatures in the Sacramento River at Red Bluff were examined during the
8 February through May late fall-run Chinook salmon spawning and egg incubation period (Appendix
9 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in*
10 *the Fish Analysis*). There would be no differences (<5%) in mean monthly water temperature
11 between NAA_ELT and H3_ELT in any month or water year type throughout the period.

12 The number of days at Red Bluff on which temperature exceeded 56°F by >0.5°F to >5°F in 0.5°F
13 increments was determined for each month, during October through April, and year of the 82-year
14 modeling period (Table 11-4A-13). The combination of number of days and degrees above the 56°F
15 **threshold were further assigned a “level of concern”, as defined in** Table 11-4A-14. Differences
16 between baselines and H3_ELT in the highest level of concern across all months and all 82 modeled
17 years are presented in Table 11-4A-28. There would be 1 (5%) more **year with a “red” level of**
18 **concern** under H3_ELT. This difference would not be biologically meaningful to late fall-run Chinook
19 salmon spawners and eggs.

20 Total degree-days exceeding 56°F were summed by month and water year type at Red Bluff during
21 October through April. Total degree-days under H3_ELT would be 19% higher than those under
22 NAA_ELT during March and similar during the remaining months (Table 11-4A-29).

23 SacEFT predicts that there would be difference 6% reduction in in the percentage of years with good
24 spawning availability for late fall-run Chinook salmon, measured as weighted usable area, between
25 NAA_ELT and H3_ELT (Table 11-4A-58). SacEFT predicts that there would be a 1% reduction in
26 redd scour risk between NAA_ELT and H3_ELT. SacEFT predicts that there would be no difference in
27 the percentage of years with good (lower) egg incubation conditions and redd dewatering risk
28 between H3_ELT and NAA_ELT.

1 Table 11-4A-58. **Difference and Percent Difference in Percentage of Years with “Good”** Conditions
2 for Late Fall-Run Chinook Salmon Habitat Metrics in the Upper Sacramento River (from SacEFT)

Metric	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
Spawning WUA	-7 (-13%)	-3 (-6%)
Redd Scour Risk	-3 (-4%)	-1 (-1%)
Egg Incubation	0 (0%)	0 (0%)
Redd Dewatering Risk	-6 (-10%)	0 (0%)
Juvenile Rearing WUA	-2 (-4%)	-14 (-25%)
Juvenile Stranding Risk	-21 (-29%)	-9 (-15%)

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

WUA = Weighted Usable Area.

3

4 *Clear Creek*

5 No water temperature modeling was conducted in Clear Creek.

6 *Fall-Run*

7 Clear Creek flows below Whiskeytown Reservoir were examined for the September through
8 February fall-run Chinook salmon spawning and egg incubation period (Appendix 11C, *CALSIM II*
9 *Model Results utilized in the Fish Analysis*). Mean flows under H3_ELT would generally be similar to
10 flows under NAA_ELT.

11 The potential risk of redd dewatering in Clear Creek was evaluated by comparing the magnitude of
12 flow reduction each month during the incubation period to the flow in September when spawning is
13 assumed to occur. The greatest monthly reduction in Clear Creek flows during September through
14 February under H3_ELT would be the same as those under NAA_ELT for all water year types (Table
15 11-4A-59).

16 Table 11-4A-59. Difference and Percent Difference in Greatest Monthly Reduction (Percent
17 Change) in Instream Flow in Clear Creek below Whiskeytown Reservoir during the September
18 through February Spawning and Egg Incubation Period^a

Water Year Type	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
Wet	0 (NA)	0 (NA)
Above Normal	-41 (NA)	0 (0%)
Below Normal	53 (100%)	0 (NA)
Dry	-67 (NA)	0 (0%)
Critical	-33 (-50%)	0 (0%)

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

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

^a Redd dewatering risk not applicable for months when flows during the egg incubation period were at or greater than flows in September, when spawning is assumed to occur. A negative value indicates that the greatest monthly reduction would be of greater magnitude (worse) under the alternative than under the baseline.

19

1 *Feather River*

2 *Fall-Run*

3 Flows in the Feather River in the low-flow and high-flow channels were examined for the October
4 through January fall-run Chinook salmon spawning and egg incubation period (Appendix 11C,
5 *CALSIM II Model Results utilized in the Fish Analysis*). Flows in the low-flow channel under H3_ELT
6 would be identical to those under NAA_ELT. Flows in the high-flow channel under H3_ELT would
7 generally be similar to than those under NAA_ELT, with a few exceptions.

8 The potential risk of redd dewatering in the Feather River low-flow channel was evaluated by
9 comparing the magnitude of flow reduction each month during the incubation period to the flow in
10 October when spawning is assumed to occur. Minimum flows in the low-flow channel during
11 November through January were identical between H3_ELT and NAA_ELT (Appendix 11C, *CALSIM II*
12 *Model Results utilized in the Fish Analysis*). Therefore, there would be no effect of H3_ELT on redd
13 dewatering in the Feather River low-flow channel.

14 Mean monthly water temperatures in the Feather River above Thermalito Afterbay (low-flow
15 channel) and below Thermalito Afterbay (high-flow channel) were examined during the October
16 through January fall-run Chinook salmon spawning and egg incubation period (Appendix 11D,
17 *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the*
18 *Fish Analysis*). There would be no differences (<5%) in mean monthly water temperature between
19 NAA_ELT and H3_ELT in any month or water year type throughout the period at either location.

20 Effects of H3_ELT on water temperature-related spawning and egg incubation conditions for fall-run
21 Chinook salmon in the Feather River were analyzed by comparing the percent of months between
22 October through April over the 82-year CALSIM modeling period that exceeded a 56°F temperature
23 threshold at Gridley (Table 11-4A-60). In general, differences in the percent of months exceeding the
24 threshold between NAA_ELT and H3_ELT would be negligible (<5% on an absolute scale), although
25 there would be a 5% reduction (absolute difference) in months exceeding the threshold by >5°F
26 during October.

1 Table 11-4A-60. Differences between Baseline and H3_ELT Scenarios in Percent of Months during
2 the 82-Year CALSIM Modeling Period during Which Water Temperatures in the Feather River at
3 Gridley Exceed the 56°F Threshold, October through April

Month	Degrees Above Threshold				
	>1.0	>2.0	>3.0	>4.0	>5.0
EXISTING CONDITIONS vs. H3_ELT					
October	0 (0%)	7 (9%)	11 (15%)	25 (61%)	26 (140%)
November	14 (367%)	5 (400%)	2 (NA)	0 (NA)	0 (NA)
December	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
January	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
February	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
March	15 (200%)	5 (133%)	4 (300%)	1 (NA)	1 (NA)
April	9 (12%)	12 (22%)	20 (64%)	12 (71%)	7 (67%)
NAA_ELT vs. H3_ELT					
October	-1 (-1%)	-1 (-1%)	0 (0%)	-1 (-2%)	-5 (-10%)
November	1 (8%)	0 (0%)	0 (0%)	-1 (-100%)	0 (NA)
December	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
January	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
February	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
March	4 (20%)	0 (0%)	0 (0%)	-1 (-50%)	0 (0%)
April	0 (0%)	1 (2%)	0 (0%)	0 (0%)	2 (15%)
Note: Negative numbers indicate lower values under Alternative 4A (i.e., the calculations are based on Alternative 4A minus the baseline).					
NA = could not be calculated because the denominator was 0.					

4

5 The effects of H3_ELT on water temperature-related spawning and egg incubation conditions for
6 fall-run Chinook salmon in the Feather River were also analyzed by comparing the total degree-
7 months in the Feather River at Gridley for months that exceed the 56°F NMFS threshold during the
8 October through April fall-run Chinook salmon spawning and egg incubation period for all 82 years
9 (Table 11-4A-61). Combining all water year types, there would be little difference in total degree-
10 months exceeded between NAA_ELT and H3_ELT. Overall, these methods, combined with other
11 temperature analyses, indicate that there would be no effect of H3_ELT on temperature-related fall-
12 run Chinook salmon spawning and egg incubation conditions in the Feather River.

1 Table 11-4A-61. Differences between Baseline and H3_ELT Scenarios in Total Degree-Months
2 (°F-Months) by Month and Water Year Type for Water Temperature Exceedances above 56°F in
3 the Feather River at Gridley, October through April

Month	Water Year Type	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
October	Wet	32 (44%)	-2 (-2%)
	Above Normal	12 (27%)	-2 (-3%)
	Below Normal	13 (24%)	-4 (-6%)
	Dry	21 (40%)	-1 (-1%)
	Critical	18 (44%)	0 (0%)
	All	96 (36%)	-9 (-2%)
November	Wet	1 (NA)	0 (0%)
	Above Normal	3 (150%)	0 (0%)
	Below Normal	3 (300%)	0 (0%)
	Dry	6 (NA)	0 (0%)
	Critical	4 (400%)	0 (0%)
	All	17 (425%)	0 (0%)
December	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)
January	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)
February	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)
March	Wet	1 (NA)	0 (0%)
	Above Normal	0 (0%)	1 (NA)
	Below Normal	7 (700%)	1 (14%)
	Dry	7 (175%)	0 (0%)
	Critical	6 (150%)	0 (0%)
	All	21 (210%)	2 (7%)
April	Wet	16 (114%)	1 (3%)
	Above Normal	9 (39%)	1 (3%)
	Below Normal	6 (15%)	0 (0%)
	Dry	18 (37%)	2 (3%)
	Critical	14 (48%)	3 (8%)
	All	63 (41%)	7 (3%)

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

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

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The Reclamation egg mortality model predicts that fall-run Chinook salmon egg mortality in the Feather River under H3_ELT would be similar to or lower than mortality under NAA_ELT in all water years, including above normal and below water years, in which, although there would be a 17% and 19% relative increase, the absolute increase would be 0.4% and 0.6% of the fall-run population, respectively (Table 11-4A-62). Therefore, this increase would not cause an overall effect to fall-run Chinook salmon.

Table 11-4A-62. Difference and Percent Difference in Percent Mortality of Fall-Run Chinook Salmon Eggs in the Feather River (Egg Mortality Model)

Water Year Type	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
Wet	2 (107%)	0.2 (7%)
Above Normal	2 (145%)	0.4 (17%)
Below Normal	2 (106%)	0.6 (19%)
Dry	3 (127%)	-1 (-22%)
Critical	5 (110%)	-1 (-5%)
All	3 (119%)	-0.1 (-2%)

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

American River

Fall-Run

Flows in the American River at the confluence with the Sacramento River were examined during the October through January fall-run spawning and egg incubation period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flows under H3_ELT would be similar to or up to 25% greater than flows under NAA_ELT during October, similar to or up to 15% lower than flows under NAA_ELT during November, and generally similar in December and January.

The potential risk of redd dewatering in the American River at Nimbus Dam was evaluated by comparing the magnitude of flow reduction each month during the incubation period to the flow in October, when spawning is assumed to occur. The greatest reductions in American River flows during November through January under H3_ELT would range from 30% to 52% (absolute difference) greater in magnitude than under NAA_ELT in wet, below normal, and critical water years and 9% to 13% lower in magnitude than NAA_ELT in above normal and dry water years (Table 11-4A-63).

1 Table 11-4A-63. Difference and Percent Difference in Greatest Monthly Reduction (Percent
2 Change) in Instream Flow in the American River at Nimbus Dam during the October through
3 January Spawning and Egg Incubation Period^a

Water Year Type	EXISTING CONDITIONS vs. H3_ELT	NAA vs. H3_ELT
Wet	-18 (-83%)	-39 (NA)
Above Normal	15 (50%)	9 (37%)
Below Normal	-25 (-131%)	-30 (-197%)
Dry	32 (68%)	13 (45%)
Critical	-16 (-30%)	-52 (-329%)

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

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

^a Redd dewatering risk not applicable for months when flows during the egg incubation period were at or greater than flows in October, when spawning is assumed to occur. A negative value indicates that the greatest monthly reduction would be of greater magnitude (worse) under the alternative than under the baseline.

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5 Mean water temperatures in the American River at the Watt Avenue Bridge were examined during
6 the October through January fall-run Chinook salmon spawning and egg incubation period
7 (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results*
8 *utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature
9 between NAA_ELT and H3_ELT in any month or water year type throughout the period.

10 The percent of months exceeding the 56°F temperature threshold in the American River at the Watt
11 Avenue Bridge was evaluated during November through April (Table 11-4A-64). The percent of
12 months exceeding the threshold under H3_ELT would generally be similar to the percent under
13 NAA_ELT, except for the >5.0°F exceedance category during November, which would be 4% lower
14 (absolute difference) under H3_ELT.

1 Table 11-4A-64. Differences between Baseline and H3_ELT Scenarios in Percent of Months during
2 the 82-Year CALSIM Modeling Period during Which Water Temperatures in the American River at
3 the Watt Avenue Bridge Exceed the 56°F Threshold, November through April

Month	Degrees Above Threshold				
	>1.0	>2.0	>3.0	>4.0	>5.0
EXISTING CONDITIONS vs. H3_ELT					
November	32 (70%)	35 (127%)	28 (209%)	26 (1050%)	14 (1100%)
December	1 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
January	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
February	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
March	6 (50%)	5 (67%)	5 (200%)	1 (100%)	2 (NA)
April	17 (25%)	12 (20%)	17 (38%)	17 (54%)	5 (18%)
NAA_ELT vs. H3_ELT					
November	-5 (-6%)	1 (2%)	-1 (-3%)	-2 (-8%)	-4 (-20%)
December	0 (0%)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
January	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
February	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
March	0 (0%)	-1 (-9%)	-2 (-25%)	0 (0%)	0 (0%)
April	0 (0%)	0 (0%)	-1 (-2%)	0 (0%)	0 (0%)

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

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

4
5 Total degree-months exceeding 56°F were summed by month and water year type at the Watt
6 Avenue Bridge during November through April (Table 11-4A-65). Total degree-months would be
7 similar between NAA_ELT and H3_ELT for all months.

1 Table 11-4A-65. Differences between Baseline and H3 Scenarios in Total Degree-Months
2 (°F-Months) by Month and Water Year Type for Water Temperature Exceedances above 56°F in
3 the American River at the Watt Avenue Bridge, November through April

Month	Water Year Type	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
November	Wet	34 (136%)	-5 (-8%)
	Above Normal	16 (145%)	-1 (-4%)
	Below Normal	22 (275%)	-4 (-12%)
	Dry	25 (192%)	-1 (-3%)
	Critical	19 (119%)	1 (3%)
	All	116 (159%)	-10 (-5%)
December	Wet	0 (NA)	0 (NA)
	Above Normal	0 (NA)	0 (NA)
	Below Normal	1 (NA)	0 (0%)
	Dry	0 (NA)	0 (NA)
	Critical	0 (NA)	0 (NA)
	All	1 (NA)	0 (0%)
January	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)
February	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)
March	Wet	2 (100%)	0 (0%)
	Above Normal	3 (NA)	0 (0%)
	Below Normal	2 (67%)	0 (0%)
	Dry	3 (75%)	-2 (-22%)
	Critical	6 (60%)	-1 (-6%)
	All	16 (84%)	-3 (-8%)
April	Wet	22 (79%)	0 (0%)
	Above Normal	14 (64%)	0 (0%)
	Below Normal	15 (42%)	-1 (-2%)
	Dry	15 (20%)	0 (0%)
	Critical	14 (24%)	-2 (-3%)
	All	80 (36%)	-3 (-1%)

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

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

4
5 The Reclamation egg mortality model predicts that fall-run Chinook salmon egg mortality in the
6 American River under H3_ELT would be similar to mortality under NAA_ELT (Table 11-4A-66).

1 Table 11-4A-66. Difference and Percent Difference in Percent Mortality of Fall-Run Chinook
 2 Salmon Eggs in the American River (Egg Mortality Model)

Water Year Type	EXISTING CONDITIONS vs. H3_ELT	NAA_ELT vs. H3_ELT
Wet	15 (99%)	-0.2 (-1%)
Above Normal	14 (130%)	-1 (-3%)
Below Normal	13 (105%)	0.3 (1%)
Dry	10 (59%)	0 (0%)
Critical	4 (19%)	0 (0%)
All	12 (77%)	0 (0%)

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

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4 *Stanislaus River*

5 *Fall-Run*

6 Flows in the Stanislaus River at the confluence with the San Joaquin River were examined for the
 7 October through January fall-run Chinook salmon spawning and egg incubation period (Appendix
 8 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H3_ELT would be
 9 similar to flows under NAA_ELT throughout the period.

10 Water temperatures throughout the Stanislaus River would be similar under NAA_ELT and H3_ELT
 11 throughout the October through January period (Appendix 11D, *Sacramento River Water Quality*
 12 *Model and Reclamation Temperature Model Results utilized in the Fish Analysis*).

13 *San Joaquin River*

14 *Fall-Run*

15 Flows in the San Joaquin River at Vernalis were examined for the October through January fall-run
 16 Chinook salmon spawning and egg incubation period (Appendix 11C, *CALSIM II Model Results*
 17 *utilized in the Fish Analysis*). Mean flows under H3_ELT would be similar to flows under NAA_ELT
 18 throughout the period.

19 Water temperature modeling was not conducted in the San Joaquin River.

20 *Mokelumne River*

21 *Fall-Run*

22 Flows in the Mokelumne River at the Delta were examined for the October through January fall-run
 23 Chinook salmon spawning and egg incubation period (Appendix 11C, *CALSIM II Model Results*
 24 *utilized in the Fish Analysis*). There would be no differences in mean flows between H3_ELT and
 25 NAA_ELT throughout the period for all water year types

26 Water temperature modeling was not conducted in the Mokelumne River.

1 H4_ELT /HOS_ELT

2 *Sacramento River*

3 *Fall-Run*

4 Mean flows in the Sacramento River upstream of Red Bluff during October through January under
 5 H4_ELT would be similar to flows under NAA_ELT, except during November in which flows would
 6 be up to 15% lower, depending on water year type) (Appendix 11C, *CALSIM II Model Results utilized*
 7 *in the Fish Analysis*).

8 September Shasta mean storage volume under H4_ELT would be similar to storage volume under
 9 NAA_ELT, except in critical water years, in which storage volume would be 24% greater under
 10 H4_ELT (Table 11-4A-36).

11 Mean water temperatures in the Sacramento River at Red Bluff were examined during the October
 12 through January fall-run Chinook salmon spawning and egg incubation period (Appendix 11D,
 13 *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the*
 14 *Fish Analysis*). There would be no differences (<5%) in mean water temperature between NAA_ELT
 15 and H4_ELT in any month or water year type throughout the period.

16 The number of days at Red Bluff on which temperature exceeded 56°F by >0.5°F to >5°F in 0.5°F
 17 increments was determined for each month during October through April and year of the 82-year
 18 modeling period (Table 11-4A-13). The combination of number of days and degrees above the 56°F
 19 threshold were **further assigned a “level of concern”, as defined in** Table 11-4A-14. Differences
 20 between baselines and H4_ELT in the highest level of concern across all months and all 82 modeled
 21 years are presented in Table 11-4A-67. There would be 6 (27%) more years without any of the three
 22 levels of concern, under H4_ELT relative to NAA_ELT. These results suggest that water temperatures
 23 would improve for fall-run Chinook salmon spawning and egg incubation in the Sacramento River
 24 under H4_ELT.

25 Table 11-4A-67. Differences between Baseline Scenarios and H4_ELT Scenarios in the Number of
 26 Years in Which Water Temperature Exceedances above 56°F Are within Each Level of Concern,
 27 Sacramento River at Red Bluff, October through April

Level of Concern ^a	EXISTING CONDITIONS vs. H4_ELT	NAA_ELT vs. H4_ELT
Red	9 (75%)	0 (0%)
Orange	2 (33%)	-5 (-38%)
Yellow	12 (92%)	-1 (-4%)
None	-23 (-45%)	6 (27%)

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

^a For definitions of levels of concern, see Table 11-4A-14.

28

29 Total degree-days exceeding 56°F were summed by month and water year type at Red Bluff during
 30 October through April. Total degree-days under H4_ELT would be 10% lower than those under
 31 NAA_ELT for October, 20% lower for November, 16% higher for March, and would be similar for the
 32 remaining four months (Table 11-4A-68). The largest difference in degree-days would be the 353
 33 degree-day reduction for October.

1 Table 11-4A-68. Differences between Baseline and H4_ELT Scenarios in Total Degree-Days (°F-Days) by
2 Month and Water Year Type for Water Temperature Exceedances above 56°F in the Sacramento River
3 at Red Bluff, October through April

Month	Water Year Type	EXISTING CONDITIONS vs. H4_ELT	NAA vs. H4_ELT
October	Wet	406 (158%)	-16 (-2%)
	Above Normal	191 (73%)	-6 (-1%)
	Below Normal	229 (110%)	-29 (-6%)
	Dry	286 (58%)	-88 (-10%)
	Critical	201 (34%)	-214 (-21%)
	All	1,313 (72%)	-353 (-10%)
November	Wet	7 (700%)	-1 (-11%)
	Above Normal	4 (NA)	1 (33%)
	Below Normal	1 (NA)	-1 (-50%)
	Dry	31 (388%)	-11 (-22%)
	Critical	13 (325%)	-5 (-23%)
	All	56 (431%)	-17 (-20%)
December	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)
January	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)
February	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)
March	Wet	1 (NA)	0 (0%)
	Above Normal	0 (NA)	0 (NA)
	Below Normal	10 (111%)	9 (90%)
	Dry	20 (143%)	0 (0%)
	Critical	11 (1100%)	0 (0%)
	All	42 (175%)	9 (16%)
April	Wet	97 (84%)	0 (0%)
	Above Normal	68 (49%)	-4 (-2%)
	Below Normal	99 (125%)	5 (3%)
	Dry	118 (63%)	11 (4%)
	Critical	49 (408%)	7 (13%)
	All	431 (81%)	19 (2%)

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

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

1 Due to similar Sacramento River flows, reservoir storage, and water temperatures between H4_ELT
2 and H3_ELT, results for additional analyses (e.g., Reclamation egg mortality model, SacEFT) under
3 H4_ELT would be similar to results for analyses under H3_ELT. As a result, these additional analyses
4 were not conducted for H4_ELT. Overall, results for H4_ELT would be similar to those for H3_ELT.

5 *Late Fall-Run*

6 There would be no difference (<5%) in mean flows in the Sacramento River upstream of Red Bluff
7 during February through May between NAA_ELT and H4_ELT in any month or water year type
8 throughout the period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

9 September Shasta mean storage volume under H4_ELT would be similar to storage volume under
10 NAA_ELT except in critical water years, in which storage volume would be 24% greater under
11 H4_ELT (Table 11-4A-36).

12 Mean water temperatures in the Sacramento River at Red Bluff were examined during the February
13 through May late fall-run Chinook salmon spawning and egg incubation period (Appendix 11D,
14 *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the*
15 *Fish Analysis*). There would be no differences (<5%) in mean water temperature between NAA_ELT
16 and H4_ELT in any month or water year type throughout the period.

17 The number of days at Red Bluff on which temperature exceeded 56°F by >0.5°F to >5°F in 0.5°F
18 increments was determined for each month during October through April and year of the 82-year
19 modeling period (Table 11-4A-13). The combination of number of days and degrees above the 56°F
20 **threshold were further assigned a “level of concern”, as defined in** Table 11-4A-14. Differences
21 between baselines and H4_ELT in the highest level of concern across all months and all 82 modeled
22 years are presented in Table 11-4A-67. There would be 6 (27%) more years without any of the three
23 levels of concern, under H4_ELT relative to NAA_ELT. These results indicate that water temperature
24 conditions would improve for late fall-run Chinook salmon spawning and egg incubation in the
25 Sacramento River under H4_ELT.

26 Total degree-days exceeding 56°F were summed by month and water year type at Red Bluff during
27 October through April. Total degree-days under H4_ELT would be 10% lower than those under
28 NAA_ELT for October, 20% lower for November, 16% higher for March, and would be similar for the
29 remaining four months (Table 11-4A-68). The largest difference in degree-days would be the 353
30 degree-day reduction for October, which would correspond to a <0.2°F change per day, which is not
31 expected to affect spawning and egg incubation.

32 Due to similar Sacramento River flows, reservoir storage, and water temperatures between H4_ELT
33 and H3_ELT, results for additional analyses (e.g., Reclamation egg mortality model, SacEFT) under
34 H4_ELT would be similar to results for analyses under H3_ELT. As a result, these additional analyses
35 were not conducted for H4_ELT. Overall, results for H4_ELT would be similar to those for H3_ELT.

36 *Clear Creek*

37 No water temperature modeling was conducted in Clear Creek.

38 *Fall-Run*

39 There would be no differences (<5%) between H4_ELT and NAA_ELT in mean flows in Clear Creek
40 below Whiskeytown Reservoir during October through January for any month or water year type
41 (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

1 Feather River

2 Fall-Run

3 Mean flows in the Feather River low-flow channel during October through January would be the
4 same (<5%) between H4_ELT and NAA_ELT (Appendix 11C, *CALSIM II Model Results utilized in the*
5 *Fish Analysis*). Mean flows under H4_ELT in the high-flow channel would generally be similar to
6 those under NAA_ELT, with minor exceptions.

7 Differences in the percent of months exceeding the 56°F NMFS threshold between NAA_ELT and
8 H4_ELT would be negligible (<5% on an absolute scale) during all months except October, March,
9 and April, in which the percent of months under H4_ELT would be similar to or up to 20% lower
10 than (absolute difference) those under NAA_ELT (Table 11-4A-69). This method indicates that there
11 would be benefits of H4_ELT on temperature-related fall-run Chinook salmon spawning and egg
12 incubation conditions in the Feather River.

13 Table 11-4A-69. Differences between Baselines and H4_ELT Scenarios in Percent of Months during
14 the 82-Year CALSIM Modeling Period during Which Water Temperatures in the Feather River at
15 Gridley Exceed the 56°F Threshold, October through April

Month	Degrees Above Threshold				
	>1.0	>2.0	>3.0	>4.0	>5.0
EXISTING CONDITIONS vs. H4_ELT					
October	1 (1%)	7 (9%)	5 (7%)	22 (55%)	26 (140%)
November	12 (333%)	9 (700%)	4 (NA)	0 (NA)	0 (NA)
December	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
January	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
February	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
March	2 (33%)	2 (67%)	2 (200%)	1 (NA)	0 (NA)
April	-11 (-16%)	-6 (-11%)	2 (8%)	2 (14%)	-1 (-11%)
NAA_ELT vs. H4_ELT					
October	0 (0%)	-1 (-1%)	-6 (-7%)	-4 (-6%)	-5 (-10%)
November	0 (0%)	4 (60%)	1 (50%)	-1 (-100%)	0 (NA)
December	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
January	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
February	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
March	-9 (-47%)	-2 (-29%)	-1 (-25%)	-1 (-50%)	-1 (-100%)
April	-20 (-25%)	-17 (-25%)	-17 (-34%)	-10 (-33%)	-6 (-38%)

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

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

16

17 Combining all water year types, there would be no difference between NAA_ELT and H4_ELT in total
18 degree-months exceeded in all months except October, November, March, and April. For October
19 and November, degree-months would be higher by 8% and 62%, respectively, while for March and
20 April they would be lower by 14% and 19%, respectively (Table 11-4A-70). Splitting monthly
21 results into water year types yields highly variable outcomes. There would be small increases and
22 decreases in degree-months under H4_ELT relative to NAA_ELT depending on month and water
23 year type. Large relative differences between NAA_ELT and H4_ELT during some months and water
24 year types are mathematical artifacts due to small values of degree-months for NAA_ELT and would
25 not translate into biologically meaningful effects on fall-run Chinook salmon. Overall, this method

1 indicates that there would be no effects of H4_ELT on temperature-related fall-run Chinook salmon
2 spawning and egg incubation conditions in the Feather River.

3 Table 11-4A-70. Differences between Baselines and H4_ELT Scenarios in Total Degree-Months (°F-
4 Months) by Month and Water Year Type for Water Temperature Exceedances above 56°F in the
5 Feather River at Gridley, October through April

Month	Water Year Type	EXISTING CONDITIONS vs. H4_ELT	NAA_ELT vs. H4_ELT
October	Wet	47 (64%)	13 (12%)
	Above Normal	15 (34%)	1 (2%)
	Below Normal	24 (44%)	7 (10%)
	Dry	31 (58%)	9 (12%)
	Critical	18 (44%)	0 (0%)
	All	135 (51%)	30 (8%)
November	Wet	8 (NA)	7 (700%)
	Above Normal	3 (150%)	0 (0%)
	Below Normal	7 (700%)	4 (100%)
	Dry	10 (NA)	4 (67%)
	Critical	2 (200%)	-2 (-40%)
	All	30 (750%)	13 (62%)
December	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)
January	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)
February	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)
March	Wet	1 (NA)	0 (0%)
	Above Normal	-1 (-100%)	0 (NA)
	Below Normal	3 (300%)	-3 (-43%)
	Dry	7 (175%)	0 (0%)
	Critical	6 (150%)	0 (0%)
	All	15 (150%)	-4 (-14%)
April	Wet	5 (36%)	-10 (-34%)
	Above Normal	-4 (-17%)	-12 (-39%)
	Below Normal	-16 (-40%)	-22 (-48%)
	Dry	16 (33%)	0 (0%)
	Critical	14 (48%)	3 (8%)
	All	15 (10%)	-41 (-19%)

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

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

6

1 *American River*

2 *Fall-Run*

3 Flows in the American River at the confluence with the Sacramento River during October through
4 January would generally be similar between H4_ELT and NAA_ELT, except during October, in which
5 flows would be up to 24% higher under H4 (Appendix 11C, *CALSIM II Model Results utilized in the*
6 *Fish Analysis*).

7 Mean monthly water temperatures in the American River at the Watt Avenue Bridge were examined
8 during the October through January fall-run Chinook salmon spawning and egg incubation period
9 (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results*
10 *utilized in the Fish Analysis*). There would be no differences (<5%) in mean monthly water
11 temperature between NAA_ELT and H4_ELT in any month or water year type throughout the period.

12 The percent of months exceeding the 56°F temperature threshold in the American River at the Watt
13 Avenue Bridge was evaluated during November through April (Table 11-4A-71). The percent of
14 months exceeding the threshold under H4_ELT would be similar to or up to 11% lower (absolute
15 difference) than the percent under NAA_ELT.

16 Total degree-months exceeding 56°F were summed by month and water year type at the Watt
17 Avenue Bridge during November through April (Table 11-4A-72). Total degree-months would
18 generally be similar between NAA_ELT and H4_ELT for all months.

19 Table 11-4A-71. Differences between Baseline and H4_ELT Scenarios in Percent of Months during
20 the 82-Year CALSIM Modeling Period during Which Water Temperatures in the American River at
21 the Watt Avenue Bridge Exceed the 56°F Threshold, November through April

Month	Degrees Above Threshold				
	>1.0	>2.0	>3.0	>4.0	>5.0
EXISTING CONDITIONS vs. H4_ELT					
November	27 (59%)	26 (95%)	23 (173%)	17 (700%)	10 (800%)
December	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
January	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
February	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
March	2 (20%)	5 (67%)	4 (150%)	1 (100%)	1 (NA)
April	11 (16%)	6 (10%)	10 (22%)	10 (31%)	4 (14%)
NAA_ELT vs. H4_ELT					
November	-10 (-12%)	-7 (-12%)	-6 (-14%)	-11 (-36%)	-7 (-40%)
December	-1 (-100%)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
January	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
February	0 (NA)	0 (NA)	0 (NA)	0 (NA)	0 (NA)
March	-4 (-20%)	-1 (-9%)	-4 (-38%)	0 (0%)	-1 (-50%)
April	-6 (-7%)	-6 (-8%)	-9 (-13%)	-7 (-15%)	-1 (-4%)
Note: Negative numbers indicate lower values under Alternative 4A (i.e., the calculations are based on Alternative 4A minus the baseline).					
NA = could not be calculated because the denominator was 0.					

1 Table 11-4A-72. Differences between Baseline H4_ELT Scenarios in Total Degree-Months (°F-
2 Months) by Month and Water Year Type for Water Temperature Exceedances above 56°F in the
3 American River at the Watt Avenue Bridge, November through April

Month	Water Year Type	EXISTING CONDITIONS vs. H4_ELT	NAA_ELT vs. H4_ELT
November	Wet	36 (144%)	-3 (-5%)
	Above Normal	16 (145%)	-1 (-4%)
	Below Normal	24 (300%)	-2 (-6%)
	Dry	23 (177%)	-3 (-8%)
	Critical	20 (125%)	2 (6%)
	All	118 (162%)	-8 (-4%)
December	Wet	0 (NA)	0 (NA)
	Above Normal	0 (NA)	0 (NA)
	Below Normal	1 (NA)	0 (0%)
	Dry	0 (NA)	0 (NA)
	Critical	0 (NA)	0 (NA)
	All	1 (NA)	0 (0%)
January	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)
February	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)
March	Wet	2 (100%)	0 (0%)
	Above Normal	3 (NA)	0 (0%)
	Below Normal	2 (67%)	0 (0%)
	Dry	5 (125%)	0 (0%)
	Critical	7 (70%)	0 (0%)
	All	19 (100%)	0 (0%)
April	Wet	19 (68%)	-3 (-6%)
	Above Normal	14 (64%)	0 (0%)
	Below Normal	16 (44%)	0 (0%)
	Dry	14 (18%)	-1 (-1%)
	Critical	17 (29%)	1 (1%)
	All	80 (36%)	-3 (-1%)

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

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

1 *Stanislaus River*

2 *Fall-Run*

3 Flows in the Stanislaus River at the confluence with the San Joaquin River were examined for the
4 October through January fall-run Chinook salmon spawning and egg incubation period (Appendix
5 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H4_ELT would be
6 similar to flows under NAA_ELT throughout the period.

7 Water temperatures throughout the Stanislaus River would be similar under NAA_ELT and H4_ELT
8 throughout the October through January period (Appendix 11D, *Sacramento River Water Quality
9 Model and Reclamation Temperature Model Results utilized in the Fish Analysis*).

10 *San Joaquin River*

11 *Fall-Run*

12 Flows in the San Joaquin River at Vernalis were examined for the October through January fall-run
13 Chinook salmon spawning and egg incubation period (Appendix 11C, *CALSIM II Model Results
14 utilized in the Fish Analysis*). Mean flows under H4_ELT would be similar to flows under NAA_ELT
15 throughout the period.

16 Water temperature modeling was not conducted in the San Joaquin River.

17 *Mokelumne River*

18 *Fall-Run*

19 Flows in the Mokelumne River at the Delta were examined for the October through January fall-run
20 Chinook salmon spawning and egg incubation period (Appendix 11C, *CALSIM II Model Results
21 utilized in the Fish Analysis*). There would be no differences in mean flows between H4_ELT and NAA
22 throughout the period for all water year types.

23 Water temperature modeling was not conducted in the Mokelumne River.

24 *NEPA Effects:* Collectively, it is concluded that the effect is not adverse because spawning and egg
25 incubation habitat conditions are not substantially reduced. There are no reductions in flows under
26 Alternative 4A or increases in temperatures that would translate into biologically meaningful effects
27 on fall-/late fall-run Chinook salmon. In all rivers, there are no large or consistent differences
28 relative to NAA_ELT. Biological modeling results also indicate that Alternative 4A would not
29 substantially affect fall-/late fall-run Chinook salmon spawning and egg incubation habitat relative
30 to the NAA_ELT. There would generally be no differences among scenarios.

31 *CEQA Conclusion:* In general, Alternative 4A would degrade the quantity and quality of spawning
32 and egg incubation habitat for fall-/late fall-run Chinook salmon relative to Existing Conditions.
33 However, as further described below in the Summary of CEQA Conclusion, reviewing the
34 **alternative's impacts in relation to the NAA_ELT is a better approach because it isolates the effect of**
35 **the alternative from those of sea level rise, climate change, and future water demand.** Informed by
36 the NAA_ELT comparison, Alternative 4A would not affect the quantity and quality of spawning and
37 egg incubation habitat for fall-/late fall-run Chinook salmon relative to the CEQA baseline.

1 H3_ELT /ESO_ELT

2 *Sacramento River*

3 *Fall-Run*

4 Flows in the Sacramento River upstream of Red Bluff were examined during the October through
5 January fall-run Chinook salmon spawning and egg incubation period (Appendix 11C, *CALSIM II*
6 *Model Results utilized in the Fish Analysis*). Flows under H3_ELT would be up to 16% lower than
7 flows under Existing Conditions during October and November, and similar during December and
8 January.

9 Shasta storage volume at the end of September would be 7% to 11% lower under H3_ELT relative to
10 Existing Conditions depending on water year type (Table 11-4A-27).

11 Mean water temperatures in the Sacramento River at Red Bluff were examined during the October
12 through January fall-run Chinook salmon spawning and egg incubation period (Appendix 11D,
13 *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the*
14 *Fish Analysis*). There would be no differences (<5%) in mean water temperature between Existing
15 Conditions and H3_ELT during the period.

16 The number of days at Red Bluff on which temperature exceeded 56°F by >0.5°F to >5°F in 0.5°F
17 increments was determined for each month during October through April and year of the 82-year
18 modeling period (Table 11-4A-13). The combination of number of days and degrees above the 56°F
19 threshold were further **assigned a “level of concern”**, as defined in Table 11-4A-14. Differences
20 between H3_ELT and baselines in the highest level of concern across all months and all 82 modeled
21 years are presented in Table 11-4A-28. There would be 10 (83%) and 5 (83%) more years with
22 **“red” and “orange” levels of concern under H3_ELT** than under Existing Conditions. Total degree-
23 days exceeding 56°F were summed by month and water year type at Red Bluff during October
24 through April. Total degree-days under H3_ELT would be 78% to 554% higher than those under
25 Existing Conditions during October, November, March, and April, and there were no differences
26 during December through February (Table 11-4A-29).

27 The Reclamation egg mortality model predicts that fall-run Chinook salmon egg mortality in the
28 Sacramento River under H3_ELT would be 18% to 62% greater than mortality under Existing
29 Conditions, depending on water year type (Table 11-4A-55).

30 SacEFT predicts that there would be a 19% increase in the percentage of years with good spawning
31 availability, measured as weighted usable area, under H3_ELT relative to Existing Conditions (Table
32 11-4A-56). SacEFT predicts that there would be a 5% reduction in the percentage of years with good
33 (lower) redd scour risk under H3_ELT relative to Existing Conditions. SacEFT predicts that there
34 would be a 5% relative decrease in the percentage of years with good (lower) egg incubation
35 conditions under H3_ELT compared to Existing Conditions. SacEFT predicts that there would be no
36 difference in the percentage of years with good (lower) redd dewatering risk between H3_ELT and
37 Existing Conditions.

38 *Late Fall-Run*

39 Flows in the Sacramento River upstream of Red Bluff were examined during the February through
40 May late fall-run Chinook salmon spawning and egg incubation period (Appendix 11C, *CALSIM II*

1 *Model Results utilized in the Fish Analysis*). Mean flows under H3_ELT would generally be similar to
2 flows under Existing Conditions for all months and water year types during the period.

3 Shasta storage volume at the end of September would be 7% to 11% lower under H3_ELT relative to
4 Existing Conditions, depending on water year type (Table 11-4A-27).

5 Mean water temperatures in the Sacramento River at Red Bluff were examined during the February
6 through May late fall-run Chinook salmon spawning and egg incubation period (Appendix 11D,
7 *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the*
8 *Fish Analysis*). There would be no differences (<5%) in mean water temperature between Existing
9 Conditions and H3_ELT in any month or water year type throughout the period.

10 The number of days at Red Bluff on which temperature exceeded 56°F by >0.5°F to >5°F in 0.5°F
11 increments was determined for each month during October through April and year of the 82-year
12 modeling period (Table 11-4A-13). The combination of number of days and degrees above the 56°F
13 threshold were further assigned a “level of concern”, as defined in Table 11-4A-14. Differences
14 between H3_ELT and baselines in the highest level of concern across all months and all 82 modeled
15 years are presented in Table 11-4A-28. There would be 10 (83%) and 5 (83%) more years with
16 “red” and “orange” levels of concern under H3_ELT than under Existing Conditions.

17 Total degree-days exceeding 56°F were summed by month and water year type at Red Bluff during
18 October through April. Total degree-days under H3_ELT would be 78% to 554% higher than those
19 under Existing Conditions during October, November, March, and April, and there would be no
20 differences during December through February (Table 11-4A-29).

21 The Reclamation egg mortality model predicts that late fall-run Chinook salmon egg mortality in the
22 Sacramento River under H3_ELT would be 60% to 120% greater than mortality under Existing
23 Conditions (Table 11-4A-57). However, absolute differences in the percent of the late-fall population
24 subject to mortality would be minimal in all water years.

25 SacEFT predicts that there would be a 13% relative decrease in the percentage of years with good
26 spawning availability, measured as weighted usable area, under H3_ELT compared to Existing
27 Conditions (Table 11-4A-58). SacEFT predicts that there would be a 4% relative decrease in the
28 percentage of years with good (lower) redd scour risk under H3_ELT compared to Existing
29 Conditions. SacEFT predicts that there would be no difference in the percentage of years with good
30 (lower) egg incubation conditions under H3_ELT relative to Existing Conditions. SacEFT predicts
31 that there would be a 10% relative decrease in the percentage of years with good (lower) redd
32 dewatering risk under H3 compared to Existing Conditions.

33 *Clear Creek*

34 No water temperature modeling was conducted in Clear Creek.

35 *Fall-Run*

36 Flows in Clear Creek below Whiskeytown Reservoir were examined during the September through
37 February fall-run spawning and egg incubation period. Flows under H3_ELT would be up to 40%
38 greater during January and February, and generally similar during September through December to
39 flows under Existing Conditions, with minor exceptions.

40 The potential risk of redd dewatering in Clear Creek was evaluated by comparing the magnitude of
41 flow reduction each month during the incubation period to the flow in September when spawning

1 occurred. Clear Creek flows would be reduced during October through February under H3_ELT up to
2 67% (absolute difference) in above normal, dry, and critical water years and increased in below
3 normal water years (Table 11-4A-59).

4 *Feather River*

5 *Fall-Run*

6 Flows in the Feather River low-flow channel during October through January under H3_ELT would
7 be identical to those under Existing Conditions (Appendix 11C, *CALSIM II Model Results utilized in*
8 *the Fish Analysis*). Mean flows in the high-flow channel under H3_ELT would be up to 47% lower
9 than flows under Existing Conditions during January, up to 24% greater during October, 18% higher
10 and up to 26% lower in December, and generally similar during November.

11 The potential risk of redd dewatering in the Feather River low-flow channel was evaluated by
12 comparing the magnitude of flow reduction each month during the incubation period to the flow in
13 October when spawning is assumed to occur. Minimum flows in the low-flow channel were identical
14 between H3_ELT and Existing Conditions (Appendix 11C, *CALSIM II Model Results utilized in the Fish*
15 *Analysis*). Therefore, there would be no effect of Alternative 4 on redd dewatering in the Feather
16 River low-flow channel.

17 Mean water temperatures in the Feather River above Thermalito Afterbay (low-flow channel) and
18 below Thermalito Afterbay (high-flow channel) were examined during the October through January
19 fall-run Chinook salmon spawning and egg incubation period (Appendix 11D, *Sacramento River*
20 *Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). Mean
21 water temperatures under H3_ELT and Existing Conditions would be no different (<5%) at either
22 location.

23 Effects of H3_ELT on water temperature-related spawning and egg incubation conditions for fall-run
24 Chinook salmon in the Feather River were analyzed by comparing the percent of months between
25 October through April over the 82-year CALSIM modeling period that exceed a 56°F temperature
26 threshold at Gridley (Table 11-4A-60). In general, the percent of months exceeding the threshold
27 under H3_ELT would be up to 25% greater than the percent under Existing Conditions in all months
28 except December, January, and February, during which the percent would not differ from Existing
29 Conditions. This comparison includes the effects of climate change.

30 The effects of H3_ELT on water temperature-related spawning and egg incubation conditions for
31 fall-run Chinook salmon in the Feather River were also analyzed by comparing the total degree-
32 months for months that exceed the 56°F NMFS threshold during the October through April fall-run
33 Chinook salmon spawning and egg incubation period for all 82 years (Table 11-4A-61). In general,
34 total degree-months under H3_ELT would be up to 96 degree-months (36%) greater than under
35 Existing Conditions in all months except December, January, and February, during which degree-
36 months would not differ from Existing Conditions. This comparison includes the effects of climate
37 change.

38 The Reclamation egg mortality model predicts that fall-run Chinook salmon egg mortality in the
39 Feather River under H3_ELT would be 106% to 145% greater than mortality under Existing
40 Conditions (Table 11-4A-62).

1 *American River*

2 *Fall-Run*

3 Flows in the American River at the confluence with the Sacramento River under H3_ELT would
4 generally be up to 24% lower than flows under Existing Conditions during November and January,
5 but generally similar to flows under Existing Conditions during October and December, with some
6 exceptions.

7 The potential risk of redd dewatering in the American River at Nimbus Dam was evaluated by
8 comparing the magnitude of flow reduction each month during the incubation period to the flow in
9 October when spawning is assumed to occur. The greatest monthly reduction in American River
10 flows during November through January under H3_ELT would be 30% to 131% greater magnitude
11 than those under Existing Conditions for all year types except above normal (50% lower
12 magnitude)(Table 11-4A-63).

13 Mean water temperatures in the American River at the Watt Avenue Bridge were examined during
14 the October through January fall-run Chinook salmon spawning and egg incubation period
15 (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results*
16 *utilized in the Fish Analysis*). Mean temperatures under H3_ELT would be 6% to 7% higher than
17 those under Existing Conditions during October of all water year types except critical (5% higher).

18 The percent of months exceeding the 56°F temperature threshold in the American River at the Watt
19 Avenue Bridge was evaluated during November through April (Table 11-4A-64). The percent of
20 months exceeding the threshold under H3_ELT would be up to 35% greater (absolute difference)
21 than the percent under Existing Conditions during November, March, and April and similar to the
22 percent under Existing Conditions during December through February.

23 Total degree-months exceeding 56°F were summed by month and water year type at the Watt
24 Avenue Bridge during November through April (Table 11-4A-65). Total degree-months under
25 H3_ELT would be 36% to 159% greater than total degree-months under Existing Conditions during
26 November, March and April and similar to total degree months under Existing Conditions during
27 December through February.

28 The Reclamation egg mortality model predicts that fall-run Chinook salmon egg mortality in the
29 American River under H3_ELT would be 19% to 130% greater than mortality under Existing
30 Conditions (Table 11-4A-66).

31 *Stanislaus River*

32 *Fall-Run*

33 Flows in the Stanislaus River at the confluence with the San Joaquin River were examined during the
34 October through January fall-run spawning and egg incubation period (Appendix 11C, *CALSIM II*
35 *Model Results utilized in the Fish Analysis*). Mean flows under H3_ELT would generally be similar to
36 those under Existing Conditions.

37 Water temperatures in the Stanislaus River at the confluence with the San Joaquin River were
38 examined during the October through January fall-run spawning and egg incubation period
39 (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results*
40 *utilized in the Fish Analysis*). Mean water temperatures under H3_ELT would not be different (<5%)
41 from those under Existing Conditions for all months and water year types of the period.

1 *San Joaquin River*

2 *Fall-Run*

3 Flows in the San Joaquin River at Vernalis were examined for the October through January fall-run
4 Chinook salmon spawning and egg incubation period (Appendix 11C, *CALSIM II Model Results*
5 *utilized in the Fish Analysis*). Mean flows under H3_ELT would generally be similar in all months of
6 the period.

7 Water temperature modeling was not conducted in the San Joaquin River.

8 *Mokelumne River*

9 *Fall-Run*

10 Flows in the Mokelumne River at the Delta were examined for the October through January fall-run
11 Chinook salmon spawning and egg incubation period (Appendix 11C, *CALSIM II Model Results*
12 *utilized in the Fish Analysis*). Flows under H3_ELT would be up to 28% greater than flows under
13 Existing Conditions during December, and would generally be similar to flows under Existing
14 Conditions during the other three months of the period.

15 Water temperature modeling was not conducted in the Mokelumne River.

16 H4_ELT /HOS_ELT

17 *Sacramento River*

18 *Fall-Run*

19 Flows in the Sacramento River upstream of Red Bluff were examined during the October through
20 January fall-run spawning and egg incubation period (Appendix 11C, *CALSIM II Model Results utilized*
21 *in the Fish Analysis*). Mean flows under H4_ELT 4 would generally be similar to flows under Existing
22 Conditions. September Shasta storage volume under H4_ELT would be similar to or up to 12% lower
23 than to storage volume under Existing Conditions, depending on water year type (Table 11-4A-36).

24 Mean water temperatures in the Sacramento River at Red Bluff were examined during the October
25 through January fall-run Chinook salmon spawning and egg incubation period (Appendix 11D,
26 *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the*
27 *Fish Analysis*). There would be no differences (<5%) in mean monthly water temperature between
28 Existing Conditions and H4_ELT during the period.

29 The number of days at Red Bluff on which temperature exceeded 56°F by >0.5°F to >5°F in 0.5°F
30 increments was determined for each month during October through April and year of the 82-year
31 modeling period (Table 11-4A-13). The combination of number of days and degrees above the 56°F
32 **threshold were further assigned a “level of concern”, as defined** in Table 11-4A-14. Differences
33 between baselines and H4_ELT in the highest level of concern across all months and all 82 modeled
34 years are presented in Table 11-4A-67. There would be 75% and 33% increases in the number of
35 **years with “red” and “orange”** levels of concern, respectively, under H4_ELT relative to Existing
36 Conditions.

37 Total degree-days exceeding 56°F were summed by month and water year type at Red Bluff during
38 October through April. Total degree-days under H4_ELT would be 72% to 431% higher than those

1 under Existing Conditions during October, November, March, and April, and similar during
2 December through February (Table 11-4A-68).

3 *Late Fall-Run*

4 Flows in the Sacramento River upstream of Red Bluff were evaluated during the February through
5 May late fall-run Chinook salmon spawning and egg incubation period (Appendix 11C, *CALSIM II*
6 *Model Results utilized in the Fish Analysis*). Mean flows under H4_ELT would generally be similar to
7 flows under Existing Conditions. End of September Shasta storage volume under H4_ELT would be
8 up to 12% lower than storage volume under Existing Conditions (Table 11-4A-36).

9 Mean monthly water temperatures in the Sacramento River at Red Bluff were examined during the
10 February through May late fall-run Chinook salmon spawning and egg incubation period (Appendix
11 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in*
12 *the Fish Analysis*). There would be no differences (<5%) in mean monthly water temperature
13 between Existing Conditions and H4_ELT during the period.

14 The number of days at Red Bluff on which temperature exceeded 56°F by >0.5°F to >5°F in 0.5°F
15 increments was determined for each month during October through April and year of the 82-year
16 modeling period (Table 11-4A-13). The combination of number of days and degrees above the 56°F
17 **threshold were further assigned a “level of concern”, as defined in** Table 11-4A-14. Differences
18 between baselines and H1 in the highest level of concern across all months and all 82 modeled years
19 are presented in Table 11-4A-67. There would be 75% and 33% increases in the number of years
20 **with “red” and “orange” levels of concern, respectively, under H4_ELT** relative to Existing
21 Conditions.

22 Total degree-days exceeding 56°F were summed by month and water year type at Red Bluff during
23 October through April. Total degree-days under H4_ELT would be 72% to 431% higher than those
24 under Existing Conditions during October, November, March, and April, and similar during
25 December through February (Table 11-4A-68).

26 *Clear Creek*

27 No water temperature modeling was conducted in Clear Creek.

28 *Fall-Run*

29 Flows in Clear Creek flows below Whiskeytown Reservoir were examined during the October
30 through January fall-run Chinook salmon spawning and egg incubation period (Appendix 11C,
31 *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H4_ELT would be up to 40%
32 greater during January and February, and generally similar during September through December,
33 than flows under Existing Conditions.

34 *Feather River*

35 *Fall-Run*

36 Flows in the Feather River were evaluated in the low- and high-flow channels during the October
37 through January fall-run Chinook salmon spawning and egg incubation period (Appendix 11C,
38 *CALSIM II Model Results utilized in the Fish Analysis*). Flows in the low-flow channel would be
39 identical between Existing Conditions and H4_ELT. Mean flows in the high-flow channel under

1 H4_ELT would be up to 36% lower than those under Existing Conditions throughout the period,
2 with a few exceptions.

3 Mean water temperatures in the Feather River above Thermalito Afterbay (low-flow channel) and
4 below Thermalito Afterbay (high-flow channel) were examined during the October through January
5 fall-run Chinook salmon spawning and egg incubation period (Appendix 11D, *Sacramento River*
6 *Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). Mean
7 monthly water temperatures would be no different (<5%) under H4_ELT relative to Existing
8 Conditions at either location.

9 Differences in the percent of months exceeding the 56°F NMFS threshold between Existing
10 Conditions and H4_ELT would be negligible (<5% on an absolute scale) during all months except
11 October, November, March, and April, in which the percent of months under H4_ELT would be
12 similar to or up to 26% higher (absolute difference) than those under Existing Conditions.

13 Combining all water year types, there would be no difference between Existing Conditions and
14 H4_ELT in total degree-months exceeded in all months except October, November, March, and April,
15 during which degree-months under H4_ELT would be greater by up to 135 degree-months (51%
16 higher).

17 *American River*

18 *Fall-Run*

19 Flows were evaluated in the American River at the confluence with the Sacramento River during the
20 October through January fall-run Chinook salmon spawning and egg incubation period (Appendix
21 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flows under H4_ELT would be up to 25%
22 lower than those under Existing Conditions during November and would generally be similar
23 between Existing Conditions and H4_ELT during the other three months of the period, with a few
24 exceptions.

25 Mean water temperatures in the American River at the Watt Avenue Bridge were examined during
26 the October through January fall-run Chinook salmon spawning and egg incubation period
27 (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results*
28 *utilized in the Fish Analysis*). Mean temperatures under H4_ELT would be 6% to 7% greater than
29 those under Existing Conditions during October of all water year types except critical (5% greater)
30 and would be no different (<5%) for all other months and water year types of the period.

31 The percent of months exceeding the 56°F temperature threshold in the American River at the Watt
32 Avenue Bridge was evaluated during November through April (Table 11-4A-71). The percent of
33 months exceeding the threshold under H4_ELT would be up to 27% greater (absolute difference)
34 than the percent under Existing Conditions during November, March, and April and similar to the
35 percent under Existing Conditions during December through February.

36 Total degree-months exceeding 56°F were summed by month and water year type at the Watt
37 Avenue Bridge during November through April (Table 11-4A-72). Total degree-months under H4
38_ELT would be 36% to 159% greater than total degree-months under Existing Conditions during
39 November, March and April and similar to total degree months under Existing Conditions during
40 December through February.

1 *Stanislaus River*

2 *Fall-Run*

3 Flows in the Stanislaus River at the confluence with the San Joaquin River were examined during the
4 October through January fall-run spawning and egg incubation period (Appendix 11C, *CALSIM II*
5 *Model Results utilized in the Fish Analysis*). Mean flows under H4_ELT would generally be similar
6 between Existing Conditions and H4_ELT.

7 Water temperatures in the Stanislaus River at the confluence with the San Joaquin River were
8 examined during the October through January fall-run spawning and egg incubation period
9 (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results*
10 *utilized in the Fish Analysis*). Mean water temperatures under H4_ELT would be no different (<5%)
11 than Existing Conditions throughout the period.

12 *San Joaquin River*

13 *Fall-Run*

14 Flows in the San Joaquin River at Vernalis were examined for the October through January fall-run
15 Chinook salmon spawning and egg incubation period (Appendix 11C, *CALSIM II Model Results*
16 *utilized in the Fish Analysis*). Mean flows under H4_ELT would be generally similar to those under
17 Existing Conditions throughout the period.

18 Water temperature modeling was not conducted in the San Joaquin River.

19 *Mokelumne River*

20 *Fall-Run*

21 Flows in the Mokelumne River at the Delta were examined for the October through January fall-run
22 Chinook salmon spawning and egg incubation period (Appendix 11C, *CALSIM II Model Results*
23 *utilized in the Fish Analysis*). Flows under H4_ELT would generally be similar to flows under Existing
24 Conditions during October, November, and January, and up to 28% greater than flows under
25 Existing Conditions during December.

26 Water temperature modeling was not conducted in the Mokelumne River.

27 Summary of CEQA Conclusion

28 Under Alternative 4A, there would be moderate to substantial flow reductions and substantial
29 increases in temperatures and temperature exceedances above thresholds in the Sacramento,
30 Feather, and American Rivers, which would interfere with fall-/late fall--run Chinook salmon
31 spawning and egg incubation. Biological models, including the Reclamation egg mortality model and
32 SacEFT, predict substantially degraded spawning and egg incubation habitat conditions in the
33 Sacramento, Feather, and American Rivers. These modeling results are generally consistent for
34 H3_ELT and H4_ELT. Contrary to the NEPA conclusion set forth above, these modeling results
35 indicate that the difference between Existing Conditions and Alternative 4A could be significant
36 because the alternative could substantially reduce suitable spawning habitat and substantially
37 reduce the number of fall-/late fall-run Chinook salmon as a result of egg mortality.

1 However, this interpretation of the biological modeling results is likely attributable to different
2 modeling assumptions for four factors: sea level rise, climate change, future water demands, and
3 implementation of the alternative. As discussed in Section 11.3.3, because of differences between the
4 CEQA and NEPA baselines, it is sometimes possible for CEQA and NEPA significance conclusions to
5 vary between one another under the same impact discussion. The baseline for the CEQA analysis is
6 Existing Conditions at the time the NOP was prepared. Both the action alternative and the NEPA
7 baseline (NAA_ELT) models anticipated future conditions that would occur at 2025 (ELT
8 implementation period), including the projected effects of climate change (precipitation patterns),
9 sea level rise and future water demands, as well as implementation of required actions under the
10 2008 USFWS BiOp and the 2009 NMFS BiOp. Because the action alternative modeling does not
11 partition the effects of implementation of the alternative from the effects of sea level rise, climate
12 change, and future water demands, the comparison to Existing Conditions may not offer a clear
13 understanding of the impact of the alternative on the environment. This suggests that the
14 comparison of results between the alternative and NAA_ELT is a better approach because it isolates
15 the effect of the alternative from those of sea level rise, climate change, and future water demands.

16 When compared to NAA_ELT and informed by the NEPA analysis above, there would be no effect of
17 Alternative 4A on flows, reservoir storage, and water temperatures that would cause a substantial
18 reduction in fall-/late fall-run Chinook salmon. These modeling results represent the increment of
19 change attributable to the alternative, demonstrating the similarities in flows, reservoir storage, and
20 water temperature under Alternative 4A and the NAA_ELT, and addressing the limitations of the
21 CEQA baseline (Existing Conditions). Therefore, this impact is found to be less than significant and
22 no mitigation is required.

23 Impact AQUA-77: Effects of Water Operations on Rearing Habitat for Chinook Salmon
24 (Fall-/Late Fall-Run ESU)

25 In general, Alternative 4A would not affect the quantity and quality of larval and juvenile rearing
26 habitat for fall-/late fall-run Chinook salmon relative to the NAA_ELT.

27 H3_ELT /ESO_ELT

28 *Sacramento River*

29 *Fall-Run*

30 Sacramento River flows upstream of Red Bluff were examined for the January through May fall-run
31 Chinook salmon juvenile rearing period (Appendix 11C, *CALSIM II Model Results utilized in the Fish*
32 *Analysis*). Mean flows in the Sacramento River upstream of Red Bluff under H3_ELT would generally
33 be similar to flows under NAA_ELT.

34 Shasta Reservoir storage at the end of September would affect flows during the fall-run larval and
35 juvenile rearing period. As reported in AQUA-58, mean end of September Shasta Reservoir storage
36 under H3_ELT would be similar to storage under NAA_ELT in all water year types (Table 11-4A-27).

37 Mean monthly water temperatures in the Sacramento River at Red Bluff were examined during the
38 January through May fall-run Chinook salmon juvenile rearing period (Appendix 11D, *Sacramento*
39 *River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*).
40 There would be no differences (<5%) in mean monthly water temperature between NAA_ELT and
41 H3_ELT in any month or water year type throughout the period.

1 SacEFT predicts that there would be an 11% decrease (4% on an absolute scale) in the percentage of
2 years with good juvenile rearing availability for fall-run Chinook salmon, measured as weighted
3 usable area, under H3_ELT relative to NAA_ELT (Table 11-4A-56). SacEFT predicts that there would
4 be no difference in the percentage of years with “good” (lower) juvenile stranding risk between
5 H3_ELT and NAA_ELT.

6 SALMOD predicts that fall-run smolt equivalent habitat-related mortality under H3_ELT would be
7 similar to mortality under NAA_ELT.

8 *Late Fall-Run*

9 Sacramento River flows upstream of Red Bluff were examined for the March through July late fall-
10 run Chinook salmon juvenile rearing period (Appendix 11C, *CALSIM II Model Results utilized in the*
11 *Fish Analysis*). Upstream of Red Bluff, mean flows under H3_ELT would generally be similar to those
12 under NAA throughout the period.

13 Shasta Reservoir storage at the end of September and May would affect flows during the late fall-run
14 larval and juvenile rearing period. As reported in AQUA-156, end of September Shasta Reservoir
15 storage under H3_ELT would be similar to storage under NAA_ELT in all water year types (Table 11-
16 4A-27).

17 As reported in AQUA-40, May Shasta storage volume under H3_ELT would be similar to storage
18 under NAA_ELT for all water year types (Table 11-4A-19).

19 Mean water temperatures in the Sacramento River at Red Bluff were examined during the March
20 through July late fall-run Chinook salmon juvenile rearing period (Appendix 11D, *Sacramento River*
21 *Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There
22 would be no differences (<5%) in mean water temperature between NAA_ELT and H3_ELT in any
23 month or water year type throughout the period.

24 SacEFT predicts that there would be a 25% relative decrease in the percentage of years with good
25 juvenile rearing habitat availability for late fall-run Chinook salmon, measured as weighted usable
26 area, under H3_ELT compared to NAA_ELT (Table 11-4A-58). SacEFT predicts that there would be a
27 15% reduction in the percentage of years with “good” (lower) juvenile stranding risk under H3_ELT
28 relative to NAA_ELT, which would be negligible on an absolute scale (4% difference).

29 SALMOD predicts that late fall-run smolt equivalent habitat-related mortality under H3_ELT would
30 be similar (<5% difference) to mortality under NAA_ELT. These results are inconsistent with SacEFT
31 results, which indicate that juvenile rearing habitat availability would decline under H3_ELT (Table
32 11-4A-58).

33 Both SacEFT and SALMOD are considered to be reliable models for late fall-run Chinook salmon in
34 the Sacramento River. SALMOD has been used for decades for assessing changes in flows associated
35 with SWP and CVP and SacEFT has been peer-reviewed. Therefore, results of both models were used
36 to draw conclusions about late fall-run Chinook salmon rearing conditions. The SALMOD model
37 incorporates effects to all early life stages, including eggs, fry, and juveniles. Therefore, although
38 SacEFT predicts that juvenile rearing habitat availability may be reduced under H3_ELT, when
39 combined with all early life stage effects in SALMOD, there would be no effect of H3_ELT on late-fall-
40 run Chinook salmon habitat-related survival of all early life stages, including juveniles. Further,
41 results from SALMOD are consistent with results described above that indicate that there would be
42 no differences in instream flows or reservoir storage between NAA_ELT and H3_ELT.

1 *Clear Creek*

2 No water temperature modeling was conducted in Clear Creek.

3 *Fall-Run*

4 Flows in Clear Creek below Whiskeytown Reservoir were examined for the January through May
5 fall-run Chinook salmon rearing period (Appendix 11C, *CALSIM II Model Results utilized in the Fish*
6 *Analysis*). Mean flows under H3_ELT would be similar to those under NAA_ELT throughout the
7 period.

8 *Feather River*

9 *Fall-Run*

10 Flows in the Feather River both above (low-flow channel) and at Thermalito Afterbay (high-flow
11 channel) during December through June were reviewed to determine flow-related effects on larval
12 and juvenile fall-run rearing period (Appendix 11C, *CALSIM II Model Results utilized in the Fish*
13 *Analysis*). Relatively constant flows in the low-flow channel throughout this period under H3_ELT
14 would not differ from those under NAA_ELT. In the high-flow channel, mean flows under H3_ELT
15 would generally be similar to those under NAA_ELT during December through April and up to 106%
16 greater during May and June.

17 As reported in AQUA-59, May Oroville mean storage volume under H3_ELT would be similar to
18 storage under NAA_ELT for all water year types (Table 11-4A-42).

19 As reported in AQUA-58, September Oroville mean storage volume under H3_ELT would be similar
20 to volume in wet, above normal, and below normal water years and 12% to 15% greater than
21 volume under NAA_ELT during dry and critical water years (Table 11-4A-39).

22 Mean water temperatures in the Feather River in both above (low-flow channel) and at Thermalito
23 Afterbay (high-flow channel) were examined during the December through June fall-run Chinook
24 salmon juvenile rearing period (Appendix 11D, *Sacramento River Water Quality Model and*
25 *Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences
26 (<5%) in mean monthly water temperature between NAA_ELT and H3_ELT in any month or water
27 year type throughout the period at either location.

28 *American River*

29 *Fall-Run*

30 Flows in the American River at the confluence with the Sacramento River were examined for the
31 January through May fall-run larval and juvenile rearing period (Appendix 11C, *CALSIM II Model*
32 *Results utilized in the Fish Analysis*). Mean flows under H3_ELT would generally be similar to those
33 under NAA_ELT throughout the period.

34 Mean monthly water temperatures in the American River at the Watt Avenue Bridge were examined
35 during the January through May fall-run Chinook salmon juvenile rearing period (Appendix 11D,
36 *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the*
37 *Fish Analysis*). There would be no differences (<5%) in mean monthly water temperature between
38 NAA_ELT and H3_ELT in any month or water year type throughout the period.

1 *Stanislaus River*

2 *Fall-Run*

3 Flows in the Stanislaus River at the confluence with the San Joaquin River for H3_ELT are not
4 different from those under NAA_ELT, for the January through May fall-run Chinook salmon juvenile
5 rearing period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

6 Mean monthly water temperatures throughout the Stanislaus River would be similar between
7 NAA_ELT and H3_ELT throughout the January through May fall-run rearing period (Appendix 11D,
8 *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the*
9 *Fish Analysis*).

10 *San Joaquin River*

11 *Fall-Run*

12 Flows in the San Joaquin River at Vernalis for H3_ELT are not different from those under NAA_ELT,
13 for the January through May fall-run larval and juvenile rearing period (Appendix 11C, *CALSIM II*
14 *Model Results utilized in the Fish Analysis*).

15 Water temperature modeling was not conducted in the San Joaquin River.

16 *Mokelumne River*

17 *Fall-Run*

18 Flows in the Mokelumne River at the Delta for H3_ELT are not different from those under NAA_ELT,
19 for the January through May fall-run larval and juvenile rearing period (Appendix 11C, *CALSIM II*
20 *Model Results utilized in the Fish Analysis*).

21 Water temperature modeling was not conducted in the Mokelumne River.

22 H4_ELT/HOS_ELT

23 *Sacramento River*

24 *Fall-Run*

25 Sacramento River flows upstream of Red Bluff were evaluated during the January through May fall-
26 run Chinook salmon juvenile rearing period (Appendix 11C, *CALSIM II Model Results utilized in the*
27 *Fish Analysis*). The mean flows under H4_ELT during this period would generally be similar to those
28 under NAA_ELT.

29 September Shasta mean storage volume under H4_ELT would generally be similar to September
30 storage volume under NAA_ELT, except in critical years (24% higher under H4_ELT) (Table 11-4A-
31 36).

32 Mean water temperatures in the Sacramento River at Red Bluff were examined during the January
33 through May fall-run Chinook salmon juvenile rearing period (Appendix 11D, *Sacramento River*
34 *Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There
35 would be no differences (<5%) in mean water temperature between NAA and H4 in any month or
36 water year type throughout the period.

1 *Late Fall-Run*

2 Sacramento River flows upstream of Red Bluff were evaluated during the March through July late
3 fall-run Chinook salmon juvenile rearing period (Appendix 11C, *CALSIM II Model Results utilized in*
4 *the Fish Analysis*). Mean flows under H4_ELT during this period would be similar to those under
5 NAA_ELT for all year types throughout the period.

6 September Shasta mean storage volume under H4_ELT would be similar to September storage
7 volume under NAA_ELT except in critical years (24% higher under H4) (Table 11-4A-36). May
8 Shasta storage volume under H4_ELT would be similar to May storage volume under NAA_ELT
9 except in critical years (11% higher under H4_ELT) (Table 11-4A-19).

10 Mean water temperatures in the Sacramento River at Red Bluff were examined during the March
11 through July late fall-run Chinook salmon juvenile rearing period (Appendix 11D, *Sacramento River*
12 *Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There
13 would be no differences (<5%) in mean water temperature between NAA_ELT and H4_ELT in any
14 month or water year type throughout the period.

15 *Clear Creek*

16 No water temperature modeling was conducted in Clear Creek.

17 *Fall-Run*

18 Mean flows in Clear Creek below Whiskeytown Reservoir during January through May under
19 H4_ELT would generally be similar to those under NAA_ELT (Appendix 11C, *CALSIM II Model Results*
20 *utilized in the Fish Analysis*).

21 *Feather River*

22 *Fall-Run*

23 Flows in the Feather River were evaluated at both above (low-flow channel) and at (high-flow
24 channel) Thermalito Afterbay during the December through June fall-run juvenile rearing period
25 (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows in the low-flow
26 channel would be identical between NAA_ELT and H4_ELT. Mean flows in the high-flow channel
27 would generally be similar to or greater than those under NAA_ELT (up to 548% greater for below
28 normal year types in April) than flows under NAA_ELT.

29 September Oroville mean storage under H4_ELT would generally be similar to mean storage volume
30 under NAA_ELT in wet, above normal, and below normal water year types and 28% to 44% greater
31 in dry and critical water year types (Table 11-4A-39). May Oroville storage under H4_ELT would be
32 11% to 16% lower than storage under NAA_ELT in wet, above normal, and below normal water
33 years, similar in dry water years, and 24% greater in critical water years (Table 11-4A-45).

34 Mean water temperatures in the Feather River in both above (low-flow channel) and at Thermalito
35 Afterbay (high-flow channel) were examined during the December through June fall-run Chinook
36 salmon juvenile rearing period (Appendix 11D, *Sacramento River Water Quality Model and*
37 *Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences
38 (<5%) in mean water temperature between NAA_ELT and H4_ELT in any month or water year type
39 throughout the period at either location.

1 *American River*

2 *Fall-Run*

3 Flows in the American River at the confluence with the Sacramento River were evaluated during the
4 January through May fall-run Chinook salmon juvenile rearing period (Appendix 11C, *CALSIM II*
5 *Model Results utilized in the Fish Analysis*). Mean flows under H4_ELT would generally be similar to
6 flows under NAA_ELT throughout the period.

7 Mean water temperatures in the American River at the Watt Avenue Bridge were examined during
8 the January through May fall-run Chinook salmon juvenile rearing period (Appendix 11D,
9 *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the*
10 *Fish Analysis*). There would be no differences (<5%) in mean water temperature between NAA_ELT
11 and H4_ELT in any month or water year type throughout the period.

12 *Stanislaus River*

13 *Fall-Run*

14 Mean flows in the Stanislaus River at the confluence with the San Joaquin River for H4_ELT are not
15 different (<5%) from those under NAA_ELT for the January through May fall-run Chinook salmon
16 juvenile rearing period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

17 Mean water temperatures throughout the Stanislaus River would be similar between NAA_ELT and
18 H4_ELT throughout the January through May fall-run rearing period (Appendix 11D, *Sacramento*
19 *River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*).

20 *San Joaquin River*

21 *Fall-Run*

22 Mean flows in the San Joaquin River at Vernalis for H4_ELT are not different (<5%) from those
23 under NAA_ELT for the January through May fall-run larval and juvenile rearing period (Appendix
24 11C, *CALSIM II Model Results utilized in the Fish Analysis*)

25 Water temperature modeling was not conducted in the San Joaquin River.

26 *Mokelumne River*

27 *Fall-Run*

28 Mean flows in the Mokelumne River at the Delta for H4_ELT are not different (<5%) from those
29 under NAA_ELT for the January through May fall-run larval and juvenile rearing period (Appendix
30 11C, *CALSIM II Model Results utilized in the Fish Analysis*)

31 Water temperature modeling was not conducted in the Mokelumne River.

32 *NEPA Effects:* All changes in flow rates and water temperatures are generally small and infrequent
33 under Alternative 4A relative to the NAA_ELT. Therefore, there would be no biologically meaningful
34 effects to fall- or late fall-run Chinook salmon. Biological modeling generally supports this
35 conclusion, except for a reduction in late fall-run Chinook salmon juvenile rearing habitat conditions
36 predicted by SacEFT. However, review of this result in combination with SALMOD results, which
37 evaluates habitat-related survival of all early life stages and found no effect of Alternative 4A, it is

1 concluded that the effect to juvenile habitat conditions predicted by SacEFT would not have a
2 substantial effect on all early life stages combined, including juveniles, as predicted by SALMOD. As
3 such, the effect is not adverse because it does not have the potential to substantially reduce the
4 amount of suitable habitat of fish.

5 *CEQA Conclusion:* In general, Alternative 4A would not affect the quantity and quality of larval and
6 juvenile rearing habitat for fall-/late fall-run Chinook salmon relative to Existing Conditions.

7 H3_ELT /ESO_ELT

8 *Sacramento River*

9 *Fall-Run*

10 Sacramento River flows upstream of Red Bluff were examined for the January through May fall-run
11 Chinook salmon juvenile rearing period (Appendix 11C, *CALSIM II Model Results utilized in the Fish*
12 *Analysis*). Mean flows under H3_ELT would generally be similar to those under Existing Conditions
13 throughout the period.

14 As reported in AQUA-58, end of September Shasta Reservoir mean storage would be 7% to 11%
15 lower under H3_ELT relative to Existing Conditions, depending on water year type (Table 11-4A-
16 27).

17 Mean water temperatures in the Sacramento River at Red Bluff were examined during the January
18 through May fall-run Chinook salmon juvenile rearing period (Appendix 11D, *Sacramento River*
19 *Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There
20 would be no differences (<5%) in mean water temperature between Existing Conditions and
21 H3_ELT in any month or water year type throughout the period.

22 SacEFT predicts that there would be a 3% increase in the percentage of years with good juvenile
23 rearing availability for fall-run Chinook salmon, measured as weighted usable area, under H3_ELT
24 relative to Existing Conditions (Table 11-4A-56). SacEFT predicts that there would be a 26%
25 **reduction in the percentage of years with “good” (lower) juvenile stranding risk** under H3_ELT
26 relative to Existing Conditions.

27 SALMOD predicts that fall-run smolt equivalent habitat-related mortality under H3_ELT would be
28 similar to mortality under Existing Conditions.

29 *Late Fall-Run*

30 Sacramento River flows upstream of Red Bluff were examined for the March through July late fall-
31 run Chinook salmon juvenile rearing period (Appendix 11C, *CALSIM II Model Results utilized in the*
32 *Fish Analysis*). Flows under H3 would generally be up to 20% greater during May and June, and
33 similar in the remaining months.

34 As reported in AQUA-58, mean storage volume at the end of September under H3_ELT would be 7%
35 to 11% lower relative to Existing Conditions, depending on water year type (Table 11-4A-27).

36 As reported in AQUA-40, Shasta Reservoir mean storage volume at the end of May under H3_ELT
37 would be similar to volume under Existing Conditions for all water year types (Table 11-4A-19).

38 Mean monthly water temperatures in the Sacramento River at Red Bluff were examined during the
39 March through July late fall-run Chinook salmon juvenile rearing period (Appendix 11D, *Sacramento*

1 *River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis).*
2 There would be no differences (<5%) in mean monthly water temperature between Existing
3 Conditions and H3 in any month or water year type throughout the period.

4 SacEFT predicts that there would be a 4% reduction in the percentage of years with good juvenile
5 rearing availability for late fall-run Chinook salmon, measured as weighted usable area, under
6 H3_ELT relative to Existing Conditions (Table 11-4A-58). SacEFT predicts that there would be a 29%
7 **reduction in the percentage of years with “good” (lower) juvenile stranding risk under H3_ELT**
8 relative to Existing Conditions.

9 SALMOD predicts that late fall-run smolt equivalent habitat-related mortality under H3_ELT would
10 be 4% higher than mortality under Existing Conditions.

11 *Clear Creek*

12 No temperature modeling was conducted in Clear Creek.

13 *Fall-Run*

14 Flows in Clear Creek below Whiskeytown Reservoir were examined from January through May fall-
15 run Chinook salmon rearing period (Appendix 11C, *CALSIM II Model Results utilized in the Fish*
16 *Analysis*). Mean flows under H3_ELT would generally be similar to those under Existing Conditions,
17 except for critical year types during January through April (10% greater under H3_ELT in all four
18 months) and wet year types in January and February (up to 40% greater under H3_ELT) (Appendix
19 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

20 *Feather River*

21 *Fall-Run*

22 Flows in the Feather River both above (low-flow channel) and at Thermalito Afterbay (high-flow
23 channel) during December through June were reviewed to determine flow-related effects on larval
24 and juvenile fall-run rearing period (Appendix 11C, *CALSIM II Model Results utilized in the Fish*
25 *Analysis*). Relatively constant flows in the low-flow channel throughout the period under H3_ELT
26 would not differ from those under Existing Conditions. In the high-flow channel, relative to Existing
27 Conditions, mean flows under H3_ELT would generally be similar during December, March, and
28 April, lower during January and February (by up to 48%), and higher during May and June (up to
29 140%).

30 As reported under AQUA-59, May Oroville mean storage volume under H3_ELT would be up to 12%
31 lower (dry year types) than Existing Conditions (Table 11-4A-42).

32 As reported in AQUA-58, September Oroville mean storage volume would be 5% to 29% lower
33 under H3_ELT relative to Existing Conditions depending on water year type, except for critical years
34 (Table 11-4A-33).

35 Mean water temperatures in the Feather River in both above (low-flow channel) and at Thermalito
36 Afterbay (high-flow channel) were examined during the December through June fall-run Chinook
37 salmon juvenile rearing period (Appendix 11D, *Sacramento River Water Quality Model and*
38 *Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences
39 (5%) in mean water temperature between H3_ELT and Existing Conditions in any month or water
40 year type throughout the period at either location.

1 *American River*

2 *Fall-Run*

3 Flows in the American River at the confluence with the Sacramento River were examined for the
4 January through May fall-run larval and juvenile rearing period (Appendix 11C, *CALSIM II Model*
5 *Results utilized in the Fish Analysis*). Mean flows under H3_ELT during the period would be up to
6 18% lower and up to 15% higher than flows under Existing Conditions, depending on the month and
7 water year type.

8 Mean water temperatures in the American River at the Watt Avenue Bridge were examined during
9 the January through May fall-run Chinook salmon juvenile rearing period (Appendix 11D,
10 *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the*
11 *Fish Analysis*). Mean water temperatures under H3_ELT would be no different than (<5%) those
12 under Existing Conditions during the period.

13 *Stanislaus River*

14 *Fall-Run*

15 Mean flows in the Stanislaus River at the confluence with the San Joaquin River for H3_ELT would
16 generally be lower than those under Existing Conditions during the January through May fall-run
17 larval and juvenile rearing period for most water year types (up to 29% lower for critical year types
18 in February) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

19 Mean water temperatures in the Stanislaus River at the confluence with the San Joaquin River were
20 examined during the January through May fall-run Chinook salmon juvenile rearing period
21 (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results*
22 *utilized in the Fish Analysis*). Mean water temperatures under H3_ELT would be no different than
23 (<5%) those under Existing Conditions throughout the period.

24 *San Joaquin River*

25 *Fall-Run*

26 Flows in the San Joaquin River at Vernalis were examined for the January through May fall-run
27 Chinook salmon larval and juvenile rearing period (Appendix 11C, *CALSIM II Model Results utilized in*
28 *the Fish Analysis*). Mean flows under H3_ELT would generally be similar to or moderately lower than
29 flows under Existing Conditions throughout the period.

30 Water temperature modeling was not conducted in the San Joaquin River.

31 *Mokelumne River*

32 *Fall-Run*

33 Flows in the Mokelumne River at the Delta were examined for January through May fall-run Chinook
34 salmon larval and juvenile rearing period (Appendix 11C, *CALSIM II Model Results utilized in the Fish*
35 *Analysis*). Mean flows under H3_ELT would be generally similar to or moderately greater than those
36 under Existing Conditions during January through March and similar to or slightly lower than flows
37 under Existing Conditions during April and May.

38 Water temperature modeling was not conducted in the Mokelumne River.

1 H4_ELT/HOS_ELT

2 *Sacramento River*

3 *Fall-Run*

4 Sacramento River mean flows upstream of Red Bluff during January through May under H4_ELT
5 would generally be similar to flows under Existing Conditions (Appendix 11C, *CALSIM II Model*
6 *Results utilized in the Fish Analysis*). September Shasta mean storage volume under H4_ELT would
7 generally be similar to or slightly lower than September mean storage volume under Existing
8 Conditions (Table 11-4A-27).

9 Mean water temperatures in the Sacramento River at Red Bluff were examined during the January
10 through March fall-run Chinook salmon juvenile rearing period (Appendix 11D, *Sacramento River*
11 *Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There
12 would be no differences (<5%) in mean monthly water temperature between Existing Conditions
13 and H4_ELT in any month or water year type throughout the period.

14 *Late Fall-Run*

15 Sacramento River mean flows upstream of Red Bluff during March through July under H4_ELT
16 would generally be similar to flows under Existing Conditions throughout the period (Appendix 11C,
17 *CALSIM II Model Results utilized in the Fish Analysis*).

18 September Shasta mean storage volume under H4_ELT would generally similar to or slightly lower
19 than September mean storage volume under Existing Conditions (Table 11-4A-36). May Shasta
20 mean storage volume under H4_ELT would be similar to mean storage volume under Existing
21 Conditions for all water year types (Table 11-4A-19).

22 Mean monthly water temperatures in the Sacramento River at Red Bluff were examined during the
23 March through July late fall-run Chinook salmon juvenile rearing period (Appendix 11D, *Sacramento*
24 *River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*).
25 There would be no differences (<5%) in mean monthly water temperature between Existing
26 Conditions and H4_ELT in any month or water year type throughout the period.

27 *Clear Creek*

28 No water temperature modeling was conducted in Clear Creek.

29 *Fall-Run*

30 Mean flows in Clear Creek below Whiskeytown Reservoir during January through May under
31 H4_ELT would be similar to or greater than those under Existing Conditions (up to 40% greater for
32 wet years in January) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

33 *Feather River*

34 *Fall-Run*

35 Flows were evaluated in the Feather River both above (low-flow channel) and at (high-flow channel)
36 Thermalito Afterbay during the December through June fall-run Chinook salmon juvenile rearing
37 period (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows in the low-
38 flow channel would be identical between Existing Conditions and H4_ELT. Mean flows in the high-

1 flow channel under H4_ELT would generally be lower than flows under Existing Conditions during
2 December through February (up to 36% lower for below normal year types in January), similar
3 during March, and greater than flows under Existing Conditions during April through June (up to
4 509% greater for below normal year types in April).

5 September Oroville mean storage under H4_ELT would be 23% to 24% lower than flows under
6 Existing Conditions in wet, above normal, and below normal water years, and 5% to 32% higher in
7 dry and critical water years (Table 11-4A-39). May Oroville mean storage would be 11% to 19%
8 lower under H4_ELT than under Existing Conditions in all water year types except critical, in which
9 storage would be 15% higher (Table 11-4A-45).

10 Mean monthly water temperatures in the Feather River both above (low-flow channel) and at
11 Thermalito Afterbay (high-flow channel) were examined during the December through June fall-run
12 Chinook salmon juvenile rearing period (Appendix 11D, *Sacramento River Water Quality Model and*
13 *Reclamation Temperature Model Results utilized in the Fish Analysis*). There would be no differences
14 (5%) in mean water temperature between H4_ELT and Existing Conditions in any month or water
15 year type throughout the period at either location.

16 *American River*

17 *Fall-Run*

18 Flows were evaluated in the American River at the confluence with the Sacramento River during the
19 January through May fall-run Chinook salmon juvenile rearing period (Appendix 11C, *CALSIM II*
20 *Model Results utilized in the Fish Analysis*). Mean flows under H4_ELT would be up to 20% lower
21 than flows under Existing Conditions during May, up to 14% higher during February, and similar,
22 with minor exceptions, in the remaining months of the rearing period.

23 Mean monthly water temperatures in the American River at the Watt Avenue Bridge were examined
24 during the January through May fall-run Chinook salmon juvenile rearing period (Appendix 11D,
25 *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the*
26 *Fish Analysis*). There would be no differences (5%) in mean water temperature between H4_ELT and
27 Existing Conditions in any month or water year type throughout the period.

28 *Stanislaus River*

29 *Fall-Run*

30 Mean flows in the Stanislaus River at the confluence with the San Joaquin River for H4_ELT would be
31 lower for most water year types than those under Existing Conditions in the January through May
32 fall-run larval and juvenile rearing period (up to 29% lower for critical years during February)
33 (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

34 Mean monthly water temperatures in the Stanislaus River at the confluence with the San Joaquin
35 River were examined during the January through May fall-run Chinook salmon juvenile rearing
36 period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model*
37 *Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water
38 temperature between H4_ELT and Existing Conditions in any month or water year type throughout
39 the period.

1 *San Joaquin River*

2 *Fall-Run*

3 Flows in the San Joaquin River at Vernalis were examined for the January through May fall-run
4 Chinook salmon larval and juvenile rearing period (Appendix 11C, *CALSIM II Model Results utilized in*
5 *the Fish Analysis*). Mean flows under H4_ELT would be similar to or moderately lower than those
6 under Existing Conditions for most water year types in the January through May fall-run larval and
7 juvenile rearing period. Water temperature modeling was not conducted in the San Joaquin River.

8 *Mokelumne River*

9 *Fall-Run*

10 Flows in the Mokelumne River at the Delta were examined for January through May fall-run Chinook
11 salmon larval and juvenile rearing period (Appendix 11C, *CALSIM II Model Results utilized in the Fish*
12 *Analysis*). Mean monthly flows under H4_ELT would be similar to those under Existing Conditions
13 for most water year types than in the January through May fall-run larval and juvenile rearing
14 period.

15 Water temperature modeling was not conducted in the Mokelumne River.

16 Summary of CEQA Conclusion

17 Under Alternative 4A, including climate change effects, there would be persistent moderate flow
18 reductions in the Feather, American, Stanislaus, Mokelumne, and San Joaquin Rivers, which would
19 interfere with fall-/late fall--run Chinook salmon juvenile rearing habitat conditions. Contrary to the
20 NEPA conclusion set forth above, these modeling results indicate that the difference between
21 Existing Conditions and Alternative 4A could be significant because the alternative could
22 substantially reduce suitable rearing habitat and substantially reduce the number of fall-/late fall-
23 run Chinook salmon as a result of degraded juvenile rearing conditions.

24 However, this interpretation of the biological modeling results is likely attributable to different
25 modeling assumptions for four factors: sea level rise, climate change, future water demands, and
26 implementation of the alternative. As discussed in Section 11.3.3, because of differences between the
27 CEQA and NEPA baselines, it is sometimes possible for CEQA and NEPA significance conclusions to
28 vary between one another under the same impact discussion. The baseline for the CEQA analysis is
29 Existing Conditions at the time the NOP was prepared. Both the action alternative and the NEPA
30 baseline (NAA_ELT) models anticipated future conditions that would occur at 2025 (ELT
31 implementation period), including the projected effects of climate change (precipitation patterns),
32 sea level rise and future water demands, as well as implementation of required actions under the
33 2008 USFWS BiOp and the 2009 NMFS BiOp. Because the action alternative modeling does not
34 partition the effects of implementation of the alternative from the effects of sea level rise, climate
35 change, and future water demands, the comparison to Existing Conditions may not offer a clear
36 understanding of the impact of the alternative on the environment. This suggests that the
37 comparison of results between the alternative and NAA_ELT is a better approach because it isolates
38 the effect of the alternative from those of sea level rise, climate change, and future water demands.
39 When compared to NAA_ELT and informed by the NEPA analysis above, flows, reservoir storage,
40 and water temperatures in the Sacramento River would generally be similar between NAA_ELT and
41 Alternative 4A. These modeling results represent the increment of change attributable to the
42 alternative, demonstrating the similarities in flows, reservoir storage, and water temperature under

1 Alternative 4A and the NAA_ELT, and addressing the limitations of the CEQA baseline (Existing
2 Conditions). Therefore, this impact is found to be less than significant and no mitigation is required.

3 Impact AQUA-78: Effects of Water Operations on Migration Conditions for Chinook Salmon
4 (Fall-/Late Fall-Run ESU)

5 With implementation of Mitigation Measure AQUA-78d, the effect of Alternative 4A on migration
6 conditions for fall-/late fall-run Chinook salmon relative to the No Action Alternative would not be
7 adverse.

8 Upstream of the Delta

9 H3_ELT /ESO_ELT

10 *Sacramento River*

11 *Fall-Run*

12 Flows in the Sacramento River upstream of Red Bluff were examined for juvenile fall-run migrants
13 during February through May (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).
14 Mean flows under H3_ELT would generally be similar to flows under NAA_ELT throughout the
15 juvenile migration period.

16 Mean water temperatures in the Sacramento River at Red Bluff were examined during the February
17 through May juvenile fall-run Chinook salmon migration period (Appendix 11D, *Sacramento River*
18 *Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There
19 would be no differences (<5%) in mean water temperature between NAA_ELT and H3_ELT in any
20 month or water year type throughout the period.

21 Flows in the Sacramento River upstream of Red Bluff were examined for the adult fall-run Chinook
22 salmon upstream migration period (August through December) (Appendix 11C, *CALSIM II Model*
23 *Results utilized in the Fish Analysis*). Mean flows under H3_ELT would generally be similar to those
24 under NAA_ELT during August, October and December, and would be up to 18% lower during
25 September and November (mean reduction combining all water year types of 6% and 12%,
26 respectively). These reductions would not be of sufficient magnitude or frequency to cause a
27 biologically meaningful effect to fall-run Chinook salmon migration.

28 Mean monthly water temperatures in the Sacramento River at Red Bluff were examined during the
29 August through December adult fall-run Chinook salmon upstream migration period (Appendix 11D,
30 *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the*
31 *Fish Analysis*). There would be no differences (<5%) in mean monthly water temperature between
32 NAA_ELT and H3_ELT in any month or water year type throughout the period.

33 *Late Fall-Run*

34 Mean flows in the Sacramento River upstream of Red Bluff for juvenile late fall-run migrants
35 (January through March) under H3_ELT would generally be similar to flows under NAA_ELT
36 (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

37 Mean water temperatures in the Sacramento River at Red Bluff were examined during the January
38 through March juvenile late fall-run Chinook salmon emigration period (Appendix 11D, *Sacramento*
39 *River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*).

1 There would be no differences (<5%) in mean water temperature between NAA_ELT and H3_ELT in
2 any month or water year type throughout the period.

3 Mean flows in the Sacramento River upstream of Red Bluff during the adult late fall-run Chinook
4 salmon upstream migration period (December through February) under H3_ELT would be generally
5 be similar to flows under NAA_ELT (Appendix 11C, *CALSIM II Model Results utilized in the Fish*
6 *Analysis*).

7 Mean water temperatures in the Sacramento River at Red Bluff were examined during the December
8 through February adult late fall-run Chinook salmon migration period (Appendix 11D, *Sacramento*
9 *River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*).
10 There would be no differences (<5%) in mean water temperature between NAA and H3 in any
11 month or water year type throughout the period.

12 *Clear Creek*

13 Water temperature modeling was not conducted in Clear Creek.

14 *Fall-Run*

15 Flows in Clear Creek below Whiskeytown Reservoir were examined for juvenile fall-run migrants
16 during February through May (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).
17 Mean flows under H3_ELT would be similar to those under NAA_ELT.

18 Flows in Clear Creek below Whiskeytown Reservoir were examined during the adult fall-run
19 Chinook salmon upstream migration period (August through December) (Appendix 11C, *CALSIM II*
20 *Model Results utilized in the Fish Analysis*). Flows under H3_ELT would generally be similar to flows
21 under NAA_ELT with few exceptions.

22 *Feather River*

23 *Fall-Run*

24 Flows in the Feather River at the confluence with the Sacramento River were reviewed for the fall-
25 run juvenile migration period (February through May) (Appendix 11C, *CALSIM II Model Results*
26 *utilized in the Fish Analysis*). Mean flows under H3_ELT would generally be similar to or greater than
27 flows under NAA_ELT throughout the period (up to 12% greater for above normal year types in
28 February).

29 Mean water temperatures in the Feather River at the confluence with the Sacramento River were
30 examined during the February through May juvenile fall-run Chinook salmon migration period
31 (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results*
32 *utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature
33 between NAA_ELT and H3_ELT in any month or water year type throughout the period.

34 Flows in the Feather River at the confluence with the Sacramento River were reviewed for the
35 August through December fall-run Chinook salmon adult migration period (Appendix 11C, *CALSIM II*
36 *Model Results utilized in the Fish Analysis*). Mean flows under H3_ELT would generally be similar or
37 or up to 17% greater than those under NAA_ELT during October through December. During August and
38 September, flows would be up to 28% lower than flows under NAA_ELT except in critical water
39 years in which the flows would be up to 21% greater. Mean flow reductions across all water year
40 types for August and September would be 11% and 15%, respectively. These reductions would not

1 be of sufficient magnitude or frequency to cause a biologically meaningful effect to fall-run Chinook
2 salmon migration. Flows would be similar between NAA_ELT and H3_ELT during November.

3 Mean water temperatures in the Feather River at the confluence with the Sacramento River were
4 examined during the August through December fall-run Chinook salmon adult upstream migration
5 period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model
6 Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water
7 temperature between NAA_ELT and H3_ELT in any month or water year type throughout the period.

8 *American River*

9 *Fall-Run*

10 Flows in the American River at the confluence with the Sacramento River were examined during the
11 February through May juvenile Chinook salmon fall-run migration period (Appendix 11C, *CALSIM II
12 Model Results utilized in the Fish Analysis*). Mean flows under H3_ELT would generally be similar to
13 flows under NAA_ELT throughout the migration period, except during April of critical years (17%
14 greater mean flow under H3_ELT).

15 Mean water temperatures in the American River at the confluence with the Sacramento River were
16 examined during the February through May juvenile fall-run Chinook salmon migration period
17 (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results
18 utilized in the Fish Analysis*). There would be no differences (<5%) in mean monthly water
19 temperature between NAA_ELT and H3_ELT in any month or water year type throughout the period.

20 Flows in the American River at the confluence with the Sacramento River were examined during the
21 August through December adult fall-run Chinook salmon upstream migration period (Appendix 11C,
22 *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H3_ELT would be up to 25%
23 lower than flows under NAA_ELT during August, September and November, and similar or up to
24 25% higher during October and December. Mean flow reductions across all water year types during
25 August, September and November would be 11%, 16%, and 10%, respectively. Because these
26 reductions occur in the majority of migration months, this is considered an adverse effects to fall-
27 run Chinook salmon migration conditions.

28 Mean monthly water temperatures in the American River at the confluence with the Sacramento
29 River were examined during the August through December adult fall-run Chinook salmon upstream
30 migration period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation
31 Temperature Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in
32 mean monthly water temperature between NAA_ELT and H3_ELT in any month or water year type
33 throughout the period.

34 *Stanislaus River*

35 *Fall-Run*

36 Flows in the Stanislaus River at the confluence with the San Joaquin River were examined during the
37 February through May juvenile fall-run Chinook salmon migration period (Appendix 11C, *CALSIM II
38 Model Results utilized in the Fish Analysis*). Mean flows under H3_ELT would be no different than
39 (<5%) those under NAA_ELT in all months and water year types throughout the period.

1 Mean water temperatures in the American River at the confluence with the Sacramento River were
2 examined during the September and October adult fall-run Chinook salmon upstream migration
3 period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model*
4 *Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water
5 temperature between NAA_ELT and H3_ELT in any month or water year type throughout the period.

6 Flows in the Stanislaus River at the confluence with the San Joaquin River were examined during the
7 August through December adult fall-run Chinook salmon upstream migration period (Appendix 11C,
8 *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H3_ELT would be no
9 different than (<5%) those under NAA_ELT in both months and water year types of the period.

10 Mean water temperatures in the Stanislaus River at the confluence with the San Joaquin River were
11 examined during the August through December adult fall-run Chinook salmon upstream migration
12 period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model*
13 *Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water
14 temperature between NAA_ELT and H3_ELT in either month or any water year type of the period.

15 *San Joaquin River*

16 *Fall-Run*

17 Flows in the San Joaquin River at Vernalis were examined during the February through May juvenile
18 Chinook salmon fall-run migration period (Appendix 11C, *CALSIM II Model Results utilized in the Fish*
19 *Analysis*). Mean flows under H3_ELT would be no different than (<5%) those under NAA_ELT in all
20 months and water year types throughout the period.

21 Flows in the San Joaquin River at Vernalis were examined during the August through December
22 adult fall-run Chinook salmon upstream migration period (Appendix 11C, *CALSIM II Model Results*
23 *utilized in the Fish Analysis*). There would be no differences (<5%) in mean flow between NAA_ELT
24 and H3_ELT in either month or any water year type of the period.

25 Water temperature modeling was not conducted in the San Joaquin River.

26 *Mokelumne River*

27 *Fall-Run*

28 Flows in the Mokelumne River at the Delta were examined during the February through May
29 juvenile Chinook salmon fall-run migration period (Appendix 11C, *CALSIM II Model Results utilized in*
30 *the Fish Analysis*). There would be no differences (<5%) in mean flow between NAA_ELT and
31 H3_ELT in any month or water year type throughout the period.

32 Flows in the Mokelumne River at the Delta were examined during the August through December
33 adult fall-run Chinook salmon upstream migration period (Appendix 11C, *CALSIM II Model Results*
34 *utilized in the Fish Analysis*). There would be no differences (<5%) in mean flow between NAA_ELT
35 and H3_ELT in either month or any water year type of the period.

36 Water temperature modeling was not conducted in the Mokelumne River.

1 H4_ELT /HOS_ELT

2 *Sacramento River*

3 *Fall-Run*

4 Flows in the Sacramento River upstream of Red Bluff were examined for the juvenile fall-run
5 Chinook salmon downstream migration period (February through May) (Appendix 11C, *CALSIM II*
6 *Model Results utilized in the Fish Analysis*). Mean flows under H4_ELT would be similar to flows
7 under NAA_ELT throughout the period (Appendix 11C, *CALSIM II Model Results utilized in the Fish*
8 *Analysis*).

9 Mean water temperatures in the Sacramento River at Red Bluff were examined during the February
10 through May juvenile fall-run Chinook salmon migration period (Appendix 11D, *Sacramento River*
11 *Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There
12 would be no differences (<5%) in mean water temperature between NAA_ELT and H4_ELT in any
13 month or water year type throughout the period.

14 Flows in the Sacramento River upstream of Red Bluff were examined for the adult fall-run Chinook
15 salmon upstream migration period (August through December) (Appendix 11C, *CALSIM II Model*
16 *Results utilized in the Fish Analysis*). Mean flows under H4_ELT would generally be similar to those
17 under NAA_ELT except during November, when flows would be up to 15% lower under H4_ELT.

18 Mean monthly water temperatures in the Sacramento River at Red Bluff were examined during the
19 August through December adult fall-run Chinook salmon upstream migration period (Appendix 11D,
20 *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the*
21 *Fish Analysis*). There would be no differences (<5%) in mean water temperature between NAA_ELT
22 and H4_ELT in either month or any water year type of the period.

23 *Late Fall-Run*

24 Flows in the Sacramento River upstream of Red Bluff were examined for the juvenile fall-run
25 Chinook salmon downstream migration period (January through March) (Appendix 11C, *CALSIM II*
26 *Model Results utilized in the Fish Analysis*). Mean flows under H4_ELT would be similar to flows
27 under NAA_ELT throughout the period for all water year types.

28 Mean water temperatures in the Sacramento River at Red Bluff were examined during the January
29 through March juvenile late fall-run Chinook salmon emigration period (Appendix 11D, *Sacramento*
30 *River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*).
31 There would be no differences (<5%) in mean water temperature between NAA_ELT and H4_ELT in
32 any month or water year type throughout the period.

33 Flows in the Sacramento River upstream of Red Bluff were examined for the adult fall-run Chinook
34 salmon upstream migration period (December through February) (Appendix 11C, *CALSIM II Model*
35 *Results utilized in the Fish Analysis*). Mean flows under H4_ELT would generally be similar to flows
36 under NAA_ELT throughout the period.

37 Mean water temperatures in the Sacramento River at Red Bluff were examined during the December
38 through February adult late fall-run Chinook salmon upstream migration period (Appendix 11D,
39 *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the*
40 *Fish Analysis*). There would be no differences (<5%) in mean water temperature between NAA_ELT
41 and H4_ELT in either month or any water year type of the period.

1 *Clear Creek*

2 Water temperature modeling was not conducted in Clear Creek.

3 *Fall-Run*

4 Flows in the Clear Creek below Whiskeytown Reservoir during the February through May fall-run
5 Chinook salmon juvenile migration period under H4_ELT would generally be similar to flows under
6 NAA_ELT, (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Flows in the Clear
7 Creek below Whiskeytown Reservoir during the August through December fall-run Chinook salmon
8 adult migration period under H4_ELT would generally be no different than (<5%) those under
9 NAA_ELT.

10 *Feather River*

11 *Fall-Run*

12 Flows were evaluated in the Feather River at the confluence with the Sacramento River during the
13 February through May juvenile late fall-run Chinook salmon emigration period (Appendix 11C,
14 *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H4_ELT would generally be
15 similar to or greater than flows under NAA_ELT throughout the period (up to 119% greater for April
16 of below normal year types).

17 Mean water temperatures in the Feather River at the confluence with the Sacramento River were
18 examined during the February through May juvenile late fall-run Chinook salmon emigration period
19 (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results*
20 *utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature
21 between NAA_ELT and H4_ELT in any month or water year type throughout the period.

22 Flows were evaluated in the Feather River at the confluence with the Sacramento River during the
23 August through December fall-run Chinook salmon adult migration period (Appendix 11C, *CALSIM II*
24 *Model Results utilized in the Fish Analysis*). Mean flows under H4_ELT would be lower during August
25 and September than those under NAA_ELT for all water year types except critical year types (up to
26 42% lower in August of wet years and up to 42% higher in August of critical years). Mean reductions
27 for all water year types combined during August and September would be 32% and 22%,
28 respectively. These reductions are substantial and, therefore, would cause an adverse effect to fall-
29 run Chinook salmon. Mean flows during October through December would generally be similar to
30 flows under NAA_ELT.

31 *American River*

32 *Fall-Run*

33 Flows were evaluated in the American River at the confluence with the Sacramento River during the
34 February through May fall-run Chinook salmon juvenile migration period (Appendix 11C, *CALSIM II*
35 *Model Results utilized in the Fish Analysis*). Mean flows under H4_ELT would be similar to flows
36 under NAA_ELT throughout the period, except for critical years types in April (12% higher under
37 H4_ELT) and May (17% lower under H4_ELT).

38 Mean water temperatures in the American River at the confluence with the Sacramento River were
39 examined during the February through May juvenile fall-run Chinook salmon migration period
40 (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results*

1 *utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature
2 between NAA_ELT and H4_ELT in any month or water year type throughout the period.

3 Flows were evaluated in the American River at the confluence with the Sacramento River during the
4 August through December fall-run Chinook salmon adult migration period (Appendix 11C, *CALSIM II*
5 *Model Results utilized in the Fish Analysis*). Mean flows under H4_ELT would generally be lower than
6 those under NAA_ELT during September and November (up to 22% lower), but would generally be
7 similar or higher during August, October and December (up to 24% higher). However, flow during
8 August of critical water years would be 33% lower under H4_ELT. These flow reductions would not
9 be frequent or of high enough magnitude to be considered adverse.

10 Mean water temperatures in the American River at the confluence with the Sacramento River were
11 examined during the September and October adult fall-run Chinook salmon upstream migration
12 period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model*
13 *Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water
14 temperature between NAA_ELT and H4_ELT in either month or any water year type of the period.

15 *Stanislaus River*

16 *Fall-Run*

17 Flows in the Stanislaus River at the confluence with the San Joaquin River were examined during the
18 February through May juvenile fall-run Chinook salmon migration period (Appendix 11C, *CALSIM II*
19 *Model Results utilized in the Fish Analysis*). Mean flows under H4_ELT would be no different than
20 (<5%) those under NAA_ELT in all months and water year types of the period.

21 Mean water temperatures in the Stanislaus River at the confluence with the Sacramento River were
22 examined during the February through May juvenile fall-run Chinook salmon migration period
23 (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results*
24 *utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature
25 between NAA_ELT and H4_ELT in any month or water year type throughout the period.

26 Flows in the Stanislaus River at the confluence with the San Joaquin River were examined during the
27 August through December adult fall-run Chinook salmon upstream migration period (Appendix 11C,
28 *CALSIM II Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean
29 flows between NAA_ELT and H4_ELT in either month or any water year type of the period.

30 Mean water temperatures in the Stanislaus River at the confluence with the San Joaquin River were
31 examined during the August through December adult fall-run Chinook salmon upstream migration
32 period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model*
33 *Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water
34 temperature between NAA_ELT and H4_ELT in either month or any water year type of the period.

35 *San Joaquin River*

36 *Fall-Run*

37 Flows in the San Joaquin River at Vernalis were examined during the February through May juvenile
38 Chinook salmon fall-run migration period (Appendix 11C, *CALSIM II Model Results utilized in the Fish*
39 *Analysis*). Mean flows under H4_ELT would be no different than (<5%) those under NAA_ELT for all
40 months or water year types of the period.

1 Flows in the San Joaquin River at Vernalis were examined during the August through December
2 adult fall-run Chinook salmon upstream migration period (Appendix 11C, *CALSIM II Model Results*
3 *utilized in the Fish Analysis*). There would be no differences (<5%) in mean flow between NAA_ELT
4 and H4_ELT in either month or any water year type of the period.

5 Water temperature modeling was not conducted in the San Joaquin River.

6 *Mokelumne River*

7 *Fall-Run*

8 Flows in the Mokelumne River at the Delta were examined during the February through May
9 juvenile Chinook salmon fall-run migration period (Appendix 11C, *CALSIM II Model Results utilized in*
10 *the Fish Analysis*). There would be no differences (<5%) in mean flow between NAA_ELT and
11 H4_ELT in any month or water year type throughout the period.

12 Flows in the Mokelumne River at the Delta were examined during the August through December
13 adult fall-run Chinook salmon upstream migration period (Appendix 11C, *CALSIM II Model Results*
14 *utilized in the Fish Analysis*). There would be no differences (<5%) in mean flow between NAA_ELT
15 and H4_ELT in either month or any water year type of the period.

16 Water temperature modeling was not conducted in the Mokelumne River.

17 *Through-Delta*

18 *Sacramento River*

19 *Fall-Run*

20 *Juveniles*

21 Alternative 4A operations would generally reduce OMR reverse flows under Scenario H3_ELT
22 (Appendix B, Supplemental Modeling for Alternative 4A), with a corresponding increase in net
23 positive downstream flows, during the migration period of Chinook salmon through the interior
24 Delta channels. Conditions under Scenario H4_ELT would further improve overall average OMR
25 flows compared to NAA_ELT. These improved net positive downstream flows would be benefits of
26 the proposed operations.

27 Predation risk at the north Delta would be increased due to the installation of the proposed
28 SWP/CVP North Delta intake facilities on the Sacramento River. Bioenergetics modeling with a
29 median predator density predicts a predation loss under Alternative 4 of less than 0.6% of the
30 annual juvenile production (0.24% fall run; 0.57% late fall-run) (Table 11-4A-54). A conservative
31 assumption of 5% loss per intake would yield a cumulative loss of about 13% of juvenile fall-run and
32 late fall-run Chinook that reach the north Delta. This assumption is uncertain and represents an
33 upper bound estimate. For a discussion of this topic see Impact AQUA-42 for Alternative 1A and
34 additional discussion under Impact AQUA-42 of Alternative 4A for winter-run Chinook salmon.

35 *H3_ELT*

36 Flows below the north Delta intakes would be reduced during the juvenile emigration period for
37 fall-run Chinook (February through May) and late fall-run Chinook salmon (January through March),
38 which may increase predation potential. Mean monthly flows averaged across all water years would

1 decrease about 17% to 22% under H3_ELT compared to NAA_ELT. As noted for winter-run and
2 spring-run Chinook salmon, the modeling of NAA_ELT does not account for any flow entering the
3 Yolo Bypass because of Fremont Weir modifications that would occur separately from Alternative
4 4A (but which are included in the modeling of H3_ELT and H4_ELT; see also section 4.1.1.3 of
5 Section 4); this would slightly decrease the amount of water in the Sacramento River under
6 NAA_ELT, so the above comparison of H3_ELT vs. NAA_ELT is conservative.

7 Under Scenario H3_ELT, through-Delta survival of Sacramento River fall-run Chinook salmon, as
8 estimated by the Delta Passage Model, averaged 24.3% across all years, 20.6% in drier years and
9 30.5% in wetter years (Table 11-4A-74). Compared to NAA_ELT, average survival under Scenario H3
10 would be similar (<4% lower) across all years, although this estimate does not account for the
11 adjustments that can be made during real-time operations to further protect migrating fish. These
12 real-time operational adjustments would be based on biological and hydrological triggers developed
13 by NMFS and DFW to protect migrating salmonids. However, as noted for winter-run Chinook
14 salmon in the discussion of Impact AQUA-42, the DPM modeling results do not account for the
15 inclusion of Yolo Bypass improvements in NAA_ELT. Applying the same modification to NAA_ELT
16 outputs as described in the discussion of Impact AQUA-42 resulted in the relative difference
17 between NAA_ELT and H3_ELT increasing: the relative difference across all years increased from
18 4% less compared to NAA_ELT to nearly 6% less compared to NAA_ELT (mod.)(Table 11-4A-74).

19 H4_ELT

20 Under the high outflow scenario H4_ELT, mean monthly flows below the NDD would decrease by
21 about 4% to 18% during the emigration period, with the greatest relative reduction of 18% in
22 February of below normal years. Under H4_ELT, flow decreases in April and May would be less than
23 10% compared to NAA_ELT, with small increases in mean monthly flow in some water year types
24 (e.g., 7–15% greater than NAA_ELT in below normal years). Survival based on the DPM under
25 Scenario H4 would be similar to NAA_ELT (<2% relative difference; Table 11-4A-74) based on
26 operations assuming no adjustments made in real-time in response to actual presence of fish; as
27 described above, real-time operational adjustments would be made, based on biological and
28 hydrological triggers developed by NMFS and DFW to protect migrating salmonids. As noted in the
29 discussion for H3_ELT, the DPM modeling results do not account for the inclusion of Yolo Bypass
30 improvements in NAA_ELT. Applying the same modification to NAA_ELT outputs as described in the
31 discussion of Impact AQUA-42 for winter-run Chinook salmon resulted in the relative difference
32 between NAA_ELT and H4_ELT changing slightly: the relative difference across all years changed
33 from 1.6% more compared to NAA_ELT to nearly 0.4% less compared to NAA_ELT (mod.)(Table 11-
34 4A-74).

35 Overall, Alternative 4A would not have an adverse effect on Sacramento River fall-run Chinook
36 salmon juvenile survival due to relatively low differences in survival for most operations, as well as
37 the inclusion in Alternative 4A of bypass flow criteria, real-time management, and several
38 conservation measures (Environmental Commitment 6, Environmental Commitment 15,
39 Environmental Commitment 16) to offset any adverse effects, as discussed for winter-run Chinook
40 salmon under Impact AQUA-42.

1 Table 11-4A-74. Through-Delta Survival (%) of Emigrating Juvenile Fall-Run Chinook Salmon under
2 Alternative 4A (Scenarios H3_ELT and H4_ELT)

		Average Percentage Survival				Difference in Percentage Survival (Relative Difference)					
						EXISTING CONDITIONS vs. Alt 4A Scenario		NAA_ELT vs. Alt 4A Scenario			
Water Year Type	EXISTING CONDITIONS	Scenario		H3_ ELT	H4_ ELT	H3_ELT	H4_ELT	H3_ELT	H4_ELT	H3_ELT	H4_ELT
		NAA_ ELT	NAA_ ELT (mod.)							(vs. NAA_ELT mod.)	(vs. NAA_EL T mod.)
Sacramento											
Wetter	34.5	33.0	33.3	30.5	34.4	-4.0 (-11.6%)	-0.1 (-0.2%)	-2.5 (-7.5%)	1.4 (4.3%)	-2.8 (-8.3%)	1.1 (3.4%)
Drier	20.6	20.7	21.3	20.6	20.4	0.0 (0.0%)	-0.1 (-0.7%)	-0.1 (-0.4%)	-0.2 (-1.1%)	-0.7 (-3.5%)	-0.9 (-4.0%)
All Years	25.8	25.3	25.8	24.3	25.7	-1.5 (-5.8%)	-0.1 (-0.4%)	-1.0 (-3.9%)	0.4 (1.6%)	-1.5 (-5.8%)	-0.1 (-0.4%)
Mokelumne											
Wetter	17.2	16.3	N/A	18.2	19.2	1.0 (5.6%)	2.1 (11.9%)	1.9 (11.6%)	3.0 (18.2%)	N/A	N/A
Drier	15.6	15.7	N/A	15.6	15.8	-0.1 (-0.4%)	0.2 (1.1%)	-0.2 (-1.1%)	0.1 (0.4%)	N/A	N/A
All Years	16.2	15.9	N/A	16.5	17.1	0.3 (1.9%)	0.9 (5.6%)	0.6 (3.8%)	1.2 (7.5%)		
San Joaquin											
Wetter	19.3	20.7	N/A	16.9	16.6	-2.5 (-12.7%)	-2.7 (-14.0%)	-3.8 (-18.5%)	-4.1 (-19.7%)	N/A	N/A
Drier	9.9	9.8	N/A	10.9	10.7	1.0 (9.9%)	0.8 (7.5%)	1.1 (11.1%)	0.9 (8.7%)	N/A	N/A
All Years	13.5	13.9	N/A	13.2	12.9	-0.3 (-2.2%)	-0.6 (-4.4%)	-0.7 (-5.0%)	-1.0 (-7.2%)	N/A	N/A

Note: Average Delta Passage Model results for survival to Chipps Island.

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

Wetter = Wet and Above Normal Water Years (6 years).

Drier = Below Normal, Dry and Critical Water Years (10 years).

H3_ELT = ESO_ELT operations, H4_ELT = High Outflow.

NAA_ELT (mod.) = NAA_ELT with Yolo Bypass entry % and Yolo Bypass survival of H3_ELT.

N/A = not applicable because the Mokelumne and San Joaquin populations do not encounter the upstream end of the Yolo Bypass.

3

4 *Adults*

5 Attraction flows and olfactory cues in the west Delta for migrating adults would be altered because
6 of shifts in exports from the south Delta to the North Delta under Alternative 4A. Sacramento River
7 flows downstream of the north Delta diversion would be reduced, with concomitant increase in San
8 Joaquin River flow contribution.

1 Results of fingerprint simulation modeling (DSM2 modeling of percentage of water at Collinsville
2 that originated in the Sacramento River water) for Scenario H3_ELT predicted a minimal reduction
3 in Sacramento River source water September–November (1–4% less) compared with NAA (Table
4 11-4A-75). Studies indicate that a 20% or less reduction in source flows that provides olfactory cues
5 would not adversely affect adult attraction (Fretwell 1989). The reduction in olfactory cues under
6 Scenario H3_ELT is small and is expected to be within the broad range of olfactory cues and
7 migration conditions that currently occur within the lower reach of the Sacramento River.

8 Table 11-4A-75. Percentage (%) of Water at Collinsville that Originated in the Sacramento River and
9 San Joaquin River during the Adult Fall-Run and Late Fall-Run Chinook Salmon Migration Period for
10 Alternative 4A (Scenario H3_ELT)

Month	Scenario			Percentage Difference	
	EXISTING CONDITIONS	NAA_ELT	H3_ELT	EXISTING CONDITIONS vs. H3_ELT	NAA vs. H3_ELT
Fall-Run—Sacramento River					
September	60	65	61	0	-4
October	60	64	65	5	1
November	60	64	63	3	-1
December	67	67	65	-1	-1
Fall-Run—San Joaquin River					
September	0.3	0.2	1.7	1.4	1.5
October	0.2	0.2	3.5	3.4	3.3
November	0.4	0.8	5.2	4.8	4.4
December	0.9	1.0	2.9	2.0	1.9
Late Fall-Run—Sacramento River					
December	67	67	65	-1	-1
January	76	75	73	-2	-2
February	75	74	69	-6	-4
March	78	77	69	-9	-8
Shading indicates 10% or greater absolute difference.					
Note: Negative numbers indicate lower values under Alternative 4A (i.e., the calculations are based on Alternative 4A minus the baseline).					

11

12 *Late Fall-Run*

13 *Juveniles*

14 Alternative 4A operations would generally reduce OMR reverse flows under all flow scenarios
15 (Appendix B, Supplemental Modeling for Alternative 4A), with a corresponding increase in net
16 positive downstream flows that would benefit juveniles migrating through the Delta. Reduced flows
17 below the north Delta intakes may increase predation potential. Through-Delta survival by
18 emigrating juvenile late fall-run Chinook salmon under Scenario H3_ELT as estimated with the DPM
19 averaged 22% across all years, 19.4% in drier years, and 26.4% in wetter years (Table 11-4A-76).
20 Juvenile survival under the Scenario H3_ELT was similar or slightly lower than under NAA_ELT for
21 drier, wetter and all years averaged (around 3-4% less in relative difference) based on operations
22 assuming no adjustments made in real-time in response to actual presence of fish (Table 11-4A-76).

1 The results were similar for H4_ELT, in keeping with the timing of late fall-run emigration through
 2 the Delta mostly lying outside the spring period in which H3_ELT operations would differ from
 3 H4_ELT operations. However, as noted for winter-run Chinook salmon in the discussion of Impact
 4 AQUA-42, the DPM modeling results do not account for the inclusion of Yolo Bypass improvements
 5 in NAA_ELT. Applying the same modification to NAA_ELT outputs as described in the discussion of
 6 Impact AQUA-42 resulted in the relative difference between NAA_ELT and H3_ELT/H4_ELT
 7 increasing: for H3_ELT, the relative difference across all years increased from 3.4% less compared to
 8 NAA_ELT to just over 5.8% less compared to NAA_ELT (mod.); whereas for H4_ELT, the relative
 9 difference across all years increased from 3.5% less compared to NAA_ELT to 6.1% less compared to
 10 NAA_ELT (mod.) (Table 11-4A-51). Overall, Alternative 4A would not have an adverse effect on late
 11 fall-run Chinook salmon juvenile survival due to similar survival between Alternative 4A and
 12 NAA_ELT during all water year types.

13 Table 11-4A-76. Through-Delta Survival (%) of Emigrating Juvenile Late Fall-Run Chinook Salmon under
 14 Alternative 4A (Scenarios H3_ELT and H4_ELT)

Average Percentage Survival						Difference in Percentage Survival (Relative Difference)					
Scenario						EXISTING CONDITIONS vs. Alt 4A Scenario		NAA_ELT vs. Alt 4A Scenario			
Water Year Type	EXISTING CONDITIONS	NAA_ ELT	NAA_ ELT (mod.)	H3_ ELT	H4_ ELT	H3_ELT	H4_ELT	H3_ELT	H4_ELT	H3_ELT (vs. NAA_ELT mod.)	H4_ELT (vs. NAA_ELT mod.)
Wetter	28.8	27.5	28.1	26.4	26.5	-2.4 (-8.2%)	-2.3 (-7.9%)	-1.1 (-4.0%)	-1.0 (-3.7%)	-1.7 (-6.1%)	-1.6 (-5.9%)
Drier	18.8	20.0	20.5	19.4	19.3	0.7 (3.5%)	0.5 (2.7%)	-0.6 (-3.0%)	-0.8 (-3.7%)	-1.1 (-5.5%)	-1.3 (-6.3%)
All Years	22.5	22.8	23.4	22.0	22.0	-0.5 (-2.2%)	-0.5 (-2.2%)	-0.8 (-3.4%)	-0.8 (-3.5%)	-1.4 (-5.8%)	-1.4 (-6.1%)

Note: Delta Passage Model results for survival to Chipps Island.

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

Wetter = Wet and Above Normal Water Years (6 years).

Drier = Below Normal, Dry and Critical Water Years (10 years).

H3_ELT = ESO_ELT operations, H4_ELT = High Outflow.

NAA_ELT (mod.) = NAA_ELT with Yolo Bypass entry % and Yolo Bypass survival of H3_ELT.

15

16 *Adults*

17 Flows in the Sacramento River downstream of the north Delta intake diversions would be reduced
 18 under Alternative 4A, with concomitant proportional increases in San Joaquin River flows. Under
 19 Scenario H3_ELT, the percentage of Sacramento River water at Collinsville would be similar in
 20 December, and slightly reduced (2% to 8%) in January through March compared to NAA (Table 11-
 21 4A-75). The effect on olfactory cues for migrating adults late fall-run Chinook salmon would be
 22 negligible because the change in flow proportions is less than 10% in absolute terms.

1 *Mokelumne River*

2 *Fall-Run*

3 *Juveniles*

4 Through-Delta survival of Mokelumne River fall-run Chinook salmon under Scenario H3_ELT
5 averaged 16.5% across all years (Table 11-4A-74). Survival under Scenario H3_ELT was similar to
6 NAA_ELT averaged across all years (0.6% greater, or 4% more in relative difference) and in drier
7 years (a 1% relative difference), and there was a 2% increase in survival (nearly a 12% relative
8 difference) in wetter years. Juvenile survival under H4_ELT (high outflow) was similar to Scenarios
9 H3_ELT and NAA_ELT in drier years, and slightly increased (by 7.5% relative difference) when
10 averaged across all years. In wetter years, survival increased 3% under Scenario H4_ELT (an 18%
11 relative difference). Overall, Alternative 4A would not have an adverse effect on Mokelumne River
12 fall-run Chinook salmon juvenile survival due to minor differences in survival for most operations,
13 and a moderate increase in survival for the high outflow years, particularly under operations
14 Scenario H4_ELT. Note that this analysis is conservative because increased flow into the Yolo Bypass
15 with Fremont Weir modifications under NAA_ELT would result in less flow remaining in the
16 Sacramento River; these Fremont Weir modifications were not accounted for in the modeling of
17 NAA_ELT. As described in *BDCP Appendix 5.C, Section 5C.4.3.2 hereby incorporated by reference*, the
18 export-dependent survival function for juvenile Chinook salmon in the interior Delta (including
19 Mokelumne River fall-run) is a ratio of survival in the mainstem Sacramento River below Georgiana
20 Slough, which has a positive relationship with Sacramento River flow. Thus, the estimates of
21 through-Delta survival under NAA_ELT for Mokelumne River fall-run Chinook salmon that do not
22 account for flow entering the Yolo Bypass because of Fremont Weir modifications would tend to
23 slightly overestimate survival for NAA_ELT; therefore, the differences between NAA_ELT and
24 H3_ELT/H4_ELT discussed above would be somewhat greater if the flow entering Yolo Bypass
25 under NAA_ELT was accounted for.

26 *San Joaquin River*

27 *Fall-Run*

28 *Juveniles*

29 Under Alternative 4A Scenario H3_ELT operations, through-Delta survival by juvenile fall-run
30 Chinook salmon emigrating from the San Joaquin River averaged 13% across all years, 11% in drier
31 years, and 17% in wetter years (Table 11-4A-74). Compared to NAA_ELT, average survival across all
32 years was lower for both operations scenarios (H3_ELT and H4_ELT). Survival is slightly increased
33 in drier years (1% greater, a 9–11% relative difference). Survival is greatest in wetter years, but is
34 moderately reduced relative to NAA_ELT by about 4% (19-20% relative difference for Scenarios
35 H3_ELT and H4_ELT). As described in *BDCP Appendix 5.C, Section 5C.5.3.4.5 hereby incorporated by*
36 *reference*, these results are driven by appreciably lower through-Delta survival of San Joaquin River
37 fall-run Chinook salmon under Alternative 4A scenarios relative to NAA_ELT in very wet years
38 (1982/1983). During these types of years, the Head of Old River operable gate would not be closed
39 because of exceedance of the 10,000-cfs Vernalis flow criterion permitting its closure, so less fish
40 would use the main stem San Joaquin River pathway. In addition, south Delta exports would be very
41 low (averaging 40-50 cfs for H3_ELT in 1983, for example) because of operation of the north Delta
42 **intakes, which would result in estimated survival that is relatively low because of the DPM's positive**
43 **relationship between survival and exports, based on current relationships. There is considerable**

1 uncertainty in effects on San Joaquin River Chinook salmon survival at such low levels of exports
2 because the studies upon which the DPM flow- and export-survival relationships are based did not
3 include these low levels of exports. SalSim, a recently completed San Joaquin River watershed
4 Chinook salmon analysis tool that includes juvenile survival through the Delta derived in a different
5 manner than DPM, includes a positive relationship between probability of juvenile survival and flow
6 in the mainstem San Joaquin River at Stockton Deepwater Ship Channel; this flow term is positively
7 related to flow at Vernalis, inversely related to south Delta exports, and positively related to Head of
8 Old River barrier operation; the results of SalSim modeling therefore would be expected to illustrate
9 a benefit of Alternative 4A across any modeled year, which is more in keeping with the anticipated
10 effect of the alternative. Overall and in light of these uncertainties, Alternative 4A would not have an
11 adverse effect on through-Delta migration because the reduction in south Delta exports generally
12 would be expected to benefit through-Delta survival.

13 *Adults*

14 The percentage of water at Collinsville that originated from the San Joaquin River is very small (no
15 more than 1% under NAA_ELT) during the fall-run migration period (September to December). The
16 fingerprinting analysis showed a small increase in olfactory cues from the San Joaquin River passing
17 downstream through the Delta under Scenario H3_ELT (Table 11-4A-75). Although the relative
18 change is substantial (i.e., a severalfold increase in the percentage of flow from the San Joaquin River
19 under Scenario H3_ELT compared to NAA_ELT), the percentage of flow attributable to San Joaquin
20 River water under all scenarios is quite low (no more than around 5%). Scenario H4_ELT would not
21 have as great a relative change because exports at the north Delta diversion would be lower than
22 under Scenario H3_ELT. Overall, Alternative 4A operations conditions would incrementally increase
23 olfactory cues associated with attraction flows in the lower San Joaquin River, but the increase
24 would be small. However, even this seemingly small increase could provide moderate benefits: as
25 illustrated in *BDCP Appendix 5.C, Section 5C.5.3.13.1.5 hereby incorporated by reference*, based on the
26 study of Marston et al. (2012), greater olfactory cues under Alternative 4A could decrease
27 severalfold the straying rate of adult San Joaquin River Chinook salmon to the Sacramento River.
28 This would not be an adverse effect on adult fall-run Chinook salmon migrating to the San Joaquin
29 River.

30 *NEPA Effects:* Upstream of the Delta, these modeling results indicate that the effect of Alternative 4A
31 could be adverse because flows in the Feather and American Rivers (depending on scenario –
32 H3_ELT or H4_ELT) would be reduced substantially and persistently and could cause biologically
33 meaningful effects to fall-run Chinook salmon adult migration. There are no substantial upstream
34 flow changes in other rivers evaluated and no water temperature-related effects in any river for
35 which temperature modeling is available. However, with implementation of Mitigation Measure
36 AQUA-78d, this impact would not be adverse.

37 As described for winter-run and spring-run Chinook salmon, near-field effects of Alternative 4A
38 NDD on fall- and late fall-run Chinook salmon related to impingement and predation associated with
39 three new intake structures could result in negative effects on juvenile migrating fall- and late fall-
40 run Chinook salmon, although there is high uncertainty regarding the overall effects. Estimates
41 within the effects analysis range from very low levels of effects (<1% mortality) to more significant
42 effects (~ 13% mortality above current baseline levels). Environmental Commitment 15 would be
43 implemented with the intent of providing localized and temporary reductions in predation pressure
44 at the NDD. Additionally, several pre-construction surveys to better understand how to minimize
45 losses associated with the three new intake structures will be implemented as part of the final NDD

1 screen design effort. Similarly, Alternative 4A also includes investigations to better understand
2 factors affecting juvenile through-Delta migration (as described in the adaptive management and
3 monitoring program in Section 4.1) and includes biologically based triggers for real time operations.
4 However, at this time, due to the absence of comparable facilities anywhere in the lower Sacramento
5 River/Delta, the degree of predation-related mortality expected from near-field effects at the NDD
6 remains highly uncertain.

7 As noted for Alternative 4, two recent studies (Newman 2003 and Perry 2010) indicate that far-field
8 effects associated with the new intakes could cause a reduction in smolt survival in the Sacramento
9 River downstream of the NDD intakes due to reduced flows in this area. The analyses of other
10 elements of Alternative 4A related to reduced interior Delta entry (Environmental Commitment 16)
11 and reduced south Delta entrainment suggest that these could counter the far-field effects of
12 reduced flow (see, for example, Table 5.C.5.3-46 in the *BDCP Effects Analysis Appendix 5.C hereby
13 incorporated by reference*). The overall magnitude of each of these factors and how they might
14 interact and/or offset each other in affecting salmonid survival through the plan area is uncertain,
15 and the adaptive management and monitoring program will investigate these outcomes.

16 As described for Alternative 4 and as discussed for winter-run and spring-run Chinook salmon
17 above, the DPM is a flow-based model incorporating flow-survival and junction routing relationships
18 with flow modeling of Alternative 4a operations to estimate relative differences between scenarios
19 in smolt migration survival throughout the entire Delta. The DPM predicted that smolt migration
20 survival under Alternative 4A would be similar or slightly lower than survival estimated for
21 NAA_ELT, based on operations assuming no adjustments made in real-time in response to actual
22 presence of fish. Although refinements to the DPM are likely to occur based on new data available
23 from future studies and the current analysis has some uncertainty, the DPM analysis of Alternative
24 4A on juvenile fall-/late fall-run Chinook salmon migration suggests a potential adverse effect of
25 small magnitude. As noted for winter-run Chinook salmon, the DPM focuses on smolt-sized
26 individuals (70 mm or more) and is not based on survival data for fry-sized individuals, which also
27 may be migrating and could be affected by Alternative 4A operations. There are no fry through-Delta
28 survival data to inform the effects to these individuals in relation to operations and it is uncertain
29 whether the relative difference between scenarios estimated from the DPM for smolt-sized fish
30 would be representative of relative differences for fry. The potential adverse effect on fall-run and
31 late-fall run Chinook salmon would be minimized through the inclusion within Alternative 4A of
32 specific important Environmental Commitments. These include *Environmental Commitment 6
33 Channel Margin Enhancement* to offset loss of channel margin habitat to the NDD footprint and far-
34 field (water level) effects; *Environmental Commitment 15 Localized Reduction of Predatory Fishes* to
35 limit predation potential at the NDD; and *Environmental Commitment 16 Nonphysical Fish Barriers* to
36 reduce entry of Chinook salmon juveniles into the low-survival interior Delta.

37 Overall, with implementation of Mitigation Measure AQUA-78d to address upstream flow
38 reductions, the effects on fall-/late-fall run Chinook migration are not adverse in the ELT.

39 The effect of Alternative 4A in the LLT on fall-/late-fall run Chinook upstream migration conditions
40 would be not adverse. Instream flows in the Sacramento, Feather, and American Rivers during late
41 summer and fall months would decline from ELT to LLT such that flows would be substantially
42 reduced under Alternative 4A relative to the NEPA baseline in the LLT, compared to the ELT
43 comparison. Similar to ELT, implementation of Mitigation Measure AQUA-78d will reduce the
44 magnitude of this effect.

1 *CEQA Conclusion:* With implementation of Mitigation Measure AQUA-78d, the impact of Alternative
2 4A on migration conditions for fall-/late fall-run Chinook salmon relative to Existing Conditions
3 would be less than significant.

4 Upstream of the Delta

5 H3_ELT /ESO_ELT

6 *Sacramento River*

7 *Fall-Run*

8 Flows in the Sacramento River upstream of Red Bluff were examined for juvenile fall-run migrants
9 during February through May (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).
10 Mean flows under H3_ELT would generally be similar to those under Existing Conditions.

11 Mean water temperatures in the Sacramento River at Red Bluff were examined during the February
12 through May juvenile fall-run Chinook salmon migration period (Appendix 11D, *Sacramento River*
13 *Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*). There
14 would be no differences (<5%) in mean water temperature between Existing Conditions and
15 H3_ELT in any month throughout the period.

16 Flows in the Sacramento River upstream of Red Bluff were examined during the adult fall-run
17 Chinook salmon upstream migration period (August through December) (Appendix 11C, *CALSIM II*
18 *Model Results utilized in the Fish Analysis*). Mean flows under H3_ELT during August and September
19 would be up to 22% lower (September of dry years) and up to 32% higher (September of above
20 normal years) than those under Existing Conditions. Mean flows would be up to 17% lower under
21 H3_ELT during October and November, would be similar during December. The flow reductions in
22 three of five migration months would constitute a substantial impact to fall-run Chinook salmon
23 migration conditions.

24 Mean water temperatures in the Sacramento River at Red Bluff were examined during the August
25 through December adult fall-run Chinook salmon upstream migration period (Appendix 11D,
26 *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the*
27 *Fish Analysis*). There would be no differences (<5%) in mean water temperature between Existing
28 Conditions and H3_ELT in any month throughout the period.

29 *Late Fall-Run*

30 Mean flows in the Sacramento River upstream of Red Bluff for juvenile late fall-run migrants
31 (January through March) under H3_ELT would be similar to flows under Existing Conditions, with
32 minor exceptions (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

33 Mean monthly water temperatures in the Sacramento River at Red Bluff were examined during the
34 January through March juvenile late fall-run Chinook salmon emigration period (Appendix 11D,
35 *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the*
36 *Fish Analysis*). There would be no differences (<5%) in mean water temperature between Existing
37 Conditions and H3_ELT in any month throughout the period. Mean flows in the Sacramento River
38 upstream of Red Bluff during the adult late fall-run Chinook salmon upstream migration period
39 (December through February) under H3_ELT would generally be similar to flows under Existing
40 Conditions (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

1 Mean water temperatures in the Sacramento River at Red Bluff were examined during the December
2 through February adult late fall-run Chinook salmon migration period (Appendix 11D, *Sacramento*
3 *River Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*).
4 There would be no differences (<5%) in mean water temperature between Existing Conditions and
5 H3_ELT in any month throughout the period.

6 *Clear Creek*

7 *Fall-Run*

8 Flows in Clear Creek below Whiskeytown Reservoir were examined during the juvenile fall-run
9 Chinook salmon upstream migration period (February through May). Mean flows under H3_ELT
10 would generally be similar to or slightly greater than those under Existing Conditions (Appendix
11 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

12 Mean flows in Clear Creek below Whiskeytown Reservoir during the adult fall-run Chinook salmon
13 upstream migration period (August through December) under H3_ELT would generally be similar to
14 those under Existing Conditions, except for September of critical years (19% lower under H3_ELT)
15 (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

16 Water temperature modeling was not conducted in Clear Creek

17 *Feather River*

18 *Fall-Run*

19 Mean flows in the Feather River at the confluence with the Sacramento River during the fall-run
20 juvenile migration period (February through May) under H3_ELT would generally be similar to or
21 lower than flows under Existing Conditions (up to 15% lower for March of below normal years)
22 (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

23 Mean water temperatures in the Feather River at the confluence with the Sacramento River were
24 examined during the February through May juvenile fall-run Chinook salmon migration period
25 (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results*
26 *utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature
27 between Existing Conditions and H3_ELT in any month throughout the period.

28 Flows in the Feather River at the confluence with the Sacramento River were examined during the
29 August through December fall-run Chinook salmon adult migration period. Mean flows under
30 H3_ELT during August and September would be up to 100% greater (September of wet years) and
31 up to 43% lower (August of dry years) than flows under Existing Conditions. Mean flows under
32 H3_ELT during October through December would be similar to or up to 21% greater (dry years)
33 than those under Existing Conditions, except for 19% lower flow in December of critical years
34 (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*).

35 Mean water temperatures in the Feather River at the confluence with the Sacramento River were
36 examined during the August through December fall-run Chinook salmon adult upstream migration
37 period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model*
38 *Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean monthly water
39 temperature between Existing Conditions and H3 in any month throughout the period.

1 *American River*

2 *Fall-Run*

3 Flows in the American River at the confluence with the Sacramento River were examined during the
4 February through May juvenile Chinook salmon fall-run migration period (Appendix 11C, *CALSIM II*
5 *Model Results utilized in the Fish Analysis*). Mean flows under H3_ELT would generally be up to 15%
6 greater than flows under Existing Conditions during February and March, and similar during April,
7 and up to 18% lower than flows under Existing Conditions during January and May, depending on
8 water year type.

9 Mean water temperatures in the American River at the confluence with the Sacramento River were
10 examined during the February through May juvenile fall-run Chinook salmon migration period
11 (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results*
12 *utilized in the Fish Analysis*). There would be no differences (<5%) in mean monthly water
13 temperature between Existing Conditions and H3 in any month throughout the period.

14 Flows in the American River at the confluence with the Sacramento River were examined during the
15 August through December adult fall-run Chinook salmon upstream migration period (Appendix 11C,
16 *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H3_ELT during August,
17 September, and November would be consistently lower than flows under Existing Conditions,
18 ranging from 10% lower to 52% lower. Mean flows under H3_ELT during October and December
19 would be up to 11% lower and up to 15% higher than flows under Existing Conditions, depending
20 on water year type, but mean reductions across water year types would be small (-2% and 4%,
21 respectively).

22 Mean water temperatures in the American River at the confluence with the Sacramento River were
23 examined during the August through December adult fall-run Chinook salmon upstream migration
24 period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model*
25 *Results utilized in the Fish Analysis*). Mean water temperatures under H3_ELT would be 5% higher
26 than those under Existing Conditions during August of dry years and 5% to 6% higher during
27 October, except in critical water years. There would there would be no differences (<5%) during the
28 other three months of the period.

29 *Stanislaus River*

30 *Fall-Run*

31 Flows in the Stanislaus River at the confluence with the San Joaquin River were examined during the
32 February through May juvenile fall-run Chinook salmon migration period (Appendix 11C, *CALSIM II*
33 *Model Results utilized in the Fish Analysis*). Mean flows under H3_ELT throughout this period would
34 generally be lower than Existing Conditions for all water year types (up to 29% lower for February
35 of critical years), except for wet water years, in which flows would be similar or up to 17% greater
36 (February) than flows under Existing Conditions.

37 Mean water temperatures in the Stanislaus River at the confluence with the San Joaquin River were
38 examined during the February through May juvenile fall-run Chinook salmon migration period
39 (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results*
40 *utilized in the Fish Analysis*). There would be no differences (<5%) in mean monthly water
41 temperature between Existing Conditions and H3 in any month throughout the period.

1 Flows in the Stanislaus River at the confluence with the San Joaquin River were examined during the
2 August through December adult fall-run Chinook salmon upstream migration period (Appendix 11C,
3 *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H3_ELT would generally be
4 similar to flows under Existing Conditions for all months and water year types of the period.

5 Mean water temperatures in the Stanislaus River at the confluence with the San Joaquin River were
6 examined during the August through December adult fall-run Chinook salmon upstream migration
7 period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model*
8 *Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean monthly water
9 temperature between Existing Conditions and H3 in either month or any water year type of the
10 period.

11 *San Joaquin River*

12 *Fall-Run*

13 Flows in the San Joaquin River at Vernalis were examined during the February through May juvenile
14 Chinook salmon fall-run migration period (Appendix 11C, *CALSIM II Model Results utilized in the Fish*
15 *Analysis*). Mean flows under H3_ELT would generally be similar to flows under Existing Conditions
16 with few exceptions (up to 12% lower).

17 Flows in the San Joaquin River at Vernalis were examined during the August through December
18 adult fall-run Chinook salmon upstream migration period (Appendix 11C, *CALSIM II Model Results*
19 *utilized in the Fish Analysis*). Mean flows under H3_ELT would be lower than those under Existing
20 Conditions during August and September (up to 14%), but similar to flows under Existing
21 Conditions during the remaining three months.

22 Water temperature modeling was not conducted in the San Joaquin River.

23 *Mokelumne River*

24 *Fall-Run*

25 Flows in the Mokelumne River at the Delta were examined during the February through May
26 juvenile Chinook salmon fall-run migration period (Appendix 11C, *CALSIM II Model Results utilized in*
27 *the Fish Analysis*). Mean flows under H3_ELT would generally be similar to those under Existing
28 Conditions during March through May, and would be up to 15% higher than flows under Existing
29 Conditions during February.

30 Flows in the Mokelumne River at the Delta were examined during the August through December
31 adult fall-run Chinook salmon upstream migration period (Appendix 11C, *CALSIM II Model Results*
32 *utilized in the Fish Analysis*). Mean flows under H3_ELT would be up to 32% lower than flows under
33 Existing Conditions during August and September, and up to 28% greater than flows under Existing
34 Conditions during December. Flows during October and November would be largely similar
35 between H3_ELT and Existing Conditions.

36 Water temperature modeling was not conducted in the Mokelumne River.

1 H4_ELT /HOS_ELT

2 *Sacramento River*

3 *Fall-Run*

4 Mean monthly flows and water temperatures in the Sacramento River at Red Bluff were examined
5 during the February through May juvenile fall-run Chinook salmon migration period. Mean flows
6 under H4_ELT would generally be similar to flows under Existing Conditions (Appendix 11C, *CALSIM II*
7 *Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean monthly
8 water temperature between Existing Conditions and H4_ELT in any month throughout the period
9 (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results*
10 *utilized in the Fish Analysis*).

11 Flows and water temperatures in the Sacramento River at Red Bluff were examined during the
12 August through December adult fall-run Chinook salmon upstream migration period. Mean flows
13 during September under H4_ELT would be up to 49% greater (above normal years) and up to 18%
14 lower (dry years) than flows under Existing Conditions, but flows during the other four months of
15 the period would generally be similar (Appendix 11C, *CALSIM II Model Results utilized in the Fish*
16 *Analysis*). Mean water temperatures under H4_ELT would not be different (<5%) from those under
17 Existing Conditions (Appendix 11D, *Sacramento River Water Quality Model and Reclamation*
18 *Temperature Model Results utilized in the Fish Analysis*).

19 *Late Fall-Run*

20 Mean flows and water temperatures in the Sacramento River at Red Bluff were examined during the
21 January through March juvenile late fall-run Chinook salmon emigration period. Mean flows under
22 H4_ELT would generally be similar to flows under Existing Conditions (Appendix 11C, *CALSIM II*
23 *Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in water
24 temperature between Existing Conditions and H4_ELT in any month or water year type. (Appendix
25 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in*
26 *the Fish Analysis*).

27 Mean flows and water temperatures in the Sacramento River at Red Bluff were examined during the
28 December through February adult late fall-run Chinook salmon migration period. Mean flows under
29 H4_ELT would generally be similar to flows under Existing Conditions (Appendix 11C, *CALSIM II*
30 *Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water
31 temperature between Existing Conditions and H4_ELT in either month of the period (Appendix 11D,
32 *Sacramento River Water Quality Model and Reclamation Temperature Model Results utilized in the*
33 *Fish Analysis*).

34 *Clear Creek*

35 *Fall-Run*

36 Mean flows in the Clear Creek below Whiskeytown Reservoir during February through May under
37 H4_ELT would generally be similar to or up to 13% greater than flows under Existing Conditions
38 (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows in the Clear Creek
39 below Whiskeytown Reservoir during August through December under H4_ELT would generally be
40 similar to flows under Existing Conditions.

1 Water temperature modeling was not conducted in Clear Creek.

2 *Feather River*

3 *Fall-Run*

4 Flows and water temperatures in the Feather River at the confluence with the Sacramento River
5 were examined during the February through May juvenile fall-run Chinook salmon migration
6 period. Mean flows under H4_ELT would generally be similar to flows under Existing Conditions
7 during February and March, but would be up to 112% greater during April and May (Appendix 11C,
8 *CALSIM II Model Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean
9 water temperature between Existing Conditions and H4_ELT in any month throughout the period
10 (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results*
11 *utilized in the Fish Analysis*).

12 Flows and water temperatures in the Feather River at the confluence with the Sacramento River
13 were examined during the August through December fall-run Chinook salmon adult upstream
14 migration period. Mean flows under H4_ELT during August and September would be from 51%
15 lower (August of dry years) to 87% higher (September of wet years) than flows under Existing
16 Conditions, and from 26% lower to 19% higher than flows under Existing Conditions during October
17 through December (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). The
18 prevalence of reduced flows across months and water year types suggests that this would be an
19 adverse effect to fall-run Chinook salmon migration conditions.

20 Mean water temperatures under H4_ELT would be no different from (<5%) those under Existing
21 Conditions during both months and all water year types (Appendix 11D, *Sacramento River Water*
22 *Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*).

23 *American River*

24 *Fall-Run*

25 Flows and water temperatures in the American River at the confluence with the Sacramento River
26 were examined during the February through May juvenile fall-run Chinook salmon migration
27 period. Mean flows under H4_ELT would generally be similar to or higher than flows under Existing
28 Conditions during February (up to 14% higher for above normal years), and similar to or lower than
29 flows under Existing Conditions during March through May (up to 20% lower for May of above
30 normal years) (Appendix 11C, *CALSIM II Model Results utilized in the Fish Analysis*). There would be
31 no differences (<5%) in mean water temperature between Existing Conditions and H4_ELT in any
32 month throughout the period (Appendix 11D, *Sacramento River Water Quality Model and*
33 *Reclamation Temperature Model Results utilized in the Fish Analysis*).

34 Flows and water temperatures in the American River at the confluence with the Sacramento River
35 were examined during the August through December adult fall-run Chinook salmon upstream
36 migration period. Mean flows under H4_ELT during August, September, and November would be
37 lower than those under Existing Conditions for almost all water year types, ranging from 7% lower
38 in November of above normal years to 47% lower in September of critical years (Appendix 11C,
39 *CALSIM II Model Results utilized in the Fish Analysis*). Flows during October and December would
40 generally be similar to or greater than those under Existing Conditions. Mean water temperatures
41 under H4_ELT would be 5% to 6% higher during October than those under Existing Conditions and

1 would be similar during the remainder of the migration period (Appendix 11D, *Sacramento River*
2 *Water Quality Model and Reclamation Temperature Model Results utilized in the Fish Analysis*).

3 *Stanislaus River*

4 *Fall-Run*

5 Flows in the Stanislaus River at the confluence with the San Joaquin River were examined during the
6 February through May juvenile fall-run Chinook salmon migration period (Appendix 11C, *CALSIM II*
7 *Model Results utilized in the Fish Analysis*). Mean flows under H4_ELT throughout this period would
8 generally be lower than Existing Conditions (up to 29% lower for February of critical years), except
9 in wet years, in which flows would be similar or up to 17% greater (February) than flows under
10 Existing Conditions.

11 Mean water temperatures in the Stanislaus River at the confluence with the San Joaquin River were
12 examined during the February through May juvenile fall-run Chinook salmon migration period
13 (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model Results*
14 *utilized in the Fish Analysis*). There would be no differences (<5%) in mean water temperature
15 between Existing Conditions and H4_ELT in any month throughout the period.

16 Flows in the Stanislaus River at the confluence with the San Joaquin River were examined during the
17 August through December adult fall-run Chinook salmon upstream migration period (Appendix 11C,
18 *CALSIM II Model Results utilized in the Fish Analysis*). Mean flows under H4_ELT would generally be
19 similar to flows under Existing Conditions throughout the migration period.

20 Mean water temperatures in the Stanislaus River at the confluence with the San Joaquin River were
21 examined during the August through December adult fall-run Chinook salmon upstream migration
22 period (Appendix 11D, *Sacramento River Water Quality Model and Reclamation Temperature Model*
23 *Results utilized in the Fish Analysis*). There would be no differences (<5%) in mean water
24 temperature between Existing Conditions and H4_ELT in either month of the period.

25 *San Joaquin River*

26 *Fall-Run*

27 Flows in the San Joaquin River at Vernalis were examined during the February through May juvenile
28 Chinook salmon fall-run migration period (Appendix 11C, *CALSIM II Model Results utilized in the Fish*
29 *Analysis*). Mean flows under H4_ELT would generally be similar to flows under Existing Conditions
30 for all months with some exceptions (up to 12% lower).

31 Flows in the San Joaquin River at Vernalis were examined during the August through December
32 adult fall-run Chinook salmon upstream migration period (Appendix 11C, *CALSIM II Model Results*
33 *utilized in the Fish Analysis*). Flows under H4_ELT would be over than those under Existing
34 Conditions during August and September (up to 14%), but similar to flows under Existing
35 Conditions during the remaining three months. Water temperature modeling was not conducted in
36 the San Joaquin River.

1 *Mokelumne River*

2 *Fall-Run*

3 Flows in the Mokelumne River at the Delta were examined during the February through May
4 juvenile Chinook salmon fall-run migration period (Appendix 11C, *CALSIM II Model Results utilized in*
5 *the Fish Analysis*). Mean flows under H4_ELT would be similar to or up to 15% higher than those
6 under Existing Conditions during February, generally similar during March and April, and up to 11%
7 lower than flows under Existing Conditions during May.

8 Flows in the Mokelumne River at the Delta were examined during the August through December
9 adult fall-run Chinook salmon upstream migration period (Appendix 11C, *CALSIM II Model Results*
10 *utilized in the Fish Analysis*). Mean flows under H4_ELT would be up to 32% lower than flows under
11 Existing Conditions during August and September, and up to 28% greater than flows under Existing
12 Conditions during December. Flows during October and November would be largely similar
13 between H4_ELT and Existing Conditions.

14 Water temperature modeling was not conducted in the Mokelumne River.

15 *Through-Delta*

16 *Sacramento River*

17 *Fall-Run*

18 *Juveniles*

19 As described above, Scenario H3_ELT operations would reduce overall OMR reverse flows and
20 reduce Sacramento River flows below the north Delta diversions (Appendix B, Supplemental
21 Modeling for Alternative 4A). Based on the DPM, survival of Sacramento River fall-run Chinook
22 salmon juveniles under Scenario H3_ELT averaged for all years was less than Existing Conditions,
23 was similar in drier years, and was moderately reduced by about 4% (a 12% relative difference) in
24 wetter years (Table 11-4A-74). Under Scenario H4_ELT average survival was similar (~1% or less
25 relative decrease) to Existing Conditions for all years, drier years, and wetter years. These results do
26 not account for adjustments that would be made during real-time operations to further protect
27 migrating fish, based on biological and hydrological triggers developed by NMFS and DFW.

28 *Adults*

29 The percentage of Sacramento River origin flow at Collinsville, would be slightly increased (5% or
30 less in September to December) under Scenario H3_ELT compared to Existing Conditions (Table 11-
31 4A-75). This would not significantly affect olfactory cues for adults migrating to the Sacramento
32 River because the change is less than 10%.

33 *Late Fall-Run*

34 *Juveniles*

35 As described above, Alternative 4A operations would reduce OMR reverse flows and reduce
36 Sacramento River flows below the north Delta diversions (Appendix B, Supplemental Modeling for
37 Alternative 4A). Conditions under Scenario H4_ELT would further improve OMR flow conditions
38 relative to the Scenario H3_ELT. As estimated by DPM, through-Delta survival by emigrating juvenile

1 late fall-run Chinook salmon under Scenario H3_ELT averaged across all years was similar (around
2 2% relative difference) to Existing Conditions (Table 11-4A-76). Survival was marginally greater in
3 drier years (0.7% increase, a 3.5% relative difference) but reduced in wetter years (2.4%, an 8%
4 relative difference). The results for H4_ELT were very similar to those for H3_ELT because the late
5 fall-run migration period lies outside the spring period when H4_ELT and H3_ELT operations differ
6 (higher outflow under H4_ELT). As noted for fall-run Chinook salmon from the Sacramento River
7 (described above), the DPM results do not account for adjustments that would be made during real-
8 time operations to further protect migrating fish, based on biological and hydrological triggers
9 developed by NMFS and DFW.

10 *Adults*

11 As described above, the percentage of Sacramento River water would be slightly reduced in
12 December and March (1% to 9% less) compared to NAA_ELT (Table 11-4A-75). This effect would be
13 less in March under Scenario H4_ELT compared to Scenario H3_ELT due to reduced north Delta
14 exports. Olfactory cues would be slightly decreased, but the impact would be minor because flow
15 changes are than 10% for the bulk of the late fall-run migration.

16 *Mokelumne River*

17 *Fall-Run*

18 Average through-Delta survival of emigrating juveniles estimated by DPM under Scenario H3_ELT
19 was similar to Existing Conditions for all years and drier years (less than 2% relative difference),
20 whereas average survival in wetter years was slightly greater than Existing Conditions (1% absolute
21 difference in survival, 5.6% relative difference) (Table 11-4A-74). Average through-Delta survival
22 under Scenario H4_ELT was similar to Existing Conditions in drier years, but was slightly greater
23 than Existing Conditions when averaged over all years (5.6% relative difference) and was
24 moderately greater than Existing Conditions in wetter years (nearly 12% relative difference). This
25 reflected the inclusion of higher outflow in wetter years under H4_ELT compared to H3_ELT.

26 *San Joaquin River*

27 *Fall-Run*

28 *Juveniles*

29 Under Alternative 4A (operation Scenarios H3_ELT and H4_ELT), mean survival of juveniles
30 migrating from the San Joaquin River averaged around 13% (Table 11-4A-74). Alternative 4A
31 survival under both was similar (less than 5% relative difference) to Existing Conditions when
32 averaged over all years. Survival was slightly greater than Existing Conditions in drier years (0.8–
33 1% greater survival, or 7.5–10% more in relative difference) and moderately reduced in wetter
34 years (2.5–2.7% decrease, or 13-14% less in relative difference). As described for the NEPA analysis
35 above and described further in *BDCP Appendix 5.C, Section 5C.5.3.4.5 hereby incorporated by*
36 *reference*, these results are driven by appreciably lower through-Delta survival of San Joaquin River
37 fall-run Chinook salmon under Alternative 4A scenarios relative to Existing Conditions in very wet
38 years (1982/1983) during which the Head of Old River operable gate would not be closed and south
39 Delta exports would be very low, resulting in estimated survival that is relatively low because of the
40 **DPM's positive relationship between survival and exports. There is considerable uncertainty in**
41 effects on San Joaquin River Chinook salmon survival at such low levels of exports because the

1 studies upon which the DPM flow- and export-survival relationships are based did not include these
2 low levels of exports. As noted in the NEPA analysis above, SalSim, a recently completed San Joaquin
3 River watershed Chinook salmon analysis tool that includes juvenile survival through the Delta
4 derived in a different manner than DPM, includes a positive relationship between probability of
5 juvenile survival and flow in the mainstem San Joaquin River at Stockton Deepwater Ship Channel;
6 this flow term is positively related to flow at Vernalis, inversely related to south Delta exports, and
7 positively related to Head of Old River barrier operation; the results of SalSim modeling therefore
8 would be expected to illustrate a benefit of Alternative 4A across any modeled year, which is more in
9 keeping with the anticipated effect of the alternative.

10 *Adults*

11 As described above, the percentage of San Joaquin River water at Collinsville is very small (less than
12 1% under Existing Conditions) during the fall-run migration period (September to December).
13 Under Scenario H3_ELT operations, this would increase by 1.4–4.8% in September-December (Table
14 11-4A-75). Olfactory cues for adults migrating to the San Joaquin River would be slightly increased
15 under all flow scenarios for Alternative 4A.

16 Summary of CEQA Conclusion

17 These modeling results indicate that the difference between Existing Conditions and Alternative 4A
18 could be significant because the alternative could substantially reduce migration conditions for fall-
19 /late fall-run Chinook salmon upstream of the Delta. Under Alternative 4A, instream flows would be
20 lower in multiple upstream rivers during the fall-run Chinook salmon migration period relative to
21 Existing Conditions, depending on scenario (H3_ELT or H4_ELT). Degraded migration habitat
22 conditions would delay or eliminate successful migration necessary to complete the fall-run Chinook
23 salmon life cycle. However, the impact of Alternative 4A across the operational range (Scenarios
24 H3_ELT and H4_ELT) on through-Delta migration conditions would be small due to generally similar
25 juvenile survival and a minor effect on olfactory cues for adults.

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

41 This impact would still be considered significant in the ELT due to changes in upstream flows.
42 However, when informed by the NEPA analysis above, and with the implementation of Mitigation
43 Measure AQUA-78d, this impact would be less than significant to fall-/late fall-run Chinook salmon.

1 As noted for winter-run and spring-run Chinook salmon and described in the adaptive management
2 and monitoring program in Section 4.1, several pre-construction studies to better understand how
3 to minimize losses associated with the three new intake structures will be implemented as part of
4 the final NDD screen design effort. Similarly, Alternative 4A also includes investigations to better
5 understand factors affecting juvenile through-Delta migration (as described in the adaptive
6 management and monitoring program in Section 4.1) and includes biologically based triggers for
7 real time operations. Also, with the inclusion of *Environmental Commitment 6 Channel Margin*
8 *Enhancement*, *Environmental Commitment 15 Localized Reduction of Predatory Fishes*, and
9 *Environmental Commitment 16 Nonphysical Barriers*, the impacts would be minimized.

10 Given that Mitigation Measure AQUA-78d reduces this impact to less than significant for fall-run
11 Chinook, the impact on the fall-run Chinook salmon commercial fishery also would be less than
12 significant in the ELT.

13 Mitigation Measure AQUA-78d: Slightly adjust the timing and magnitude of Shasta,
14 Folsom, and/or Oroville Reservoir releases, within all existing regulations and
15 requirements, to ameliorate changes in instream flows that would cause an adverse effect
16 to fall-run Chinook salmon.

17 Whenever possible during real-time operations, project proponents will slightly adjust Shasta,
18 Folsom and/or Oroville Reservoir operations to ensure that instream flows are sufficient to
19 minimize or avoid migration-related effects to fall-run Chinook salmon. Based on the timing of
20 the modeled flow fluctuations, it is expected that adjustments to minimize drastic changes in
21 releases during operations among various months in which there are increases and decreases in
22 flow, will minimize or avoid substantial reductions in flow without effects on existing applicable
23 regulations or operations.

24 Fall-/late fall-run Chinook salmon migration conditions in the Sacramento, Feather, and American
25 rivers, would substantially decline from ELT to LLT. However, when informed by the NEPA analysis
26 above, implementation of Mitigation Measure AQUA-78d will reduce the magnitude of this effect to
27 less than adverse. The commercial fishery effect of Alternative 4 in the LLT would be less than
28 significant in the LLT.

29 Restoration Measures (Environmental Commitment 4, Environmental Commitment 6,
30 Environmental Commitment 7, and Environmental Commitment 10)

31 As described for winter-run Chinook salmon, Alternative 4A includes a greatly reduced extent of
32 restoration measures relative to Alternative 4 and Alternative 1A, upon which the discussion of
33 impacts for Alternative 4 is based. The general discussion of impacts to winter-run Chinook salmon
34 (Impacts AQUA-43, AQUA-44, and AQUA-45) also applies to fall-/late fall-run Chinook salmon, which
35 would have the potential to overlap the effects of restoration measures both temporally and
36 spatially.

37 Impact AQUA-79: Effects of Construction of Restoration Measures on Chinook Salmon (Fall-
38 /Late Fall-Run ESU)

39 As noted above, the impact discussion for winter-run Chinook salmon (Impact AQUA-43) is also
40 applicable to fall-run/late fall-run Chinook salmon.

1 *NEPA Effects:* For the reasons described under Impact AQUA-43, the effects of short-term
2 construction activities would not be adverse to fall-run/late fall-run Chinook salmon.

3 *CEQA Conclusion:* As discussed for winter-run Chinook salmon, the potential impact of habitat
4 restoration activities is considered less than significant because it would not substantially reduce
5 fall-run/late fall-run Chinook salmon habitat, restrict its range, or interfere with its movement. No
6 additional mitigation would be required.

7 Impact AQUA-80: Effects of Contaminants Associated with Restoration Measures on Chinook
8 Salmon (Fall-/Late Fall-Run ESU)

9 As noted above, the impact discussion for winter-run Chinook salmon (Impact AQUA-44) is also
10 applicable to fall-run/late fall-run Chinook salmon.

11 *NEPA Effects:* As noted for winter-run Chinook salmon, the effect of restoration measures on
12 chemical contaminants is not adverse to fall-run/late fall-run with respect to selenium, copper,
13 ammonia, pesticides, and methylmercury (with implementation of Environmental Commitment 12).

14 *CEQA Conclusion:* As noted for winter-run Chinook salmon, the impact of contaminants is
15 considered less than significant because it would not substantially affect fall-run/late fall-run
16 Chinook salmon either directly or through habitat modifications. Consequently, no mitigation would
17 be required.

18 Impact AQUA-81: Effects of Restored Habitat Conditions on Chinook Salmon (Fall-/Late Fall-
19 Run ESU)

20 As noted above, the impact discussion for winter-run Chinook salmon (Impact AQUA-45) is also
21 applicable to fall-run/late fall-run Chinook salmon.

22 *NEPA Effects:* The effects of restored habitat conditions on fall-run/late fall-run Chinook salmon
23 would not be adverse because effects would be avoided by limiting the frequency, duration, and
24 spatial extent of in-water work and implementing the commitments described in detail under
25 Impact AQUA-1 and in Appendix 3B, *Environmental Commitments*.

26 *CEQA Conclusion:* As described for winter-run Chinook salmon, habitat restoration activities could
27 result in short-term effects on fall-run/late fall-run Chinook salmon, primarily as a result of
28 increased potential for contaminated sediments to enter the water column. However, these effects
29 are likely to be localized, sporadic, and of low magnitude. Adverse effects during restoration would
30 be avoided by limiting the frequency, duration, and spatial extent of in-water work and
31 implementing the commitments described in detail under Impact AQUA-1 and in Appendix 3B,
32 *Environmental Commitments*. The potential impact of habitat restoration activities is considered less
33 than significant because it would not substantially reduce fall-run/late fall-run Chinook salmon
34 habitat, restrict its range or interfere with its movement. Additionally, there would be substantial
35 long-term net benefits of habitat restoration. Consequently, no additional mitigation would be
36 required.

37 Other Environmental Commitments (Environmental Commitment 12, Environmental Commitment
38 15, and Environmental Commitment 16)

39 As noted for winter-run Chinook salmon, Alternative 4A includes three other Environmental
40 Commitments, which are reduced in their extent relative to the Conservation Measures included in

1 other Alternatives (e.g., Alternative 1A and Alternative 4). While the extent of these measures is
2 reduced compared to these alternatives, the nature of the mechanisms remains the same. The
3 general discussion of impacts to winter-run Chinook salmon (Impacts AQUA-46, AQUA-49, and
4 AQUA-50) also applies to fall-run/late fall-run Chinook salmon.

5 Impact AQUA-82: Effects of Methylmercury Management on Chinook Salmon (Fall-/Late Fall-
6 Run ESU) (Environmental Commitment 12)

7 As noted above, the impact discussion for winter-run Chinook salmon (Impact AQUA-46) is also
8 applicable to fall-run/late fall-run Chinook salmon.

9 NEPA Effects: The effects of methylmercury management on fall-run/late fall-run Chinook salmon
10 would not be adverse because it is expected to reduce overall methylmercury levels resulting from
11 habitat restoration.

12 CEQA Conclusion: As noted for winter-run Chinook salmon, effects of Environmental Commitment
13 12 Methylmercury Management within the areas restored under Alternative 4A are expected to
14 reduce overall methylmercury levels resulting from habitat restoration. Because it is designed to
15 improve water quality and habitat conditions, impacts would be less than significant. Consequently,
16 no mitigation is required.

17 Impact AQUA-85: Effects of Localized Reduction of Predatory Fish on Chinook Salmon (Fall-
18 /Late Fall-Run ESU) (Environmental Commitment 15)

19 As noted above, the impact discussion for winter-run Chinook salmon (Impact AQUA-49) is also
20 applicable to fall-run/late fall-run Chinook salmon.

21 *NEPA Effects:* Environmental Commitment 15 would not have an adverse effect on Chinook salmon
22 and could potentially benefit the species. As noted for winter-run Chinook salmon, due to the
23 uncertainty in the effectiveness of Environmental Commitment 15, there would be no demonstrable
24 effect of this conservation measure on fall-run/late fall-run Chinook salmon.

25 *CEQA Conclusion:* Due to the uncertainties associated with this Environmental Commitment, there
26 would be no demonstrable effect on fall-run/late fall-run Chinook salmon. Thus, the impact would
27 be less than significant. Consequently, no mitigation would be required.

28 Impact AQUA-86: Effects of Nonphysical Fish Barriers on Chinook Salmon (Fall-/Late Fall-
29 Run ESU) (Environmental Commitment 16)

30 As noted above, the impact discussion for winter-run Chinook salmon (Impact AQUA-50) is also
31 applicable to fall-/late fall-run Chinook salmon. In addition, fall-run Chinook salmon from the San
32 Joaquin River watershed would be unlikely to encounter the nonphysical barrier at the divergence
33 of Georgiana Slough from the Sacramento River.

34 *NEPA Effects:* The effects of NPBs would not be adverse, because it is expected to improve Chinook
35 salmon migration conditions.

36 *CEQA Conclusion:* As concluded for winter-run Chinook salmon, the impacts of *Environmental*
37 *Commitment 16 Nonphysical Fish Barriers* are expected to be less than significant because it is
38 expected to improve Chinook salmon migration conditions. Consequently, no mitigation would be
39 required.