Appendix 12C
Fisheries Impact Summary

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APPENDIX 12C
Fisheries Impact Summary

This appendix summarizes the results of the Fisheries Impact Assessment for waterbodies in the Extended and Secondary Study Areas that may be affected by operation of the SWP and CVP facilities as a result of implementing the Sites Reservoir Project (Project) and alternatives. The potential impacts due to construction, operation, and maintenance of Project facilities in the Primary Study Area are described in Chapter 12 Aquatic Biological Resources.

12C.1 Methodology

For a description of the impact assessment methodology, assumptions, and indicator variables used in the fisheries and aquatic impact assessment for operational impacts in the Extended and Secondary Study Areas, refer to Appendix 12B Fisheries Impact Assessment Methodology. The following summarizes the potential impacts on fish species based on changes in the indicator variables for each species/lifestage evaluated. Detailed information and results of modeling tools relevant to the impact analyses for fisheries and aquatic resources are presented in the following appendices:

- Simulated riverine, reservoir, bypass, Delta hydrology, and X2 location:
  - Appendix 6B – Water Resources System Modeling
  - Appendix 6C – Upper Sacramento River Daily River Flow and Operations Modeling
- Simulated water temperatures:
  - Appendix 7E – River Temperature Modeling
  - Appendix 7F – Sites Reservoir Discharge Temperature Modeling
- Summarized simulated hydrology (Appendix 6B Water Resources System Modeling) and water temperature data (Appendix 12E Fisheries Water Temperature Assessment Summary Tables)
- Simulated fisheries habitat and population parameters:
  - Appendix 8B – Sacramento River Ecological Flows
  - Appendix 12F – Reservoir Water Surface Elevation Summary Tables
  - Appendix 12G – Smelt Analysis
  - Appendix 12H – Early Life-Stage Salmon Mortality Modeling
  - Appendix 12I – Salmonid Population Modeling
  - Appendix 12J – Winter Run Chinook Salmon Life Cycle Modeling
  - Appendix 12K – Delta Passage Modeling
  - Appendix 12L – Weighted Useable Area Analysis
  - Appendix 12M – Sturgeon Analysis
  - Appendix 12N – Yolo Bypass Flow and Fremont Weir Spill Analysis

12C.2 Approach to Analyzing the Effects of Alternatives on Fish

The analysis of the effects of changes in operation of the CVP and SWP on fish and aquatic resources in this EIR/EIS is influenced by numerous factors related to the complexity of the ecosystem, changes within the system (e.g., climate change and species population trends), and the imprecision of operational controls and resolution in modeling tools. These factors are further complicated by the scientific uncertainty about some fundamental aspects of aquatic species life history and how these species respond

to changes in the system, as well as sometimes competing points of view on the interpretation of biological and physical data within the scientific community. In light of these factors, the analysis takes an approach that presents available information and model outputs, synthesizes the results, and draws logical conclusions regarding the likely effects of the various alternatives.

Many modeling tools have been developed to evaluate changes in CVP and SWP water management, and as a result, multiple sources of information are available to characterize conditions (e.g., water temperature, flows, reservoir storage). Most of these modeling tools explain or provide insight on one or two of the factors affecting the species, while some tools are more integrative (e.g., SALMOD, SacEFT, and IOS) and capture multiple relationships among physical conditions and biological responses. Where integrative models were available, these were relied upon more than evaluation of the individual components. For species where these tools were not available, the analysis used a preponderance of evidence approach that drew conclusions based on trends indicated by the majority of the information. This approach assembled the full range of available information and model outputs and determined the direction (neutral, positive, or negative) of effect supported by the information.

As described in Appendix 12B Fisheries Impact Assessment Methodology, it was determined that incremental changes of 5 percent or less in an indicator variable such as flow or other indicators based on flow (e.g., WUA) were related to the uncertainties in the model processing. Therefore, changes of 5 percent or less are considered to be not substantially different, or "similar" in this comparative analysis. For exceedance of water temperature index values, a 1 percent difference in the probability of exceedance of applicable temperature thresholds (Appendix 12D Water Temperature Index Value Selection Rationale) was used to determine similarity. Differences between alternatives and the Existing Conditions/No Project/No Action Condition of less than these levels are described below as being similar or only slightly different.

12C.3 Impacts Associated with Alternative A Relative to the Existing Conditions/No Project/No Action Condition

12C.3.1 Extended Study Area – Alternative A Relative to the Existing Conditions/No Project/No Action Condition

12C.3.1.1 San Luis Reservoir

Reservoir storage model results (Appendix 6B Water Resources System Modeling) were examined for San Luis Reservoir during April through November for coldwater fish species; reductions in average monthly surface elevations greater than 6 feet (Appendix 12F Reservoir Water Surface Elevation Summary Tables) were examined during March through June for warmwater species.

Coldwater Fish Species

Relative to the Existing Conditions/No Project/No Action Condition, Alternative A would generally be expected to provide:

- Similar habitat for coldwater fish species, based on reservoir storage conditions, according to modeling results indicating: (1) similar long-term average monthly storage during most of the evaluation period, with slightly higher storage occurring in October and November; and (2) higher average monthly storage by water year type occurring during most months except in dry and critical

water year types when the average monthly storage throughout the evaluation period would be substantially reduced.

However, it is unlikely that coldwater fish habitat is limiting in San Luis Reservoir; therefore, it is unlikely that changes in reservoir storage under Alternative A would have a population level effect on coldwater fish species in San Luis Reservoir, relative to the Existing Conditions/No Project/No Action Condition.

Warmwater Fish Species

Relative to the Existing Conditions/No Project/No Action Condition, Alternative A would be expected to provide:

- Similar or less suitable warmwater fish nesting, based on modeling results indicating similar frequencies of monthly water surface elevation reductions of 6 feet or more during April through June and a higher frequency of water surface elevation reductions during March.

It is unlikely that a small difference in the number of years with monthly water surface elevation reductions of greater than 6 feet under Alternative A would have a population level effect on bass and other warmwater fish in San Luis Reservoir, relative to the Existing Conditions/No Project/No Action Condition.

12C.3.2 Secondary Study Area – Alternative A Relative to the Existing Conditions/No Project/No Action Condition

12C.3.2.1 Trinity Lake

Reservoir storage model results (Appendix 6B Water Resources System Modeling) were examined for Trinity Lake during April through November for coldwater fish species; reductions in average monthly surface elevations greater than 6 feet (Appendix 12F Reservoir Water Surface Elevation Summary Tables) were examined during March through June for warmwater species.

Coldwater Fish Species

Relative to the Existing Conditions/No Project/No Action Condition, Alternative A would be expected to provide:

- Similar or higher amounts of habitat for coldwater fish species based on modeling results for reservoir storage conditions indicating slightly higher long-term average monthly storage, and slightly higher average monthly storage by water year type during all months of the evaluation period.

However, it is unlikely that coldwater fish habitat is limiting in Trinity Lake; therefore, it is unlikely that changes in reservoir storage under Alternative A would have a population level effect on coldwater fish species in Trinity Lake, relative to the Existing Conditions/No Project/No Action Condition.

Warmwater Fish Species

Relative to the Existing Conditions/No Project/No Action Condition, Alternative A would be expected to provide:

- Similar warmwater fish nesting conditions, based on modeling results indicating similar or slightly reduced frequencies of monthly water surface elevation reductions of 6 feet or more.

It is unlikely that a small difference in the number of years with monthly water surface elevation reductions of greater than 6 feet under Alternative A would have a population level effect on bass and other warmwater fish in Trinity Lake, relative to the Existing Conditions/No Project/No Action Condition.

12C.3.2.2 Trinity River

Flow and water temperature model results were examined for the Trinity River below Lewiston Dam, at Douglas City, and at North Fork for all species (Appendix 6B Water Resources System Modeling, Appendix 7E River Temperature Modeling, and Appendix 12E Fisheries Water Temperature Assessment Summary Tables). For most species and life stages, only modeled flows and water temperatures were available, and the analyses of habitat conditions for these species and life stages were based primarily on the water temperature results. Model results for early life stage mortality were also examined for fall-run Chinook salmon (Appendix 12H Early Life-Stage Salmon Mortality Modeling). In general, average monthly flows and water temperatures would be similar under Alternative A and the Existing Conditions/No Project/No Action Condition; the potential for Project-related changes in aquatic habitat conditions and impacts on aquatic resources in the Trinity River are described below.

Coho Salmon

Relative to the Existing Conditions/No Project/No Action Condition, Alternative A would generally be expected to provide:

- Similar or slightly improved adult immigration and holding conditions based on modeling results indicating: (1) similar long-term average monthly flows during the evaluation period, and similar average monthly flows during most water year types, except for December of wet water years when average monthly flows would be up to 8 percent lower; and (2) similar or lower, and therefore more suitable, average monthly probabilities of exceeding specified water temperature index values, throughout the evaluation period except during January when probabilities of exceeding the lowest water temperature index values would be slightly higher.

- Similar or slightly improved adult spawning and embryo incubation conditions based on modeling results indicating: (1) similar long-term average monthly flows during the evaluation period, and similar average monthly flows during most water year types, except for above normal and below normal water years, when flows would be substantially lower during March and February, respectively; and (2) similar or lower probabilities of exceeding specified water temperature index values, and therefore more suitable water temperatures, occurring during most of the evaluation period, with the exception of January when probabilities of exceeding the lowest water temperature index values would be higher at Douglas City and below Lewiston Dam.

- Similar or improved juvenile rearing and emigration conditions based on modeling results indicating: (1) similar long-term average monthly flows over the entire year, and similar or slightly higher average monthly flows during most water year types, except for above normal and below normal water years, when flows would be substantially lower during March and February, respectively; (2) equivalent or lower probabilities of exceeding specified water temperature index values throughout most of the year, particularly during August through October.

- Similar or slightly improved smolt emigration conditions based on modeling results indicating: (1) similar long-term average monthly flows during the evaluation period, and equivalent or slightly higher average monthly flows during most water year types, except for above normal and below normal water years, when flows would be substantially lower during March and February, respectively; (2) similar or slightly lower probabilities of exceeding specified water temperature index values during the evaluation period.

In conclusion, in consideration of potential impacts to all life stages of Coho salmon in the Trinity River, Alternative A would result in similar or more suitable conditions for Coho salmon, relative to the Existing Conditions/No Project/No Action Condition.

Spring-Run Chinook Salmon

Relative to the Existing Conditions/No Project/No Action Condition, Alternative A would generally be expected to provide:

- Similar or improved adult immigration and holding conditions based on modeling results indicating: (1) similar long-term average monthly flows during the evaluation period, and equivalent average monthly flows during most water year types, except during April of wet water years when average monthly flows would be slightly higher; and (2) similar, or lower, and therefore more suitable, monthly probabilities of exceeding specified water temperature index values, particularly during August and September.
- Similar or improved adult spawning and egg incubation conditions based on modeling results indicating: (1) equivalent or slightly higher long-term average monthly flows during the evaluation period, and similar or slightly higher average monthly flows during all water year types; and (2) lower probabilities of exceeding specified water temperature index values during most of the evaluation period, and therefore more suitable water temperatures except in September when probabilities may higher.
- Similar or improved juvenile rearing and emigration conditions based on modeling results indicating: (1) similar long-term average monthly flows over the entire year, and similar or slightly higher average monthly flows during most water year types, except for above normal and below normal water years, when flows would be substantially lower during March and February, respectively; and (2) similar or slightly lower probabilities of exceeding specified water temperature index values throughout most of the year, with lower probabilities of exceedance in September.
- Similar or improved smolt emigration conditions based on modeling results indicating: (1) similar long-term average monthly flows over the entire year, and similar or slightly higher average monthly flows during most water year types, except for above normal and below normal water years, when flows would be substantially lower during March and February, respectively; and (2) similar or slightly lower probabilities of exceeding specified water temperature index values throughout most of the year, with lower probabilities of exceedance in September.

In conclusion, in consideration of potential impacts to all life stages of spring-run Chinook salmon in the Trinity River, Alternative A would result in similar or more suitable conditions for spring-run Chinook salmon, relative to the Existing Conditions/No Project/No Action Condition.

Fall-Run Chinook Salmon

Relative to the Existing Conditions/No Project/No Action Condition, Alternative A would generally be expected to provide:

- Similar or improved adult immigration and holding conditions based on modeling results indicating: (1) similar long-term average monthly flows during the evaluation period, and equivalent or slightly higher average monthly flows during most water year types, except during December of wet water years when average monthly flows would be slightly lower, though they would be higher during November of Above Normal year types; and (2) similar or lower (particularly during August and September), and therefore more suitable, average monthly probabilities of exceeding specified water temperature index values.
- Similar adult spawning conditions based on modeling results indicating: (1) similar long-term average monthly flows during the evaluation period, and similar or slightly higher average monthly flows during most water year types, except during March of above normal and February of below normal water years, when flows would be substantially lower; and (2) similar probabilities of exceeding specified water temperature index values, with lower probabilities, and therefore more suitable water temperatures, during October.
- Similar embryo incubation conditions based on modeling results, indicating: (1) similar total annual early life stage mortality; and (2) similar probabilities of exceeding specified water temperature index values, with lower probabilities, and therefore more suitable water temperatures, during October.
- Similar or slightly improved juvenile rearing and emigration conditions based on modeling results indicating: (1) similar long-term average monthly flows during the evaluation period, and similar or slightly higher average monthly flows during most water year types, except during March of above normal and February of below normal water years, when flows would be substantially lower; and (2) similar or slightly lower probabilities of exceeding specified water temperature index values throughout most the evaluation period, particularly from July through September.
- Similar smolt emigration conditions due to modeling results indicating: (1) similar long-term average monthly flows during the evaluation period, and equivalent or slightly higher average monthly flows during most water year types, except for above normal and below normal water years, when flows would be substantially lower during March and February, respectively; and (2) similar or slightly lower probabilities of exceeding specified water temperature index values, particularly during June and July.

In conclusion, in consideration of potential impacts to all life stages of fall-run Chinook salmon in the Trinity River, Alternative A would result in similar conditions for fall-run Chinook salmon, relative to the Existing Conditions/No Project/No Action Condition.

Steelhead (Winter-run and Summer-run)

Relative to the Existing Conditions/No Project/No Action Condition, Alternative A would generally be expected to provide:

- Similar or slightly improved adult immigration and holding conditions for winter-run steelhead based on modeling results indicating: (1) similar long-term average monthly flows during the evaluation period, and equivalent or slightly higher average monthly flows during most water year types, except during March of above normal and February of below normal water years, when flows would be

substantially lower; and (2) similar, or slightly lower average monthly probabilities of exceeding specified water temperature index values, particularly from August through October.

- Similar adult immigration and holding conditions for summer-run steelhead based on modeling results indicating: (1) equivalent long-term average monthly flows during the evaluation period, and equivalent average monthly flows during all water year types; (2) similar probabilities of exceeding specified water temperature index values during the evaluation period.
- Similar adult spawning and egg incubation conditions based on modeling results indicating: (1) similar long-term average monthly flows during the evaluation period, and equivalent average monthly flows during most water year types, except during March of above normal and February of below normal water years, when flows would be substantially lower; and (2) similar probabilities of exceeding specified water temperature index values throughout the evaluation period.
- Similar or slightly improved juvenile rearing and emigration conditions based on modeling results indicating: (1) similar long-term average monthly flows throughout the evaluation period, and similar or slightly higher average monthly flows during most water year types, except for above normal and below normal water years, when flows would be substantially lower during March and February, respectively; (2) equivalent or similar probabilities of exceeding specified water temperature index values throughout most of the year, with lower probabilities of exceedance, and therefore more suitable water temperatures, from July through September.
- Similar smolt emigration conditions based on modeling results indicating: (1) similar long-term average monthly flows during the evaluation period, and similar or slightly higher average monthly flows, except for during above normal and below normal water years, when flows would be substantially reduced during March and February; and (2) similar probabilities of exceeding specified water temperature index values.

In conclusion, in consideration of potential impacts to all life stages of steelhead (winter-run and summer-run) in the Trinity River, Alternative A would result in similar conditions for steelhead, relative to the Existing Conditions/No Project/No Action Condition.

Green Sturgeon

Relative to the Existing Conditions/No Project/No Action Condition, Alternative A would generally be expected to provide:

- Similar or slightly improved adult immigration and holding conditions based on modeling results indicating: (1) similar long-term average monthly flows during the evaluation period, and equivalent or slightly higher average monthly flows during most water year types, except for above normal and below normal water years, except during March and February, when reductions of 31.2 and 33.6 percent, respectively, would occur; and (2) similar, or slightly lower average monthly probabilities of exceeding specified water temperature index values, particularly during June, July, and September, though slightly higher probabilities of exceedance would occur during August.
- Similar adult spawning conditions based on modeling results indicating: (1) similar long-term average monthly flows during the evaluation period, and equivalent average monthly flows during all water year types, except during March of Above Normal water year types, when flow would be reduced by 31.2 percent; and (2) equivalent probabilities of exceeding specified water temperature index values

throughout the evaluation period, except during July when probabilities would be slightly lower, and therefore more suitable water temperature conditions.

- Similar or improved juvenile rearing and emigration conditions based on modeling results indicating: (1) similar long-term average monthly flows over the entire year, and similar or slightly higher average monthly flows during most water year types, except during March of above normal and February of below normal water years, when flows would be substantially reduced by 31.2 and 33.6 percent, respectively; and (2) equivalent probabilities of exceeding specified water temperature index values throughout most of the year, with lower probabilities of exceedance during June, July, and September, though higher probabilities of exceedance would occur during August.

In conclusion, in consideration of potential impacts to all life stages of green sturgeon in the Trinity River, Alternative A would result in similar or slightly more suitable conditions for green sturgeon, relative to the Existing Conditions/No Project/No Action Condition.

White Sturgeon

Relative to the Existing Conditions/No Project/No Action Condition, Alternative A would generally be expected to provide:

- Similar adult immigration and holding conditions based on modeling results indicating: (1) similar long-term average monthly flows during the evaluation period, and similar or slightly higher average monthly flows during most water year types, except for above normal and below normal water years, except during March and February, when reductions of 31.2 and 33.6 percent, respectively, would occur; and (2) equivalent average monthly probabilities of exceeding specified water temperature index values throughout the entire evaluation period.

- Similar adult spawning conditions based on modeling results indicating: (1) similar long-term average monthly flows during the evaluation period, and similar or slightly higher average monthly flows during most water year types, except for above normal and below normal water years, when flows would be substantially lower, 31.2 and 33.6 percent, during March and February, respectively; and (2) equivalent average monthly probabilities of exceeding specified water temperature index values.

- Similar or slightly improved juvenile rearing and emigration conditions based on modeling results indicating: (1) similar long-term average monthly flows over the entire year, and similar or slightly higher average monthly flows during most water year types, except during March of above normal and February of below normal water years, when flows would be substantially lower, 31.2 and 33.6 percent, respectively; and (2) equivalent probabilities of exceeding specified water temperature index values throughout most of the evaluation period, with lower probabilities of exceedance during June, July, and September, although higher probabilities of exceedance would occur during August.

In conclusion, in consideration of potential impacts to all life stages of white sturgeon in the Trinity River, Alternative A would result in generally similar conditions for white sturgeon, relative to the Existing Conditions/No Project/No Action Condition.

Pacific Lamprey

Relative to the Existing Conditions/No Project/No Action Condition, Alternative A would generally be expected to provide:

- Similar adult immigration conditions based on modeling results indicating: (1) similar long-term average monthly flows during the evaluation period, and similar or slightly higher average monthly flows during most water year types, except for above normal and below normal water years, when flows would be substantially lower during March and February, respectively.
- Similar adult spawning and egg incubation conditions based on modeling results indicating: (1) similar long-term average monthly flows during the evaluation period, and equivalent or slightly higher average monthly flows during most water year types, except during above normal and below normal water years, when flows would be reduced by 31.2 and 33.6 percent during March and February, respectively; and (2) similar probabilities of exceeding specified water temperature index values, with lower probabilities of exceedance during July and August and slightly higher probabilities during April and May.
- Similar juvenile rearing and emigration conditions based on modeling results indicating: (1) similar long-term average monthly flows over the entire evaluation period, and equivalent or slightly higher average monthly flows during most water year types, except for during above normal and below normal water years, when flow reductions of 31.2 and 33.6 percent during March and February, respectively, would occur; and (2) equivalent average monthly probabilities of remaining with the specified water temperature range.

In conclusion, in consideration of potential impacts to all life stages of Pacific lamprey in the Trinity River, Alternative A would result in similar conditions for Pacific lamprey, relative to the Existing Conditions/No Project/No Action Condition.

12C.3.2.3 Klamath River downstream of the Trinity River

Changes to Klamath River flows and water temperatures downstream of the confluence with the Trinity River were analyzed qualitatively. Because Trinity River flows and water temperatures would be similar under Alternative A and the Existing Conditions/No Project/No Action Condition, it is anticipated that flows in the lower Klamath River due to implementation of Alternative A also would be similar to the Existing Conditions/No Project/No Action Condition; and implementation of Alternative A would not result in increased water temperatures on the lower Klamath River under Alternative A, as compared to the Existing Conditions/No Project/No Action Condition. Therefore, it is expected that implementation of Alternative A would not result in any changes in habitat conditions for aquatic resources in the Klamath River downstream of the Trinity River confluence.

12C.3.2.4 Shasta Lake

Over the long term, average monthly storage in Shasta Lake under Alternative A would be similar to the Existing Conditions/No Project/No Action Condition, as shown in Appendix 6B Water Resources System Modeling. In Dry and Critical water years, average monthly storage in Shasta Lake under Alternative A would be similar to the Existing Conditions/No Project/No Action Condition from January through May. From June through December, average monthly storage in Shasta Lake would increase under Alternative A because water would be released from Sites Reservoir to meet Delta water quality and other downstream flow criteria, which would allow cold water storage in Shasta Lake to increase.

Reservoir storage model results (Appendix 6B Water Resources System Modeling) were examined for Shasta Lake during April through November for coldwater fish species; reductions in average monthly surface elevations greater than 6 feet (Appendix 12F Reservoir Water Surface Elevation Summary

Tables) were examined during March through June for warmwater species. The potential impacts on aquatic resources in Shasta Lake are described below.

Coldwater Fish Species

Relative to the Existing Conditions/No Project/No Action Condition, Alternative A would generally be expected to provide:

- Similar or larger amounts of habitat for coldwater fish species, based on modeling results indicating slightly higher long-term average monthly storage, and slightly higher average monthly storage by water year type during most of the evaluation period, particularly during dry and critical water year types, when end-of-month storage would be substantially higher.

However, it is unlikely that coldwater fish habitat is limiting in Shasta Lake; therefore, it is unlikely that changes in reservoir storage under Alternative A would have a population level effect on coldwater fish species in Shasta Lake, relative to the Existing Conditions/No Project/No Action Condition.

Warmwater Fish Species

Relative to the Existing Conditions/No Project/No Action Condition, Alternative A would be expected to provide:

- Similar or improved warmwater fish spawning and early life stage conditions, based on modeling results indicating similar or slightly reduced frequencies of monthly water surface elevation reductions of 6 feet or more during the evaluation period.

It is unlikely that a small difference in the number of years with monthly water surface elevation reductions of greater than 6 feet under Alternative A would have a population level effect on bass and other warmwater fish in Shasta Lake, relative to the Existing Conditions/No Project/No Action Condition.

12C.3.2.5 Sacramento River

Flows in the Sacramento River below Keswick Dam would be influenced by Project diversions from the Sacramento River into Sites Reservoir, primarily from January through March and releases from Sites Reservoir to meet Delta water quality objectives, primarily from July through November. Sites Reservoir operations could also affect flows in the Sacramento River and elsewhere (e.g., Feather and American rivers) though coordinated changes in CVP and SWP operations. Flow and water temperature model results were examined for the Sacramento River below Keswick Reservoir and at several points downstream, including the proposed Delevan Pipeline Intake/Discharge Facilities for all species (Appendix 6B Water Resources System Modeling, Appendix 7E River Temperature Modeling, and Appendix 12E Fisheries Water Temperature Assessment Summary Tables). The flow and water temperature results were used in combination with a number of other model outputs and indicators to assess potential changes in aquatic habitats for each species and life stage present as detailed in Appendix 12B Fisheries Impact Assessment Methodology. For several species and life stages, only modeled flows and water temperatures were available and the analyses of habitat conditions for these species and life stages were based primarily on the water temperature results. The potential for Project-related changes in aquatic habitat conditions and impacts on aquatic resources in the Sacramento River are described below.

Winter-run Chinook Salmon

Relative to the Existing Conditions/No Project/No Action Condition, Alternative A would generally be expected to provide:

- Similar adult immigration and holding conditions, based on modeling results indicating: (1) similar or higher long-term average monthly flows generally occurring during the early months of the evaluation period, December through February, but similar or lower long-term average monthly flows occurring during the late part of the evaluation period, March through July, and lower average monthly flows in drier water years occurring during March through June at Keswick Dam; (2) similar or lower long-term average monthly flows during most months below RBDD, particularly in drier water year types; (3) similar long-term average monthly flows during most months with potential flow reductions in drier water year types at Verona, Freeport, and Rio Vista; (4) similar, or slightly higher (particularly during April) or slightly lower (particularly during May through July) average monthly probabilities of exceeding specified water temperature index values.
- Improved spawning conditions based on modeling results indicating increased monthly spawning habitat availability (WUA) during the entire April through August adult spawning period; (2) generally lower probabilities of exceeding specified water temperature index values, and therefore more suitable water temperatures, particularly during months with relatively warm water temperature conditions (i.e., July and August).
- Improved embryo incubation conditions based on modeling results indicating: (1) reduced total annual early life stage mortality; and (2) lower probabilities of exceeding specified water temperature index values, and therefore more suitable water temperatures, particularly during months with relatively warm water temperature conditions (July and August).
- Improved juvenile rearing and outmigration conditions based on modeling results indicating: (1) generally similar or lower long-term average monthly flows from July through September, with generally similar or higher flows from October through February below Keswick Reservoir; (2) generally higher long-term average flows would occur from July through November and similar or lower flows from January through April in the lower Sacramento River (Verona, Freeport and Rio Vista), particularly in drier water years; (3) similar fry and juvenile rearing habitat availability (WUA) in the upper Sacramento River; (4) a similar frequency and duration of floodplain inundation in the Sutter and Yolo bypasses; and (5) lower, and therefore more suitable, monthly probabilities of exceeding specified water temperature index values, particularly from July through September.
- Similar or improved production potential (SALMOD) based on modeling results indicating long-term average total annual winter-run Chinook salmon production would increase by 2 percent, while average total annual production would increase during wet water years by less than 1 percent, during above normal water years by 6 percent, during below normal water years by 1 percent, and during dry and critical water years by 3 percent.
- Improved conditions pertaining to early life stage survival and abundance of spawners (IOS) based on modeling results indicating: (1) over the 81-year evaluation period, long-term average annual egg to fry survival would increase by 3 percent, and average annual egg to fry survival by water year type would decrease during wet and above normal water years by 1 percent, and would increase during below normal water years by 3 percent, during dry water years by 5 percent and during critical water years by 26 percent; (2) long-term average annual fry to smolt survival would increase by 4 percent,

and average annual fry to smolt survival by water year type would increase during wet water years by 3 percent, during above normal water years by 4 percent, and during critical water years by 16 percent, and would be equivalent during below normal and dry water years; and (3) long-term average annual female spawner abundance would increase by 8 percent, and average annual female spawner abundance by water year type would increase during wet water years by 9 percent, during above normal water years by 13 percent, during below normal water years by 2 percent, during dry water years by 7 percent and during critical water years by 10 percent.

In conclusion, in consideration of potential impacts to all life stages of winter-run Chinook salmon in the Sacramento River, Alternative A would result in more suitable conditions for winter-run Chinook salmon, relative to the Existing Conditions/No Project/No Action Condition.

Spring-run Chinook Salmon

Relative to the Existing Conditions/No Project/No Action Condition, Alternative A would generally be expected to provide:

- Similar adult immigration and holding conditions, based on modeling results indicating: (1) similar long-term average monthly flows during most months in the upper Sacramento River (below Keswick Reservoir and Red Bluff Diversion Dam [RBDD]), with reduced flows from February through May in drier water year types; (2) similar or increased long-term average monthly flows from April through September, with reduced flows during February and March of drier water year types occurring in the lower Sacramento River; and (3) similar monthly probabilities of exceeding specified water temperature index values during February and March, but slightly higher probabilities during April, and slightly lower probabilities during the remainder of the evaluation period, May through September.
- Improved spawning conditions based on modeling results indicating: (1) slightly higher long-term average monthly flows below Keswick Dam and at Bend Bridge except during September when flows would be slightly reduced, and slightly lower throughout the evaluation period at the RBDD, and similar average monthly flow patterns by water year type at the three locations evaluated; and (2) lower probabilities of exceeding specified water temperature index values, and therefore more suitable water temperatures, particularly during months with warm water temperature conditions, September and October.
- Improved embryo incubation conditions based on modeling results indicating: (1) reduced total annual early life stage mortality; and (2) lower probabilities of exceeding specified water temperature index values, and therefore more suitable water temperatures, particularly during September and October.
- Similar or improved juvenile rearing and emigration conditions based on modeling results indicating: (1) slightly lower long-term average monthly flows and average monthly flows by water year type most of the year in the upper Sacramento River, except October through February below Keswick Dam, and October, December, and July at the RBDD when long-term average flow and average monthly flow by water year type would increase, particularly in drier water year types; (2) a similar frequency and duration of floodplain inundation in the Sutter and Yolo bypasses; and (3) similar or slightly lower, and therefore more suitable, monthly probabilities of exceeding specified water temperature index values, particularly May through October.

- Similar smolt emigration conditions based on modeling results indicating: (1) similar or reduced long-term average monthly flows and average monthly flows by water year type, particularly from January through May below RBDD; (2) similar or reduced long-term average monthly flows and average monthly flows by water year type, particularly from January through May, and similar or increased flows during October, November, and June in the lower Sacramento River; (2) higher monthly probabilities of exceeding specified water temperature index values during April and May, and lower monthly probabilities of exceeding specified water temperature index values during October.
- Similar or improved production potential based on (SALMOD) modeling results indicating long-term average total annual spring-run Chinook salmon production would increase by 3 percent, while average total annual production would increase during wet water years by 2 percent, during above normal water years by 1 percent, during below normal water years by less than 1 percent, during dry water years by 9 percent, and during critical water years by 4 percent.

In conclusion, in consideration of potential impacts to all life stages of spring-run Chinook salmon in the Sacramento River, Alternative A would result more suitable conditions for spring-run Chinook salmon, relative to the Existing Conditions/No Project/No Action Condition.

Fall-run Chinook Salmon

Relative to the Existing Conditions/No Project/No Action Condition, Alternative A would generally be expected to provide:

- Similar or improved adult immigration and holding conditions, based on modeling results indicating: (1) similar or reduced flows from July through September and similar or increased flows from October through December in the upper Sacramento River; (2) generally increased long-term average monthly flows and flows by water year type from July through November in the lower Sacramento River; and (3) lower, and therefore more suitable, monthly probabilities of exceeding specified water temperature index values, particularly during July through October.
- Similar spawning conditions based on modeling results indicating: (1) similar spawning habitat availability (WUA) in the upper Sacramento River during the October through January spawning period, with increases occurring in half the months and decreases occurring in the remaining months; and (2) similar probabilities of exceeding specified water temperature index values throughout the evaluation period, except during October when probabilities would be lower, and therefore more suitable water temperatures.
- Improved embryo incubation conditions based on modeling results indicating: (1) reduced levels of annual early life stage mortality; and (2) similar probabilities of exceeding specified water temperature index values throughout the evaluation period, except during October when probabilities would be lower, and therefore more suitable water temperatures.
- Similar or less suitable juvenile rearing and outmigration conditions based on modeling results indicating: (1) similar or reduced long-term average monthly flows and average monthly flows by water year type from January through May below the RBDD; (2) similar or reduced average monthly flows from January through May, particularly in drier water year types in the lower Sacramento River; (3) similar or reduced fry rearing habitat availability (WUA) and similar juvenile rearing habitat availability (WUA) in the upper Sacramento River; (4) a similar frequency and duration of

floodplain inundation in the Sutter and Yolo bypasses; and (5) similar monthly probabilities of exceeding specified water temperature index values, except during April when less suitable water temperatures would occur more frequently.

- Similar or improved production potential based on (SALMOD) modeling results indicating long-term average annual fall-run Chinook salmon production would increase by 3 percent, while average total annual production would decrease during wet water years by 8 percent and during below normal water years by less than 1 percent, and would increase during above normal water years by 11 percent, during dry water years by 6 percent, and during critical water years by 10 percent.

In conclusion, in consideration of potential impacts to all life stages of fall-run Chinook salmon in the Sacramento River, Alternative A would result in similar or improved conditions for fall-run Chinook salmon, relative to the Existing Conditions/No Project/No Action Condition.

Late Fall-run Chinook Salmon

Relative to the Existing Conditions/No Project/No Action Condition, Alternative A would generally be expected to provide:

- Similar adult immigration and holding conditions, based on modeling results indicating: (1) similar or higher long-term average monthly flows and average monthly flows by water year type from October through February below Keswick Dam, particularly during wetter water year types, and similar or reduced flows during March and April, particularly in drier water year types; (2) similar or higher long-term average monthly flows and average monthly flows by water year type from October through December below RBDD, with similar or reduced flows from January through April below RBDD; (3) similar or higher long-term average monthly flows and average monthly flows by water year type during October and November, with similar or reduced flows from December through April in the lower Sacramento River; and (4) similar monthly probabilities of exceeding specified water temperature index values during much of the evaluation period, but with more suitable water temperatures during October and less suitable water temperatures during April.
- Similar spawning conditions based on modeling results indicating: (1) similar spawning habitat availability (WUA) from January through April; and (2) similar probabilities of exceeding specified water temperature index values, with more suitable water temperatures during May and less suitable water temperatures during April.
- Similar suitable embryo incubation conditions based on modeling results indicating: (1) similar annual early life stage mortality; and (2) similar probabilities of exceeding specified water temperature index values, with more suitable water temperatures during May and less suitable water temperatures during April.
- Similar or improved juvenile rearing and outmigration conditions based on modeling results indicating: (1) similar or reduced flows during the evaluation period, with reduced flows from April through May in drier water year types below RBDD; (2) similar or increased long-term average monthly flows and monthly flows by water year type from April through December in the lower Sacramento River; (3) generally similar fry and juvenile rearing habitat availability (WUA) in the upper Sacramento River; (4) a similar frequency and duration of floodplain inundation in the Sutter and Yolo bypasses; and (5) generally lower monthly probabilities of exceeding specified water

temperature index values, and therefore more suitable water temperature conditions, particularly from June through October.

- Similar or improved production potential based on (SALMOD) modeling results indicating long-term average total annual late fall-run Chinook salmon production would increase by 2 percent, while average total annual production by water year type would decrease during wet water years by less than 1 percent, and increase during above normal water years by 2 percent, during below normal water years by 2 percent, during dry water years by 1 percent, and during critical water years by 8 percent.

In conclusion, in consideration of potential impacts to all life stages of late fall-run Chinook salmon in the Sacramento River, Alternative A would result in similar or improved conditions for late fall-run Chinook salmon, relative to the Existing Conditions/No Project/No Action Condition.

Steelhead

Relative to the Existing Conditions/No Project/No Action Condition, Alternative A would generally be expected to provide:

- Similar or improved adult immigration and holding conditions, based on modeling results indicating: (1) similar or increased long-term average monthly flows during much of the evaluation period below Keswick Reservoir, except during August and September when average monthly flows could be lower; (2) similar or lower average monthly flows during the evaluation period at RBDD, particularly in drier water year types; (3) generally higher long-term average monthly flows and average monthly flows by water year type in the lower Sacramento River from August through November and generally lower flows from December through March, particularly in drier water year types; and (4) generally lower monthly probabilities of exceeding specified water temperature index values during September and October, and higher monthly probabilities of exceeding specified water temperature index values during March.
- Similar spawning conditions based on modeling results indicating: (1) similar spawning habitat availability (WUA) from December through April; (2) similar probabilities of exceeding specified water temperature index values; and (3) similar spawning habitat availability conditions according to SacEFT results.
- Similar embryo incubation conditions based on modeling results indicating: (1) higher mean monthly flows and flow exceedance probabilities during December through February, and lower flows during March and April; (2) similar probabilities of exceeding specified water temperature index values; and (3) SacEFT results indicate that redd scouring conditions would be equivalent.
- Similar juvenile rearing and emigration conditions based on modeling results indicating: (1) similar or increased long-term average monthly flows from October through February, and similar or lower monthly flows from March through September below Keswick Dam and at Bend Bridge; (2) similar or lower average monthly flows from January through September at RBDD, particularly in drier water year types, and similar or higher monthly flows from October through December; (3) a similar frequency and duration of floodplain inundation in the Sutter and Yolo bypasses; (4) equivalent monthly probabilities of exceeding specified water temperature index values, but with lower probabilities of exceeding 65°F during August and September at all locations evaluated, and therefore

more suitable water temperature conditions; and (5) slightly increased juvenile rearing habitat availability and increased juvenile stranding potential according to SacEFT results.

- Similar smolt emigration conditions based on modeling results indicating: (1) similar or lower average monthly flows from January through May at RBDD, particularly in drier water year types, and similar or higher monthly flows from October through December; (2) generally higher long-term average monthly flows and average monthly flows by water year type in the lower Sacramento River during October and November, with similar or lower monthly flows from during December through March, particularly in drier water year types; and (3) similar or slightly higher monthly probabilities of exceeding specified water temperature index values, and therefore slightly less suitable water temperature conditions.

In conclusion, in consideration of potential impacts to all life stages of steelhead in the Sacramento River, Alternative A would result in similar conditions for steelhead, relative to the Existing Conditions/No Project/No Action Condition.

Green Sturgeon

Relative to the Existing Conditions/No Project/No Action Condition, Alternative A would generally be expected to provide:

- Similar or improved adult immigration and holding conditions, based on modeling results indicating: (1) generally similar or lower long-term average monthly flows during much of the evaluation period, except during February when flows may be increased below Keswick Reservoir; (2) generally similar or lower long-term average monthly and average monthly flows by water year type from February through April, and similar or higher monthly flows from May through July below the proposed Delevan Pipeline Intake Facilities and at Rio Vista; and (3) lower, and therefore more suitable, average monthly probabilities of exceeding specified water temperature index values, except during April and May when the exceedance probability would be slightly increased.

- Similar spawning and egg incubation conditions based on modeling results indicating: (1) similar or lower long-term average monthly and average monthly flows by water year type below Keswick Dam and RBDD, and generally higher long-term average monthly and average monthly flows by water year type at Wilkins Slough; (2) equivalent probabilities of exceeding the specified water temperature index value below Keswick Dam and RBDD; and (3) SacEFT results indicating reduced water temperatures more often near Hamilton City and potentially increased survival.

- Similar or improved juvenile rearing and outmigration conditions based on modeling results indicating: (1) similar or lower average monthly flows from January through May at RBDD, particularly in drier water year types, and similar or higher monthly flows from October through December at RBDD; (2) generally higher long-term average monthly flows and average monthly flows by water year type below the proposed Delevan Pipeline Intake Facilities and at Rio Vista from May through November, with similar or lower monthly flows from during December through March, particularly in drier water year types; and (3) equivalent or lower, and therefore more suitable, monthly probabilities of exceeding specified water temperature index values at all locations evaluated, particularly June through October.

In conclusion, in consideration of potential impacts to all life stages of green sturgeon in the Sacramento River, Alternative A would result in similar or improved conditions for green sturgeon, relative to the Existing Conditions/No Project/No Action Condition.

White Sturgeon

Relative to the Existing Conditions/No Project/No Action Condition, Alternative A would generally be expected to provide:

- Similar adult immigration and holding conditions, based on modeling results indicating: (1) similar or reduced long-term average monthly and average monthly flows by water year type during most of the evaluation period except during November when flows may be increased below the proposed Delevan Pipeline Intake Facilities and at Rio Vista; and (2) equivalent monthly probabilities of exceeding specified water temperature index values during the evaluation period.
- Similar spawning and egg incubation conditions, according to modeling results indicating: (1) generally lower long-term average and average by water year type monthly flows from February through May; and (2) similar probabilities of exceeding specified water temperature index values, except during April when exceedance probabilities would be slightly higher.
- Similar or more suitable juvenile rearing and outmigration conditions based on modeling results indicating: (1) generally higher long-term average monthly flows and average monthly flows by water year type below the proposed Delevan Pipeline Intake Facilities and at Wilkins Slough and Rio Vista from May through November, with similar or lower monthly flows from during December through March, particularly in drier water year types; and (2) lower monthly probabilities of exceeding specified water temperature index values, and therefore more suitable water temperature conditions, from May through October and equivalent exceedance probabilities for the remainder of the year.

In conclusion, in consideration of potential impacts to all life stages of white sturgeon in the Sacramento River, Alternative A would result in similar conditions for white sturgeon, relative to the Existing Conditions/No Project/No Action Condition.

River Lamprey

Relative to the Existing Conditions/No Project/No Action Condition, Alternative A would generally be expected to provide:

- Similar adult immigration conditions, based on modeling results indicating: (1) similar or lower long-term average monthly flows and average monthly flows by water year type in September and March through June below Keswick Dam with similar or higher flows from October through February; and (2) generally higher long-term average monthly and average monthly flows by water year type below the proposed Delevan Pipeline Intake Facilities and at Freeport, except from December through April when flows may be lower.
- Similar or improved spawning and egg incubation conditions, based on modeling results indicating: (1) similar or lower long-term average and average by water year type monthly flows below Keswick Dam and below RBDD, although flows may be higher in February below Keswick Dam; (2) similar or lower long-term average and average by water year type monthly flows from February through April with similar or higher average monthly flows from May through July below the proposed

Delevan Pipeline Intake Facilities; and (3) higher probabilities of occurring within specified water temperature ranges, and therefore more suitable water temperatures.

- Generally similar ammocoete rearing and emigration conditions based on modeling results indicating: (1) similar or increased long-term average monthly flows from October through February below Keswick Dam with similar or lower monthly flows from March through September; (2) similar or lower average monthly flows from January through September at RBDD, particularly in drier water year types, and similar or higher monthly flows from October through December; (3) similar or higher average monthly flows and average monthly flows by water year type from May through November, and similar or lower average monthly flows from December through April at Freeport; and (4) similar monthly probabilities of exceeding specified water temperature index values, with lower probabilities of exceeding 72°F at Freeport during July and August, but higher probabilities during May, June, and September.

In conclusion, in consideration of potential impacts to all life stages of river lamprey in the Sacramento River, Alternative A would result in similar conditions for river lamprey, relative to the Existing Conditions/No Project/No Action Condition.

Pacific Lamprey

Relative to the Existing Conditions/No Project/No Action Condition, Alternative A would generally be expected to provide:

- Similar adult immigration conditions, based on modeling results indicating: (1) similar or lower long-term average and average monthly by water year type flows below Keswick Dam during the evaluation period, except during January and February when flows may be higher; (2) similar or lower long-term average monthly and average monthly flows by water year type below the proposed Delevan Pipeline Intake Facilities and at Freeport, except during May and June when flows may be higher during some water year types.

- Similar or improved spawning and egg incubation conditions, based on modeling results indicating: (1) similar or lower long-term average and average by water year type monthly flows below Keswick Dam and below RBDD, although flows may be higher in January and February below Keswick Reservoir; (2) similar or lower long-term average and average by water year type monthly flows from January through April, with similar or higher average monthly flows from May through August below the proposed Delevan Pipeline Intake Facilities; and (3) higher probabilities of water temperatures occurring within the specified water temperature range, and therefore more suitable water temperatures.

- Similar or improved ammocoete rearing and emigration conditions based on modeling results indicating: (1) similar or increased long-term average monthly flows from October through February below Keswick Dam with similar or lower monthly flows from March through September; (2) similar or lower average monthly flows from January through September at RBDD, particularly in drier water year types, and similar or higher monthly flows from October through December; (3) similar or higher average monthly flows and average monthly flows by water year type from May through November, and similar or lower average monthly flows from December through April at Freeport; and (4) similar monthly probabilities of exceeding specified water temperature index values, with lower exceedance probabilities in July and August at Freeport.

In conclusion, in consideration of potential impacts to all life stages of Pacific lamprey in the Sacramento River, Alternative A would result in similar conditions for Pacific lamprey, relative to the Existing Conditions/No Project/No Action Condition.

Hardhead

Relative to the Existing Conditions/No Project/No Action Condition, Alternative A would generally be expected to provide:

- Similar or less suitable adult and other life stage conditions, based on modeling results indicating: (1) similar or increased long-term average monthly flows from October through February below Keswick Dam with similar or lower monthly flows from March through September; (2) similar or higher average monthly flows and average monthly flows by water year type from May through November, and similar or lower average monthly flows from December through April below the proposed Delevan Pipeline Intake Facilities and at Freeport; and (3) lower probabilities of water temperatures occurring within the specified range from June through September, and therefore, less suitable water temperatures.
- Similar or improved spawning conditions, based on modeling results indicating: (1) similar long-term average and average by water year type monthly flows below the proposed Delevan Pipeline Intake Facilities and at Freeport, but similar or lower average monthly flows below Keswick Dam, particularly in drier water year types; (2) higher probabilities of occurring within the specified water temperature range, particularly below the proposed Delevan Pipeline Intake Facilities, and therefore more suitable water temperatures.

In conclusion, in consideration of potential impacts to all life stages of hardhead in the Sacramento River, Alternative A would result in similar conditions for hardhead, relative to the Existing Conditions/No Project/No Action Condition.

Sacramento Splittail

Relative to the Existing Conditions/No Project/No Action Condition, Alternative A would generally be expected to provide:

- Similar spawning and egg/larval life stage conditions, based on modeling results indicating: (1) a similar frequency that water temperatures are within the range specified for splittail in the Sacramento River (that is, 45 through 75 degrees Fahrenheit [°F]); and (2) a similar frequency and duration of floodplain inundation in the Sutter and Yolo bypasses.

In conclusion, in consideration of potential impacts to all life stages of splittail in the Sacramento River, Alternative A would result in similar conditions for splittail, relative to the Existing Conditions/No Project/No Action Condition.

American Shad

Relative to the Existing Conditions/No Project/No Action Condition, Alternative A would generally be expected to provide:

- Similar adult spawning and other life stage conditions, based on modeling results indicating: (1) similar long-term average and average by water year type monthly flows at Freeport and Verona, with similar or lower average monthly flows below RBDD, particularly in drier water year types; and

(2) similar but slightly higher probabilities of water temperatures occurring within the specified water temperature range below the Feather River Confluence and at Freeport, and slightly lower probabilities of water temperatures occurring within the specified range below RBDD.

- Similar or improved larvae, fry, and juvenile emigration conditions, based on modeling results indicating: (1) generally higher long-term average and average by water year type monthly flows from July through November at the proposed Delevan Pipeline Intake Facilities, Verona, and Freeport; and (2) generally similar or higher probabilities of water temperatures occurring within the specified water temperature range, except from June through August at the Delevan Intake when the probability would be lower.

In conclusion, in consideration of potential impacts to all life stages of American shad in the Sacramento River, Alternative A would result in similar or improved conditions for the American shad, relative to the Existing Conditions/No Project/No Action Condition.

Striped Bass

Relative to the Existing Conditions/No Project/No Action Condition, Alternative A would generally be expected to provide:

- Similar or improved adult spawning and other life stage conditions, based on modeling results indicating: (1) similar long-term average monthly and average monthly flows by water year type below the proposed Delevan Pipeline Intake Facilities and at Verona; and (2) slightly higher probabilities of water temperatures occurring within the specified water temperature range.
- Similar or improved larvae, fry, and juvenile emigration conditions, based on modeling results indicating: (1) similar or higher average monthly flows and average monthly flows by water year type from May through November, and similar or lower average monthly flows from December through April below the proposed Delevan Pipeline Intake Facilities and at Verona; and (2) generally higher probabilities of water temperatures occurring within the specified water temperature range, except in October when the probability may be lower.

In conclusion, in consideration of potential impacts to all life stages of striped bass in the Sacramento River, Alternative A would result in similar or improved conditions for striped bass, relative to the Existing Conditions/No Project/No Action Condition.

Largemouth Bass

Relative to the Existing Conditions/No Project/No Action Condition, Alternative A would generally be expected to provide:

- Similar or improved adult and other life stage conditions, based on modeling results indicating: (1) similar or increased long-term average monthly flows from October through February below Keswick Dam with similar or lower monthly flows from March through September; and (2) similar or higher average monthly flows and average monthly flows by water year type from May through November, and similar or lower average monthly flows from December through April below the proposed Delevan Pipeline Intake Facilities and at Freeport.
- Similar spawning conditions, based on modeling results indicating similar monthly probabilities of water temperatures occurring within the specified water temperature range below Keswick Dam and

at Freeport, with higher probabilities of occurring within the range, and therefore more suitable temperatures, below the proposed Delevan Pipeline Intake Facilities during April.

In conclusion, in consideration of potential impacts to all life stages of largemouth bass in the Sacramento River, Alternative A would result in similar conditions for largemouth bass, relative to the Existing Conditions/No Project/No Action Condition.

12C.3.2.6 Clear Creek

Flow and water temperature model results were examined for Clear Creek downstream of Whiskeytown Lake (Appendix 6B Water Resources System Modeling, Appendix 7E River Temperature Modeling, and Appendix 12E Fisheries Water Temperature Assessment Summary Tables). For most species and life stages, only modeled flows and water temperatures were available and the analyses of habitat conditions for these species and life stages were based primarily on the water temperature results. Model results for spawning and rearing habitat availability (WUA) were also examined Chinook salmon and steelhead (Appendix 12N Weighted Usable Area Analysis). In general, average monthly flows and water temperatures would be similar under Alternative A and the Existing Conditions/No Project/No Action Condition, except for increased flows in July; the potential for Project-related changes in aquatic habitat conditions and impacts on aquatic resources in Clear Creek are described below.

Spring-run Chinook Salmon

Relative to the Existing Conditions/No Project/No Action Condition, Alternative A would generally be expected to provide:

- Similar or improved adult immigration and holding conditions, based on modeling results indicating: (1) similar long-term average monthly and average monthly flows by water year type, except for substantially higher mean monthly flows during July; and (2) lower monthly probabilities of exceeding specified water temperature index values, and therefore more suitable water temperatures, particularly during July, September, and October.
- Similar or improved spawning and embryo incubation conditions based on modeling results indicating: (1) similar long-term average monthly and average monthly flows by water year type; (2) similar spawning habitat availability (WUA) in September; and (3) similar or slightly lower monthly probabilities of exceeding specified water temperature index values, particularly during September and October, and therefore more suitable water temperatures.
- Similar or slightly improved juvenile rearing and emigration conditions based on modeling results indicating: (1) similar long-term average monthly and average monthly flows by water year type, except for substantially higher mean monthly flows during July; (2) similar fry and juvenile rearing habitat availability (WUA) except in July when juvenile rearing may be increased; and (3) slightly lower monthly probabilities of exceeding specified water temperature index values, and therefore more suitable water temperatures, particularly July through October.
- Similar smolt emigration conditions based on modeling results indicating: (1) similar long-term average monthly and average monthly flows by water year type; and (2) similar monthly probabilities of exceeding specified water temperature index values.

In conclusion, in consideration of potential impacts to all life stages of spring-run Chinook salmon in Clear Creek, Alternative A would result in similar or slightly improved conditions for spring-run Chinook salmon, relative to the Existing Conditions/No Project/No Action Condition.

Fall-run Chinook Salmon

Relative to the Existing Conditions/No Project/No Action Condition, Alternative A would generally be expected to provide:

- Similar or slightly improved adult immigration and holding conditions, based on modeling results indicating: (1) similar long-term average monthly and average monthly flows by water year type; and (2) similar monthly probabilities of exceeding specified water temperature index values, with slightly lower probabilities, and therefore more suitable water temperatures, occurring during September and October.
- Similar or slightly improved spawning and embryo incubation conditions based on modeling results indicating: (1) similar long-term average monthly and average monthly flows by water year type; (2) similar spawning habitat availability (WUA), except in critical water year types when WUA may be increased in October; and (2) similar lower monthly probabilities of exceeding specified water temperature index values, with slightly lower probabilities, and therefore more suitable water temperatures, occurring during October.
- Similar fry and juvenile rearing and emigration conditions based on modeling results indicating: (1) equivalent long-term average monthly and average monthly flows by water year type; (2) similar fry and juvenile rearing habitat availability (WUA); and (3) similar monthly probabilities of exceeding specified water temperature index values.

In conclusion, in consideration of potential impacts to all life stages of fall-run Chinook salmon in Clear Creek, Alternative A would result in similar conditions for fall-run Chinook salmon, relative to the Existing Conditions/No Project/No Action Condition.

Late Fall-run Chinook Salmon

Relative to the Existing Conditions/No Project/No Action Condition, Alternative A would generally be expected to provide:

- Similar adult immigration and holding conditions, based on modeling results indicating: (1) similar long-term average monthly and average monthly flows by water year type; and (2) similar monthly probabilities of exceeding specified water temperature index values.
- Similar spawning and embryo incubation conditions based on to modeling results indicating: (1) similar long-term average monthly and average monthly flows by water year type; and (2) similar monthly probabilities of exceeding specified water temperature index values.
- Similar or slightly improved juvenile rearing and emigration conditions based on modeling results indicating: (1) similar long-term average monthly and average monthly flows by water year type, except for substantially higher mean monthly flows during July; and (2) slightly lower monthly probabilities of exceeding specified water temperature index values, and therefore more suitable water temperatures, particularly from July through October.

In conclusion, in consideration of potential impacts to all life stages of late fall-run Chinook salmon in Clear Creek, Alternative A would result in similar conditions for late fall-run Chinook salmon, relative to the Existing Conditions/No Project/No Action Condition.

Steelhead

Relative to the Existing Conditions/No Project/No Action Condition, Alternative A would generally be expected to provide:

- Similar adult immigration and holding conditions, based on modeling results indicating: (1) similar long-term average monthly and average monthly flows by water year type; and (2) similar or slightly lower monthly probabilities of exceeding specified water temperature index values.
- Similar spawning and embryo incubation conditions based on modeling results indicating: (1) equivalent long-term average monthly and average monthly flows by water year type; (2) similar spawning habitat availability (WUA); and (3) similar monthly probabilities of exceeding specified water temperature index values, with slightly lower probabilities during April and slightly higher probabilities during May.
- Similar or slightly improved juvenile rearing and emigration conditions based on modeling results indicating: (1) similar long-term average monthly and average monthly flows by water year type, except for substantially higher mean monthly flows during July; (2) similar fry and juvenile rearing habitat availability (WUA); and (3) slightly lower monthly probabilities of exceeding specified water temperature index values, and therefore more suitable water temperatures, particularly from July through October.

In conclusion, in consideration of potential impacts to all life stages of steelhead in Clear Creek, Alternative A would result in similar conditions for steelhead, relative to the Existing Conditions/No Project/No Action Condition.

River Lamprey

Relative to the Existing Conditions/No Project/No Action Condition, Alternative A would generally be expected to provide:

- Similar adult immigration and holding conditions, based on modeling results indicating: similar long-term average monthly and average monthly flows by water year type.
- Similar spawning and embryo incubation conditions based on modeling results indicating: (1) similar long-term average monthly and average monthly flows by water year type, except for substantially higher mean monthly flows during July; and (2) similar monthly probabilities of water temperatures occurring within the specified water temperature range.
- Similar ammocoete rearing and emigration conditions based on modeling results indicating: (1) similar long-term average monthly and average monthly flows by water year type, except for substantially higher mean monthly flows during July; and (2) similar monthly probabilities of exceeding specified water temperature index values.

In conclusion, in consideration of potential impacts to all life stages of river lamprey in Clear Creek, Alternative A would result in similar conditions for river lamprey, relative to the Existing Conditions/No Project/No Action Condition.

Pacific Lamprey

Relative to the Existing Conditions/No Project/No Action Condition, Alternative A would generally be expected to provide:

- Similar adult immigration and holding conditions, based on modeling results indicating similar long-term average monthly and average monthly flows by water year type.
- Similar spawning and embryo incubation conditions based on modeling results indicating: (1) similar long-term average monthly and average monthly flows by water year type, except for substantially higher mean monthly flows during July; and (2) similar monthly probabilities of water temperatures occurring within the specified water temperature range.
- Similar ammocoete rearing and emigration conditions based on modeling results indicating: (1) similar long-term average monthly and average monthly flows by water year type, except for substantially higher mean monthly flows during July; and (2) similar monthly probabilities of exceeding specified water temperature index values.

In conclusion, in consideration of potential impacts to all life stages of Pacific lamprey in Clear Creek, Alternative A would result in similar conditions for Pacific lamprey, relative to the Existing Conditions/No Project/No Action Condition.

Hardhead

Relative to the Existing Conditions/No Project/No Action Condition, Alternative A would generally be expected to provide:

- Similar adult and other life stage conditions, based on modeling results indicating: (1) similar long-term average monthly and average monthly flows by water year type, except for substantially higher mean monthly flows during July; and (2) similar monthly probabilities of exceeding specified water temperature index values.
- Similar spawning conditions based on modeling results indicating: (1) equivalent long-term average monthly and average monthly flows by water year type; and (2) similar or slightly higher monthly probabilities of water temperatures occurring within the specified water temperature range.

In conclusion, in consideration of potential impacts to all life stages of hardhead in Clear Creek, Alternative A would result in similar conditions for hardhead, relative to the Existing Conditions/No Project/No Action Condition.

12C.3.2.7 Lake Oroville

Over the long term, average monthly storage in Lake Oroville under Alternative A would be similar to the Existing Conditions/No Project/No Action Condition, as shown in Appendix 6B Water Resources System Modeling. In Dry and Critical water years, average monthly storage in Lake Oroville under Alternative A would be similar to the Existing Conditions/No Project/No Action Condition. Reservoir storage model results were examined for Lake Oroville during April through November for coldwater fish species; reductions in average monthly surface elevations greater than 6 feet (Appendix 12F Reservoir Water Surface Elevation Summary Tables) were examined during March through June for warmwater species. The potential impacts on aquatic resources in Lake Oroville are described below.

Coldwater Fish Species

Relative to the Existing Conditions/No Project/No Action Condition, Alternative A would generally be expected to provide:

- Similar amounts of habitat for coldwater fish species based on modeling results for reservoir storage conditions indicating similar long-term average monthly storage, and similar average monthly storage by water year type during the evaluation period, except in Critical water years when storage may be increased.

It is unlikely that coldwater fish habitat is limiting in Lake Oroville; therefore, it is unlikely that changes in reservoir storage under Alternative A would have a population level effect on coldwater fish species in Lake Oroville, relative to the Existing Conditions/No Project/No Action Condition.

Warmwater Fish Species

Relative to the Existing Conditions/No Project/No Action Condition, Alternative A would generally be expected to provide:

- Similar warmwater fish nesting conditions, based on modeling results indicating minor differences in the frequency of monthly water surface elevation reductions of 6 feet or more during the evaluation period.

It is unlikely that a small difference in the number of years with monthly water surface elevation reductions of greater than 6 feet under Alternative A would have a population level effect on bass and other warmwater fish in Lake Oroville, relative to the Existing Conditions/No Project/No Action Condition.

12C.3.2.8 Feather River

Flows in the Low Flow Channel below the Fish Barrier Dam were modeled consistent with the terms of the FERC Settlement Agreement. As shown in Appendix 6B Water Resources System Modeling, modeled results for long-term average flows, and average flows by water year type, were similar under Alternative A and the Existing Conditions/No Project/No Action Condition. Although these results are not repeated for the discussions below, the model results for the Low Flow Channel below the Fish Barrier Dam were considered along with the information presented below and were incorporated into the impact determinations for the following species: spring-run Chinook salmon, fall-run Chinook salmon, steelhead, green sturgeon, white sturgeon, river lamprey, Pacific lamprey, and hardhead.

Flows in the Feather River below Lake Oroville would be influenced by Project diversions and releases primarily though coordinated changes in CVP and SWP operations. Flow and water temperature model results were examined for the Feather River at several points downstream of Lake Oroville (Appendix 6B Water Resources System Modeling, Appendix 7E River Temperature Modeling, and Appendix 12E Fisheries Water Temperature Assessment Summary Tables). For several species and life stages, only modeled flows and water temperatures were available; and the analyses of habitat conditions for these species and life stages were based primarily on the water temperature results. Model results for spawning habitat availability (WUA) were also examined for Chinook salmon and steelhead (Appendix 12N Weighted Usable Area Analysis). The potential for Project-related changes in aquatic habitat conditions and impacts on aquatic resources in the Feather River are described below.

Spring-run Chinook Salmon

Relative to the Existing Conditions/No Project/No Action Condition, Alternative A would generally be expected to provide:

- Similar adult immigration and holding conditions, based on modeling results indicating: (1) generally higher long-term average monthly flows and average monthly flows by water year type during the evaluation period below the Thermalito Afterbay outlet and at the mouth of the Feather River, except during drier water year types when lower monthly flows would occur more often; and (2) similar probabilities of exceeding specified water temperature index values at all Feather River locations evaluated.
- Similar or improved spawning conditions based on modeling results indicating: (1) similar long-term average monthly flows and average monthly flows by water year type; and (2) significantly higher spawning habitat availability (WUA) during half of the adult spawning period, although slightly lower spawning habitat availability would occur during the remainder of the evaluation period; and (3) similar or slightly lower probabilities of exceeding specified water temperature index values, and therefore more suitable water temperatures, during the evaluation period.
- Similar or improved embryo incubation conditions based on modeling results indicating: (1) reduced annual long-term average early life stage mortality; and (2) similar or slightly lower probabilities of exceeding specified water temperature index values, and therefore more suitable water temperatures during the evaluation period.
- Similar juvenile rearing and outmigration conditions based on modeling results indicating: (1) similar long-term average monthly flows and average monthly flows by water year type below the Thermalito Afterbay outlet, with slightly higher long-term average monthly flows occurring January through March and June through September, and slightly lower flows occurring during the remaining months, and generally lower average monthly flows during below normal and dry water year types below the Thermalito Afterbay outlet; and (2) similar monthly probabilities of exceeding specified water temperature index values at all Feather River locations evaluated.
- Similar smolt emigration conditions, based on modeling results indicating: (1) generally lower long-term average monthly flows during most of the evaluation period below the Thermalito Afterbay outlet and at the mouth of the Feather River, and similar or generally lower average monthly flows by water year type occurring during most water year types below the Thermalito Afterbay outlet and at the mouth of the Feather River; and (2) similar or slightly lower monthly probabilities of exceeding specified water temperature index values at all Feather River locations evaluated.

In conclusion, in consideration of potential impacts to all life stages of spring-run Chinook salmon in the Feather River, Alternative A would result in similar conditions for spring-run Chinook salmon, relative to the Existing Conditions/No Project/No Action Condition.

Fall-run Chinook Salmon

Relative to the Existing Conditions/No Project/No Action Condition, Alternative A would generally be expected to provide:

- Similar adult immigration and holding conditions, based on modeling results indicating: (1) generally higher long-term average monthly flows and average monthly flows by water year type occurring from July through September and lower average monthly flows from October through December

below the Thermalito Afterbay outlet and at the mouth of the Feather River; and (2) similar probabilities of exceeding specified water temperature index values during the evaluation period.

- Improved spawning conditions based on modeling results indicating: (1) substantially higher spawning habitat availability (WUA) during October and December, although slightly lower spawning habitat availability would occur during November; and (2) similar or slightly lower probabilities of exceeding specified water temperature index values during most of the evaluation period.
- Similar or improved embryo incubation conditions based on modeling results indicating: (1) reduced annual long-term average early life stage mortality; and (2) lower probabilities of exceeding specified water temperature index values during most of the evaluation period, particularly in the Low Flow Channel below the Fish Barrier Dam.
- Similar juvenile rearing and outmigration conditions based on modeling results indicating: (1) similar or slightly lower long-term average monthly flows and average monthly flows by water year type below the Thermalito Afterbay outlet and at the mouth of the Feather River; and (2) similar monthly probabilities of exceeding specified water temperature index values at all Feather River locations evaluated.

In conclusion, in consideration of potential impacts to all life stages of fall-run Chinook salmon in the Feather River, Alternative A would result in similar conditions for fall-run Chinook salmon, relative to the Existing Conditions/No Project/No Action Condition.

Steelhead

Relative to the Existing Conditions/No Project/No Action Condition, Alternative A would generally be expected to provide:

- Similar or improved adult immigration and holding conditions, based on modeling results indicating: (1) generally higher long-term average monthly flows and average monthly flows by water year type below the Thermalito Afterbay outlet and at the mouth of the Feather River; and (2) similar or lower monthly probabilities of exceeding specified water temperature index values, and therefore more suitable water temperatures, during most of the evaluation period.
- Similar or improved spawning conditions based on modeling results indicating: (1) slightly increased spawning habitat availability (WUA), with substantially increased WUA during December and April but substantially reduced WUA during February and March; and (2) similar or slightly lower probabilities of exceeding specified water temperature index values during most of the evaluation period.
- Generally similar embryo incubation conditions based on modeling results indicating: (1) similar long-term average monthly flows and average monthly flows by water year type during the evaluation period below the Thermalito Afterbay outlet; and (2) similar or slightly lower monthly probabilities of exceeding specified water temperature index values during most of the evaluation period at all Feather River locations evaluated.
- Similar juvenile rearing and outmigration conditions based on modeling results indicating: (1) similar long-term average monthly flows and average monthly flows by water year type below the Thermalito Afterbay outlet, with slightly higher long-term average monthly flows occurring January

through March and June through September, and slightly lower flows occurring during the remaining months, and generally lower average monthly flows during below normal and dry water year types below the Thermalito Afterbay outlet; and (2) similar monthly probabilities of exceeding specified water temperature index values at all Feather River locations evaluated.

- Similar smolt emigration conditions, based on modeling results indicating: (1) generally lower long-term average monthly flows during most of the evaluation period below the Thermalito Afterbay outlet and at the mouth of the Feather River, and similar or generally lower average monthly flows by water year type during most water year types below the Thermalito Afterbay outlet and at the mouth of the Feather River; and (2) similar or slightly lower monthly probabilities of exceeding specified water temperature index values at all Feather River locations evaluated.

In conclusion, in consideration of potential impacts to all life stages of steelhead in the Feather River, Alternative A would result in similar conditions for steelhead, relative to the Existing Conditions/No Project/No Action Condition.

Green Sturgeon

Relative to the Existing Conditions/No Project/No Action Condition, Alternative A would generally be expected to provide:

- Similar adult immigration and holding conditions, based on modeling results indicating: (1) similar or slightly higher long-term average monthly flows and average monthly flows by water year type during much of the evaluation period at Shanghai Bend and at the mouth of the Feather River, and higher average monthly flows by water year type during above normal and below normal water year types at Shanghai Bend and during above normal water year types at the mouth of the Feather River; and (2) similar monthly probabilities of exceeding specified water temperature index values during the evaluation period.

- Similar adult spawning and embryo incubation conditions based on modeling results indicating: (1) generally higher long-term average monthly flows and average monthly flows by water year type during much of the evaluation period below the Thermalito Afterbay outlet; and (2) similar monthly probabilities of exceeding specified water temperature index values below the Thermalito Afterbay outlet.

- Similar juvenile rearing conditions based on modeling results indicating: (1) similar long-term average monthly flows and average monthly flows by water year type below the Thermalito Afterbay outlet, with slightly higher long-term average monthly flows occurring January through March and June through September, and slightly lower flows occurring during the remaining months, and generally lower average monthly flows during below normal and dry water year types below the Thermalito Afterbay outlet; and (2) similar monthly probabilities of exceeding specified water temperature index values at all Feather River locations evaluated.

- Similar or improved juvenile emigration conditions based on modeling results indicating: (1) generally higher long-term average monthly flows and average monthly flows by water year type occurring during much of the evaluation period below the Thermalito Afterbay outlet, at Shanghai Bend, and at the mouth of the Feather River; and (2) similar monthly probabilities of exceeding specified water temperature index values below the Thermalito Afterbay outlet and at the mouth of the Feather River.

In conclusion, in consideration of potential impacts to all life stages of green sturgeon in the Feather River, Alternative A would result in similar conditions for green sturgeon, relative to the Existing Conditions/No Project/No Action Condition.

White Sturgeon

Relative to the Existing Conditions/No Project/No Action Condition, Alternative A would generally be expected to provide:

- Similar adult immigration and holding conditions, based on modeling results indicating: (1) generally lower long-term average monthly flows and average monthly flows by water year type during much of the evaluation period at Shanghai Bend and at the mouth of the Feather River, except during below normal water years when higher average monthly flows occur; and (2) equivalent monthly probabilities of exceeding specified water temperature index values at all locations evaluated.
- Similar spawning and egg incubation conditions based on modeling results indicating: (1) similar long-term average monthly flows and average monthly flows by water year type throughout the evaluation period at Shanghai Bend and at the mouth of the Feather River, and higher average monthly flows by water year type occurring more often during most water year types at Shanghai Bend and at the mouth of the Feather River, except during dry and critical water year types when lower average monthly flows occurred; and (2) similar monthly probabilities of exceeding specified water temperature index values at all locations evaluated.
- Similar juvenile rearing and outmigration conditions based on modeling results indicating: (1) similar long-term average monthly flows and average monthly flows by water year type below the Thermalito Afterbay outlet, with slightly higher long-term average monthly flows occurring January through March and June through September, and slightly lower flows occurring during the remaining months, and generally lower average monthly flows during below normal and dry water year types below the Thermalito Afterbay outlet; and (2) similar monthly probabilities of exceeding specified water temperature index values at all Feather River locations evaluated.

In conclusion, in consideration of potential impacts to all life stages of white sturgeon in the Feather River, Alternative A would result in similar conditions for white sturgeon, relative to the Existing Conditions/No Project/No Action Condition.

River Lamprey

Relative to the Existing Conditions/No Project/No Action Condition, Alternative A would generally be expected to provide:

- Similar adult immigration conditions, based on modeling results indicating similar long-term average monthly flows and average flows by water year type during much of the evaluation period below the Thermalito Afterbay outlet and at the mouth of the Feather River, with generally higher average monthly flows occurring during above normal and below normal water year types below the Thermalito Afterbay outlet and at the mouth of the Feather River, and lower average monthly flows occurring during dry and critical water year types below the Thermalito Afterbay outlet and at the mouth of the Feather River.

- Similar adult spawning and egg incubation conditions, based on modeling results indicating: (1) similar or slightly higher long-term average monthly flows and average monthly flows by water year type during most water year types below the Thermalito Afterbay outlet and at the mouth of the Feather River, except during dry and critical water year types when generally lower monthly flows would occur; and (2) slightly lower probability of water temperatures occurring within the specified water temperature range with similar frequency during the evaluation period at all Feather River locations evaluated.
- Similar ammocoete rearing and emigration conditions based on modeling results indicating: (1) similar long-term average monthly flows and average monthly flows by water year type below the Thermalito Afterbay outlet, with slightly higher long-term average monthly flows occurring January through March and June through September, and slightly lower flows occurring during the remaining months, and generally lower average monthly flows during below dry and critical water year types below the Thermalito Afterbay outlet; and (2) similar monthly probabilities of exceeding specified water temperature index values at all Feather River locations evaluated.

In conclusion, in consideration of potential impacts to all life stages of river lamprey in the Feather River, Alternative A would result in similar conditions for river lamprey, relative to the Existing Conditions/No Project/No Action Condition.

Pacific Lamprey

Relative to the Existing Conditions/No Project/No Action Condition, Alternative A would generally be expected to provide:

- Similar adult immigration conditions, based on modeling results indicating similar or slightly higher long-term average monthly flows and average monthly flows by water year type occurring during most water years below the Thermalito Afterbay outlet and at the mouth of the Feather River, except during dry and critical water year types when generally lower monthly flows would occur.
- Similar spawning and egg incubation conditions, based on modeling results indicating: (1) similar or slightly higher long-term average monthly flows and average monthly flows by water year type below the Thermalito Afterbay outlet and at the mouth of the Feather River, except during dry and critical water year types when generally lower monthly flows would occur; and (2) slightly lower probability of water temperatures occurring within the specified water temperature range during the evaluation period at all Feather River locations evaluated.
- Similar ammocoete rearing and emigration conditions based on modeling results indicating: (1) similar long-term average monthly flows and average monthly flows by water year type below the Thermalito Afterbay outlet, with slightly higher long-term average monthly flows occurring January through March and June through September, and slightly lower flows occurring during the remaining months, and generally lower average monthly flows during below dry and critical water year types below the Thermalito Afterbay outlet; and (2) similar monthly probabilities of exceeding specified water temperature index values at all Feather River locations evaluated.

In conclusion, in consideration of potential impacts to all life stages of Pacific lamprey in the Feather River, Alternative A would result in similar conditions for Pacific lamprey, relative to the Existing Conditions/No Project/No Action Condition.

Hardhead

Relative to the Existing Conditions/No Project/No Action Condition, Alternative A would generally be expected to provide:

- Similar adult and juvenile life stage conditions based on modeling results indicating: (1) similar long-term average monthly flows and average monthly flows by water year type below the Thermalito Afterbay outlet, with slightly higher long-term average monthly flows occurring January through March and June through September, and slightly lower flows occurring during the remaining months, and generally lower average monthly flows during below dry and critical water year types below the Thermalito Afterbay outlet; and (2) similar monthly probabilities of exceeding specified water temperature index values at all Feather River locations evaluated.
- Similar adult spawning conditions, based on modeling results indicating: (1) slightly lower long-term average monthly flows during April and May and slightly higher long-term monthly flows during June below the Thermalito Afterbay outlet and at the mouth of the Feather River, and slightly higher average monthly flows by water year type except dry and critical water year types below the Thermalito Afterbay outlet and at the mouth of the Feather River;; and (2) similar or slightly lower probabilities of water temperatures occurring within the specified water temperature range at all Feather River locations evaluated.

In conclusion, in consideration of potential impacts to all life stages of hardhead in the Feather River, Alternative A would result in similar conditions for hardhead, relative to the Existing Conditions/No Project/No Action Condition.

Sacramento Splittail

Relative to the Existing Conditions/No Project/No Action Condition, Alternative A would generally be expected to provide:

- Similar spawning conditions, based on modeling results indicating: (1) higher long-term monthly flows during February and March and lower long-term average monthly flows during April and May at the mouth of the Feather River, and similar or slightly higher average monthly flows by water year type during most water year types, although lower average monthly flows would occur during dry and critical water year types; and (2) equivalent probability of exceeding specified water temperature values occurring during the evaluation period.

In conclusion, in consideration of potential impacts to all life stages of splittail in the Feather River, Alternative A would result in similar conditions for splittail, relative to the Existing Conditions/No Project/No Action Condition.

Striped Bass

Relative to the Existing Conditions/No Project/No Action Condition, Alternative A would generally be expected to provide:

- Similar adult spawning and other life stage conditions, based on modeling results indicating: (1) similar long-term average monthly flows and average monthly flows by water year type below the Thermalito Afterbay outlet, with slightly higher long-term average monthly flows occurring January through March and June through September, and slightly lower flows occurring during the remaining months, and generally lower average monthly flows during below dry and critical water year types

below the Thermalito Afterbay outlet; and (2) similar monthly probabilities of exceeding specified water temperature index values at all Feather River locations evaluated.

- Generally similar larvae, fry, and juvenile emigration conditions, based on modeling results indicating: (1) similar long-term average monthly flows and average monthly flows by water year type below the Thermalito Afterbay outlet, with slightly higher long-term average monthly flows occurring January through March and June through September, and slightly lower flows occurring during the remaining months, and generally lower average monthly flows during below dry and critical water year types below the Thermalito Afterbay outlet; and (2) similar monthly probabilities of exceeding specified water temperature index values at all Feather River locations evaluated.

In conclusion, in consideration of potential impacts to all life stages of striped bass in the Feather River, Alternative A would result in similar conditions for striped bass, relative to the Existing Conditions/No Project/No Action Condition.

American Shad

Relative to the Existing Conditions/No Project/No Action Condition, Alternative A would generally be expected to provide:

- Similar adult spawning and other life stage conditions, based on modeling results indicating: (1) similar long-term average monthly flows and average monthly flows by water year type below the Thermalito Afterbay outlet, with slightly higher long-term average monthly flows occurring January through March and June through September, and slightly lower flows occurring during the remaining months, and generally lower average monthly flows during below dry and critical water year types below the Thermalito Afterbay outlet; and (2) similar or slightly higher monthly probabilities of exceeding specified water temperature index values at all Feather River locations evaluated.
- Similar larvae, fry, and juvenile emigration conditions, based on modeling results indicating: (1) slightly higher long-term average and average monthly flows by water year type during much of the evaluation period at all Feather River locations evaluated, except during October and most months of wet and below normal water year types; and (2) similar probability of water temperatures occurring within the specified water temperature range at all Feather River locations evaluated.

In conclusion, in consideration of potential impacts to all life stages of American shad in the Feather River, Alternative A would result in similar conditions for American shad, relative to the Existing Conditions/No Project/No Action Condition.

Largemouth Bass

Relative to the Existing Conditions/No Project/No Action Condition, Alternative A would generally be expected to provide:

- Similar adult and other life stage conditions, based on modeling results indicating: (1) similar long-term average monthly flows and average monthly flows by water year type below the Thermalito Afterbay outlet, with slightly higher long-term average monthly flows occurring January through March and June through September, and slightly lower flows occurring during the remaining months, and generally lower average monthly flows during below dry and critical water year types below the Thermalito Afterbay outlet; and (2) similar monthly probabilities of exceeding specified water temperature index values at all Feather River locations evaluated.

- Similar spawning conditions, based on modeling results indicating generally similar monthly probabilities of water temperatures occurring within the specified water temperature range for all Feather River locations evaluated.

In conclusion, in consideration of potential impacts to all life stages of largemouth bass in the Feather River, Alternative A would result in similar conditions for largemouth bass, relative to the Existing Conditions/No Project/No Action Condition.

12C.3.2.9 Sutter Bypass

Flows enter the Sutter Bypass at Tisdale Weir, Colusa Weir, Moulton Weir, and the weir at Ord Ferry. Overall, flows into Sutter Bypass would generally be reduced in the wetter months (between November and April) as flows are diverted from the Sacramento River into the Sites Reservoir.

In general, there would be no flows over the Moulton Weir and weir at Ord Ferry into the Sutter Bypass from May through November, and in Below Normal, Dry and Critical water year types under Alternative A and the Existing Conditions/No Project/No Action Condition. In December, flows would increase under Alternative A, as compared to the Existing Conditions/No Project/No Action Condition as flows are released from upstream reservoirs for flood management purposes. From January through April, flows would be similar or reduced compared to the Existing Conditions/No Project/No Action Condition as water from the Sacramento River is diverted to Sites Reservoir.

In general, there would be no flows over the Colusa Weir into the Sutter Bypass from June through October and in Critical water years under Alternative A and the Existing Conditions/No Project/No Action Condition. From January through April and in November, flows would be similar or reduced compared to the Existing Conditions/No Project/No Action Condition as water from the Sacramento River is diverted to Sites Reservoir. In December, flows may increase under Alternative A, as compared to the Existing Conditions/No Project/No Action Condition as flows are released from upstream reservoirs for flood management purposes.

In general, there would be no flows over the Tisdale Weir into the Sutter Bypass from June through October under Alternative A and the Existing Conditions/No Project/No Action Condition. From November through May, flows would be similar or reduced compared to the Existing Conditions/No Project/No Action Condition as water from the Sacramento River is diverted to Sites Reservoir. In October, flows may increase under Alternative A as compared to the Existing Conditions/No Project/No Action Condition as flows are released from upstream reservoirs for flood management purposes.

Relative to the Existing Conditions/No Project/No Action Condition, Alternative A would generally be expected to provide similar conditions for salmonids and splittail, based on modeling results (Appendix 12N Yolo and Sutter Bypass and Weir Flow Analysis) that indicate the following:

- Similar juvenile rearing conditions in the Sutter Bypass based on modeling results indicating a similar frequency and duration of floodplain inundation.

In conclusion, in consideration of potential impacts rearing salmonids and all life stages of splittail in the Sutter Bypass, Alternative A would result in similar habitat conditions for salmonids and splittail in the Sutter Bypass, relative to the Existing Conditions/No Project/No Action Condition.

12C.3.2.10 Folsom Lake

Over the long term, average monthly storage in Folsom Lake under Alternative A would be similar to the Existing Conditions/No Project/No Action Condition, as shown in Appendix 6B Water Resources System Modeling. In Dry and Critical water years, average monthly storage in Folsom Lake under Alternative A would be similar to the Existing Conditions/No Project/No Action Condition from February through June; from July through November the average monthly storage in Folsom Lake under Alternative A would increase as compared to the Existing Conditions/No Project/No Action Condition because water would be released from Sites Reservoir to meet Delta water quality objectives, allowing more water to be stored in Folsom Lake.

Reservoir storage model results (Appendix 6B Water Resources System Modeling) were examined for Folsom Lake during April through November for coldwater fish species; reductions in average monthly surface elevations greater than 6 feet (Appendix 12F Reservoir Water Surface Elevation Summary Tables) were examined during March through June for warmwater species. The potential impacts on aquatic resources in Folsom Lake are described below.

Coldwater Fish Species

Relative to the Existing Conditions/No Project/No Action Condition, Alternative A would generally be expected to provide:

- Improved conditions for coldwater fish species based on modeling results indicating higher long-term average monthly storage, and higher average monthly storage by water year type occurring during most months of the evaluation period.

However, it is unlikely that coldwater fish habitat is limiting in Folsom Lake; therefore, it is unlikely that changes in reservoir storage under Alternative A would have a population level effect on coldwater fish species in Folsom Lake, relative to the Existing Conditions/No Project/No Action Condition.

Warmwater Fish Species

Reservoir water surface elevation model results (Appendix 12F Reservoir Water Surface Elevation Summary Tables) were examined for Folsom Lake during March through June.

Relative to the Existing Conditions/No Project/No Action Condition, Alternative A would generally be expected to provide:

- Similar warmwater fish nesting conditions, based on modeling results indicating minor differences in the frequency of monthly water surface elevation reductions of 6 feet or more during the evaluation period.

It is unlikely that a small difference in the number of years with monthly water surface elevation reductions of greater than 6 feet under Alternative A would have a population level effect on bass and other warmwater fish in Folsom Lake, relative to the Existing Conditions/No Project/No Action Condition.

12C.3.2.11 American River

Flows in the American River downstream of Lake Natoma would be influenced by Project diversions and releases, primarily though coordinated changes in CVP and SWP operations. Flow and water temperature model results were examined for the American River at several points downstream of Lake Natoma

(Appendix 6B Water Resources System Modeling, Appendix 7E River Temperature Modeling, and Appendix 12E Fisheries Water Temperature Assessment Summary Tables). For several species and life stages, only modeled flows and water temperatures were available; and the analyses of habitat conditions for these species and life stages were based primarily on the water temperature results. Model results for spawning habitat availability (WUA) were also examined for Chinook salmon and steelhead (Appendix 12N Weighted Usable Area Analysis). The potential for Project-related changes in aquatic habitat conditions and impacts on aquatic resources in the American River are described below.

Fall-run Chinook Salmon

Relative to the Existing Conditions/No Project/No Action Condition, Alternative A would generally be expected to provide:

- Similar adult immigration and holding conditions based on modeling results indicating: (1) slightly higher long-term average monthly flows and average monthly flows by water year type during most months of the evaluation period; and (2) generally similar monthly probabilities of exceeding specified water temperature index values, except in October when the exceedance frequency may be lower, and therefore provide more suitable water temperatures.
- Similar or improved adult spawning conditions based on modeling results indicating: (1) slightly lower spawning habitat availability (WUA) during October and December, although significantly higher spawning habitat availability would occur during November; and (2) generally reduced monthly probabilities of exceeding specified water temperature index values, and therefore more suitable water temperatures.
- Similar embryo incubation conditions based on modeling results indicating: (1) slightly lower annual early life stage mortality; and (2) generally similar or reduced monthly probabilities of exceeding specified water temperature index values, except in March when the probability of exceedance may be increased.
- Similar juvenile rearing and emigration conditions based on modeling results indicating: (1) slightly higher long-term average monthly flows during the evaluation period, except during June, and similar or slightly higher average monthly flows by water year type during most water year types at all locations evaluated in the American River; and (2) generally similar probabilities of exceeding specified water temperature index values below Nimbus Dam, with similar or somewhat increased probabilities of exceeding the lowest temperature indices at Watt Avenue and at the mouth from April through June.

In conclusion, in consideration of potential impacts to all life stages of fall-run Chinook salmon in the American River, Alternative A would result in similar conditions for fall-run Chinook salmon, relative to the Existing Conditions/No Project/No Action Condition.

Spring-run Chinook Salmon

Relative to the Existing Conditions/No Project/No Action Condition, Alternative A would generally be expected to provide:

- Similar non-natal juvenile rearing conditions based on modeling results indicating: (1) slightly higher long-term average monthly flows during the evaluation period, except for November, and similar or

slightly higher average monthly flows by water year type; and (2) generally similar probabilities of exceeding specified water temperature index values throughout the evaluation period.

In conclusion, in consideration of potential impacts to all life stages of spring-run Chinook salmon in the American River, Alternative A would result in similar conditions for spring-run Chinook salmon, relative to the Existing Conditions/No Project/No Action Condition.

Steelhead

Relative to the Existing Conditions/No Project/No Action Condition, Alternative A would generally be expected to provide:

- Similar adult immigration and holding conditions based on modeling results indicating: (1) slightly higher long-term average monthly flows during the evaluation period, except for November, and similar or slightly higher average monthly flows by water year type; and (2) generally similar probabilities of exceeding specified water temperature index values, except during November and December when the probabilities would be lower, and in March and April when the probabilities of exceedance may be higher.
- Less suitable spawning conditions based on modeling results indicating: (1) lower spawning habitat availability (WUA); and (2) similar or higher monthly probabilities of exceeding specified water temperature index values.
- Less suitable embryo incubation conditions based on modeling results indicating: (1) similar or slightly higher long-term average monthly flows and average monthly flows by water year type during the evaluation period; and (2) similar or higher probabilities of exceeding specified water temperature index values.
- Similar juvenile rearing and emigration conditions based on modeling results indicating: (1) similar or slightly higher long-term average monthly flows and average monthly flows by water year type during the evaluation period, although lower flows would occur more frequently during November, June, and July; and (2) generally similar probabilities of exceeding specified water temperature index values, except from August through October when probabilities may be lower, and in July when the probabilities of exceedance may be higher.
- Similar smolt emigration conditions based on modeling results indicating: (1) slightly higher long-term average monthly flows and average monthly flows by water year type during the evaluation period, except during June; and (2) generally similar or higher probabilities of exceeding specified water temperature index values, except in April when the probabilities of exceedance may be lower.

In conclusion, in consideration of potential impacts to all life stages of steelhead in the American River, Alternative A would result in similar conditions for steelhead, relative to the Existing Conditions/No Project/No Action Condition.

Green Sturgeon

Relative to the Existing Conditions/No Project/No Action Condition, Alternative A would generally be expected to provide:

- Similar adult immigration and holding conditions based on modeling results indicating: (1) similar or slightly higher long-term average monthly flows during the evaluation period, and similar or slightly

higher average monthly flows by water year type, although lower flows would occur more frequently during November, June, and July; and (2) similar probabilities of exceeding specified water temperature index values, except in October when the probability of exceedance may be lower.

- Similar spawning and egg incubation conditions based on modeling results indicating: (1) similar or slightly higher long-term average monthly flows and average monthly flows by water year type during the evaluation period, although lower flows would occur more frequently during July; and (2) similar probabilities of exceeding specified water temperature index values, except in August when the probability may be lower.
- Similar juvenile rearing and emigration conditions based on modeling results indicating: (1) similar or slightly higher long-term average monthly flows and average monthly flows by water year type during the evaluation period, although lower flows would occur more frequently during July; and (2) generally similar or lower probabilities of exceeding specified water temperature index values, except in July and September when the probabilities of exceedance may be higher.

In conclusion, in consideration of potential impacts to all life stages of green sturgeon in the American River, Alternative A would result in similar conditions for green sturgeon, relative to the Existing Conditions/No Project/No Action Condition.

River Lamprey

Relative to the Existing Conditions/No Project/No Action Condition, Alternative A would generally be expected to provide:

- Similar adult immigration conditions based on modeling results indicating: similar or slightly higher long-term average monthly flows and average monthly flows by water year type during the evaluation period, although slightly lower flows would occur more frequently during November and June.
- Similar spawning and egg incubation conditions based on modeling results indicating: (1) similar or slightly higher long-term average monthly flows and average monthly flows by water year type during the evaluation period, although slightly lower flows would occur more frequently during July; and (2) generally similar monthly probabilities of water temperatures occurring within the specified water temperature range, except from May through July when the probability of water temperatures within the range may be lower at Watt Avenue.
- Similar ammocoete rearing and emigration conditions based on modeling results indicating: (1) similar or slightly higher long-term average monthly flows and average monthly flows by water year type during the evaluation period, although lower flows would occur more frequently during November, June, and July; and (2) generally similar or lower probabilities of exceeding specified water temperature index values, particularly from July through September.

In conclusion, in consideration of potential impacts to all life stages of river lamprey in the American River, Alternative A would result in similar conditions for river lamprey, relative to the Existing Conditions/No Project/No Action Condition.

Pacific Lamprey

Relative to the Existing Conditions/No Project/No Action Condition, Alternative A would generally be expected to provide:

- Similar adult immigration conditions based on modeling results indicating similar or slightly higher long-term average monthly flows and average monthly flows by water year type during the evaluation period.
- Similar spawning and egg incubation conditions based on modeling results indicating: (1) similar or slightly higher long-term average monthly flows and average monthly flows by water year type during the evaluation period, although lower flows would occur more frequently during July; and (2) generally similar monthly probabilities of water temperatures occurring within the specified water temperature range, except from May through July when the probability of water temperatures within the range may be lower at Watt Avenue.
- Similar or improved ammocoete rearing and emigration conditions based on modeling results indicating: (1) similar or slightly higher long-term average monthly flows and average monthly flows by water year type during the evaluation period, although lower flows would occur more frequently during November, June, and July; and (2) generally similar or lower probabilities of exceeding specified water temperature index values, particularly from July through September.

In conclusion, in consideration of potential impacts to all life stages of Pacific lamprey in the American River, Alternative A would result in similar or improved conditions for Pacific lamprey, relative to the Existing Conditions/No Project/No Action Condition.

Hardhead

Relative to the Existing Conditions/No Project/No Action Condition, Alternative A would generally be expected to provide:

- Similar adult and other life stage conditions based on modeling results indicating: (1) similar or slightly higher long-term average monthly flows and average monthly flows by water year type during the evaluation period, although lower flows would occur more frequently during November, June, and July; and (2) similar or slightly lower probabilities of water temperatures remaining within the specified water temperature range.
- Similar spawning conditions based on modeling results indicating: (1) similar long-term average monthly flows and average monthly flows by water year type during the evaluation period; and (2) a higher probability of remaining within the specified water temperature range in April, but a lower probability of remaining within the range in May and June.

In conclusion, in consideration of potential impacts to all life stages of hardhead in the American River, Alternative A would result in similar conditions for hardhead, relative to the Existing Conditions/No Project/No Action Condition.

Sacramento Splittail

Relative to the Existing Conditions/No Project/No Action Condition, Alternative A would generally be expected to provide:

- Similar spawning conditions based on modeling results indicating: (1) similar long-term average monthly flows and monthly flows by water year type during the evaluation period, except in March and April of drier water year types when flows may be increased; and (2) equivalent probabilities of exceeding specified water temperature index values.

In conclusion, in consideration of potential impacts to all life stages of splittail in the American River, Alternative A would result in similar conditions for splittail, relative to the Existing Conditions/No Project/No Action Condition.

Striped Bass

Relative to the Existing Conditions/No Project/No Action Condition, Alternative A would generally be expected to provide:

- Similar or more suitable adult spawning, embryo incubation, and initial rearing conditions based on modeling results indicating: (1) similar long-term average monthly flows and average monthly flows by water year type during the evaluation period; and (2) similar or higher probabilities of remaining within the specified water temperature range during the evaluation period, except in May when the probability may be lower at Watt Avenue.
- Similar or improved larvae, fry, and juvenile rearing and emigration conditions based on modeling results indicating: (1) similar or slightly higher long-term average monthly flows and average monthly flows by water year type during the evaluation period, although lower flows would occur more frequently during November, June, and July; and (2) generally similar or higher probabilities of remaining within the specified water temperature range, with a lower probability in October.

In conclusion, in consideration of potential impacts to all life stages of striped bass in the American River, Alternative A would result in similar or improved conditions for striped bass, relative to the Existing Conditions/No Project/No Action Condition.

American Shad

Relative to the Existing Conditions/No Project/No Action Condition, Alternative A would generally be expected to provide:

- Similar or improved adult spawning, embryo incubation, and initial rearing conditions based on modeling results indicating: (1) similar long-term average monthly flows and average monthly flows by water year type during the evaluation period; and (2) generally higher probabilities of remaining within the specified water temperature range during the evaluation period.
- Similar larvae, fry, and juvenile rearing and emigration conditions based on modeling results indicating: (1) similar long-term average monthly flows and average monthly flows by water year type during the evaluation period, although lower flows would occur more frequently during July and November; and (2) generally similar or slightly higher monthly probabilities of water temperatures occurring within the specified water temperature range, except in October when the probability of remaining within the range may be lower.

In conclusion, in consideration of potential impacts to all life stages of American shad in the American River, Alternative A would result in similar conditions for American shad, relative to the Existing Conditions/No Project/No Action Condition.

Largemouth Bass

Relative to the Existing Conditions/No Project/No Action Condition, Alternative A would generally be expected to provide:

- Similar adult and other life stage conditions based on modeling results indicating similar or slightly higher long-term average monthly flows and average monthly flows by water year type during the evaluation period, although lower flows would occur more frequently during November, June, and July.
- Similar spawning conditions based on modeling results indicating similar or increased probabilities of remaining within the specified water temperature range.

In conclusion, in consideration of potential impacts to all life stages of largemouth bass in the American River, Alternative A would result in similar conditions for largemouth bass, relative to the Existing Conditions/No Project/No Action Condition.

12C.3.2.12 Sacramento-San Joaquin Delta and Yolo Bypass

Delta Smelt in the Delta Region

Relative to the Existing Conditions/No Project/No Action Condition, Alternative A would generally be expected to provide:

- Similar adult conditions, based on modeling results indicating: (1) similar monthly probabilities of water temperatures at Freeport occurring within the specified water temperature range; and (2) similar mean monthly entrainment at the SWP and CVP export facilities.
- Similar egg and embryo conditions, based on modeling results indicating similar monthly probabilities of water temperatures at Freeport occurring within the specified water temperature range.
- Similar conditions for larvae based on modeling results indicating: (1) similar monthly probabilities of water temperatures at Freeport occurring within the specified water temperature range; and (2) similar long-term average Delta outflow and average monthly Delta outflow by water year type during May but slightly increased during June.
- Similar or slightly improved juvenile conditions according to modeling results indicating: (1) similar monthly probabilities of water temperatures at Freeport occurring within the specified water temperature range; (2) similar overall juvenile entrainment at the SWP and CVP export facilities; and (3) when X2 is between RKm 65 and 80, long-term average and average by water year type X2 location would be equivalent during May, move slightly downstream during June (by 0.6 RKm or less), and move downstream during July (by 1.2, 1.5 and 1.5 RKm during wet, above normal and below normal water years, respectively).

In conclusion, in consideration of potential impacts to all life stages of delta smelt in the Delta, Alternative A would result in similar conditions for Delta Smelt, relative to the Existing Conditions/No Project/No Action Condition.

Longfin Smelt in the Delta Region

Relative to the Existing Conditions/No Project/No Action Condition, Alternative A would generally be expected to provide:

- Similar adult conditions based on modeling results that indicate: (1) similar OMR flows (not substantially more negative) during the evaluation period; and (2) a similar index of relative adult abundance.

- Similar larvae and juvenile conditions based on modeling results indicating: (1) slightly lower mean monthly OMR flows during April of dry and critical water years (by 2.5 and 4.9 percent, respectively) and during May of critical water years (by 12.5 percent) and would be higher during May of dry water years (by 6.6 percent); (2) slightly lower (during January through April) and slightly higher (during May and June) monthly exceedance probabilities of X2 location occurring at or downstream of 75 RKm during January through June.

In conclusion, in consideration of potential impacts to all life stages of longfin smelt in the Delta, Alternative A would result in similar conditions for Longfin Smelt, relative to the Existing Conditions/No Project/No Action Condition.

Sacramento Splittail in the Delta and Yolo Bypass

Relative to the Existing Conditions/No Project/No Action Condition, Alternative A would generally be expected to provide:

- Similar or less suitable adult upstream migration, spawning, egg, and larval conditions based on modeling results indicating: (1) similar or reduced long-term average monthly flows in the Yolo Bypass, particularly during March; and (2) similar frequencies and duration of inundation events in the Yolo Bypass.
- Similar juvenile rearing and emigration conditions based on modeling results indicating similar long-term average monthly flows and average monthly flows by water year type in the Yolo Bypass.

In conclusion, in consideration of potential impacts to all life stages of Sacramento splittail in the Delta Region including the Yolo Bypass, Alternative A would result similar conditions for splittail, relative to the Existing Conditions/No Project/No Action Condition.

Winter-run Chinook Salmon in the Delta and Yolo Bypass

Relative to the Existing Conditions/No Project/No Action Condition, Alternative A would generally be expected to provide:

- Similar Delta conditions, based on IOS modeling results indicating similar monthly through-Delta survival probabilities.
- Similar juvenile rearing conditions in the Yolo Bypass based on modeling results indicating a similar frequency and duration of floodplain inundation.

In conclusion, in consideration of potential impacts to juvenile winter-run Chinook salmon, Alternative A would result in similar juvenile rearing and outmigration conditions for winter-run Chinook salmon in the Yolo Bypass and Delta Region, relative to the Existing Conditions/No Project/No Action Condition.

Spring-run Chinook Salmon in the Delta and Yolo Bypass

Relative to the Existing Conditions/No Project/No Action Condition, Alternative A would generally be expected to provide:

- Similar juvenile outmigration conditions, based on DPM modeling results indicating similar monthly Delta survival probabilities.
- Similar juvenile rearing conditions in the Yolo Bypass based on modeling results indicating a similar frequency and duration of floodplain inundation.

In conclusion, in consideration of potential impacts to spring-run Chinook salmon, Alternative A would result in similar juvenile rearing and outmigration conditions for spring-run Chinook salmon in the Yolo Bypass and Delta Region, relative to the Existing Conditions/No Project/No Action Condition.

Fall-run and Late Fall-run Chinook Salmon in the Delta and Yolo Bypass

Relative to the Existing Conditions/No Project/No Action Condition, Alternative A would generally be expected to provide:

- Similar juvenile outmigration conditions based on DPM modeling results indicating similar monthly Delta survival probabilities.
- Similar juvenile rearing conditions in the Yolo Bypass based on modeling results indicating a similar frequency and duration of floodplain inundation.

In conclusion, in consideration of potential impacts to juvenile and fall and late fall-run Chinook salmon, Alternative A would result in similar juvenile rearing and outmigration conditions for fall- and late fall-run Chinook salmon in the Yolo Bypass and Delta Region, relative to the Existing Conditions/No Project/No Action Condition.

Steelhead in the Delta and Yolo Bypass

Relative to the Existing Conditions/No Project/No Action Condition, Alternative A would generally be expected to provide:

- Similar or less suitable juvenile rearing and outmigration conditions in the Delta based on modeling results indicating: (1) lower long-term average and average by water year type monthly Delta outflow during most months of most water year types, but with higher Delta outflow during June and July of all water year types, during October and November of below normal water years, during October of dry water years and during October and December of critical water years; (2) OMR flows would be reduced over the evaluation period and substantially more negative relative to the Existing Conditions/No Project/No Action Condition in October and November of wetter water year types and most months of critically dry water years.
- Similar juvenile rearing conditions in the Yolo Bypass based on modeling results indicating a similar frequency and duration of floodplain inundation.

In conclusion, in consideration of potential impacts to juvenile Central Valley steelhead, Alternative A would result in similar juvenile rearing and outmigration conditions for steelhead in the Yolo Bypass and Delta Region, relative to the Existing Conditions/No Project/No Action Condition.

Green and White Sturgeon in the Delta Region

Relative to the Existing Conditions/No Project/No Action Condition, Alternative A would generally be expected to provide:

- Similar juvenile rearing and emigration conditions based on modeling results indicating: (1) similar long-term average and average by water year type Delta outflows from March through July; and (2) similar probabilities of Delta outflows exceeding 50,000 cfs providing for strong year classes of sturgeon.

In conclusion, in consideration of potential impacts to sturgeon in the Delta, Alternative A would result in similar conditions for sturgeon, relative to the Existing Conditions/No Project/No Action Condition.

American Shad in the Delta Region

Relative to the Existing Conditions/No Project/No Action Condition, Alternative A would generally be expected to provide:

- Similar egg and larval conditions in the Delta based on modeling results indicating: (1) slight upstream movements in mean monthly X2 location during June of all water year types and equivalent X2 locations during April and May of most water year types; and (2) slightly lower (during April and May) and slightly higher (during June) exceedance probabilities of X2 location being located at or downstream of 75 RKm during April through June.

In conclusion, in consideration of potential impacts to American shad in the Delta, Alternative A would result in similar conditions for American shad, relative to the Existing Conditions/No Project/No Action Condition.

Striped Bass in the Delta Region

Relative to the Existing Conditions/No Project/No Action Condition, Alternative A would generally be expected to provide:

- Similar egg and larval conditions in the Delta based on modeling results indicating slight upstream movements in mean monthly X2 location during June of all water year types and equivalent X2 locations during April and May of most water year types.

In conclusion, in consideration of potential impacts to striped bass in the Delta, Alternative A would result in similar conditions for striped bass, relative to the Existing Conditions/No Project/No Action Condition.

12C.3.2.13 Suisun, San Pablo, and San Francisco Bays

Fish species of primary management concern, including Chinook salmon, steelhead, river lamprey, Pacific lamprey, green sturgeon, white sturgeon, and splittail utilize the bays as a migration corridor and/or for juvenile rearing. Potential increases in Delta outflow during the summer and fall and reductions in Delta outflow during the spring would not result in substantial changes to migration or rearing habitat for these fish species in the bays. Striped bass and American shad also utilize the bays for migration and rearing, however, changes in X2 location were evaluated during the striped bass and American shad spawning and initial rearing period to evaluate potential changes in larval transport and rearing habitat in the Bay-Delta (see the Delta Region, above). Potential effects on delta smelt and longfin smelt migration and rearing in the Bay-Delta also were analyzed through evaluation of changes in X2 location (see the Delta Region, above).

12C.4 Impacts Associated with Alternative B Relative to the Existing Conditions/No Project/No Action Condition

12C.4.1 Extended Study Area – Alternative B Relative to the Existing Conditions/No Project/No Action Condition

12C.4.1.1 San Luis Reservoir

Coldwater Fish Species

Relative to Existing Conditions/No Project/No Action Condition, Alternative B would generally be expected to provide:

- Potentially more habitat for coldwater fish species based on modeling results indicating (1) similar long-term average monthly storage during most months of the evaluation period with slightly higher storage levels in November; and (2) higher average monthly storage during wetter water year types, particularly from September through November and lower monthly storage levels during dry and critical water year types during most months of the evaluation period.

However, it is unlikely that coldwater fish habitat is limiting in San Luis Reservoir; therefore, it is unlikely that changes in reservoir storage under Alternative B would have a population level effect on coldwater fish species in San Luis Reservoir, relative to the Existing Conditions/No Project/No Action Condition.

Warmwater Fish Species

Relative to the Existing Conditions/No Project/No Action Condition, Alternative B would generally be expected to provide:

- Similar or slightly less suitable warmwater fish nesting conditions, based on modeling results indicating slightly increased or similar frequencies of monthly water surface elevation reductions of 6 feet or more during the evaluation period.

It is unlikely that a small difference in the number of years with monthly water surface elevation reductions of greater than 6 feet under Alternative B would have a population level effect on bass and other warmwater fish in San Luis Reservoir, relative to the Existing Conditions/No Project/No Action Condition.

12C.4.2 Secondary Study Area – Alternative B Relative to the Existing Conditions/No Project/No Action Condition

12C.4.2.1 Trinity Lake

Coldwater Fish Species

Relative to the Existing Conditions/No Project/No Action Condition, Alternative B would generally be expected to provide:

- Similar or higher amounts of habitat for coldwater fish species based on modeling results for reservoir storage conditions indicating slightly higher long-term average monthly storage, and higher average monthly storage from September through November of dry and critical water year types.

However, it is unlikely that coldwater fish habitat is limiting in Trinity Lake; therefore, it is unlikely that changes in reservoir storage under Alternative B would have a population level effect on coldwater fish species in Trinity Lake, relative to the Existing Conditions/No Project/No Action Condition.

Warmwater Fish Species

Relative to the Existing Conditions/No Project/No Action Condition, Alternative B would generally be expected to provide:

- Similar warmwater fish nesting conditions, based on modeling results indicating minor differences in the frequency of monthly water surface elevation reductions of 6 feet or more during the elevation period.

It is unlikely that a small difference in the number of years with monthly water surface elevation reductions of greater than 6 feet under Alternative B would have a population level effect on bass and other warmwater fish in Trinity Lake, relative to the Existing Conditions/No Project/No Action Condition.

12C.4.2.2 Trinity River

Flow and water temperature model results were examined for the Trinity River below Lewiston Dam, at Douglas City, and at North Fork for all species (Appendix 6B Water Resources System Modeling, Appendix 7E River Temperature Modeling, and Appendix 12E Fisheries Water Temperature Assessment Summary Tables). For most species and life stages, only modeled flows and water temperatures were available, and the analyses of habitat conditions for these species and life stages were based primarily on the water temperature results. Model results for early life stage mortality were also examined for fall-run Chinook salmon (Appendix 12H *Early Life-Stage Salmon Mortality Modeling*). In general, average monthly flows and water temperatures would be similar under Alternative B and Existing Conditions/No Project/No Action Condition; the potential for Project-related changes in aquatic habitat conditions and impacts on aquatic resources are described below.

Coho Salmon

Relative to the Existing Conditions/No Project/No Action Condition, Alternative B would generally be expected to provide:

- Similar or improved adult immigration and holding conditions based on modeling results indicating: (1) similar or slightly lower long-term average monthly flows during the evaluation period, and similar average monthly flows during most water year types; and (2) similar average monthly probabilities of exceeding specified water temperature index values, with lower probabilities of exceedance during September and October.
- Similar adult spawning and embryo incubation conditions based on modeling results indicating: (1) similar or slightly lower long-term average monthly flows in the evaluation period, and similar average monthly flows during most water year types, except for above normal and below normal water years, when flows would be substantially lower during March and February, respectively; and (2) similar probabilities of exceeding specified water temperature index values, with slightly lower probabilities of exceedance during October and November.

- Similar juvenile rearing and emigration conditions based on modeling results indicating: (1) similar or slightly lower long-term average monthly flows over the entire year, and similar monthly flows during most water year types, except for above normal and below normal water years, when flows would be substantially lower during March and February, respectively; and (2) equivalent or lower probabilities of exceeding specified water temperature index values throughout most of the year, particularly during August through October, although higher probabilities of exceedance would occur during June.
- Similar smolt emigration conditions based on modeling results indicating: (1) similar long-term average monthly flows during the evaluation period, and equivalent or slightly higher average monthly flows during most water year types, except for above normal and below normal water years, when flows would be substantially lower during March and February, respectively; and (2) similar probabilities of exceeding specified water temperature index values during the evaluation period, with slightly lower probabilities during April and May.

In conclusion, in consideration of potential impacts to all life stages of Coho salmon in the Trinity River, Alternative B would result in similar conditions for coho salmon, relative to the Existing Conditions/No Project/No Action Condition.

Spring-Run Chinook Salmon

Relative to the Existing Conditions/No Project/No Action Condition, Alternative B would generally be expected to provide:

- Similar or slightly improved adult immigration and holding conditions based on modeling results indicating: (1) similar long-term average monthly flows during the evaluation period, and equivalent average monthly flows during most water year types with slightly higher flows in April; and (2) similar or slightly lower monthly probabilities of exceeding specified water temperature index values, particularly during August and September.
- Improved adult spawning and egg incubation conditions based on modeling results indicating: (1) equivalent or slightly lower long-term average monthly flows during the evaluation period, and equivalent or slightly lower average monthly flows during all water year types; and (2) lower probabilities of exceeding specified water temperature index values, and therefore more suitable water temperatures, for most water temperature indices.
- Similar juvenile rearing and emigration conditions based on modeling results indicating: (1) similar long-term average monthly flows over the entire year, and similar average monthly flows during most water year types, except for above normal and below normal water years, when flows would be substantially lower during March and February, respectively; and (2) generally similar probabilities of exceeding specified water temperature index values throughout the year.
- Similar smolt emigration conditions based on modeling results indicating: (1) similar long-term average monthly flows during the evaluation period, and similar average monthly flows during most water year types, except for wet years when flows would be slightly higher, and during above normal and below normal water years, when flows would be substantially lower during March and February, respectively; and (2) generally similar probabilities of exceeding specified water temperature index values throughout the year.

In conclusion, in consideration of potential impacts to all life stages of spring-run Chinook salmon in the Trinity River, Alternative B would result in similar or improved conditions for spring-run Chinook, relative to the Existing Conditions/No Project/No Action Condition.

Fall-Run Chinook Salmon

Relative to the Existing Conditions/No Project/No Action Condition, Alternative B would generally be expected to provide:

- Similar or slightly improved adult immigration and holding conditions based on modeling results indicating: (1) similar or slightly lower long-term average monthly flows during the evaluation period, and equivalent or slightly lower average monthly flows during most water year types; and (2) similar or lower probabilities of exceeding specified water temperature index values (particularly during September), and therefore more suitable water temperatures.
- Similar adult spawning conditions based on modeling results indicating: (1) similar long-term average monthly flows during the evaluation period, and similar or slightly higher average monthly flows during most water year types, except for above normal and below normal water years, when flows would be substantially lower during March and February, respectively; and (2) similar probabilities of exceeding specified water temperature index values, with lower probabilities, and therefore more suitable water temperatures, during June and October.
- Similar embryo incubation conditions based on modeling results indicating: (1) similar total annual early life stage mortality; and (2) equivalent probabilities of exceeding specified water temperature index values throughout most of the year, with lower probabilities of exceedance during October.
- Similar juvenile rearing and emigration conditions based on modeling results indicating: (1) similar long-term average monthly flows during the evaluation period, and similar or slightly higher average monthly flows during most water year types, except for above normal and below normal water years, when flows would be substantially lower during March and February, respectively; and (2) similar probabilities of exceeding specified water temperature index values.
- Similar smolt emigration conditions based on modeling results indicating: (1) similar long-term average monthly flows during the evaluation period, and equivalent or slightly higher average monthly flows during most water year types, except for above normal and below normal water years, when flows would be substantially lower during March and February, respectively; and (2) similar or slightly lower probabilities of exceeding specified water temperature index values, particularly during July.

In conclusion, in consideration of potential impacts to all life stages of fall-run Chinook salmon in the Trinity River, Alternative B would result in similar conditions for fall-run Chinook salmon, relative to the Existing Conditions/No Project/No Action Condition.

Steelhead (Winter-run and Summer-run)

Relative to the Existing Conditions/No Project/No Action Condition, Alternative B would generally be expected to provide:

- Similar adult immigration and holding conditions for winter-run steelhead based on modeling results indicating: (1) similar or slightly lower long-term average monthly flows during the evaluation period, and similar average monthly flows during most water year types, except for above normal and

below normal water years, when flows would be substantially lower during March and February, respectively; and (2) similar, or slightly lower probabilities of exceeding specified water temperature index values (particularly during October).

- Similar adult immigration and holding conditions for summer-run steelhead based on modeling results indicating: (1) equivalent long-term average monthly flows during the evaluation period, and equivalent average monthly flows during all water year types; and (2) similar probabilities of exceeding specified water temperature index values during the evaluation period, although slightly higher probabilities of exceedance would occur during June.
- Similar adult spawning and egg incubation conditions based on modeling results indicating: (1) similar or slightly lower long-term average monthly flows during the evaluation period, and similar average monthly flows during most water year types, except for above normal and below normal water years, when flows would be substantially lower during March and February, respectively; and (2) similar probabilities of exceeding specified water temperature index values throughout the evaluation period, with slightly higher probabilities of exceedance during March, May, and June.
- Similar juvenile rearing and emigration conditions based on modeling results indicating: (1) similar or slightly lower long-term average monthly flows over the entire year, and similar average monthly flows during most water year types, except for above normal and below normal water years, when flows would be substantially lower during March and February, respectively; and (2) equivalent probabilities of exceeding specified water temperature index values throughout most of the year, with lower probabilities of exceedance during July, although higher probabilities would occur during August and September.
- Similar smolt emigration conditions based on modeling results indicating: (1) similar or slightly lower long-term average monthly flows during the evaluation period, and equivalent or slightly higher average monthly flows, except for during above normal and below normal water years, when flows would be substantially lower during March and February, respectively; and (2) similar probabilities of exceeding specified water temperature index values, with lower probabilities of exceedance during April, although higher probabilities would occur during May and June.

In conclusion, in consideration of potential impacts to all life stages of steelhead (winter-run and summer-run) in the Trinity River, Alternative B would result in similar conditions for steelhead, relative to the Existing Conditions/No Project/No Action Condition.

Green Sturgeon

Relative to the Existing Conditions/No Project/No Action Condition, Alternative B would generally be expected to provide:

- Similar adult immigration and holding conditions based on modeling results indicating: (1) similar long-term average monthly flows during the evaluation period, and similar average monthly flows during most water year types, except for above normal and below normal water years, when flows would be substantially lower during March and February, respectively; and (2) similar average monthly probabilities of exceeding specified water temperature index values, with slightly lower probabilities in June at the North Fork confluence.

- Similar adult spawning conditions based on modeling results indicating: (1) similar or slightly lower long-term average monthly flows during the evaluation period, and equivalent average monthly flows during all water year types; and (2) similar probabilities of exceeding specified water temperature index values during the evaluation period with lower probabilities of exceedance in July.
- Similar or reduced juvenile rearing and emigration conditions based on modeling results indicating: (1) similar long-term average monthly flows over the entire year, and similar average monthly flows during most water year types, except for above normal and below normal water years, when flows would be substantially lower during March and February, respectively; and (2) similar probabilities of exceeding specified water temperature index values throughout most of the year, with slightly higher probabilities of exceedance during July through September.

In conclusion, in consideration of potential impacts to all life stages of green sturgeon in the Trinity River, Alternative B would result in similar conditions for green sturgeon, relative to the Existing Conditions/No Project/No Action Condition.

White Sturgeon

Relative to the Existing Conditions/No Project/No Action Condition, Alternative B would generally be expected to provide:

- Similar adult immigration and holding conditions based on modeling results indicating: (1) similar long-term average monthly flows during the evaluation period, and similar average monthly flows during most water year types, except for above normal and below normal water years, when flows would be substantially lower during March and February, respectively; and (2) equivalent average monthly probabilities of exceeding specified water temperature index values.
- Similar adult spawning conditions based on modeling results indicating: (1) similar long-term average monthly flows during the evaluation period, and equivalent or slightly higher average monthly flows during most water year types, except for above normal and below normal water years, when flows would be substantially lower during March and February, respectively; and (2) equivalent average monthly probabilities of exceeding specified water temperature index values.
- Similar or reduced juvenile rearing and emigration conditions based on modeling results indicating: (1) similar long-term average monthly flows over the entire year, and similar average monthly flows during most water year types, except for above normal and below normal water years, when flows would be substantially lower during March and February, respectively; and (2) similar probabilities of exceeding specified water temperature index values throughout most of the year.

In conclusion, in consideration of potential impacts to all life stages of white sturgeon in the Trinity River, Alternative B would result in similar conditions for white sturgeon, relative to the Existing Conditions/No Project/No Action Condition.

Pacific Lamprey

Relative to the Existing Conditions/No Project/No Action Condition, Alternative B would generally be expected to provide:

- Similar adult immigration conditions based on modeling results indicating similar or slightly lower long-term average monthly flows during the evaluation period, and similar average monthly flows during most water year types, except for above normal and below normal water years, when flows would be substantially lower during March and February, respectively.
- Similar adult spawning and egg incubation conditions based on modeling results indicating: (1) similar long-term average monthly flows during the evaluation period, and similar average monthly flows during most water year types, except for above normal and below normal water years, when flows would be substantially lower during March and February, respectively; and (2) similar average monthly probabilities of remaining within the specified water temperature range, although slightly lower probabilities of exceedance would occur directly below Lewiston Dam and at Douglas City in some months of the evaluation period.
- Similar ammocoete rearing and emigration conditions based on modeling results indicating: (1) similar long-term average monthly flows over the entire year, and similar average monthly flows during most water year types, except for during above normal and below normal water years, when flows would be substantially lower during March and February, respectively; and (2) equivalent average monthly probabilities of exceeding specified water temperature index values, with slightly higher probabilities of exceedance during September.

In conclusion, in consideration of potential impacts to all life stages of Pacific lamprey in the Trinity River, Alternative B would result in similar conditions for Pacific lamprey, relative to the Existing Conditions/No Project/No Action Condition.

12C.4.2.3 Klamath River downstream of the Trinity River

Potential impacts to fisheries and aquatic resources in the Klamath River, downstream of the Trinity River under Alternative B relative to the Existing Conditions/No Project/No Action Condition, would be similar to those discussed under Alternative A relative to the Existing Conditions/No Project/No Action Condition, above.

12C.4.2.4 Shasta Lake

Over the long term, average monthly storage in Shasta Lake under Alternative B would be similar to the Existing Conditions/No Project/No Action Condition, as shown in Appendix 6B Water Resources System Modeling. In Dry and Critical water years, average monthly storage in Shasta Lake under Alternative B would be similar to the Existing Conditions/No Project/No Action Condition from January through May. From June through December, average monthly storage in Shasta Lake would increase under Alternative B because water would be released from Sites Reservoir to meet Delta water quality and other downstream flow criteria, which would allow cold water storage in Shasta Lake to increase.

Reservoir storage model results (Appendix 6B Water Resources System Modeling) were examined for Shasta Lake during April through November for coldwater fish species; reductions in average monthly surface elevations greater than 6 feet (Appendix 12F Reservoir Water Surface Elevation Summary Tables) were examined during March through June for warmwater species. The potential impacts on aquatic resources in Shasta Lake are described below.

Coldwater Fish Species

Relative to the Existing Conditions/No Project/No Action Condition, Alternative B would generally be expected to provide:

- Similar or improved conditions for coldwater fish, based on modeling results indicating: slightly higher long-term average monthly storage, and higher average monthly storage by water year type during most months of the evaluation period; except in dry and critical water year types when storage would be substantially higher.

However, it is unlikely that coldwater fish habitat is limiting in Shasta Lake; therefore, it is unlikely that changes in reservoir storage under Alternative B would have a population level effect on coldwater fish species in Shasta Lake, relative to the Existing Conditions/No Project/No Action Condition.

Warmwater Fish Species

Relative to the Existing Conditions/No Project/No Action Condition, Alternative B would generally be expected to provide:

- Potentially improved warmwater fish spawning and early life stage conditions, based on modeling results indicating decreased frequencies of monthly water surface elevation reductions of 6 feet or more during most of the March through June evaluation period.

However, it is unlikely that a small difference in the number of years with monthly water surface elevation reductions of greater than 6 feet under Alternative B would have a population level effect on bass and other warmwater fish in Shasta Lake, relative to the Existing Conditions/No Project/No Action Condition.

12C.4.2.5 Sacramento River

As described for Alternative A, flow and water temperature model results were examined for the Sacramento River below Keswick Reservoir and at several points downstream, including the proposed Delevan Pipeline Intake/Discharge Facilities for all species (Appendix 6B Water Resources System Modeling, Appendix 7E River Temperature Modeling, and Appendix 12E Fisheries Water Temperature Assessment Summary Tables). The flow and water temperature results were used in combination with a number of other model outputs and indicators to assess potential changes in aquatic habitats for each species and life stage present, as detailed in Appendix 12B Fisheries Impact Assessment Methodology. For several species and life stages, only modeled flows and water temperatures were available, and the analyses of habitat conditions for these species and life stages were based primarily on the water temperature results. The potential for Project-related changes in aquatic habitat conditions and impacts on aquatic resources in the Sacramento River are described below.

Winter-run Chinook Salmon

Relative to the Existing Conditions/No Project/No Action Condition, Alternative B would generally be expected to provide:

- Similar adult immigration and holding conditions, based on modeling results indicating: (1) similar or higher long-term average monthly flows during the early part of the evaluation period (December through February) and slightly lower average monthly flows during the later months (April through July) at Keswick Dam, particularly in drier water years; (2) similar or lower long-term average monthly flows during most of the evaluation period, with higher average monthly flows during the

later months (June and July) during most water year types in the lower Sacramento River; and (3) equivalent monthly probabilities of exceeding specified water temperature index values, but with higher probabilities of exceeding specified water temperature index values during April and May at more downstream locations, and slightly lower probabilities of exceeding specified water temperatures during June and July.

- Improved spawning conditions based on modeling results indicating: (1) increased spawning habitat availability (WUA) during all months of the spawning period, with slightly increased spawning habitat availability in June of below normal and dry water types; and (2) similar or lower probabilities of exceeding specified water temperature index values, and therefore more suitable water temperatures, particularly during months with relatively warm water temperature conditions (i.e., July and August).
- Similar or improved embryo incubation conditions based on modeling results indicating: (1) similar or slightly improved total annual early life stage mortality; and (2) lower probabilities of exceeding specified water temperature index values, and therefore more suitable water temperatures, particularly during months with relatively warm water temperature conditions (i.e., July and August).
- Improved juvenile rearing and outmigration conditions based on modeling results indicating: (1) generally similar or lower long-term average monthly flows during most of the evaluation period, except from December through February when flows would be higher below Keswick Reservoir, particularly in drier water years; (2) generally higher long-term average flows would occur from July through November in the lower Sacramento River (Verona, Freeport and Rio Vista), particularly in drier water years; (3) similar fry and juvenile rearing habitat availability (WUA) in the mainstem Sacramento River; (4) a similar frequency and duration of floodplain inundation in the Sutter and Yolo bypasses; and (5) equivalent or lower, and therefore more suitable, monthly probabilities of exceeding specified water temperature index values during July through September, and equivalent or higher probabilities of exceeding specified water temperature index values during April.
- Similar or improved production potential based on (SALMOD) modeling results indicating: long-term average total annual winter-run Chinook salmon production would increase by 1 percent, while average total annual production would increase during wet water years by less than 1 percent, during above normal water years by 8 percent, during below normal water years by less than 1 percent, during dry water years by 2 percent, and during critical water years by 1 percent.
- Improved conditions pertaining to early life stage survival and abundance of spawners based on (IOS) modeling results indicating: (1) over the 81-year evaluation period, long-term average annual egg to fry survival would increase by 3 percent, and average annual egg to fry survival by water year type would decrease during wet and above normal water years by 1 percent, and would increase during below normal water years by 4 percent, dry water years by 6 percent, and during critical water years by 21 percent; (2) long-term average annual fry to smolt survival would increase by 3 percent, and average annual fry to smolt survival by water year type would increase during wet and above normal water years by 1 percent, would be reduced during below normal and dry water years by 1 percent, and would increase during critical water years by 20 percent; (3) long-term average annual female spawner abundance would increase by 8 percent, and average annual female spawner abundance by water year type would increase during wet water years by 10 percent, during above normal water years by 13 percent, during dry water years by 6 percent and during critical water years by 11 percent, and would be reduced during below normal water years by less than 1 percent.

In conclusion, in consideration of potential impacts to all life stages of winter-run Chinook salmon in the Sacramento River, Alternative B would result in more suitable conditions for winter-run Chinook salmon, relative to Existing Conditions/No Project/No Action Condition.

Spring-run Chinook Salmon

Relative to the Existing Conditions/No Project/No Action Condition, Alternative B would generally be expected to provide:

- Similar adult immigration and holding conditions, based on modeling results indicating: (1) similar or lower long-term average monthly flows during most months in the upper Sacramento River (below Keswick and RBDD), with generally higher flows in February below Keswick Reservoir; (2) similar or increased long-term average monthly flows from June through September, with similar or reduced flows from February through May occurring in the lower Sacramento River; and (2) equivalent or lower (particularly during August and September) and equivalent or higher (particularly during April and May) monthly probabilities of exceeding specified water temperature index values.
- Improved spawning conditions based on modeling results indicating: (1) generally similar or higher long-term average monthly flows by water year type during the evaluation period in the upper Sacramento River, except in November when flows would be decreased; and (2) lower probabilities of exceeding specified water temperature index values, and therefore more suitable water temperatures, particularly during months with warm water temperature conditions (i.e., September and October).
- Improved embryo incubation conditions based on modeling results indicating slightly reduced average total annual early life stage mortality and reduced early life stage mortality, particularly in dry and critical water year types; and (2) lower probabilities of exceeding specified water temperature index values, and therefore more suitable water temperatures, particularly during months with warm water temperature conditions (i.e. September and October).
- Similar juvenile rearing conditions based on modeling results indicating: (1) generally slightly lower long-term average monthly flows and average monthly flows by water year type during most of the year in the upper Sacramento River, except in December and January when average monthly flows may be increased from Keswick Reservoir, from February through May when average monthly flows may be substantially lower at RBDD, particularly in drier water years; (2) a similar frequency and duration of floodplain inundation in the Sutter and Yolo bypasses; and (3) equivalent or lower, and therefore more suitable, monthly probabilities of exceeding specified water temperature index values, particularly in August and September.
- Similar smolt emigration conditions based on modeling results indicating: (1) similar or reduced long-term average monthly flows and average monthly flows by water year type, particularly from January through May below RBDD; (2) similar or reduced long-term average monthly flows and average monthly flows by water year type, particularly from January through May, and similar or increased flows during October, November, and June in the lower Sacramento River; and (3) higher monthly probabilities of exceeding specified water temperature index values during April and May, and lower monthly probabilities of exceeding specified water temperature index values during October and June.

- Similar or improved production potential based on (SALMOD) modeling results indicating long-term average total annual spring-run Chinook salmon production would increase by 3 percent, while average total annual production would increase during wet water years by 2 percent, during above normal water years by 1 percent, during below normal water years by less than 1 percent, during dry water years by 8 percent, and during critical water years by 3 percent.

In conclusion, in consideration of potential impacts to all life stages of spring-run Chinook salmon in the Sacramento River, Alternative B would result in more suitable conditions for spring-run Chinook salmon, relative to the Existing Conditions/No Project/No Action Condition.

Fall-run Chinook Salmon

Relative to the Existing Conditions/No Project/No Action Condition, Alternative B would generally be expected to provide:

- Similar or improved adult immigration and holding conditions, based on modeling results indicating: (1) similar or reduced flows from July through September and similar or increased flows from October through December in the upper Sacramento River; (2) generally increased long-term average monthly flows and flows by water year type from June through November in the lower Sacramento River; and (2) equivalent or lower, and therefore more suitable, monthly probabilities of exceeding specified water temperature index values.
- Similar spawning conditions based on modeling results indicating: (1) similar spawning habitat availability (WUA) in the upper Sacramento River, except during November and December when spawning habitat availability may be reduced during some water year types; and (2) lower or equivalent probabilities of exceeding specified water temperature index values, and therefore more suitable water temperatures, specifically during October.
- Similar or improved embryo incubation conditions based on modeling results indicating: (1) slightly reduced mean annual early life stage mortality and slightly reduced annual early life stage mortality during all water year types, particularly in critically dry years; and (2) similar or lower probabilities of exceeding specified water temperature index values, and therefore more suitable water temperatures, specifically in October.
- Similar or less suitable juvenile rearing and outmigration conditions based on modeling results indicating: (1) similar or reduced long-term average monthly flows and average monthly flows by water year type from January through June below the RBDD; (2) similar or reduced average monthly flows from January through May, with higher flows in June, particularly in drier water year types in the lower Sacramento River; (2) decreased fry rearing habitat availability (WUA) during much of the evaluation period in all water year types but increased juvenile rearing habitat availability in the upper Sacramento River from March through June, particularly in drier water year types; (3) a similar frequency and duration of floodplain inundation in the Sutter and Yolo bypasses; and (4) similar monthly probabilities of exceeding specified water temperature index values, but with less suitable water temperatures during April and May.
- Similar or improved production potential based on (SALMOD) modeling results indicating: long-term average total annual fall-run Chinook salmon production would increase by 2 percent, while average total annual production would decrease during wet water years by 8 percent and during below normal water years by less than 1 percent, and would increase during above normal

water years by 10 percent, during dry water years by 4 percent, and during critical water years by 9 percent.

In conclusion, in consideration of potential impacts to all life stages of fall-run Chinook salmon in the Sacramento River, Alternative B would result in similar or improved conditions for fall-run Chinook salmon, relative to the Existing Conditions/No Project/No Action Condition.

Late Fall-run Chinook Salmon

Relative to the Existing Conditions/No Project/No Action Condition, Alternative B would generally be expected to provide:

- Similar adult immigration and holding conditions, based on modeling results indicating: (1) similar or higher long-term average monthly flows and average monthly flows by water year type from October through February below Keswick Dam, particularly during wetter water year types and similar or reduced flows during March and April, particularly in drier water year types below Keswick Dam; (2) similar or higher long-term average monthly flows and average monthly flows by water year type from October through December below RBDD, and similar or reduced flows from January through April below RBDD; (3) similar or higher long-term average monthly flows and average monthly flows by water year type during October and November, with similar or reduced flows from December through April in the lower Sacramento River; and (4) similar monthly probabilities of exceeding specified water temperature index values, but with more suitable water temperatures during October and less suitable water temperatures during April.
- Similar spawning conditions based on modeling results indicating (1) similar spawning habitat availability (WUA) from January through March with similar or increased spawning habitat availability in April, particularly in drier water year types and (2) similar probabilities of exceeding specified water temperature index values, with slightly lower probabilities of exceedance in May.
- Similar embryo incubation conditions based on modeling results indicating: (1) similar average annual early life stage mortality; and (2) similar probabilities of exceeding specified water temperature index values, with slightly lower probabilities of exceedance in May.
- Similar or improved juvenile rearing and outmigration conditions based on modeling results indicating: (1) similar or reduced flows during the evaluation period, with reduced flows from April through May in drier water year types below RBDD; (2) similar or increased long-term average monthly flows and monthly flows by water year type in the lower Sacramento River, particularly from June through November; (3) similar or greater amounts of fry rearing habitat (WUA) throughout the evaluation period with generally similar amounts of juvenile rearing habitat (WUA) in the upper Sacramento River; (4) a similar frequency and duration of floodplain inundation in the Sutter and Yolo bypasses; and (5) lower monthly probabilities of exceeding specified water temperature index values more often during June through October, but higher probabilities of exceeding specified water temperature index values more often during April and May.
- Similar or improved production potential based on (SALMOD) modeling results indicating: long-term average total annual late fall-run Chinook salmon production would increase by 1 percent, while average total annual production by water year type would decrease during above normal water years by 3 percent, and would increase during wet water years by less than 1 percent, during below

normal water years by 2 percent, during dry water years by less than 1 percent, and during critical water years by 7 percent.

In conclusion, in consideration of potential impacts to all life stages of late fall-run Chinook salmon in the Sacramento River, Alternative B would result in similar conditions for late fall-run Chinook salmon, relative to the Existing Conditions/No Project/No Action Condition.

Steelhead

Relative to the Existing Conditions/No Project/No Action Condition, Alternative B would generally be expected to provide:

- Similar or improved adult immigration and holding conditions, based on modeling results indicating: (1) similar or increased long-term average monthly flows during much of the evaluation period below Keswick Dam, except during August and September when average monthly flows could be lower; (2) generally lower average monthly flows during the evaluation period at RBDD, particularly in drier water year types; (3) generally higher long-term average monthly flows and average monthly flows by water year type in the lower Sacramento River from August through November, and generally lower flows from December through March, particularly in drier water year types; (4) similar or lower monthly probabilities of exceeding specified water temperature index values more during September and October, and higher monthly probabilities of exceeding specified water temperature index values during March.
- Similar spawning conditions based on modeling results indicating: (1) similar spawning habitat availability (WUA) from December through April; (3) similar probabilities of exceeding specified water temperature index values; and (4) SacEFT results indicating that spawning habitat availability conditions would be similar.
- Similar embryo incubation conditions based on modeling results indicating: (1) similar probabilities of exceeding specified water temperature index values; (2) SacEFT results indicating that egg mortality associated with modeled water temperatures would be equivalent; (3) SacEFT results indicating that redd dewatering conditions may occur slightly less often; and (4) SacEFT results indicating that redd scouring conditions would be equivalent.
- Similar juvenile rearing and emigration conditions based on modeling results indicating: (1) similar or increased long-term average monthly flows from October through February below Keswick Dam and at Bend Bridge, with similar or lower monthly flows from March through September below Keswick Dam and at Bend Bridge; (2) similar or lower average monthly flows from January through September at RBDD, particularly in drier water year types, and similar or higher monthly flows from October through December; (3) a similar frequency and duration of floodplain inundation in the Sutter and Yolo bypasses; (4) lower monthly probabilities of exceeding specified water temperature index values, and therefore more suitable water temperature conditions in August and September; and (5) SacEFT results indicating that juvenile rearing habitat availability may increase slightly more often while juvenile stranding potential may increase more often.
- Similar smolt emigration conditions based on modeling results indicating: (1) similar or lower average monthly flows from January through May at RBDD, particularly in drier water year types, and similar or higher monthly flows from October through December; (2) generally higher long-term average monthly flows and average monthly flows by water year type in the lower Sacramento River

during October and November, with similar or lower monthly flows from during December through March, particularly in drier water year types; and (3) higher monthly probabilities of exceeding specified water temperature index values during March and April, and lower monthly probabilities of exceeding specified water temperature index values during October.

In conclusion, in consideration of potential impacts to all life stages of steelhead in the Sacramento River, Alternative B would result in similar conditions for steelhead, relative to the Existing Conditions/No Project/No Action Condition.

Green Sturgeon

Relative to the Existing Conditions/No Project/No Action Condition, Alternative B would be expected to provide:

- Similar or improved adult immigration and holding conditions, based on modeling results indicating: (1) generally similar or lower long-term average monthly flows during much of the evaluation period, except during February when flows may be increased below Keswick Dam; (2) generally similar or lower long-term average monthly and average monthly flows by water year type from February through May, and similar or higher monthly flows during June and July below the proposed Delevan Pipeline Intake Facilities and at Rio Vista; and (2) lower average monthly probabilities of exceeding specified water temperature index values, and therefore more suitable water temperatures, during June, September and October, and equivalent or higher probabilities of exceeding specified water temperature index values during April and May.
- Similar spawning and egg incubation conditions based on modeling results indicating: (1)similar or lower long-term average monthly and average monthly flows by water year type below Keswick Dam and RBDD (2) generally higher long-term average monthly and average monthly flows by water year type from June through August at Wilkins Slough and (3) equivalent monthly probabilities of exceeding the specified water temperature index value; and (4) SacEFT results indicating reduced water temperatures more often near Hamilton City and potentially increased survival.
- Similar or improved juvenile rearing and outmigration conditions based on modeling results indicating: (1) similar or lower average monthly flows from January through May at RBDD, particularly in drier water year types, and similar or higher monthly flows from October through December at RBDD; (2) generally higher long-term average monthly flows and average monthly flows by water year type below the proposed Delevan Pipeline Intake Facilities and at Rio Vista from June through November, with similar or lower monthly flows from during December through May, particularly in drier water year types; and (3) equivalent or lower, and therefore more suitable, monthly probabilities of exceeding specified water temperature index values at all locations evaluated.

In conclusion, in consideration of potential impacts to all life stages of green sturgeon in the Sacramento River, Alternative B would result in similar or improved conditions for green sturgeon, relative to the Existing Conditions/No Project/No Action Condition.

White Sturgeon

Relative to the Existing Conditions/No Project/No Action Condition, Alternative B would generally be expected to provide:

- Similar adult immigration and holding conditions, based on modeling results indicating: (1) similar or lower long-term average monthly and average monthly flows by water year type during most of the evaluation period, except during October and November when flows may be increased below the proposed Delevan Pipeline Intake Facilities and at Rio Vista; and (2) equivalent monthly probabilities of exceeding specified water temperature index values.
- Less suitable spawning and egg incubation conditions, based on modeling results indicating: (1) generally lower long-term average and average by water year type monthly flows from February through May; and (2) equivalent or higher probabilities of exceeding specified water temperature index values, and therefore less suitable water temperatures.
- Similar or more suitable juvenile rearing and outmigration conditions based on modeling results indicating: (1) generally higher long-term average monthly flows and average monthly flows by water year type below the proposed Delevan Pipeline Intake Facilities and at Wilkins Slough and Rio Vista from June through November, with similar or lower monthly flows from December through May, particularly in drier water year types; and (2) equivalent or lower monthly probabilities of exceeding specified water temperature index values, and therefore more suitable water temperature conditions.

In conclusion, in consideration of potential impacts to all life stages of white sturgeon in the Sacramento River Alternative B would result in similar conditions for white sturgeon, relative to the Existing Conditions/No Project/No Action Condition.

River Lamprey

Relative to the Existing Conditions/No Project/No Action Condition, Alternative B would generally be expected to provide:

- Similar adult immigration conditions, based on modeling results indicating: (1) similar or lower long-term average monthly flows and average monthly flows by water year type in September and March through June below Keswick Dam, with similar or higher flows from October through February; and (2) generally higher long-term average monthly and average monthly flows by water year type below the proposed Delevan intake facility and at Freeport in June and September through November, with potentially lower flows from December through May.
- Similar spawning and egg incubation conditions, based on modeling results indicating: (1) similar or lower long-term average, and average by water year type monthly flows below Keswick Dam and below RBDD, although flows may be higher in February below Keswick Dam; (2) similar or lower long-term average, and average by water year type monthly flows from February through May, with similar or higher average monthly flows during June and July below the proposed Delevan Pipeline Intake Facilities; and (3) higher probabilities of water temperatures occurring within specified water temperature ranges during most months, and therefore more suitable water temperatures.
- Similar ammocoete rearing and emigration conditions based on modeling results indicating: (1) similar or increased long-term average monthly flows from October through February below Keswick Dam, with similar or lower monthly flows from March through September; (2) similar or lower average monthly flows from January through September at RBDD, particularly in drier water year types, and similar or higher monthly flows from October through December; (3) similar or higher average monthly flows and average monthly flows by water year type from June through November, and similar or lower average monthly flows from December through May at Freeport; and

(4) equivalent or similar monthly probabilities of exceeding specified water temperature index values, but with lower probabilities of exceeding 72°F during July and August.

In conclusion, in consideration of potential impacts to all life stages of river lamprey in the Sacramento River, Alternative B would result in similar conditions for river lamprey, relative to the Existing Conditions/No Project/No Action Condition.

Pacific Lamprey

Relative to the Existing Conditions/No Project/No Action Condition, Alternative B would generally be expected to provide:

- Similar adult immigration conditions, based on modeling results indicating: (1) similar or lower long-term average monthly and average monthly flows by water year type below Keswick Dam except in January and February when flows may be higher; and (2) similar or lower long-term average monthly and average monthly flows by water year type below the proposed Delevan Pipeline Intake Facilities and at Freeport, except during June when flows may be higher during some water year types.
- Similar spawning and egg incubation conditions, based on modeling results indicating: (1) similar or lower long-term average and average by water year type monthly flows below Keswick Dam and below RBDD, although flows may be higher in January and February below Keswick Reservoir; (2) similar or lower long-term average and average by water year type monthly flows from January through May, with similar or higher average monthly flows from June through August below the proposed Delevan Pipeline Intake Facilities; and (3) similar or higher probabilities of water temperatures occurring within the specified water temperature range during most months, and therefore more suitable water temperatures.
- Similar or improved ammocoete rearing and emigration conditions based on modeling results indicating: (1) similar or increased long-term average monthly flows from October through February below Keswick Dam, with similar or lower monthly flows from March through September; (2) similar or lower average monthly flows from January through September at RBDD, particularly in drier water year types, and similar or higher monthly flows from October through December; (3) similar or higher average monthly flows and average monthly flows by water year type from June through November, and similar or lower average monthly flows from December through May at Freeport; and (4) equivalent or similar monthly probabilities of exceeding specified water temperature index values, but with lower probabilities of exceeding 72°F during July and August at Freeport.

In conclusion, in consideration of potential impacts to all life stages of Pacific lamprey in the Sacramento River, Alternative B would result in similar conditions for Pacific lamprey, relative to the Existing Conditions/No Project/No Action Condition.

Hardhead

Relative to the Existing Conditions/No Project/No Action Condition, Alternative B would generally be expected to provide:

- Similar or improved adult and other life stage conditions, based on modeling results indicating: (1) similar or increased long-term average monthly flows from October through February below Keswick Dam with similar or lower monthly flows from March through September; and (2) similar or

higher average monthly flows and average monthly flows by water year type from June through November, and similar or lower average monthly flows from December through May below the proposed Delevan Pipeline Intake Facilities and at Freeport.

- Similar spawning conditions, based on modeling results indicating: (1) similar or lower long-term average monthly flows and average monthly flows by water year type below Keswick Reservoir, particularly in drier water year types; (2) similar or higher long-term average monthly and average monthly flows by water year type below the proposed Delevan Pipeline Intake Facilities in June, with similar or lower flows in April and May; (3) generally similar flows during the evaluation period at Freeport; and (4) higher probabilities of water temperatures occurring within the specified water temperature range during April through June below the proposed Delevan Pipeline Intake Facilities, and slightly lower probabilities of water temperatures occurring within the specified range during April and May at Freeport.

In conclusion, in consideration of potential impacts to all life stages of hardhead in the Sacramento River, Alternative B would result in similar conditions for hardhead, relative to the Existing Conditions/No Project/No Action Condition.

Sacramento Splittail

Relative to the Existing Conditions/No Project/No Action Condition, Alternative B would generally be expected to provide:

- Similar spawning and egg/larval life stage conditions, based on modeling results indicating: (1) a similar frequency that water temperatures are within the range specified for splittail in the Sacramento River (that is, 45 through 75°F); and (2) a similar frequency and duration of floodplain inundation in the Sutter and Yolo bypasses.

In conclusion, in consideration of potential impacts to all life stages of splittail in the Sacramento River, Alternative B would result in similar conditions for splittail, relative to the Existing Conditions/No Project/No Action Condition.

American Shad

Relative to the Existing Conditions/No Project/No Action Condition, Alternative B would generally be expected to provide:

- Similar adult spawning and other life stage conditions, based on modeling results indicating: (1) similar or lower long-term average monthly and average monthly flows by water year type below the RBDD; (2) generally similar flows during the evaluation period at Verona and Freeport; and (3) similar but slightly higher probabilities of water temperatures occurring within the specified water temperature range below the Feather River confluence and at Freeport, and slightly lower probabilities of water temperatures occurring within the specified range below RBDD.

- Similar or improved larvae, fry, and juvenile emigration conditions, based on modeling results indicating: (1) higher long-term average and average by water year type monthly flows below the proposed Delevan Pipeline Intake Facilities and at Verona and Freeport; and (2) generally similar or higher probabilities of water temperatures occurring within the specified water temperature range, except during June and July at the Delevan Intake when the probability would be lower

In conclusion, in consideration of potential impacts to all life stages of American shad in the Sacramento River, Alternative B would result in similar or improved conditions for American shad, relative to the Existing Conditions/No Project/No Action Condition.

Striped Bass

Relative to the Existing Conditions/No Project/No Action Condition, Alternative B would generally be expected to provide:

- Similar or improved adult spawning and other life stage conditions, based on modeling results indicating: (1) generally lower long-term average monthly and average monthly flows by water year type, except in June when average monthly flows may be higher below the proposed Delevan Pipeline Intake Facilities and at Verona; and (2) higher probabilities of water temperatures occurring within the specified water temperature range at the Delevan Intake.
- Similar or improved larvae, fry, and juvenile emigration conditions, based on modeling results indicating: (1) similar or higher average monthly flows and average monthly flows by water year type from June through November, and similar or lower average monthly flows from December through May below the proposed Delevan Pipeline Intake Facilities and at Freeport; and (2) generally higher probabilities of water temperatures occurring within the specified water temperature range, except in October when probabilities may be lower.

In conclusion, in consideration of potential impacts to all life stages of striped bass in the Sacramento River, Alternative B would result in similar or improved conditions for striped Bass, relative to the Existing Conditions/No Project/No Action Condition.

Largemouth Bass

Relative to the Existing Conditions/No Project/No Action Condition, Alternative B would generally be expected to provide:

- Similar or improved adult and other life stage conditions, based on modeling results indicating: (1) similar or increased long-term average monthly flows from October through February below Keswick Dam, with similar or lower monthly flows from March through September; and (2) similar or higher average monthly flows and average monthly flows by water year type from June through November, and similar or lower average monthly flows from December through May below the proposed Delevan Pipeline Intake Facilities and at Freeport.
- Similar spawning conditions, based on modeling results indicating similar monthly probabilities of water temperatures occurring within the specified water temperature range below Keswick Dam and at Freeport, with higher probabilities of occurring within the range, and therefore more suitable temperatures, below the proposed Delevan Pipeline Intake Facilities during April and May.

In conclusion, in consideration of potential impacts to all life stages of largemouth bass in the Sacramento River, Alternative B would result in similar conditions for largemouth bass, relative to the Existing Conditions/No Project/No Action Condition.

12C.4.2.6 Clear Creek

Potential impacts to fisheries and aquatic resources in Clear Creek under Alternative B relative to the Existing Conditions/No Project/No Action Condition would be similar to those discussed under Alternative A relative to the Existing Conditions/No Project/No Action Condition, above.

12C.4.2.7 Lake Oroville

Reservoir storage model results were examined for Lake Oroville during April through November for coldwater fish species; reductions in average monthly surface elevations greater than 6 feet (Appendix 12F Reservoir Water Surface Elevation Summary Tables) were examined during March through June for warmwater species. The potential impacts on aquatic resources in Lake Oroville are described below.

Coldwater Fish Species

Relative to the Existing Conditions/No Project/No Action Condition, Alternative B would generally be expected to provide:

- Similar or improved coldwater pool storage conditions, based on modeling results indicating similar long term average monthly storage during the evaluation period, with slightly higher average monthly storage occurring critical water years.

However, it is unlikely that coldwater fish habitat is limiting in Lake Oroville; therefore, it is unlikely that changes in reservoir storage under Alternative B would have a population level effect on coldwater fish species in Lake Oroville, relative to the Existing Conditions/No Project/No Action Condition.

Warmwater Fish Species

Relative to the Existing Conditions/No Project/No Action Condition, Alternative B would generally be expected to provide:

- Similar warmwater fish spawning and early life stage conditions, based on slightly increased and decreased frequency of monthly water surface elevation reductions of 6 feet or more in May and slightly increased frequencies in June.

It is unlikely that a small difference in the number of years with monthly water surface elevation reductions of greater than 6 feet under Alternative B would have a population level effect on bass and other warmwater fish in Lake Oroville, relative to the Existing Conditions/No Project/No Action Condition.

12C.4.2.8 Feather River

Flows in the Low Flow Channel below the Fish Barrier Dam were modeled consistent with the terms of the FERC Settlement Agreement. As shown in Appendix 6B Water Resources System Modeling, modeled results for long-term average flows, average flows by water year type were similar under Alternative B and the Existing Conditions/No Project/No Action Condition. Although these results are not repeated for the discussions below, the model results for the Low Flow Channel below the Fish Barrier Dam were considered along with the information presented below and are incorporated into the impact determinations for the following species: spring-run Chinook salmon, fall-run Chinook salmon, steelhead, green sturgeon, white sturgeon, river lamprey, Pacific lamprey, and hardhead.

Flow and water temperature model results were examined for the Feather River at several points downstream of Lake Oroville (Appendix 6B Water Resources System Modeling, Appendix 7E River

Temperature Modeling, and Appendix 12E Fisheries Water Temperature Assessment Summary Tables). For several species and life stages, only modeled flows and water temperatures were available; and the analyses of habitat conditions for these species and life stages were based primarily on the water temperature results. Model results for spawning habitat availability (WUA) were also examined for Chinook salmon and steelhead (Appendix 12N Weighted Usable Area Analysis). The potential for Project-related changes in aquatic habitat conditions and impacts on aquatic resources in the Feather River are described below.

Spring run Chinook Salmon

Relative to the Existing Conditions/No Project/No Action Condition, Alternative B would generally be expected to provide:

- Similar adult immigration and holding conditions, based on modeling results indicating: (1) similar or slightly lower long-term average monthly flows during the evaluation period below the Thermalito Afterbay outlet and at the mouth of the Feather River, although slightly higher flows would occur during August and September, particularly in wet and critically dry water year types; and (2) similar or lower monthly probabilities of exceeding specified water temperature index values in August and September with slightly higher monthly probabilities of exceeding specified water temperature index values in June and July at all locations evaluated in the Feather River.
- Similar or improved spawning conditions based on modeling results indicating: (1) generally lower long-term average monthly flows and average monthly flows by water year type during the evaluation period below the Thermalito Afterbay outlet, except in September when flows may be increased; and (2) similar or slightly lower probabilities of exceeding specified water temperature index values, and therefore more suitable water temperatures, during most of the evaluation period at the evaluated locations.
- Similar embryo incubation conditions based on modeling results indicating: (1) similar annual long-term average early life stage mortality; and (2) similar or slightly lower probabilities of exceeding specified water temperature index values, and therefore more suitable water temperatures during the evaluation period.
- Similar juvenile rearing and outmigration conditions based on modeling results indicating: (1) similar or slightly lower long-term average monthly flows occurring more often during the evaluation period below the Thermalito Afterbay outlet although higher flows would occur June through September, particularly in wetter and critically dry water year types; and (2) similar or slightly lower monthly probabilities of exceeding the lowest water temperature index values at all Feather River locations evaluated.
- Similar smolt emigration conditions, based on modeling results indicating: (1) similar or lower long-term average monthly flows during most of the evaluation period below the Thermalito Afterbay outlet and at the mouth of the Feather River except during June when flows may be higher, particularly in wetter water year types; and (2) similar or slightly higher monthly probabilities of exceeding specified water temperature index values at all Feather River locations evaluated except in June when exceedance probabilities are lower and in October when exceedance probabilities are higher at the mouth of the Feather River.

In conclusion, in consideration of potential impacts to all life stages of spring-run Chinook salmon in the Feather River, Alternative B would result in similar conditions for spring-run Chinook salmon, relative to the Existing Conditions/No Project/No Action Condition.

Fall-run Chinook Salmon

Relative to the Existing Conditions/No Project/No Action Condition, Alternative B would generally be expected to provide:

- Similar adult immigration and holding conditions, based on modeling results indicating: (1) generally higher long-term average monthly flows occurring during August and September and lower average monthly flows from October through December and July below the Thermalito Afterbay outlet and at the mouth of the Feather River; and (2) similar probabilities of exceeding specified water temperature index values during the evaluation period.
- Improved spawning conditions based on modeling results indicating: (1) generally similar or higher spawning habitat availability (WUA) in the reach below Thermalito, particularly in October when WUA is substantially increased during most water year types; (2) similar or lower probabilities of exceeding specified water temperature index values in the Low Flow Channel and higher probabilities of exceedance during October below Thermalito.
- Similar embryo incubation conditions based on modeling results indicating: (1) similar annual long-term average early life stage mortality; and (2) similar probabilities of exceeding specified water temperature index values during most of the evaluation period.
- Similar juvenile rearing and outmigration conditions based on modeling results indicating: (1) similar or slightly lower long-term average monthly flows during most months of the evaluation period below the Thermalito Afterbay outlet and at the mouth of the Feather River, and similar or higher average monthly flows by water year type occurring more often than lower average monthly flows during most water year types below the Thermalito Afterbay outlet and at the mouth of the Feather River, and (2) similar monthly probabilities of exceeding specified water temperature index values at all Feather River locations evaluated.

In conclusion, in consideration of potential impacts to all life stages of fall-run Chinook salmon in the Feather River, Alternative B would result in similar conditions for fall-run Chinook salmon, relative to the Existing Conditions/No Project/No Action Condition.

Steelhead

Relative to the Existing Conditions/No Project/No Action Condition, Alternative B would generally be expected to provide:

- Similar or improved adult immigration and holding conditions, based on modeling results indicating: (1) lower long-term average monthly flows and average monthly flows by water year type occurring during much of the evaluation period, except during August and September when flows may be higher below the Thermalito Afterbay outlet and at the mouth of the Feather River; and (2) similar or lower monthly probabilities of exceeding specified water temperature index values, and therefore more suitable water temperatures, during most of the evaluation period.
- Similar spawning and egg incubation conditions based on modeling results indicating: (1) similar or higher spawning habitat availability (WUA) occurring more frequently during the adult spawning

period, and (2) similar probabilities of exceeding specified water temperature index values during most of the evaluation period at all Feather River locations.

- Similar juvenile rearing and outmigration conditions based on modeling results indicating: (1) similar or slightly lower long-term average monthly flows occurring more often during the evaluation period below the Thermalito Afterbay outlet and at the mouth of the Feather River, and lower average monthly flows by water year type occurring during most water year types below the Thermalito Afterbay outlet and at the mouth of the Feather River, except for above normal water year types when average monthly flows would be higher more often; and (2) similar monthly probabilities of exceeding specified water temperature index values at all Feather River locations evaluated.
- Similar smolt emigration conditions based on modeling results indicating: (1) similar or slightly lower long-term average monthly flows occurring more often during the evaluation period below the Thermalito Afterbay outlet and at the mouth of the Feather River, and lower average monthly flows by water year type occurring during most water year types below the Thermalito Afterbay outlet and at the mouth of the Feather River, except for above normal water year types when average monthly flows would be higher more often; and (2) similar or lower monthly probabilities of exceeding specified water temperature index values, and therefore more suitable water temperatures, at all Feather River locations evaluated, except in October when exceedance probabilities may be higher.

In conclusion, in consideration of potential impacts to all life stages of steelhead in the Feather River, Alternative B would result in similar conditions for steelhead, relative to the Existing Conditions/No Project/No Action Condition.

Green Sturgeon

Relative to the Existing Conditions/No Project/No Action Condition, Alternative B would generally be expected to provide:

- Similar adult immigration and holding conditions, based on modeling results indicating: (1) similar or slightly lower long-term average monthly flows during the evaluation period at Shanghai Bend and at the mouth of the Feather River, although higher flows would occur June through September, particularly in wetter and critically dry water year types; and (2) similar or lower monthly probabilities of exceeding specified water temperature index values during the evaluation period, except in June and July when probabilities of exceedance may be higher below Thermalito.
- Similar or less suitable adult spawning and embryo incubation conditions based on modeling results indicating: (1) similar or slightly lower long-term average monthly flows and monthly flows by water year type during the evaluation period below the Thermalito Afterbay outlet, except in August when flows may be higher; and (2) higher monthly probabilities of exceeding specified water temperature index values below the Thermalito Afterbay in June and July and lower probabilities of exceedance in August.
- Similar juvenile rearing conditions based on modeling results indicating: (1) similar or slightly lower long-term average monthly flows during the evaluation below the Thermalito Afterbay outlet and at the mouth of the Feather River, although higher flows would occur June through September, particularly in wetter and critically dry water year types; and (2) similar monthly probabilities of exceeding specified water temperature index values below the Thermalito Afterbay outlet, and at the

mouth of the Feather River, except during June when probabilities of exceedance may be higher and August when probabilities may be lower below the Thermalito Afterbay outlet.

- Similar or slightly improved juvenile emigration conditions based on modeling results indicating: (1) generally similar average monthly flows in May and June and slightly higher long-term average monthly flows and average monthly flows by water year type during August and September at all Feather River locations; and (2) similar monthly probabilities of exceeding specified water temperature index values below the Thermalito Afterbay outlet, and at the mouth of the Feather River, except during June when probabilities of exceedance may be higher and August when probabilities may be lower below the Thermalito Afterbay outlet.

In conclusion, in consideration of potential impacts to all life stages of green sturgeon in the Feather River, Alternative B would result in similar conditions for green sturgeon, relative to the Existing Conditions/No Project/No Action Condition.

White Sturgeon

Relative to the Existing Conditions/No Project/No Action Condition, Alternative B would generally be expected to provide:

- Similar adult immigration and holding conditions, based on modeling results indicating: (1) similar or slightly lower long-term average monthly flows during the evaluation period at Shanghai Bend and at the mouth of the Feather River, and similar or slightly higher average monthly flows by water year type during most water year types, except during dry water years when lower average monthly flows would occur more frequently; and (2) equivalent monthly probabilities of exceeding specified water temperature index values at all locations evaluated.

- Similar spawning and egg incubation conditions based on modeling results indicating: (1) similar to slightly lower long-term average monthly flows and average monthly flows by water year type during the evaluation period at the Feather River at Shanghai Bend and at the mouth of the Feather River; and (2) similar monthly probabilities of exceeding specified water temperature index values at all locations evaluated.

- Similar juvenile rearing and outmigration conditions based on modeling results indicating: (1) similar or slightly lower long-term average monthly flows during the evaluation below the Thermalito Afterbay outlet and at the mouth of the Feather River, although higher flows would occur July through September, particularly in wetter and critically dry water year types and (2) similar monthly probabilities of exceeding specified water temperature index values below the Thermalito Afterbay outlet, and at the mouth of the Feather River, except during June when probabilities of exceedance may be higher and August when probabilities may be lower below the Thermalito Afterbay outlet.

In conclusion, in consideration of potential impacts to all life stages of white sturgeon in the Feather River, Alternative B would result in similar conditions for White Surgeon, relative to the Existing Conditions/No Project/No Action Condition.

River Lamprey

Relative to the Existing Conditions/No Project/No Action Condition, Alternative B would generally be expected to provide:

- Similar or slightly less suitable adult immigration conditions, based on modeling results indicating generally similar or lower long-term average monthly flows and average monthly flows by water year type during the evaluation period below the Thermalito Afterbay outlet, except in September and June when flows may be higher.
- Similar or less suitable adult spawning and egg incubation conditions, based on modeling results indicating: (1) generally lower long-term average monthly flows below the Thermalito Afterbay outlet and at the mouth of the Feather River, except in June and July when flows may be higher; and (2) similar or lower probability of water temperatures occurring within the specified water temperature range with similar frequency during the evaluation period at all Feather River locations evaluated.
- Similar ammocoete rearing and emigration conditions based on modeling results indicating: (1) similar or slightly lower long-term average monthly flows occurring more often during the evaluation period below the Thermalito Afterbay outlet and at the mouth of the Feather River, and lower average monthly flows by water year type occurring during most water year types below the Thermalito Afterbay outlet and at the mouth of the Feather River, except for above normal water year types when average monthly flows would be higher more often; and (2) similar or slightly lower probability of water temperatures occurring within the specified water temperature range during most of the evaluation period at all Feather River locations evaluated, except from July through September when probabilities of exceedance may be less at the mouth of the Feather River.

In conclusion, in consideration of potential impacts to all life stages of river lamprey in the Feather River, Alternative B would result in similar conditions for river lamprey, relative to the Existing Conditions/No Project/No Action Condition.

Pacific Lamprey

Relative to the Existing Conditions/No Project/No Action Condition, Alternative B would generally be expected to provide:

- Similar or less suitable adult immigration conditions, based on modeling results indicating generally lower long-term average monthly flows and average monthly flows by water year type during the evaluation period below the Thermalito Afterbay outlet, except in March and June when flows may be higher below the Thermalito Afterbay outlet and at the mouth of the Feather River.
- Similar or less suitable spawning and egg incubation conditions, based on modeling results indicating: (1) similar long-term average monthly flows below the Thermalito Afterbay outlet and at the mouth of the Feather River, and similar or higher average monthly flows by water year type occurring during wet and above normal water year types below the Thermalito Afterbay outlet and at the mouth of the Feather River, and lower average monthly flows by water year type occurring during below normal, dry and critical water year types below the Thermalito Afterbay outlet and at the mouth of the Feather River; and (2) slightly lower probability of water temperatures occurring within the specified water temperature range during the evaluation period at all Feather River locations evaluated.
- Similar ammocoete rearing and emigration conditions based on modeling results indicating: (1) similar or slightly lower long-term average monthly flows during the evaluation below the Thermalito Afterbay outlet and at the mouth of the Feather River, although higher flows would occur

June through September, particularly in wetter and critically dry water year types; and (2) similar probabilities of exceeding the specified water temperature index at all Feather River locations evaluated, except during June through September when probabilities of exceeding the index would be slightly lower.

In conclusion, in consideration of potential impacts to all life stages of Pacific lamprey in the Feather River, Alternative B would result in similar conditions for Pacific lamprey, relative to the Existing Conditions/No Project/No Action Condition.

Hardhead

Relative to the Existing Conditions/No Project/No Action Condition, Alternative B would generally be expected to provide:

- Similar adults and juveniles habitat conditions, based on modeling results indicating: (1) similar or slightly lower long-term average monthly flows during the evaluation below the Thermalito Afterbay outlet and at the mouth of the Feather River, although higher flows would occur June through September, particularly in wetter and critically dry water year types; and (2) similar probabilities of water temperatures occurring within the specified water temperature range during most of the evaluation period at all Feather River locations evaluated, except in May and September when the probability may be lower.
- Similar or less suitable adult spawning conditions based on modeling results indicating: (1) lower long-term average monthly flows during April and May months and equivalent long-term monthly flows during June at all Feather River locations evaluated, and higher average monthly flows by water year type during most water year types, except during dry and critical water year types; and (2) similar or slightly lower monthly probabilities of water temperatures occurring within the specified water temperature range throughout the evaluation period below the Thermalito Afterbay Outlet and at the mouth of the Feather River.

In conclusion, in consideration of potential impacts to all life stages of hardhead in the Feather River, the Alternative B would result in similar conditions for hardhead, relative to the Existing Conditions/No Project/No Action Condition.

Sacramento Splittail

Relative to the Existing Conditions/No Project/No Action Condition, Alternative B would generally be expected to provide:

- Similar spawning conditions, based on modeling results indicating: (1) similar or slightly lower long-term average monthly flows, and higher and lower average monthly flows by water year type at the mouth of the Feather River; and (2) equivalent probability of exceeding specified water temperature values during the evaluation period.

In conclusion, in consideration of potential impacts to all life stages of splittail in the Feather River, Alternative B would result in similar conditions for splittail, relative to the Existing Conditions/No Project/No Action Condition.

Striped Bass

Relative to the Existing Conditions/No Project/No Action Condition, Alternative B would generally be expected to provide:

- Similar adult spawning and other life stage conditions, based on modeling results indicating: (1) lower long-term average monthly flows during April and May months and equivalent long-term monthly flows during June at all Feather River locations evaluated, and higher average monthly flows by water year type during most water year types, except during dry and critical water year types; and (2) similar or slightly lower monthly probabilities of water temperatures occurring within the specified water temperature range throughout the evaluation period below the Thermalito Afterbay Outlet and at the mouth of the Feather River, particularly in June below the Thermalito Afterbay.
- Similar larvae, fry, and juvenile emigration conditions, based on modeling results indicating: (1) similar or slightly lower long-term average monthly flows during the evaluation below the Thermalito Afterbay outlet and at the mouth of the Feather River, although higher flows would occur June through September, particularly in wetter and critically dry water year types; and (2) similar or slightly lower probability of water temperatures occurring within the specified water temperature range with similar frequencies below the Thermalito Afterbay outlet and at the mouth of the Feather River during much of the year.

In conclusion, in consideration of potential impacts to all life stages of striped bass in the Feather River, Alternative B would result in similar conditions for striped bass, relative to the Existing Conditions/No Project/No Action Condition.

American Shad

Relative to the Existing Conditions/No Project/No Action Condition, Alternative B would generally be expected to provide:

- Similar adult spawning, embryo incubating and initial rearing conditions based on modeling results indicating: (1) lower long-term average monthly flows during April and May months and equivalent long-term monthly flows during June at all Feather River locations evaluated, and higher average monthly flows by water year type during most water year types, except during dry and critical water year types; and (2) generally similar or slightly higher probabilities of water temperatures occurring within the specified water temperature range at all Feather River locations evaluated.
- Similar larvae, fry, and juvenile emigration conditions, based on modeling results indicating: (1) similar or higher long-term average and average monthly flows by water year type occurring during most water year types during the evaluation period except during October and November when average monthly flows may be lower and from June to October when average monthly flows may be higher at all Feather River locations evaluated; and (2) similar monthly probabilities of exceeding specified water temperature index values.

In conclusion, in consideration of potential impacts to all life stages of American shad in the Feather River, Alternative B would result in similar conditions for American shad, relative to the Existing Conditions/No Project/No Action Condition.

Largemouth Bass

Relative to the Existing Conditions/No Project/No Action Condition, Alternative B would generally be expected to provide:

- Similar adult and other life stage conditions, based on modeling results indicating similar or slightly lower long-term average monthly flows during the evaluation below the Thermalito Afterbay outlet and at the mouth of the Feather River, although higher flows would occur June through September, particularly in wetter and critically dry water year types.
- Similar spawning conditions, based on similar or slightly lower monthly probabilities of water temperatures occurring within the specified water temperature range during March through June for all Feather River locations evaluated.

In conclusion, in consideration of potential impacts to all life stages of largemouth bass in the Feather River, Alternative B would result in similar conditions for largemouth bass, relative to the Existing Conditions/No Project/No Action Condition.

12C.4.2.9 Sutter Bypass

Potential impacts to fisheries and aquatic resources in the Sutter Bypass under Alternative B relative to the Existing Conditions/No Project/No Action Condition would be similar to those discussed under Alternative A relative to the Existing Conditions/No Project/No Action Condition, above.

12C.4.2.10 Folsom Lake

Reservoir storage model results (Appendix 6B Water Resources System Modeling) were examined for Folsom Lake during April through November for coldwater fish species; reductions in average monthly surface elevations greater than 6 feet (Appendix 12F Reservoir Water Surface Elevation Summary Tables) were examined during March through June for warmwater species. The potential impacts on aquatic resources in Folsom Lake are described below.

Coldwater Fish Species

Relative to the Existing Conditions/No Project/No Action Condition, Alternative B would generally be expected to provide:

- Similar conditions for coldwater fish species, based on modeling results indicating similar long-term average monthly storage, and similar average monthly storage by water year type occurring during most months of the evaluation period.

However, it is unlikely that coldwater fish habitat is limiting in Folsom Lake; therefore, it is unlikely that changes in reservoir storage under Alternative B would have a population level effect on coldwater fish species in Folsom Lake, relative to the Existing Conditions/No Project/No Action Condition.

Warmwater Fish Species

Relative to the Existing Conditions/No Project/No Action Condition, Alternative B would generally be expected to provide:

- Similar warmwater fish nesting conditions, based on modeling results indicating slight increases in the frequency of monthly water surface elevation reductions of 6 feet or more during April and June.

It is unlikely that a small difference in the number of years with monthly water surface elevation reductions of greater than 6 feet under Alternative B would have a population level effect on bass and other warmwater fish in Folsom Lake, relative to the Existing Conditions/No Project/No Action Condition.

12C.4.2.11 American River

Flow and water temperature model results were examined for the American River at several points downstream of Lake Natoma (Appendix 6B Water Resources System Modeling, Appendix 7E River Temperature Modeling, and Appendix 12E Fisheries Water Temperature Assessment Summary Tables). For several species and life stages, only modeled flows and water temperatures were available; and the analyses of habitat conditions for these species and life stages were based primarily on the water temperature results. Model results for spawning habitat availability (WUA) were also examined for Chinook salmon and steelhead (Appendix 12N Weighted Usable Area Analysis). The potential for Project-related changes in aquatic habitat conditions and impacts on aquatic resources in the American River are described below.

Fall-run Chinook Salmon

Relative to the Existing Conditions/No Project/No Action Condition, Alternative B would generally be expected to provide:

- Similar adult immigration and holding conditions based on modeling results indicating: (1) lower long-term average monthly flows during the evaluation period, and lower average monthly flows by water year type during most water year types at all locations evaluated in the American River; and (2) generally similar monthly probabilities of exceeding specified water temperature index values, except in October when the exceedance frequency may be lower.
- Similar or more suitable spawning conditions based on modeling results indicating: (1) similar spawning habitat availability (WUA) from October through December, with slightly higher spawning habitat availability in October of Critical water years; and (2) generally reduced probabilities of exceeding specified water temperature index values, and therefore more suitable water temperatures.
- Similar embryo incubation conditions based on modeling results indicating slightly lower, although similar, total annual early life stage mortality and similar or reduced monthly probabilities of exceeding specified water temperature index values.
- Similar juvenile rearing and emigration conditions based on modeling results indicating: (1) similar long-term average monthly flows during the evaluation period, and similar or slightly higher average monthly flows by water year type during most water year types at all locations evaluated in the American River; and (2) generally similar probabilities of exceeding specified water temperature index values below Nimbus Dam, with similar or somewhat increased probabilities of exceeding the lowest temperature indices at Watt Avenue and at the mouth from April through June.

In conclusion, in consideration of potential impacts to all life stages of fall-run Chinook salmon in the American River, Alternative B would result in similar conditions for fall-run Chinook salmon, relative to the Existing Conditions/No Project/No Action Condition.

Spring-run Chinook Salmon

Relative to the Existing Conditions/No Project/No Action Condition, Alternative B would generally be expected to provide:

- Similar or slightly improved non-natal juvenile rearing conditions based on modeling results indicating: (1) similar or slightly higher long-term average monthly flows during most months of the evaluation period, and similar or slightly higher average monthly flows by water year type; and (2) generally similar probabilities of exceeding specified water temperature index values throughout the evaluation period.

Rearing conditions in the American River for non-natal juvenile spring-run Chinook salmon would likely be similar under Alternative B, relative to Existing Conditions/No Project/No Action Condition.

Steelhead

Relative to the Existing Conditions/No Project/No Action Condition, Alternative B would generally be expected to provide:

- Similar adult immigration and holding conditions based on modeling results indicating: (1) similar or slightly higher long-term average monthly flows during the evaluation period at all evaluated locations, and similar or slightly higher average monthly flows by water year type; and (2) generally similar probabilities of exceeding specified water temperature index values, except in November and December when the probability of exceedance would be lower and in April when the probability may be higher at Watt Avenue.
- Similar or less suitable spawning and embryo incubation conditions based on modeling results indicating: (1) similar or slightly higher long-term average monthly flows during the evaluation period, and similar or slightly higher average monthly flows by water year type; (2) similar spawning habitat availability (WUA) during the evaluation period; and (3) generally similar or higher probabilities of exceeding specified water temperature index values.
- Similar juvenile rearing and emigration conditions based on modeling results indicating: (1) similar or slightly higher long-term average monthly flows during the evaluation period, and similar or slightly higher average monthly flows by water year type, although lower flows would occur more frequently during June, July, and September; and (2) generally similar probabilities of exceeding specified water temperature index values, although higher probabilities of exceedance would occur during June, July, and September and lower probabilities of exceedance would occur in May and August.
- Similar or less suitable smolt emigration conditions based on modeling results indicating: (1) similar or slightly higher long-term average monthly flows during the evaluation period, and similar or slightly higher average monthly flows by water year type; and (2) generally similar or higher probabilities of exceeding specified water temperature index values.

In conclusion, in consideration of potential impacts to all life stages of steelhead in the American River, Alternative B would result in similar conditions for steelhead, relative to the Existing Conditions/No Project/No Action Condition.

Green Sturgeon

Relative to the Existing Conditions/No Project/No Action Condition, Alternative B would generally be expected to provide:

- Similar adult immigration and holding conditions based on modeling results indicating: (1) similar or slightly higher long-term average monthly flows during the evaluation period, and similar or slightly higher average monthly flows by water year type, although lower flows could occur throughout the evaluation period; and (2) similar or probabilities of exceeding specified water temperature index values, except in October and April when the probabilities of exceedance may be lower.
- Similar spawning and egg incubation conditions based on modeling results indicating: (1) similar or slightly higher long-term average monthly flows during the evaluation period, and similar or slightly higher average monthly flows by water year type, although lower flows would occur more frequently during June and July; and (2) similar or slightly reduced probabilities of exceeding specified water temperature index values.
- Similar juvenile rearing and emigration conditions based on modeling results indicating: (1) similar or slightly higher long-term average monthly flows during the evaluation period, and similar or slightly higher average monthly flows by water year type, although lower flows would occur more frequently during June, July, and September; and (2) generally similar or lower probabilities of exceeding specified water temperature index values, except in July and September when the probabilities of exceedance may be higher.

In conclusion, in consideration of potential impacts to all life stages of green sturgeon in the American River, Alternative B would result in similar conditions for green sturgeon, relative to the Existing Conditions/No Project/No Action Condition.

River Lamprey

Relative to the Existing Conditions/No Project/No Action Condition, Alternative B would generally be expected to provide:

- Similar or improved adult immigration conditions based on modeling results indicating similar or slightly higher long-term average monthly flows during the evaluation period, and similar or slightly higher average monthly flows by water year type, although lower flows would occur during June and September.
- Similar spawning and egg incubation conditions based on modeling results indicating: (1) similar long-term average monthly flows during the evaluation period, and similar average monthly flows by water year type, although lower flows would occur more frequently during July; and (2) generally similar monthly probabilities of water temperatures occurring within the specified water temperature range, except from May through July when the probability of water temperatures within the range may be lower at Watt Avenue.
- Similar or improved ammocoete rearing and emigration conditions based on modeling results indicating: (1) similar or slightly higher long-term average monthly flows during the evaluation period, and similar or slightly higher average monthly flows by water year type, although lower flows would occur more frequently during June, July, and September; and (2) generally similar or higher probabilities of remaining within the specified water temperature range throughout the year.

In conclusion, in consideration of potential impacts to all life stages of river lamprey in the American River, Alternative B would result in similar or more suitable conditions for river lamprey, relative to the Existing Conditions/No Project/No Action Condition.

Pacific Lamprey

Relative to the Existing Conditions/No Project/No Action Condition, Alternative B would generally be expected to provide:

- Similar adult immigration conditions based on modeling results indicating similar long-term average monthly flows during the evaluation period, and similar average monthly flows by water year type.
- Similar spawning and egg incubation conditions based on modeling results indicating: (1) similar long-term average monthly flows during the evaluation period, and similar average monthly flows by water year type, although lower flows would occur more frequently during July; and (2) similar or higher monthly probabilities of water temperatures occurring within the specified water temperature range, except from May through July when the probability of water temperatures within the range may be lower at Watt Avenue.
- Similar or improved ammocoete rearing and emigration conditions based on modeling results indicating: (1) similar or slightly higher long-term average monthly flows during the evaluation period, and similar or slightly higher average monthly flows by water year type, although lower flows would occur more frequently during June, July, and September; and (2) generally similar or lower probabilities of exceeding specified water temperature index values particularly from July through September, but slightly higher probabilities in June and July at Watt Avenue.

In conclusion, in consideration of potential impacts to all life stages of Pacific lamprey in the American River, Alternative B would result in similar or improved conditions for Pacific lamprey, relative to the Existing Conditions/No Project/No Action Condition.

Hardhead

Relative to the Existing Conditions/No Project/No Action Condition, Alternative B would generally be expected to provide:

- Similar adult and other life stage conditions based on modeling results indicating: (1) similar or slightly higher long-term average monthly flows during the evaluation period, and similar or slightly higher average monthly flows by water year type, although lower flows would occur more frequently during June, July, and September; and (2) similar probabilities of remaining within the specified water temperature range, except in October when the probability of remaining in the range may be lower.
- Similar spawning conditions based on modeling results indicating: (1) similar long-term average monthly flows during the evaluation period, and similar average monthly flows by water year type; and (2) a higher probability of remaining within the specified water temperature range in April, but a lower probability of remaining within the range in May and June.

In conclusion, in consideration of potential impacts to all life stages of hardhead in the American River, Alternative B would result in similar conditions for hardhead or more suitable, relative to the Existing Conditions/No Project/No Action Condition.

Sacramento Splittail

Relative to the Existing Conditions/No Project/No Action Condition, Alternative B would generally be expected to provide:

- Similar or more suitable spawning conditions based on modeling results indicating: (1) similar long-term average monthly flows during the evaluation period, and similar average monthly flows by water year type across most water year types, except in March and April of drier water year types when flows may be increased; and (2) equivalent probabilities of exceeding specified water temperature index values.

In conclusion, in consideration of potential impacts to all life stages of splittail in the American River, Alternative B would result in similar conditions for splittail, relative to the Existing Conditions/No Project/No Action Condition.

Striped Bass

Relative to the Existing Conditions/No Project/No Action Condition, Alternative B would generally be expected to provide:

- Similar or improved adult spawning, embryo incubation, and initial rearing conditions based on modeling results indicating: (1) similar long-term average monthly flows during the evaluation period, and similar or slightly higher average monthly flows by water year type; and (2) similar or higher probabilities of remaining within the specified water temperature range during the evaluation period.
- Similar larvae, fry, and juvenile rearing and emigration conditions based on modeling results indicating: (1) similar or slightly higher long-term average monthly flows during the evaluation period, and similar or slightly higher average monthly flows by water year type, although lower flows would occur more frequently during June, July, and September; and (2) similar probabilities of remaining within the specified water temperature range throughout the year, with a higher probability of the temperatures occurring within the specified range during August and lower probabilities in April, May, and October.

In conclusion, in consideration of potential impacts to all life stages of striped bass in the American River, Alternative B would result in similar conditions for striped bass, relative to the Existing Conditions/No Project/No Action Condition.

American Shad

Relative to the Existing Conditions/No Project/No Action Condition, Alternative B would generally be expected to provide:

- Similar or improved adult spawning, embryo incubation, and initial rearing conditions based on modeling results indicating: (1) similar long-term average monthly flows during the evaluation period, and similar or slightly higher average monthly flows by water year type; and (2) generally higher probabilities of remaining within the specified water temperature range during the evaluation period.
- Similar larvae, fry, and juvenile rearing and emigration conditions based on modeling results indicating: (1) similar long-term average monthly flows during the evaluation period, and similar or slightly higher average monthly flows by water year type, although lower flows would occur more frequently during June, July, and September; and (2) similar or higher monthly probabilities of water temperatures occurring within the specified water temperature range, except in October when the probability of remaining within the range may be lower.

In conclusion, in consideration of potential impacts to all life stages of American shad in the American River, Alternative B would result in similar conditions for American shad, relative to the Existing Conditions/No Project/No Action Condition.

Largemouth Bass

Relative to the Existing Conditions/No Project/No Action Condition, Alternative B would generally be expected to provide:

- Similar adult and other life stage conditions based on modeling results indicating similar or slightly higher long-term average monthly flows during the evaluation period, and similar or slightly higher average monthly flows by water year type, although lower flows would occur more frequently during June, July, and September.
- Similar spawning conditions based on modeling results indicating higher probabilities of remaining within the specified water temperature range during April and a reduced probability in May.

In conclusion, in consideration of potential impacts to all life stages of largemouth bass in the American River, Alternative B would result in similar conditions for largemouth bass, relative to the Existing Conditions/No Project/No Action Condition.

12C.4.2.12 Sacramento-San Joaquin Delta and Yolo Bypass

Delta Smelt in the Delta Region

Relative to the Existing Conditions/No Project/No Action Condition, Alternative B would generally be expected to provide:

- Similar adult conditions, based on modeling results indicating: (1) similar monthly probabilities of water temperatures at Freeport occurring within the specified water temperature range with a slightly lower probability during May; (2) similar mean monthly entrainment at the SWP and CVP export facilities (December through April).
- Similar egg and embryo conditions (February through May), based on modeling results indicating similar monthly probabilities of water temperatures at Freeport occurring within the specified water temperature range, with a lower probability during May.
- Similar larval conditions (March through June), based on modeling results indicating: (1) similar monthly probabilities of water temperatures at Freeport occurring within the specified water temperature range, but with a slightly higher probability during April and a slightly lower probability during May of water temperatures occurring within the specified range; (2) generally lower long-term average and average by water year type monthly Delta outflows, except in June when Delta outflows may be increased, and in drier water year types when Delta outflows may be substantially decreased in March.
- Similar or slightly improved juvenile conditions (May through July), based on modeling results indicating: (1) similar or decreased monthly probabilities of water temperatures at Freeport occurring within the specified water temperature range, but with a lower probability during May; (2) similar overall mean monthly percent juvenile entertainment at the SWP and CVP export facilities (May through July); and (3) when X2 is between RKm 65 and 80, long-term average and average by water year type X2 location would move slightly upstream during May (by less than 0.5 RKm), move

slightly downstream during June (by 0.5 RKm or less), and move downstream during July (by 1.2, 1.7 and 1.4 RKm during wet, above normal and below normal water years, respectively).

In conclusion, in consideration of potential impacts to all life stages of delta smelt in the Delta, Alternative B would result in similar conditions for Delta Smelt, relative to the Existing Conditions/No Project/No Action Condition.

Longfin Smelt in the Delta Region

Relative to the Existing Conditions/No Project/No Action Condition, Alternative B would generally be expected to provide:

- Similar adult conditions based on modeling results that indicate: (1) OMR flows would be similar (not substantially more negative) relative to Existing Conditions/No Project/No Action Condition from December through June and (2) a similar index of relative adult abundance.
- Similar larvae and juvenile conditions based on modeling results indicating: (1) during April and May of dry and critical water years, mean monthly OMR flows would be lower during April of dry and critical water years (by 1.6 and 6.4%, respectively) and during May of critical water years (by 14.6%), and would be higher during May of dry water years (by 9.8%); and (3) slightly higher (during January, May and June) and lower (from February, March and April) monthly exceedance probabilities of X2 location occurring at or downstream of RKm 75.

In conclusion, in consideration of potential impacts to all life stages of longfin smelt in the Delta, Alternative B would result in similar conditions for Longfin Smelt, relative to the Existing Conditions/No Project/No Action Condition.

Sacramento Splittail in the Delta and Yolo Bypass

Relative to the Existing Conditions/No Project/No Action Condition, Alternative B would generally be expected to provide:

- Similar or less suitable adult upstream migration, spawning, egg, and larval conditions based on modeling results indicating: (1) similar or reduced long-term average monthly flows in the Yolo Bypass, particularly during February and March; and (2) similar frequencies and duration of inundation events in the Yolo Bypass.
- Similar juvenile rearing and emigration conditions based on modeling results indicating similar long-term average monthly flows and average monthly flows by water year type in the Yolo Bypass.

In conclusion, in consideration of potential impacts to all life stages of Sacramento splittail in the Delta Region including the Yolo Bypass, Alternative B would result similar conditions for splittail, relative to the Existing Conditions/No Project/No Action Condition.

Winter-run Chinook Salmon in the Delta and Yolo Bypass

Relative to the Existing Conditions/No Project/No Action Condition, Alternative B would generally be expected to provide:

- Similar Delta conditions, based on IOS modeling results indicating similar monthly through-Delta survival probabilities.

- Similar juvenile rearing conditions in the Yolo Bypass based on modeling results indicating a similar frequency and duration of floodplain inundation.

In conclusion, in consideration of potential impacts to juvenile winter-run Chinook salmon, Alternative B would result in similar juvenile rearing and outmigration conditions for winter-run Chinook salmon in the Yolo Bypass and Delta Region, relative to the Existing Conditions/No Project/No Action Condition.

Spring-run Chinook Salmon in the Delta and Yolo Bypass

Relative to the Existing Conditions/No Project/No Action Condition, Alternative B would generally be expected to provide:

- Similar juvenile outmigration conditions, based on DPM modeling results indicating similar monthly Delta survival probabilities.
- Similar juvenile rearing conditions in the Yolo Bypass based on modeling results indicating a similar frequency and duration of floodplain inundation.

In conclusion, in consideration of potential impacts to spring-run Chinook salmon, Alternative B would result in similar juvenile rearing and outmigration conditions for spring-run Chinook salmon in the Yolo Bypass and Delta Region, relative to the Existing Conditions/No Project/No Action Condition.

Fall-run and Late Fall-run Chinook Salmon in the Delta and Yolo Bypass

Relative to the Existing Conditions/No Project/No Action Condition, Alternative B would generally be expected to provide:

- Similar juvenile outmigration conditions based on DPM modeling results indicating similar monthly Delta survival probabilities.
- Similar juvenile rearing conditions in the Yolo Bypass based on modeling results indicating a similar frequency and duration of floodplain inundation.

In conclusion, in consideration of potential impacts to juvenile and fall and late fall-run Chinook salmon, Alternative B would result in similar juvenile rearing and outmigration conditions for fall- and late fall-run Chinook salmon in the Yolo Bypass and Delta Region, relative to the Existing Conditions/No Project/No Action Condition.

Steelhead in the Delta and Yolo Bypass

Relative to the Existing Conditions/No Project/No Action Condition, Alternative B would generally be expected to provide:

- Similar or less suitable juvenile rearing and outmigration conditions in the Delta (October through July) based on modeling results indicating: (1) lower long-term average and average by water year type monthly Delta outflow during most months of most water year types, but with higher Delta outflow during June and July of all water year types, during October of above normal water years, during October through December of below normal water years, during November of dry water years and during October and December of critical water years; (2) OMR flows would be reduced over the evaluation period and substantially more negative relative to the Existing Conditions/No Project/No Action Condition in October and November of wetter water year types and most months of critically dry water years.

- Similar juvenile rearing conditions in the Yolo Bypass based on modeling results indicating a similar frequency and duration of floodplain inundation.

In conclusion, in consideration of potential impacts to juvenile Central Valley steelhead, Alternative B would result in similar juvenile rearing and outmigration conditions for steelhead in the Yolo Bypass and Delta Region, relative to the Existing Conditions/No Project/No Action Condition.

Green Sturgeon and White Sturgeon in the Delta Region

Relative to the Existing Conditions/No Project/No Action Condition, Alternative B would generally be expected to provide:

- Similar juvenile rearing and emigration conditions (year-round) based on modeling results indicating: (1) similar long-term average and average by water year type Delta outflows from March through July; (2) similar probabilities of Delta outflows exceeding 50,000 cfs providing for strong year classes of sturgeon.

In conclusion, in consideration of potential impacts to sturgeon in the Delta, Alternative B would result in similar conditions for sturgeon, relative to the Existing Conditions/No Project/No Action Condition.

American Shad in the Delta Region

Relative to the Existing Conditions/No Project/No Action Condition, Alternative B would generally be expected to provide:

- Similar egg and larval conditions in the Delta based on modeling results indicating: (1) slight upstream movements in mean monthly X2 location during June of all water year types and equivalent X2 locations during April and May of most water year types; and (2) slightly lower (during April) and slightly higher (during May and June) exceedance probabilities of X2 location being located at or downstream of RKm 75 during April through June.

In conclusion, in consideration of potential impacts to American shad in the Delta, Alternative B would result in similar conditions for American shad, relative to the Existing Conditions/No Project/No Action Condition.

Striped Bass in the Delta Region

Relative to the Existing Conditions/No Project/No Action Condition, Alternative B would generally be expected to provide:

- Similar egg and larval conditions in the Delta based on modeling results indicating: slight upstream movements in mean monthly X2 location during June of all water year types and equivalent X2 locations during April and May of most water year types.

In conclusion, in consideration of potential impacts to striped bass in the Delta, Alternative B would result in similar conditions for striped bass, relative to the Existing Conditions/No Project/No Action Condition.

12C.4.2.13 Suisun, San Pablo, and San Francisco Bays

Fish species of primary management concern, including Chinook salmon, steelhead, river lamprey, Pacific lamprey, green sturgeon, white sturgeon, and splittail, utilize the bays as a migration corridor and/or for juvenile rearing. Potential increases in Delta outflow during the summer and fall and reductions

in Delta outflow during the spring would not result in substantial changes to migration or rearing habitat for these fish species in the bays. Striped bass and American shad also utilize the bays for migration and rearing, however, changes in X2 location were evaluated during the striped bass and American shad spawning and initial rearing period to evaluate potential changes in larval transport and rearing habitat in the Bay-Delta (see the Delta Region, above). Potential effects on delta smelt and longfin smelt migration and rearing in the Bay-Delta also were analyzed through evaluation of changes in X2 location (see the Delta Region, above).

12C.5 Impacts Associated with Alternative C Relative to the Existing Conditions/No Project/No Action Condition

12C.5.1 Extended Study Area – Alternative C Relative to the Existing Conditions/No Project/No Action Condition

12C.5.1.1 San Luis Reservoir

Reservoir storage model results (Appendix 6B Water Resources System Modeling) were examined for San Luis Reservoir during April through November for coldwater fish species; reductions in average monthly surface elevations greater than 6 feet (Appendix 12F Reservoir Water Surface Elevation Summary Tables) were examined during March through June for warmwater species.

Coldwater Fish Species

Relative to the Existing Conditions/No Project/No Action Condition, Alternative C would generally be expected to provide:

- Potentially more habitat for coldwater fish species, based on reservoir storage conditions, based on modeling results indicating: (1) similar long-term average monthly storage during most months of the evaluation period with slightly higher storage levels in November and slightly lower storage levels in July and August; and (2) higher average monthly storage during wetter water year types, particularly from September through November and lower monthly storage levels during dry and critical water year types during most months of the evaluation period.

However, it is unlikely that coldwater fish habitat is limiting in San Luis Reservoir; therefore, it is unlikely that changes in reservoir storage under Alternative C would have a population level effect on coldwater fish species in San Luis Reservoir, relative to the Existing Conditions/No Project/No Action Condition.

Warmwater Fish Species

Relative to the Existing Conditions/No Project/No Action Condition, Alternative C would be expected to provide:

- Similar or slightly less suitable warmwater fish spawning and early life stage conditions, based on modeling results indicating similar or slightly increased frequencies of monthly water surface elevation reductions of 6 feet or more during most months of the evaluation period.

It is unlikely that a small difference in the number of years with monthly water surface elevation reductions of greater than 6 feet under Alternative C would have a population level effect on bass and other warmwater fish in San Luis Reservoir, relative to the Existing Conditions/No Project/No Action Condition.

12C.5.2 Secondary Study Area – Alternative C Relative to the Existing Conditions/No Project/No Action Condition

12C.5.2.1 Trinity Lake

Reservoir storage model results (Appendix 6B Water Resources System Modeling) were examined for Trinity Lake during April through November for coldwater fish species; reductions in average monthly surface elevations greater than 6 feet (Appendix 12F Reservoir Water Surface Elevation Summary Tables) were examined during March through June for warmwater species.

Coldwater Fish Species

Relative to the Existing Conditions/No Project/No Action Condition, Alternative C would generally be expected to provide:

- Similar or improved habitat conditions for coldwater fish, based on modeling results indicating: (1) higher long-term average monthly storage during most of the evaluation period, and higher average monthly storage by water year type during most water years of the evaluation period.

However, it is unlikely that coldwater fish habitat is limiting in Trinity Lake; therefore, it is unlikely that changes in reservoir storage under Alternative C would have a population level effect on coldwater fish species in Trinity Lake, relative to the Existing Conditions/No Project/No Action Condition.

Warmwater Fish Species

Relative to the Existing Conditions/No Project/No Action Condition, Alternative C would generally be expected to provide:

- Similar warmwater fish spawning and early life stage conditions, based on slightly decreased frequencies of monthly water surface elevation reductions of 6 feet or more occurring more often during the March through June evaluation period.

It is unlikely that a small difference in the number of years with monthly water surface elevation reductions of greater than 6 feet under Alternative C would have a population level effect on bass and other warmwater fish in Trinity Lake, relative to the Existing Conditions/No Project/No Action Condition.

12C.5.2.2 Trinity River

Flow and water temperature model results were examined for the Trinity River below Lewiston Dam, at Douglas City, and at North Fork for all species (Appendix 6B Water Resources System Modeling, Appendix 7E River Temperature Modeling, and Appendix 12E Fisheries Impact Water Temperature Assessment Summary Tables). For most species and life stages, only modeled flows and water temperatures were available, and the analyses of habitat conditions for these species and life stages were based primarily on the water temperature results. Model results for early life stage mortality were also examined for fall-run Chinook salmon (Appendix 12H Early Life-Stage Salmon Mortality Modeling). In general, average monthly flows and water temperatures would differ only slightly be similar under Alternative A and the Existing Conditions/No Project/No Action Condition; and the potential for Project-related changes in aquatic habitat conditions and impacts on aquatic resources in the Trinity River are described below.

Coho Salmon

Relative to the Existing Conditions/No Project/No Action Condition, Alternative C would generally be expected to provide:

- Similar adult immigration and holding conditions based on modeling results indicating: (1) similar long-term average monthly flows during the evaluation period, and similar average monthly flows during most water year types; and (2) similar, or slightly lower (particularly during September October, and December) or slightly higher (during January) average monthly probabilities of exceeding specified water temperature index values.
- Similar adult spawning and embryo incubation conditions based on modeling results indicating: (1) similar or slightly lower long-term average monthly flows during the evaluation period, and similar average monthly flows during most water year types, except for April of above normal and below normal water years, when flows would be substantially lower during March, respectively; and (2) similar probabilities of exceeding specified water temperature index values, with slightly lower probabilities of exceedance from April, May, October and November, although slightly higher probabilities of exceedance would occur during January particularly at Lewiston Dam.
- Similar juvenile rearing and emigration conditions based on modeling results indicating: (1) similar long-term average monthly flows over the entire year, and similar average monthly flows during most water year types, except for above normal and below normal water years, when flows would be substantially lower during February; and (2) similar or lower probabilities of exceeding specified water temperature index values throughout most of the year, particularly during August through October, although slightly higher probabilities of exceedance occur during December, January, and June.
- Similar or slightly improved smolt emigration conditions based on modeling results indicating: (1) similar long-term average monthly flows during the evaluation period, and similar average monthly flows during most water year types, except for wet water years when flows would be slightly higher, and above normal and below normal water years, when flows would be substantially lower during March and February, respectively; and (2) similar or slightly lower probabilities of exceeding specified water temperature index values during the evaluation period.

In conclusion, in consideration of potential impacts to all life stages of Coho salmon in the Trinity River, Alternative C would result in similar conditions for coho salmon, relative to the Existing Conditions/No Project/No Action Condition.

Spring-Run Chinook Salmon

Relative to the Existing Conditions/No Project/No Action Condition, Alternative C would generally be expected to provide:

- Similar or improved adult immigration and holding conditions based on modeling results indicating: (1) similar long-term average monthly flows during the evaluation period, and equivalent average monthly flows during most water year types, except for wet water years when average monthly flows would be slightly higher more frequently; and (2) similar lower monthly probabilities of exceeding specified water temperature index values, particularly during July through October.
- Improved adult spawning and egg incubation conditions based on modeling results indicating: (1) equivalent or slightly higher long-term average monthly flows during the evaluation period, and

equivalent or slightly higher average monthly flows during all water year types; and (2) lower probabilities of exceeding specified water temperature index values, and therefore more suitable water temperatures, for most water temperature indices.

- Similar or improved juvenile rearing and emigration conditions based on modeling results indicating: (1) similar long-term average monthly flows over the entire year, and similar monthly flows during most water year types, except for above normal and below normal water years, when flows would be substantially lower during March and February, respectively; and (2) similar or lower probabilities of exceeding specified water temperature index values, particularly during June through October.
- Similar or improved smolt emigration conditions based on modeling results indicating: (1) similar long-term average monthly flows during the evaluation period, and similar average monthly flows during most water year types, except for wet water years when flows would be slightly higher, and above normal and below normal water years, when flows would be substantially lower during February, respectively; and (2) similar or lower probabilities of exceeding specified water temperature index values, particularly during June and July.

In conclusion, in consideration of potential impacts to all life stages of spring-run Chinook salmon in the Trinity River, Alternative C would result in similar or improved conditions for spring-run Chinook salmon, relative to the Existing Conditions/No Project/No Action Condition.

Fall-Run Chinook Salmon

Relative to the Existing Conditions/No Project/No Action Condition, Alternative C would generally be expected to provide:

- Similar or slightly improved adult immigration and holding conditions based on modeling results indicating: (1) similar long-term average monthly flows during the evaluation period, and equivalent or slightly higher average monthly flows during most water year types, except during wet water years when average monthly flows would be lower in August and September; and (2) similar or lower (particularly during August and September), and therefore more suitable, average monthly probabilities of exceeding specified water temperature index values.
- Similar adult spawning conditions based on modeling results indicating: (1) similar long-term average monthly flows during the evaluation period, and similar average monthly flows during most water year types, except for above normal and below normal water years, when flows would be substantially lower during March and February, respectively; and (2) similar probabilities of exceeding specified water temperature index values, with lower probabilities, and therefore more suitable water temperatures, during September and October.
- Similar embryo incubation conditions based on modeling results indicating: (1) similar total annual early life stage mortality in critical water years; and (2) equivalent probabilities of exceeding specified water temperature index values throughout most of the year, with lower probabilities of exceedance during October.
- Similar juvenile rearing and emigration conditions based on modeling results indicating: (1) similar or slightly lower long-term average monthly flows during the evaluation period, and similar average monthly flows during most water year types, except for above normal and below normal water years, when flows would be substantially lower during March and February, respectively; and (2) similar or

slightly lower probabilities of exceeding specified water temperature index values during the evaluation period, particularly during June through September.

- Similar smolt emigration conditions due to modeling results indicating: (1) similar long-term average monthly flows during the evaluation period, and similar average monthly flows during most water year types, except for above normal and below normal water years, when flows would be substantially lower during March and February, respectively; and (2) similar or slightly lower probabilities of exceeding specified water temperature index values, particularly during June and July.

In conclusion, in consideration of potential impacts to all life stages of fall-run Chinook salmon in the Trinity River, Alternative C would result in similar conditions for fall-run Chinook salmon, relative to the Existing Conditions/No Project/No Action Condition.

Steelhead (Winter-run and Summer-run)

Relative to the Existing Conditions/No Project/No Action Condition, Alternative C would generally be expected to provide:

- Similar or improved adult immigration and holding conditions for winter-run steelhead based on modeling results indicating: (1) similar long-term average monthly flows during the evaluation period, and similar average monthly flows during most water year types, except for above normal and below normal water years, when flows would be substantially lower during March and February, respectively; and (2) similar, or lower (particularly during April, and August through October) average monthly probabilities of exceeding specified water temperature index values, although slightly higher probabilities of exceedance would occur during March.

- Similar or slightly improved adult immigration and holding conditions for summer-run steelhead based on modeling results indicating: (1) Similar or slightly lower long-term average monthly flows during the evaluation period, and equivalent average monthly flows during all water year types; and (2) similar probabilities of exceeding specified water temperature index values during the evaluation period, with lower probabilities of exceedance during, July.

- Similar adult spawning and egg incubation conditions based on modeling results indicating: (1) similar long-term average monthly flows during the evaluation period, and similar average monthly flows during most water year types, except for above normal and below normal water years, when flows would be substantially lower during March and February, respectively; and (2) similar probabilities of exceeding specified water temperature index values throughout the evaluation period, with slightly higher probabilities of exceedance during March and June, although slightly lower probabilities would occur during April and May.

- Similar juvenile rearing and emigration conditions based on modeling results indicating: (1) similar long-term average monthly flows over the entire year, and similar monthly flows during most water year types, except for above normal and below normal water years, when flows would be substantially lower during March and February, respectively; and (2) equivalent probabilities of exceeding specified water temperature index values throughout most of the year, with slightly lower probabilities of exceedance from July through September.

- Similar smolt emigration conditions based on modeling results indicating: (1) similar long-term average monthly flows during the evaluation period, and similar average monthly flows, except for

during above normal and below normal water years, when flows would be substantially lower during March and April, respectively; and (2) similar probabilities of exceeding specified water temperature index values from the evaluation period.

In conclusion, in consideration of potential impacts to all life stages of steelhead (winter-run and summer-run) in the Trinity River, Alternative C would result in similar conditions for steelhead, relative to the Existing Conditions/No Project/No Action Condition.

Green Sturgeon

Relative to the Existing Conditions/No Project/No Action Condition, Alternative C would generally be expected to provide:

- Similar adult immigration and holding conditions based on modeling results indicating: (1) equivalent or slightly lower long-term average monthly flows during the evaluation period, and equivalent or slightly higher average monthly flows during most water year types, except for wet water years when average monthly flows would be lower in some months, and particularly during above normal and below normal water years, when flows would be substantially lower during March and February, respectively; and (2) similar and slightly lower average monthly probabilities of exceeding specified water temperature index values.
- Similar or improved adult spawning conditions based on modeling results indicating: (1) similar or slightly lower long-term average monthly flows during the evaluation period, and equivalent average monthly flows during all water year types; and (2) equivalent or slightly lower probabilities of exceeding specified water temperature index values, particularly during July and August.
- Similar juvenile rearing and emigration conditions based on modeling results indicating: (1) similar long-term average monthly flows over the entire year, and similar average monthly flows during most water year types, except for above normal and below normal water years, when flows would be substantially lower during March and February, respectively; and (2) similar probabilities of exceeding specified water temperature index values during the year.

In conclusion, in consideration of potential impacts to all life stages of green sturgeon in the Trinity River, Alternative C would result in similar conditions for green sturgeon, relative to the Existing Conditions/No Project/No Action Condition.

White Sturgeon

Relative to the Existing Conditions/No Project/No Action Condition, Alternative C would generally be expected to provide:

- Similar adult immigration and holding conditions based on modeling results indicating: (1) similar slightly lower long-term average monthly flows during the evaluation period, and similar average monthly flows during most water year types, except for above normal and below normal water years, when flows would be substantially lower during March and February, respectively; and (2) equivalent average monthly probabilities of exceeding specified water temperature index values.
- Similar adult spawning conditions based on modeling results indicating: (1) similar or slightly lower long-term average monthly flows during the evaluation period, and similar average monthly flows during most water year types, except for wet water years when flows would be slightly higher, and above normal and below normal water years, when flows would be substantially lower during March

and February, respectively; and (2) equivalent average monthly probabilities of exceeding specified water temperature index values.

- Similar rearing and emigration conditions based on modeling results indicating: (1) similar or slightly lower long-term average monthly flows over the entire year, and similar average monthly flows during most water year types, except for above normal and below normal water years, when flows would be substantially lower during March and February, respectively; and (2) similar probabilities of exceeding specified water temperature index values during the year.

In conclusion, in consideration of potential impacts to all life stages of white sturgeon in the Trinity River, Alternative C would result in similar conditions for white sturgeon, relative to the Existing Conditions/No Project/No Action Condition.

Pacific Lamprey

Relative to the Existing Conditions/No Project/No Action Condition, Alternative C would generally be expected to provide:

- Similar or less suitable adult immigration conditions based on modeling results indicating similar or slightly lower long-term average monthly flows during the evaluation period, and similar average monthly flows during most water year types, except for above normal and below normal water years, when flows would be substantially lower during March and February, respectively.
- Similar adult spawning and egg incubation conditions based on modeling results indicating: (1) similar or slightly lower long-term average monthly flows during the evaluation period, and similar average monthly flows during most water year types, except for above normal and below normal water years, when flows would be substantially lower during March and February, respectively; and (2) generally lower probabilities of remaining within the specified water temperature range at Lewiston Dam and generally higher probabilities of temperatures within the specified water temperature range at Douglas City and the North Fork confluence, except in April and May.
- Similar juvenile rearing and emigration conditions based on modeling results indicating: (1) similar or slightly lower long-term average monthly flows over the entire year, and similar average monthly flows during most water year types, except for during above normal and below normal water years, when flows would be substantially lower during March and February, respectively; and (2) equivalent average monthly probabilities of exceeding specified water temperature index values.

In conclusion, in consideration of potential impacts to all life stages of Pacific lamprey in the Trinity River, Alternative C would result in similar conditions for Pacific lamprey, relative to the Existing Conditions/No Project/No Action Condition.

12C.5.2.3 Klamath River downstream of the Trinity River

Potential impacts to fisheries and aquatic resources in the Klamath River downstream of the Trinity River under Alternative C relative to the Existing Conditions/No Project/No Action Condition would be similar to those discussed under Alternative A relative to the Existing Conditions/No Project/No Action Condition, above.

12C.5.2.4 Shasta Lake

Reservoir storage model results (Appendix 6B Water Resources System Modeling) were examined for Shasta Lake during April through November for coldwater fish species; reductions in average monthly surface elevations greater than 6 feet (Appendix 12F Reservoir Water Surface Elevation Summary Tables) were examined during March through June for warmwater species.

Coldwater Fish Species

Relative to the Existing Conditions/No Project/No Action Condition, Alternative C would generally be expected to provide:

- Similar or larger amounts of habitat for coldwater fish species, based on coldwater pool storage conditions, based on modeling results indicating: (1) slightly higher long-term average monthly storage and (2) slightly higher average monthly storage by water year type during all months of the evaluation period, particularly in dry and critical water years when storage would be substantially higher.

However, it is unlikely that coldwater fish habitat is limiting in Shasta Lake; therefore, it is unlikely that changes in reservoir storage under Alternative C would have a population level effect on coldwater fish species in Shasta Lake, relative to the Existing Conditions/No Project/No Action Condition.

Warmwater Fish Species

Relative to the Existing Conditions/No Project/No Action Condition, Alternative C would generally be expected to provide:

- Improved warmwater fish spawning and early life stage conditions, based on modeling results indicating decreased frequencies of monthly water surface elevation reductions of 6 feet or more occurring more often during the March through June evaluation period.

It is unlikely that a small difference in the number of years with monthly water surface elevation reductions of greater than 6 feet under Alternative C would have a population level effect on bass and other warmwater fish in Shasta Lake, relative to the Existing Conditions/No Project/No Action Condition.

12C.5.2.5 Sacramento River

Flow and water temperature model results were examined for the Sacramento River below Keswick Reservoir and at several points downstream, including the proposed Delevan Pipeline Intake/Discharge Facilities for all species (Appendix 6B Water Resources System Modeling, Appendix 7E River Temperature Modeling, and Appendix 12E Fisheries Water Temperature Assessment Summary Tables). The flow and water temperature results were used in combination with a number of other model outputs and indicators to assess potential changes in aquatic habitats for each species and life stage present, as detailed in Appendix 12B Fisheries Impact Assessment Methodology. For several species and life stages, only modeled flows and water temperatures were available, and the analyses of habitat conditions for these species and life stages were based primarily on the water temperature results. The potential for Project-related changes in aquatic habitat conditions and impacts on aquatic resources in the Sacramento River are described below.

Winter-run Chinook Salmon

Relative to the Existing Conditions/No Project/No Action Condition, Alternative C would generally be expected to provide:

- Similar adult immigration and holding conditions, based on modeling results indicating: (1) generally higher long-term average monthly flows during the early part of the evaluation period (December through February) and similar or lower average monthly flows during the later months (March through July) at Keswick Dam, particularly in drier water years; (2) similar or lower long-term average monthly flows during most months below RBDD, particularly in drier water year types; (3) similar long-term average monthly flows during most months, with potential flow reductions in drier water year types at Verona, Freeport, and Rio Vista, although flows may be increased in June and July; and (4) equivalent monthly probabilities of exceeding specified water temperature index values, but with higher probabilities of exceeding specified water temperature index values during April, and slightly lower probabilities of exceeding specified water temperatures during June and July.
- Improved spawning conditions based on modeling results indicating: (1) similar average monthly spawning habitat availability (WUA) during all months of the spawning period; and (2) lower probabilities of exceeding specified water temperature index values, and therefore more suitable water temperatures, particularly during months with relatively warm water temperature conditions (i.e., May through August).
- Improved embryo incubation conditions based on modeling results indicating: (1) similar or slightly reduced mean total annual early life stage mortality, particularly in critical water year types when mortality would be substantially less; and (2) lower probabilities of exceeding specified water temperature index values, and therefore more suitable water temperatures, particularly during months with relatively warm water temperature conditions (i.e., July and August).
- Improved juvenile rearing and outmigration conditions based on modeling results indicating: (1) generally similar or lower long-term average monthly flows during most of the evaluation period, except from October through February when flows would be higher below Keswick Reservoir, particularly in drier water years; (2) generally higher long-term average flows would occur from June through November and similar or lower average flows from December through April in the lower Sacramento River (Verona, Freeport, and Rio Vista), particularly in drier water years; (3) generally similar fry and juvenile rearing habitat availability (WUA) in the upper Sacramento River; (4) a similar frequency and duration of floodplain inundation in the Sutter and Yolo bypasses; and (5) equivalent or lower, and therefore more suitable, monthly probabilities of exceeding specified water temperature index values during July through September, and equivalent or higher probabilities of exceeding specified water temperature index values during March and April.
- Similar or improved production potential (SALMOD) based on modeling results indicating: long-term average total annual winter-run Chinook salmon production would increase by 2 percent, while average total annual production would increase during wet water years by less than 1 percent, during above normal water years by 8 percent, during below normal water years by 1 percent, during dry water years by 2 percent and during critical water years by 3 percent.
- Improved conditions pertaining to early life stage survival and abundance of spawners based on (IOS)of modeling results indicating: (1) over the 81-year evaluation period, long-term average annual egg to fry survival would increase by 4 percent, and average annual egg to fry survival by water year

type would decrease during wet and above normal water years by 1 percent, and would increase during below normal water years by 2 percent, dry water years by 7 percent, and during critical water years by 33 percent; (2) long-term average annual fry to smolt survival would increase by 2 percent, and average annual fry to smolt survival by water year type would increase during wet water years by 2 percent and during critical water years by 13 percent, would decrease during below normal and dry water years by 1 percent, and would be equivalent during above normal water years; (3) long-term average annual female spawner abundance would increase by 8 percent, and average annual female spawner abundance by water year type would increase during wet water years by 10 percent, during above normal water years by 16 percent, during below normal water years by 2 percent, during dry water years by 6 percent and during critical water years by 9 percent.

In conclusion, in consideration of potential impacts to all life stages of winter-run Chinook salmon in the Sacramento River, Alternative C would result in more suitable conditions for winter-run Chinook salmon and less-than-significant impacts, relative to the Existing Conditions/No Project/No Action Condition.

Spring-run Chinook Salmon

Relative to the Existing Conditions/No Project/No Action Condition, Alternative C would generally be expected to provide:

- Similar adult immigration and holding conditions, based on modeling results indicating: (1) similar or lower long-term average monthly and average monthly flows by water year type during most of the evaluation period in the upper Sacramento River except in February when flows may be higher below Keswick Reservoir; (2) generally higher long-term average monthly and average monthly flows by water year type from June through September in the lower Sacramento River, particularly in drier water years, with similar or reduced flows from February through May; and (3) equivalent or lower (particularly during July through September) and equivalent or higher (particularly during April) monthly probabilities of exceeding specified water temperature index values.
- Improved spawning conditions based on modeling results indicating: (1) generally similar or higher long-term average monthly flows and average monthly flows by water year type in the upper Sacramento River above RBDD from October to February with similar or reduced flows in September, March, and April; and (2) similar or lower probabilities of exceeding specified water temperature index values, and therefore more suitable water temperatures, particularly during the primary spawning months (i.e., September and October).
- Improved embryo incubation conditions based on modeling results indicating: (1) slightly reduced total annual early life stage mortality, except during dry and critical water years when mortality would be substantially decreased; and (2) similar or lower probabilities of exceeding specified water temperature index values, particularly in September and October.
- Similar or improved juvenile rearing conditions based on modeling results indicating: (1) similar or higher long-term average monthly flows and average monthly flows by water year type from October through February, with similar or reduced flows from March through September below Keswick Reservoir; (2) generally similar flows below RBDD from June through December, with similar or reduced flows during the rest of the year, particularly in drier water year types; (3) a similar frequency and duration of floodplain inundation in the Sutter and Yolo bypasses; and (4) similar or lower, and therefore more suitable, monthly probabilities of exceeding specified water temperature

index values, particularly during the months with the warmest water temperatures (August and September).

- Similar smolt emigration conditions based on modeling results indicating: (1) similar or reduced long-term average monthly flows and average monthly flows by water year type, particularly from January through May below RBDD; (2) similar or reduced long-term average monthly flows and average monthly flows by water year type, particularly from January through May and similar or increased flows during October, November, and June in the lower Sacramento River; and (3) higher monthly probabilities of exceeding specified water temperature index values during April and May, and lower monthly probabilities of exceeding specified water temperature index values during October.
- Similar or improved production potential based on (SALMOD) modeling results indicating: long-term average annual spring-run Chinook salmon production would increase by 4 percent, while average total annual production would increase during wet water years by 3 percent, during above normal water years by 1 percent, during dry water years by 9 percent, and during critical water years by 8 percent, and decreases during below normal water years by less than 1 percent.

In conclusion, in consideration of potential impacts to all life stages of spring-run Chinook salmon in the Sacramento River, Alternative C would result in more suitable conditions for spring-run and less-than-significant impacts, relative to the Existing Conditions/No Project/No Action Condition.

Fall-run Chinook Salmon

Relative to the Existing Conditions/No Project/No Action Condition, Alternative C would generally be expected to provide:

- Similar or improved adult immigration and holding conditions, based on modeling results indicating: (1) similar or lower long-term average monthly and average monthly flows by water year type from June through September and similar or increased flows from October through December in the upper Sacramento River; 2) generally increased long-term average monthly flows and flows by water year type from July through November in the lower Sacramento River; and (3) equivalent or lower, and therefore more suitable, monthly probabilities of exceeding specified water temperature index values.
- Similar spawning conditions based on modeling results indicating (1) similar spawning habitat availability (WUA) in the upper Sacramento River from November through January with higher availability in October; and (2) similar probabilities of exceeding specified water temperature index values, with more suitable water temperatures during October.
- Similar or more suitable embryo incubation conditions based on modeling results that indicate: (1) similar annual early life stage mortality; and (2) similar or slightly lower probabilities of exceeding specified water temperature index values, with more suitable water temperatures during May and less suitable water temperatures during October.
- Similar or slightly less suitable juvenile rearing and outmigration conditions based on modeling results indicating: (1) similar or reduced long-term average monthly flows and average monthly flows by water year type from during most of the evaluation period at all locations evaluated, except in December when flows may be higher; (2) decreased fry rearing habitat availability (WUA) during much of the evaluation period, but increased juvenile rearing habitat availability from March through June in the upper Sacramento River; (3) a similar frequency and duration of floodplain inundation in

the Sutter and Yolo bypasses; and (4) similar monthly probabilities of exceeding specified water temperature index values, but with less suitable water temperatures during April and May more often and more suitable water temperatures during June.

- Similar or improved production potential based on (SALMOD) modeling results indicating: (1) long-term average annual fall-run Chinook salmon production would increase by 2 percent, while average total annual production would decrease during wet water years by 8 percent and during below normal water years by less than 1 percent, and would increase during above normal water years by 6 percent, during dry water years by 3 percent, and during critical water years by 12 percent.

In conclusion, in consideration of potential impacts to all life stages of fall-run Chinook salmon in the Sacramento River, Alternative C would result in similar or improved conditions, relative to the Existing Conditions/No Project/No Action Condition.

Late Fall-run Chinook Salmon

Relative to the Existing Conditions/No Project/No Action Condition, Alternative C would generally be expected to provide:

- Similar adult immigration and holding conditions, based on modeling results indicating: (1) similar or higher long-term average monthly flows and average monthly flows by water year type from October through February below Keswick Reservoir, particularly during wetter water year types and similar or reduced flows during March and April, particularly in drier water year; (2) similar or higher long-term average monthly flows and average monthly flows by water year type from October through December below RBDD, with similar or reduced flows from January through April below RBDD; (3) similar or higher long-term average monthly flows and average monthly flows by water year type during October and November, with similar or reduced flows from December through April in the lower Sacramento River; and (4) similar monthly probabilities of exceeding specified water temperature index values, but with more suitable water temperatures during October and less suitable water temperatures during April.
- Similar spawning conditions based on modeling results indicating: (1) similar or lower spawning habitat availability (WUA) in January and February with similar or slightly higher spawning habitat availability in March and April; and (2) similar probabilities of exceeding specified water temperature index values, with more suitable water temperatures during May.
- Similar embryo incubation conditions based on modeling results indicating: (1) similar annual early life stage mortality but with higher annual mortality; and (2) similar probabilities of exceeding specified water temperature index values, with more suitable water temperatures during May and less suitable water temperatures during April.
- Similar or improved juvenile rearing and outmigration conditions based on modeling results indicating: (1) similar or lower long-term average monthly flows and average monthly flows by water year type from April through September and similar or increased average monthly flows from October through December below RBDD; (2), generally higher long-term average monthly flows and average monthly flows by water year type in the lower Sacramento River; (3) similar or reduced fry rearing habitat availability (WUA) and similar juvenile rearing habitat availability (WUA) in the upper Sacramento River; (4) a similar frequency and duration of floodplain inundation in the Sutter and Yolo bypasses; and (5) similar or lower monthly probabilities of exceeding specified water

temperature index values at RBDD and downstream locations from June through October, and higher probabilities of exceeding specified water temperature index values more often in April and May.

- Similar or improved production potential based on (SALMOD) modeling results indicating long-term average annual late fall-run Chinook salmon production would increase by 2 percent, while average total annual production by water year type would decrease during wet water years by less than 1 percent, and would increase during above normal water years by 1 percent, during below normal water years by 2 percent, during dry water years by 1 percent, and during critical water years by 9 percent.

In conclusion, in consideration of potential impacts to all life stages of late fall-run Chinook salmon in the Sacramento River, Alternative C would result in similar conditions for late fall-run Chinook salmon, relative to the Existing Conditions/No Project/No Action Condition.

Steelhead

Relative to the Existing Conditions/No Project/No Action Condition, Alternative C would generally be expected to provide:

- Similar or improved adult immigration and holding conditions, based on modeling results indicating: (1) similar or increased long-term average monthly flows during much of the evaluation period below Keswick Reservoir, except during August, September, and March when average monthly flows could be lower; (2) similar or lower average monthly flows during the evaluation period at RBDD, particularly in drier water year types; (3) similar or increased long-term average monthly flows and average monthly flows by water year type in the lower Sacramento River, except from December through March when average monthly flows would be lower, particularly in drier water year types; and (4) similar or lower monthly probabilities of exceeding specified water temperature index values more often during September and October, and higher monthly probabilities of exceeding specified water temperature index values during November and March.

- Similar spawning conditions based on modeling results indicating: (1) similar spawning habitat availability (WUA) from December through April; (3) similar monthly probabilities of exceeding specified water temperature index values; and (4) SacEFT results indicating that spawning habitat availability conditions would be similar.

- Similar embryo incubation conditions based on modeling results indicating: (1) similar probabilities of exceeding specified water temperature index values; (2) SacEFT results indicating that egg mortality associated with modeled water temperatures would be equivalent; (3) SacEFT results indicating that redd dewatering may occur slightly less often; and (4) SacEFT results indicating that redd scouring conditions would be equivalent.

- Similar juvenile rearing and emigration conditions based on modeling results indicating: (1) similar or increased long-term average monthly flows from October through February and similar or lower monthly flows from March through September below Keswick Dam and at Bend Bridge; (2) similar or lower average monthly flows from January through September at RBDD, particularly in drier water year types, and similar or higher monthly flows from October through December; (3) a similar frequency and duration of floodplain inundation in the Sutter and Yolo bypasses; (4) lower monthly probabilities of exceeding specified water temperature index values, and therefore more suitable water temperature conditions in August and September; and (5) SacEFT results indicate that juvenile

rearing habitat availability may be increased slightly while juvenile stranding potential also may be increased.

- Similar smolt emigration conditions based on modeling results indicating: (1) similar or lower average monthly flows from January through May at RBDD, particularly in drier water year types, and similar or higher monthly flows from October through December; (2) generally higher long-term average monthly flows and average monthly flows by water year type in the lower Sacramento River during October and November, with similar or lower monthly flows from December through March, particularly in drier water year types; and (3) higher monthly probabilities of exceeding specified water temperature index values during March and April, and lower monthly probabilities of exceeding specified water temperature index values during October.

In conclusion, in consideration of potential impacts to all life stages of steelhead in the Sacramento River, Alternative C would result in similar conditions for steelhead, relative to the Existing Conditions/No Project/No Action Condition.

Green Sturgeon

Relative to the Existing Conditions/No Project/No Action Condition, Alternative C would generally be expected to provide:

- Similar or improved adult immigration and holding conditions, based on modeling results indicating: (1) generally similar or lower long-term average monthly flows during much of the evaluation period, except during February when flows may be increased below Keswick Reservoir; (2) generally similar or lower long-term average monthly and average monthly flows by water year type from February through May, and similar or higher monthly flows in June and July, below the proposed Delevan Pipeline Intake Facilities and at Rio Vista; and (3) lower monthly probabilities of exceeding specified water temperature index values during June, September and October, and equivalent or higher probabilities of exceeding specified water temperature index values during April and May.
- Similar spawning conditions based on modeling results indicating: (1) similar or lower long-term average monthly and average monthly flows by water year type below Keswick Dam and RBDD; (2) similar or lower long-term average monthly and average monthly flows by water year type from March through May and similar or higher flows from June through September at Wilkins Slough; and (3) equivalent monthly probabilities of exceeding the specified water temperature index value; and (4) SacEFT results that indicate reduced water temperatures more often near Hamilton City and potentially increased survival.
- Similar or improved juvenile rearing and outmigration conditions based on modeling results indicating: (1) similar or increased long-term average monthly flows from October through February, and similar or lower monthly flows from March through September below Keswick Dam and at Bend Bridge; (2) similar or lower average monthly flows from January through September at RBDD, particularly in drier water year types, and similar or higher monthly flows from October through December; and (3) equivalent or lower, and therefore more suitable, monthly probabilities of exceeding specified water temperature index values at all locations evaluated from June through September and higher probabilities of exceedance in May at Freeport.

In conclusion, in consideration of potential impacts to all life stages of green sturgeon in the Sacramento River, Alternative C would result in similar or improved conditions for green sturgeon, relative to the Existing Conditions/No Project/No Action Condition.

White Sturgeon

Relative to the Existing Conditions/No Project/No Action Condition, Alternative C would generally be expected to provide:

- Similar adult immigration and holding conditions, based on modeling results indicating: (1) similar or reduced long-term average monthly and average monthly flows by water year type during most of the evaluation period, except during November when flows may be increased below the proposed Delevan Pipeline Intake Facilities and at Rio Vista; and (2) equivalent monthly probabilities of exceeding specified water temperature index values.
- Similar spawning and egg incubation conditions, based on modeling results indicating: (1) generally lower long-term average and average by water year type monthly flows from February through May; and (2) similar probabilities of exceeding specified water temperature index values.
- Similar or more suitable juvenile rearing and outmigration conditions based on modeling results indicating: (1) similar or higher average monthly flows and average monthly flows by water year type during June through November, and lower average monthly flows during December through May below the proposed Delevan Pipeline Intake Facilities and at Wilkens Slough and Freeport; and (2) equivalent or lower monthly probabilities of exceeding specified water temperature index values, and therefore more suitable water temperature conditions, particularly during June through September.

In conclusion, in consideration of potential impacts to all life stages of white sturgeon in the Sacramento River, Alternative C would result in similar conditions for white sturgeon, relative to the Existing Conditions/No Project/No Action Condition.

River Lamprey

Relative to the Existing Conditions/No Project/No Action Condition, Alternative C would generally be expected to provide:

- Similar adult immigration conditions, based on modeling results indicating: (1) similar or lower long-term average monthly flows and average monthly flows by water year type in September and March through June below Keswick Dam with similar or higher flows from October through February; and (2) generally higher long-term average monthly and average monthly flows by water year type below the proposed Delevan Pipeline Intake Facilities and at Freeport, except from January through May when flows may be lower.
- Similar spawning and egg incubation conditions, based on modeling results indicating: (1) similar or lower long-term average and average by water year type monthly flows below Keswick Dam and below RBDD, although flows may be higher in February below Keswick Dam; (2) similar or lower long-term average and average by water year type monthly flows from February through May with similar or higher average monthly flows in June and July below the proposed Delevan Pipeline Intake Facilities; and (3) generally higher probabilities of water temperatures occurring within specified water temperature ranges, and therefore more suitable water temperatures, except below the proposed

Delevan Pipeline Intake Facilities, where the probability of suitable water temperatures would be lower.

- Similar or improved ammocoete rearing and emigration conditions based on modeling results indicating: (1) similar or increased long-term average monthly flows from October through February and similar or lower monthly flows from March through September below Keswick Dam; (2) similar or lower average monthly flows from December through May, and similar or increased flows from June through November at RBDD, particularly in drier water year types, and similar or higher monthly flows from October through December below the proposed Delevan Pipeline Intake Facilities and at Rio Vista; and (3) similar monthly probabilities of exceeding specified water temperature index values, except in July and August when monthly probabilities would be lower and therefore more suitable water temperatures, at Freeport.

In conclusion, in consideration of potential impacts to all life stages of river lamprey in the Sacramento River, Alternative C would result in similar conditions for river lamprey, relative to the Existing Conditions/No Project/No Action Condition.

Pacific Lamprey

Relative to the Existing Conditions/No Project/No Action Condition, Alternative C would generally be expected to provide:

- Similar adult immigration conditions, based on modeling results indicating: (1) similar or lower long-term average monthly and average monthly flows by water year type below Keswick Dam except in January and February when flows may be higher; and (2) generally lower or similar long-term average monthly and average monthly flows by water year type below the proposed Delevan Pipeline Intake and at Freeport.
- Similar spawning and egg incubation conditions, based on modeling results indicating: (1) similar or lower long-term average and average by water year type monthly flows below Keswick Dam and below RBDD, although flows may be higher in January and February below Keswick Reservoir; (2) similar or lower long-term average and average by water year type monthly flows from January through May with similar or higher average monthly flows from June through August below the proposed Delevan Pipeline Intake Facilities; and (3) similar or higher probabilities of water temperatures occurring within the specified water temperature range during most months, and therefore more suitable water temperatures.
- Similar or improved ammocoete rearing and emigration conditions based on modeling results indicating: (1) similar or increased long-term average monthly flows from October through February and similar or lower monthly flows from March through September below Keswick Dam; (2) similar or lower average monthly flows from December through May and similar or increased flows from June through November at RBDD, particularly in drier water year types, and similar or higher monthly flows from October through December below the proposed Delevan Pipeline Intake Facilities and at Rio Vista; and (3) similar monthly probabilities of exceeding specified water temperature index values, except in July and August when monthly probabilities would be lower and therefore more suitable water temperatures would occur at Freeport.

In conclusion, in consideration of potential impacts to all life stages of Pacific lamprey in the Sacramento River, Alternative C would result in similar conditions for Pacific lamprey, relative to the Existing Conditions/No Project/No Action Condition.

Hardhead

Relative to the Existing Conditions/No Project/No Action Condition, Alternative C would generally be expected to provide:

- Similar adult and other life stage conditions, based on modeling results indicating: (1) similar or increased long-term average monthly flows from October through February, and similar or lower monthly flows from March through September below Keswick Dam; (2) similar or higher average monthly flows and average monthly flows by water year type from June through November, and similar or lower average monthly flows from December through May below the proposed Delevan Pipeline Intake Facilities and at Freeport; and (3) similar or lower probabilities of water temperatures occurring within the specified range, particularly from June through September, and therefore, potentially less suitable water temperatures.
- Similar spawning conditions, based on modeling results indicating: (1)generally similar or lower long-term average monthly flows and average monthly flows by water year type below Keswick Reservoir, below the proposed Delevan Intake, and at Freeport during the evaluation period, except in June when flows may be increased below the proposed Delevan Intake, and at Freeport; and (2) similar probabilities of water temperatures occurring within the specified water temperature range during April through June below the proposed Below Keswick and at Freeport, and slightly lower probabilities of water temperatures occurring within the specified range during April below the Delevan Intake.

In conclusion, in consideration of potential impacts to all life stages of hardhead in the Sacramento River, Alternative C would result in similar conditions for hardhead, relative to the Existing Conditions/No Project/No Action Condition.

Sacramento Splittail

Relative to the Existing Conditions/No Project/No Action Condition, Alternative C would generally be expected to provide:

- Similar spawning and egg/larval life stage conditions, based on modeling results indicating: (1) a similar frequency that water temperatures are within the range specified for splittail in the Sacramento River (that is, 45 through 75°F); and (2) a similar frequency and duration of floodplain inundation in the Sutter and Yolo bypasses.

In conclusion, in consideration of potential impacts to all life stages of splittail in the Sacramento River, Alternative C would result in similar conditions for splittail, relative to the Existing Conditions/No Project/No Action Condition.

American Shad

Relative to the Existing Conditions/No Project/No Action Condition, Alternative C would generally be expected to provide:

- Similar adult spawning and other life stage conditions, based on modeling results indicating: (1) generally similar or lower long-term average monthly flows and average monthly flows by water year type below RBDD, and at Verona and Freeport during the evaluation period, except in June when flows may be increased at Verona and Freeport; and (2) similar but slightly higher probabilities of water temperatures occurring within the specified water temperature range below the Feather River Confluence and at Freeport, and slightly lower probabilities of water temperatures occurring within the specified range below RBDD.
- Similar or improved larvae, fry, and juvenile emigration conditions, based on modeling results indicating: (1) higher long-term average and average by water year type monthly flows below the proposed Delevan Pipeline Intake Facilities and at Verona and Freeport; and (2) generally similar or higher probabilities of water temperatures occurring within the specified water temperature range, except from June through August at the Delevan Intake when the probability would be lower.

In conclusion, in consideration of potential impacts to all life stages of American shad in the Sacramento River, Alternative C would result in similar or improved conditions for American shad, relative to the Existing Conditions/No Project/No Action Condition.

Striped Bass

Relative to the Existing Conditions/No Project/No Action Condition, Alternative C would generally be expected to provide:

- Similar or improved adult spawning and other life stage conditions, based on modeling results indicating: (1) generally lower long-term average monthly and average monthly flows by water year type, except in June when average monthly flows may be higher at all locations; and (2) higher probabilities of water temperatures occurring within the specified water temperature range at the Delevan Intake.
- Similar or improved larvae, fry, and juvenile emigration conditions, based on modeling results indicating: (1) similar or higher average monthly flows and average monthly flows by water year type from June through November, and similar or lower average monthly flows from December through May below the proposed Delevan Pipeline Intake Facilities and at Verona; and (2) generally higher probabilities of water temperatures occurring within the specified water temperature range, except in October when probabilities may be lower.

In conclusion, in consideration of potential impacts to all life stages of striped bass in the Sacramento River, Alternative C would result in similar or improved conditions for striped Bass, relative to the Existing Conditions/No Project/No Action Condition.

Largemouth Bass

Relative to the Existing Conditions/No Project/No Action Condition, Alternative C would generally be expected to provide:

- Similar or improved adult and other life stage conditions, based on modeling results indicating: (1) similar or increased long-term average monthly flows from October through February and similar or lower monthly flows from March through September below Keswick Dam; and (2) similar or higher average monthly flows and average monthly flows by water year type from June through

November, and similar or lower average monthly flows from December through May below the proposed Delevan Pipeline Intake Facilities and at Freeport.

- Similar spawning conditions, based on modeling results indicating similar monthly probabilities of water temperatures occurring within the specified water temperature range below Keswick Dam and at Freeport, with higher probabilities of occurring within the range, and therefore more suitable temperatures, below the proposed Delevan Pipeline Intake Facilities during April.

In conclusion, in consideration of potential impacts to all life stages of largemouth bass in the Sacramento River, Alternative C would result in similar conditions for largemouth bass, relative to the Existing Conditions/No Project/No Action Condition.

12C.5.2.6 Clear Creek

Although flows in Clear Creek downstream of Whiskeytown Lake would be increased during July under Alternative C, relative to the Existing Conditions/No Project/No Action Condition, potential impacts to fisheries and aquatic resources in Clear Creek under Alternative C would be similar to those discussed under Alternative A relative to the Existing Conditions/No Project/No Action Condition, above.

12C.5.2.7 Lake Oroville

Reservoir storage model results (Appendix 6B Water Resources System Modeling) were examined for Lake Oroville during April through November for coldwater fish species; reductions in average monthly surface elevations greater than 6 feet (Appendix 12F Reservoir Water Surface Elevation Summary Tables) were examined during March through June for warmwater species.

Coldwater Fish Species

Relative to the Existing Conditions/No Project/No Action Condition, Alternative C would generally be expected to provide:

- Similar amounts of habitat for coldwater fish species based on modeling results indicating similar long-term average monthly storage during most of the evaluation period.

However, it is unlikely that coldwater fish habitat is limiting in Lake Oroville; therefore, it is unlikely that changes in reservoir storage under Alternative C would have a population level effect on coldwater fish species in Lake Oroville, relative to the Existing Conditions/No Project/No Action Condition.

Warmwater Fish Species

Relative to the Existing Conditions/No Project/No Action Condition, Alternative C would generally be expected to provide:

- Similar warmwater fish nesting conditions, based on modeling results indication minor differences in the frequency of monthly water surface elevation reductions of 6 feet or more during the evaluation period.

It is unlikely that a small difference in the number of years with monthly water surface elevation reductions of greater than 6 feet under Alternative C would have a population level effect on bass and other warmwater fish in Lake Oroville, relative to the Existing Conditions/No Project/No Action Condition.

12C.5.2.8 Feather River

Flows in the Low Flow Channel below the Fish Barrier Dam were modeled consistently with the terms of the FERC Settlement Agreement. As shown in Appendix 6B Water Resources System Modeling, modeled results for long-term average flows, average flows by water year type were similar under Alternative C and the Existing Conditions/No Project/No Action Condition. Although these results are not repeated for the discussions below, the model results for the Low Flow Channel below the Fish Barrier Dam were considered, along with the information presented below, and are incorporated into the impact determinations for the following species: spring-run Chinook salmon, fall-run Chinook salmon, steelhead, green sturgeon, white sturgeon, river lamprey, Pacific lamprey, and hardhead.

Flow and water temperature model results were examined for the Feather River at several points downstream of Lake Oroville (Appendix 6B Water Resources System Modeling, Appendix 7E River Temperature Modeling, and Appendix 12E Fisheries Water Temperature Assessment Summary Tables). For several species and life stages, only modeled flows and water temperatures were available, and the analyses of habitat conditions for these species and life stages were based primarily on the water temperature results. Model results for spawning habitat availability (WUA) were also examined for Chinook salmon and steelhead (Appendix 12N Weighted Usable Area Analysis). The potential for Project-related changes in aquatic habitat conditions and impacts on aquatic resources in the Feather River are described below.

Spring-run Chinook Salmon

Relative to the Existing Conditions/No Project/No Action Condition, Alternative C would generally be expected to provide:

- Similar adult immigration and holding conditions, based on modeling results indicating: (1) generally higher long-term average monthly flows and average monthly flows by water year type during the evaluation period below the Thermalito Afterbay outlet and at the mouth of the Feather River, except in October and May when flows may be reduced; and (2) similar monthly probabilities of exceeding specified water temperature index values.
- Similar adult spawning conditions based on modeling results indicating: (1) generally lower long-term average monthly flows and average monthly flows by water year type during the evaluation period below the Thermalito Afterbay outlet, except in September when flows may be increased; and (2) similar probabilities of exceeding specified water temperature index values during most of the evaluation period except in October when probabilities are slightly lower.
- Similar embryo incubation conditions based on modeling results indicating equivalent or lower probabilities of exceeding specified water temperature index values.
- Similar juvenile rearing and outmigration conditions based on modeling results indicating: (1) similar lower long-term average monthly flows at low flow channel below the Fish Barrier dam and similar or slightly lower long-term average monthly flows occurring from October through January with similar or higher average monthly flows in February, March, and June through September below the Thermalito Afterbay outlet; and (2) equivalent or similar monthly probabilities of exceeding specified water temperature index values during most of the evaluation period.
- Similar or less suitable smolt emigration conditions, based on modeling results indicating: (1) lower long-term average monthly and average monthly by water year type flows during most of the

evaluation period, except during February and March below Thermalito Afterbay and at the mouth of the Feather River; and (2) equivalent or similar monthly probabilities of exceeding specified water temperature index values.

In conclusion, in consideration of potential impacts to all life stages of spring-run Chinook salmon in the Feather River, Alternative C would result in similar conditions for spring-run Chinook salmon, relative to the Existing Conditions/No Project/No Action Condition.

Fall-run Chinook Salmon

Relative to the Existing Conditions/No Project/No Action Condition, Alternative C would generally be expected to provide:

- Similar adult immigration and holding conditions, based on modeling results indicating: (1) generally higher long-term average monthly flows occurring from July through September and lower average monthly flows from October through December below the Thermalito Afterbay outlet and at the mouth of the Feather River; and (2) similar monthly probabilities of exceeding specified water temperature index values.
- Similar or improved spawning conditions based on modeling results indicating (1) generally similar or higher spawning habitat availability (WUA) in the reach below Thermalito, particularly in October and December when WUA is substantially increased during most water year types, but spawning WUA is decreased in November; and (2) similar or slightly lower probabilities of exceeding specified water temperature index values in the Low Flow Channel and higher probabilities of exceedance during October below Thermalito.
- Similar embryo incubation conditions based on modeling results indicating: (1) similar total average early life stage mortality; and (2) equivalent or slightly lower probabilities of exceeding specified water temperature index values.
- Similar juvenile rearing and outmigration conditions based on modeling results indicating: (1) similar or lower long-term average monthly flows occurring during most months of the evaluation period below the Thermalito Afterbay outlet and at the mouth of the Feather River, except during February and March, when average monthly flows may be higher; and (2) similar monthly probabilities of exceeding specified water temperature index values during most of the evaluation period.

In conclusion, in consideration of potential impacts to all life stages of fall-run Chinook salmon in the Feather River, Alternative C would result in similar conditions for fall-run Chinook salmon, relative to the Existing Conditions/No Project/No Action Condition.

Steelhead

Relative to the Existing Conditions/No Project/No Action Condition, Alternative C would generally be expected to provide:

- Similar adult immigration and holding conditions, based on modeling results indicating: (1) lower long-term average monthly and average monthly by water year type flows occurring below the Thermalito Afterbay and at the lower mouth of the Feather river, except in February, March and September when flows may be higher; and (2) equivalent or slightly lower monthly probabilities of exceeding specified water temperature index values.

- Similar or improved spawning and incubation conditions based on modeling results indicating: (1) similar or higher long-term average spawning habitat availability (WUA) during the entire adult spawning period, with increased spawning habitat availability in drier water year types and slightly reduced spawning habitat availability in wetter water years; and (2) equivalent or lower probabilities of exceeding specified water temperature index values during most of the evaluation period at all Feather River locations evaluated.
- Similar juvenile rearing and outmigration conditions based on modeling results indicating: (1) similar or slightly lower long-term average monthly flows occurring from October through April with similar or higher average monthly flows from May through September below the Thermalito Afterbay outlet and (2) generally similar or lower monthly probabilities of exceeding specified water temperature index values during most of the evaluation period.
- Similar smolt emigration conditions based on modeling results indicating: (1) generally lower long-term average monthly flows occurring more often during the evaluation period below the Thermalito Afterbay outlet and at the mouth of the Feather River, and generally lower average monthly flows by water year type occurring during most water year types below the Thermalito Afterbay outlet and at the mouth of the Feather River, except for below normal water year types when average monthly flows would be higher in some months; and (2) generally similar or slightly lower monthly probabilities of exceeding specified water temperature index values during most months, but with less suitable water temperatures during October.

In conclusion, in consideration of potential impacts to all life stages of steelhead in the Feather River, Alternative C would result in similar conditions for steelhead, relative to the Existing Conditions/No Project/No Action Condition.

Green Sturgeon

Relative to the Existing Conditions/No Project/No Action Condition, Alternative C would generally be expected to provide:

- Similar adult immigration and holding conditions, based on modeling results indicating: (1) similar or lower long-term average monthly flows and average monthly flows by water year type during much of the evaluation period at Shanghai Bend and at the mouth of the Feather River, except from June to September when flows would likely be higher and (2) similar monthly probabilities of exceeding specified water temperature index values.
- Similar or less suitable adult spawning and embryo incubation conditions based on modeling results indicating: (1) similar or slightly higher long-term average monthly flows during the evaluation period below the Thermalito Afterbay outlet, and higher average monthly flows by water year type during most water year types below the Thermalito Afterbay outlet, except during dry and critical water year types when lower average monthly flows would occur; and (2) generally higher monthly probabilities of exceeding specified water temperature index values.
- Similar juvenile rearing conditions based on modeling results indicating: (1) similar or slightly lower long-term average monthly flows occurring from October through April with similar or higher average monthly flows from May through September below the Thermalito Afterbay outlet and at the mouth of the Feather River; and (2) similar monthly probabilities of exceeding specified water

temperature index values below the Thermalito Afterbay outlet and at the mouth of the Feather River, with higher probabilities of exceedance during June and August below Thermalito.

- Similar or improved juvenile emigration conditions based on modeling results indicating: (1) higher long-term average monthly flows during the evaluation period below the Thermalito Afterbay outlet, at Shanghai Bend, and at the mouth of the Feather River, and higher average monthly flows by water year type occurring during all water year types below the Thermalito Afterbay outlet, at Shanghai Bend, and at the mouth of the Feather River, except in May when flows are may be lower; and (2) similar monthly probabilities of exceeding specified water temperature index values occurring below the Thermalito Afterbay outlet and at the mouth of the Feather River with higher probabilities of exceedance during June and August below Thermalito.

In conclusion, in consideration of potential impacts to all life stages of green sturgeon in the Feather River, Alternative C would result in similar conditions for green sturgeon, relative to the Existing Conditions/No Project/No Action Condition.

White Sturgeon

Relative to the Existing Conditions/No Project/No Action Condition, Alternative C would generally be expected to provide:

- Similar adult immigration and holding conditions, based on modeling results indicating: (1) similar or slightly lower long-term average monthly flows and average monthly flows by water year type during the evaluation period at Shanghai Bend and at the mouth of the Feather River, except during below normal water years when flows would be slightly higher; and (2) equivalent monthly probabilities of exceeding specified water temperature index values.
- Similar adult spawning and embryo incubation conditions based on modeling results indicating: (1) similar or slightly lower long-term average monthly and average monthly by water year type flows during the evaluation period Shanghai bend and at the mouth of the lower feather River and (2) similar monthly probabilities of exceeding specified water temperature index values.
- Similar juvenile rearing and emigration conditions based on modeling results indicating: (1) higher long-term average monthly flows during the evaluation period below the Thermalito Afterbay outlet, at Shanghai Bend, and at the mouth of the Feather River, and higher average monthly flows by water year type occurring during all water year types below the Thermalito Afterbay outlet, at Shanghai Bend, and at the mouth of the Feather River, except in May when flows are may be lower; and (2) similar monthly probabilities of exceeding specified water temperature index values.

In conclusion, in consideration of potential impacts to all life stages of white sturgeon in the Sacramento River, Alternative C would result in similar conditions for white sturgeon, relative to the Existing Conditions/No Project/No Action Condition.

River Lamprey

Relative to the Existing Conditions/No Project/No Action Condition, Alternative C would generally be expected to provide:

- Similar or less suitable adult immigration conditions, based on modeling results indicating generally lower long-term average monthly flows and average monthly flows by water year type during the

evaluation period below the Thermalito Afterbay outlet, except in September when flows may be higher below the Thermalito Afterbay outlet and at the mouth of the Feather River.

- Similar or less suitable spawning and egg incubation conditions, based on modeling results indicating: (1) generally higher long-term average monthly and average monthly by water year type flows occurring more often, except in April and May when flows may be higher and (2) similar or lower probabilities of water temperatures occurring within the specified water temperature range.
- Similar ammocoete rearing and emigration conditions based on modeling results indicating: (1) similar or slightly lower long-term average monthly flows occurring from October through May with similar or higher average monthly flows from June through September below Thermalito Afterbay and at the mouth of the Feather River; and (2) similar probabilities of exceeding specified water temperatures.

In conclusion, in consideration of potential impacts to all life stages of river lamprey in the Feather River, Alternative C would result in similar conditions for river lamprey, relative to the Existing Conditions/No Project/No Action Condition.

Pacific Lamprey

Relative to the Existing Conditions/No Project/No Action Condition, Alternative C would generally be expected to provide:

- Similar adult immigration conditions, based on modeling results indicating generally higher long term average and average monthly flows by water year type below the Thermalito Afterbay outlet and at the mouth of the lower feather river in February, March and June and lower flows in April and May.
- Similar or less suitable spawning and egg incubation conditions, based on modeling results indicating: (1) generally lower long-term average monthly flows and average monthly flows by water year type during the evaluation period, except from June through August when flows may be higher below the Thermalito Afterbay outlet and at the mouth of the Feather River; and (2) similar or lower probabilities of water temperatures occurring within the specified water temperature range.
- Similar ammocoete rearing and emigration conditions based on modeling results indicating: (1) similar or slightly lower long-term average monthly flows occurring from October through May with similar or higher average monthly flows from June through September below Thermalito Afterbay and at the mouth of the Feather River; and (2) similar probabilities of exceeding the specified water temperature index at all Feather River locations evaluated, except during February and March when probabilities of exceeding the index would be slightly lower.

In conclusion, in consideration of potential impacts to all life stages of Pacific lamprey in the Feather River, Alternative C would result in similar conditions for Pacific lamprey, relative to the Existing Conditions/No Project/No Action Condition.

Hardhead

Relative to the Existing Conditions/No Project/No Action Condition, Alternative C would generally be expected to provide:

- Similar adult and juvenile life stage conditions based on modeling results indicating: (1) similar or slightly lower long-term average monthly flows occurring from October through May with similar or

higher average monthly flows from June through September below Thermalito Afterbay and at the mouth of the Feather River; and (2) similar probabilities of water temperatures occurring within the specified water temperature range.

- Similar adult spawning conditions, based on modeling results indicating: (1) similar long-term average monthly and average monthly by water year type flows during April and May and higher long-term average monthly and average monthly by water year type flows during June; and (2) generally similar probabilities of water temperatures occurring within the specified water temperature range.

In conclusion, in consideration of potential impacts to all life stages of hardhead in the Feather River, Alternative C would result in similar conditions for hardhead, relative to the Existing Conditions/No Project/No Action Condition.

Sacramento Splittail

Relative to the Existing Conditions/No Project/No Action Condition, Alternative C would generally be expected to provide:

- Similar spawning conditions, based on modeling results indicating: (1) similar or slightly lower long-term average monthly flows, and average monthly flows by water year type at the mouth of the Feather River; and (2) equivalent monthly probabilities of water temperatures occurring within the specified water temperature range.

In conclusion, in consideration of potential impacts to all life stages of splittail in the Feather River, Alternative C would result in similar conditions for splittail, relative to the Existing Conditions/No Project/No Action Condition.

Striped Bass

Relative to the Existing Conditions/No Project/No Action Condition, Alternative C would generally be expected to provide:

- Similar or less suitable adult spawning and other life stage conditions, based on modeling results indicating: (1) lower long-term average monthly flows during April and May and higher long-term average monthly and average monthly by water year type flows during June; and (2) similar monthly probabilities of water temperatures occurring within the specified water temperature range.
- Similar larvae, fry, and juvenile rearing emigration conditions, based on modeling results indicating: (1) similar or slightly lower long-term average monthly flows occurring from October through May with similar or higher average monthly flows from June through September below Thermalito Afterbay and at the mouth of the Feather River; and (2) similar or slightly higher probability of water temperatures occurring within the specified water temperature range with similar frequencies below the Thermalito Afterbay outlet and at the mouth of the Feather River during much of the year.

In conclusion, in consideration of potential impacts to all life stages of striped bass in the Feather River, Alternative C would result in similar conditions for striped bass, relative to the Existing Conditions/No Project/No Action Condition.

American Shad

Relative to the Existing Conditions/No Project/No Action Condition, Alternative C would generally be expected to provide:

- Similar adult spawning and other life stage conditions, based on modeling results indicating: (1) lower long-term average monthly flows during April and May and higher long-term average monthly and average monthly by water year type flows during June; and (2) similar monthly probabilities of water temperatures occurring within the specified water temperature range.
- Similar larvae, fry, and juvenile emigration conditions, based on modeling results indicating: (1) lower long-term average monthly flows during April and May and higher long-term monthly flows during June at all Feather River locations evaluated, and higher average monthly flows by water year type during most months and water year types, except during dry and critical water year types; and (2) similar or slightly lower probabilities of water temperatures occurring within the specified water temperature range.

In conclusion, in consideration of potential impacts to all life stages of American shad in the Feather River, Alternative C would result in similar conditions for American shad, relative to the Existing Conditions/No Project/No Action Condition.

Largemouth Bass

Relative to the Existing Conditions/No Project/No Action Condition, Alternative C would generally be expected to provide:

- Similar adult and other life stage conditions based on modeling results indicating similar or slightly lower long-term average monthly flows occurring from October through May with similar or higher average monthly flows from June through September below Thermalito Afterbay and at the mouth of the Feather River.
- Similar spawning conditions, based on similar monthly probabilities of water temperatures occurring within the specified water temperature range.

In conclusion, in consideration of potential impacts to all life stages of largemouth bass in the Feather River, Alternative C would result in similar conditions for largemouth bass, relative to the Existing Conditions/No Project/No Action Condition.

12C.5.2.9 Sutter Bypass

Potential impacts to fisheries and aquatic resources in the Sutter Bypass under Alternative C relative to the Existing Conditions/No Project/No Action Condition would be similar to those discussed under Alternative A relative to the Existing Conditions/No Project/No Action Condition, above.

12C.5.2.10 Folsom Lake

Reservoir storage model results (Appendix 6B Water Resources System Modeling) were examined for Folsom Lake during April through November for coldwater fish species; reductions in average monthly surface elevations greater than 6 feet (Appendix 12F Reservoir Water Surface Elevation Summary Tables) were examined during March through June for warmwater species.

Coldwater Fish Species

Relative to the Existing Conditions/No Project/No Action Condition, Alternative C would generally be expected to provide:

- Similar conditions for coldwater fish species based on modeling results for reservoir storage conditions indicating similar long-term average monthly storage, and similar average monthly storage by water year type occurring during most months of the evaluation period.

However, it is unlikely that coldwater fish habitat is limiting in Folsom Lake; therefore, it is unlikely that changes in reservoir storage under Alternative C would have a population level effect on coldwater fish species in Folsom Lake, relative to the Existing Conditions/No Project/No Action Condition.

Warmwater Fish Species

Relative to the Existing Conditions/No Project/No Action Condition, Alternative C would generally be expected to provide:

- Similar warmwater fish spawning and early life stage conditions, based on modeling results indicating slightly decreased and increased frequencies of monthly water surface elevation reductions of 6 feet or more occurring during the March through June evaluation period.

It is unlikely that a small difference in the number of years with monthly water surface elevation reductions of greater than 6 feet under Alternative C would have a population level effect on bass and other warmwater fish in Folsom Lake, relative to the Existing Conditions/No Project/No Action Condition.

12C.5.2.11 American River

Flow and water temperature model results were examined for the American River at several points downstream of Lake Natoma (Appendix 6B Water Resources System Modeling, Appendix 7E River Temperature Modeling, and Appendix 12E Fisheries Water Temperature Assessment Summary Tables). For several species and life stages, only modeled flows and water temperatures were available, and the analyses of habitat conditions for these species and life stages were based primarily on the water temperature results. Model results for spawning habitat availability (WUA) were also examined for Chinook salmon and steelhead (Appendix 12N Weighted Usable Area Analysis). The potential for Project-related changes in aquatic habitat conditions and impacts on aquatic resources in the American River are described below.

Fall-run Chinook Salmon

Relative to the Existing Conditions/No Project/No Action Condition, Alternative C would generally be expected to provide:

- Similar or improved adult immigration and holding conditions based on modeling results indicating: (1) generally higher long-term average monthly flows during most months of the evaluation period, and higher average monthly flows by water year type during most water year types at the locations evaluated in the American River; and (2) generally similar or lower monthly probabilities of exceeding specified water temperature index values, although slightly higher probabilities of exceedance would occur during September.

- Similar or more suitable spawning conditions based on modeling results indicating: (1) similar spawning habitat availability (WUA) from October through December, with slightly higher spawning habitat availability in October of Critical water years; and (2) lower monthly probabilities of exceeding specified water temperature index values in October and November.
- Similar or improved embryo incubation conditions based on modeling results indicating: (1) similar total annual early life stage mortality; and (2) lower monthly probabilities of exceeding specified water temperature index values in October and November.
- Similar juvenile rearing and emigration conditions based on modeling results indicating: (1) similar or slightly higher long-term average monthly flows, and slightly higher average monthly flows by water year type from January through May and lower monthly flows in June, particularly in drier water year types; and (2) generally similar probabilities of exceeding specified water temperature index values below Nimbus Dam with similar or somewhat increased probabilities of exceeding the lowest temperature indices at Watt Avenue and at the mouth from April through June.

In conclusion, in consideration of potential impacts to all life stages of fall-run Chinook salmon in American River, Alternative C would result in similar or improved conditions for fall-run Chinook salmon, relative to the Existing Conditions/No Project/No Action Condition.

Spring-run Chinook Salmon

Relative to the Existing Conditions/No Project/No Action Condition, Alternative C would generally be expected to provide:

- Similar non-natal juvenile rearing conditions based on modeling results indicating: (1) higher long-term average monthly flows during the evaluation period, and higher average monthly flows by water year type; (2) generally similar probabilities of exceeding specified water temperature index values throughout the evaluation period.

Rearing conditions in the American River for non-natal juvenile spring-run Chinook salmon would likely be similar under Alternative A, relative to the Existing Conditions/No Project/No Action Condition.

Steelhead

Relative to the Existing Conditions/No Project/No Action Condition, Alternative C would generally be expected to provide:

- Similar adult immigration and holding conditions based on modeling results indicating: (1) higher long-term average monthly flows during the evaluation period, and higher average monthly flows by water year type during most water year types at all locations evaluated in the American River; and (2) generally similar probabilities of exceeding specified water temperature index values, except during November and December when the probabilities would be lower, and in March and April when the probabilities of exceedance may be higher.
- Similar or less suitable spawning and egg incubation conditions based on modeling results indicating: (1) similar spawning habitat availability (WUA); and (2) generally higher probabilities of exceeding specified water temperature index values, particularly in March and April.
- Similar or improved juvenile rearing and emigration conditions based on modeling results indicating: (1) higher long-term average monthly flows during the evaluation period, and higher average monthly

flows by water year type during most water year types at all locations evaluated; and (2) generally similar or reduced probabilities of exceeding specified water temperature index values.

- Similar or less suitable smolt emigration conditions based on modeling results indicating: (1) higher long-term average monthly flows during the evaluation period, and higher average monthly flows by water year type during most water year types at all locations evaluated; and (2) generally similar or higher probabilities of exceeding specified water temperature index values, except in April when the probabilities of exceedance may be lower.

In conclusion, in consideration of potential impacts to all life stages of steelhead in American River, Alternative C would result in similar conditions for steelhead, relative to the Existing Conditions/No Project/No Action Condition.

Green Sturgeon

Relative to the Existing Conditions/No Project/No Action Condition, Alternative C would generally be expected to provide:

- Similar adult immigration and holding conditions based on modeling results indicating: (1) higher long-term average monthly flows during the evaluation period, and higher average monthly flows by water year type during most water year types at all locations evaluated; and (2) similar probabilities of exceeding specified water temperature index values.
- Similar spawning and egg incubation conditions based on modeling results indicating: (1) higher long-term average monthly flows during the evaluation period, and higher average monthly flows by water year type during most water year types at all locations evaluated; and (2) generally similar probabilities of exceeding specified water temperature index values, although the probabilities of exceedance may be slightly reduced during July and August.
- Similar juvenile rearing and emigration conditions based on modeling results indicating: (1) higher long-term average monthly flows during the evaluation period, and higher average monthly flows by water year type during most water year types at all locations evaluated; and (2) generally similar or reduced probabilities of exceeding specified water temperature index values, except in June, July, and September when the probabilities of exceedance may be higher.

In conclusion, in consideration of potential impacts to all life stages of green sturgeon in American River, Alternative C would result in similar conditions for green sturgeon, relative to the Existing Conditions/No Project/No Action Condition.

River Lamprey

Relative to the Existing Conditions/No Project/No Action Condition, Alternative C would generally be expected to provide:

- Improved adult immigration conditions based on modeling results indicating higher long-term average monthly flows during the evaluation period, and higher average monthly flows by water year type during most water year types at all locations evaluated.
- Similar spawning and egg incubation conditions based on modeling results indicating: (1) higher long-term average monthly flows during the evaluation period, and higher average monthly flows by water year type during most water year types at all locations evaluated; and (2) similar or higher

monthly probabilities of water temperatures occurring within the specified water temperature range below Nimbus Dam, with a slightly lower probability of remaining within the specified range at Watt Avenue, particularly from May through July.

- Similar or improved ammocoete rearing and emigration conditions based on modeling results indicating: (1) higher long-term average monthly flows during the evaluation period, and higher average monthly flows by water year type during most water year types at all locations evaluated; and (2) generally similar or lower probabilities of exceeding specified water temperature index values, particularly from July through September.

In conclusion, in consideration of potential impacts to all life stages of river lamprey in American River, Alternative C would result in similar or improved conditions for river lamprey, relative to the Existing Conditions/No Project/No Action Condition.

Pacific Lamprey

Relative to the Existing Conditions/No Project/No Action Condition, Alternative C would generally be expected to provide:

- Similar or improved adult immigration conditions based on modeling results indicating: (1) higher long-term average monthly flows during the evaluation period, and higher average monthly flows by water year type during most water year types at all locations evaluated.
- Similar spawning and egg incubation conditions based on modeling results indicating: (1) higher long-term average monthly flows during the evaluation period, and higher average monthly flows by water year type during most water year types at all locations evaluated; and (2) similar or higher monthly probabilities of water temperatures occurring within the specified water temperature range below Nimbus Dam, with a slightly lower probability of remaining within the specified range at Watt Avenue, particularly from May through July.
- Similar or improved ammocoete rearing and emigration conditions based on modeling results indicating: (1) higher long-term average monthly flows during the evaluation period, and higher average monthly flows by water year type during most water year types at all locations evaluated; and (2) generally similar or lower probabilities of exceeding specified water temperature index values, particularly from July through September.

In conclusion, in consideration of potential impacts to all life stages of Pacific lamprey in American River, Alternative C would result in similar or improved conditions for Pacific lamprey, relative to the Existing Conditions/No Project/No Action Condition.

Hardhead

Relative to the Existing Conditions/No Project/No Action Condition, Alternative C would generally be expected to provide:

- Similar adult and other life stage conditions based on modeling results indicating: (1) higher long-term average monthly flows during the evaluation period, and higher average monthly flows by water year type during most water year types at all locations evaluated; and (2) similar or higher probabilities of remaining within the specified water temperature ranges, except from July through October when the probabilities of remaining in the range may be reduced.

- Similar spawning conditions based on modeling results indicating: (1) higher long-term average monthly flows during the evaluation period, and higher average monthly flows by water year type during most water year types at all locations evaluated; and (2) a higher probability of remaining within the specified water temperature range in April, but a lower probability of remaining within the range in May and June.

In conclusion, in consideration of potential impacts to all life stages of hardhead in American River, Alternative C would result in similar conditions for hardhead, relative to the Existing Conditions/No Project/No Action Condition.

Sacramento Splittail

Relative to the Existing Conditions/No Project/No Action Condition, Alternative C would generally be expected to provide:

- Similar spawning conditions based on: (1) similar long-term average monthly flows during the evaluation period, and similar average monthly flows by water year type across all water year types, except in March and April of drier water year types when flows may be higher; and (2) equivalent probabilities of remaining within the specified water temperature range.

In conclusion, in consideration of potential impacts to all life stages of splittail in the American River, Alternative C would result in similar conditions for splittail, relative to the Existing Conditions/No Project/No Action Condition.

Striped Bass

Relative to the Existing Conditions/No Project/No Action Condition, Alternative C would generally be expected to provide:

- Similar or less suitable adult spawning, embryo incubation, and initial rearing conditions based on modeling results indicating: (1) similar or slightly higher long-term average monthly flows during the evaluation period, and lower average monthly flows by water year type during most water year types at all locations evaluated; and (2) generally probabilities of remaining within the specified water temperature range during the evaluation period, except in April when the probability may be higher.
- Similar larvae, fry, and juvenile rearing and emigration conditions based on modeling results indicating: (1) higher long-term average monthly flows during the evaluation period, and higher average monthly flows by water year type during most water year types; and (2) similar or higher probabilities of remaining within the specified water temperature range throughout the year, with a lower probability of the temperatures occurring within the specified range during October.

In conclusion, in consideration of potential impacts to all life stages of striped bass in the American River, Alternative C would result in similar conditions for striped bass, relative to the Existing Conditions/No Project/No Action Condition.

American Shad

Relative to the Existing Conditions/No Project/No Action Condition, Alternative C would generally be expected to provide:

- Similar or improved adult spawning, embryo incubation, and initial rearing conditions based on modeling results indicating: (1) similar or slightly higher long-term average monthly flows during the

evaluation period, and higher average monthly flows by water year type during most water year types at all locations evaluated; and (2) generally higher probabilities of remaining within the specified water temperature range from April through June.

- Similar larvae, fry, and juvenile rearing and emigration conditions based on modeling results indicating: (1) higher long-term average monthly flows during the evaluation period, and higher average monthly flows by water year type during most water year types at all locations evaluated, except in July where flows are lower; and (2) generally similar probabilities of water temperatures occurring within the specified water temperature range, except in September and October when the probabilities would be lower.

In conclusion, in consideration of potential impacts to all life stages of American shad in the American River, Alternative C would result in similar or more suitable conditions for American shad, relative to the Existing Conditions/No Project/No Action Condition.

Largemouth Bass

Relative to the Existing Conditions/No Project/No Action Condition, Alternative C would generally be expected to provide:

- Similar or slightly improved adult and other life stage conditions based on modeling results indicating higher long-term average monthly flows during the evaluation period, and higher average monthly flows by water year type during most water year types at all locations evaluated.
- Similar spawning conditions based on modeling results indicating higher probabilities of remaining within specified water temperature ranges during April and a reduced probability in May.

In conclusion, in consideration of potential impacts to all life stages of striped bass in the American River, Alternative C would result in similar conditions for largemouth bass, relative to the Existing Conditions/No Project/No Action Condition.

12C.5.2.12 Sacramento-San Joaquin Delta and Yolo Bypass

Delta Smelt in the Delta Region

Relative to the Existing Conditions/No Project/No Action Condition, Alternative C would generally be expected to provide:

- Similar adult conditions, based on modeling results indicating: (1) similar monthly probabilities of water temperatures at Freeport occurring within the specified water temperature range (December through May); and (2) similar overall mean monthly percent entrainment at the SWP and CVP export facilities (December through April).
- Similar egg and embryo conditions (February through May), based on modeling results indicating similar monthly probabilities of water temperatures at Freeport occurring within the specified water temperature range.
- Similar conditions for larvae (March through June), based on modeling results indicating: (1) similar monthly probabilities of water temperatures at Freeport occurring within the specified water temperature range; and (2) generally lower long-term average and average by water year type monthly Delta outflows, except in June when Delta outflows may be increased, and in drier water year types when Delta outflows may be substantially decreased in March.

- Similar or slightly improved juvenile conditions (May through July), based on modeling results indicating: (1) similar monthly probabilities of water temperatures at Freeport occurring within the specified water temperature range; (2) similar overall mean monthly percent juvenile entrainment at the SWP and CVP export facilities (May through July); and (3) when X2 is Between RKm 65 and 80, long-term average and average by water year type X2 location would move slightly upstream during May (by less than 0.5 RKm), move slightly downstream during June (by 0.6 RKm or less), and move downstream during July (by 1.3, 1.6 and 1.5 RKm during wet, above normal and below normal water years, respectively).

In conclusion, in consideration of potential impacts to all life stages of delta smelt, Alternative C would result in similar conditions for Delta Smelt, relative to the Existing Conditions/No Project/No Action Condition.

Longfin Smelt in the Delta Region

Relative to the Existing Conditions/No Project/No Action Condition, Alternative C would generally be expected to provide:

- Similar adult conditions based on modeling results indicate: (1) OMR flows would be similar (not substantially more negative) relative to from December through March; and (2) a similar index of relative adult abundance.
- Similar larvae and juvenile conditions based on modeling results indicating: (1) mean monthly OMR flows would be lower during April and May of critical water years (by 8.7 and 14.5%, respectively) and would be higher during April and May of dry water years (by 2.0 and 6.4%, respectively); and (2) slightly lower (from January through April), equivalent (during May) and slightly higher (during June) monthly exceedance probabilities of X2 location occurring at or downstream of 75 RKm.

In conclusion, in consideration of potential impacts to all life stages of longfin smelt, Alternative C would result in similar conditions for Longfin Smelt, relative to the Existing Conditions/No Project/No Action Condition.

Sacramento Splittail in the Delta and Yolo Bypass

Relative to the Existing Conditions/No Project/No Action Condition, Alternative C would generally be expected to provide:

- Similar or less suitable adult upstream migration, spawning, egg, and larval conditions based on modeling results indicating: (1) similar or reduced long-term average monthly flows in the Yolo Bypass, particularly during February and March; and (2) similar frequencies and duration of inundation events in the Yolo Bypass.
- Similar juvenile rearing and emigration conditions based on modeling results indicating similar long-term average monthly flows and average monthly flows by water year type in the Yolo Bypass.

In conclusion, in consideration of potential impacts to all life stages of Sacramento splittail in the Delta Region including the Yolo Bypass, Alternative C would result similar conditions for splittail, relative to the Existing Conditions/No Project/No Action Condition.

Winter-run Chinook Salmon in the Delta and Yolo Bypass

Relative to the Existing Conditions/No Project/No Action Condition, Alternative C would generally be expected to provide:

- Similar Delta conditions, based on IOS modeling results indicating similar monthly through-Delta survival probabilities.
- Similar juvenile rearing conditions in the Yolo Bypass based on modeling results indicating a similar frequency and duration of floodplain inundation.

In conclusion, in consideration of potential impacts to juvenile winter-run Chinook salmon, Alternative C would result in similar juvenile rearing and outmigration conditions for winter-run Chinook salmon in the Yolo Bypass and Delta Region, relative to the Existing Conditions/No Project/No Action Condition.

Spring-run Chinook Salmon in the Delta and Yolo Bypass

Relative to the Existing Conditions/No Project/No Action Condition, Alternative C would generally be expected to provide:

- Similar juvenile outmigration conditions, based on DPM modeling results indicating similar monthly Delta survival probabilities.
- Similar juvenile rearing conditions in the Yolo Bypass based on modeling results indicating a similar frequency and duration of floodplain inundation.

In conclusion, in consideration of potential impacts to spring-run Chinook salmon, Alternative C would result in similar juvenile rearing and outmigration conditions for spring-run Chinook salmon in the Yolo Bypass and Delta Region, relative to the Existing Conditions/No Project/No Action Condition.

Fall-run and Late Fall-run Chinook Salmon in the Delta and Yolo Bypass

Relative to the Existing Conditions/No Project/No Action Condition, Alternative C would generally be expected to provide:

- Similar juvenile outmigration conditions based on DPM modeling results indicating similar monthly Delta survival probabilities.
- Similar juvenile rearing conditions in the Yolo Bypass based on modeling results indicating a similar frequency and duration of floodplain inundation.

In conclusion, in consideration of potential impacts to juvenile and fall and late fall-run Chinook salmon, Alternative C would result in similar juvenile rearing and outmigration conditions for fall- and late fall-run Chinook salmon in the Yolo Bypass and Delta Region, relative to the Existing Conditions/No Project/No Action Condition.

Steelhead in the Delta and Yolo Bypass

Relative to the Existing Conditions/No Project/No Action Condition, Alternative C would generally be expected to provide:

- Similar or less suitable juvenile rearing and emigration conditions in the Delta (October through July) based on modeling results indicating: (1) lower long-term average and average by water year type monthly Delta outflow during most months of most water year types, but with higher Delta outflow

during June and July of all water year types, during October and November of below normal water years, during November of dry water years and during October and December of critical water years; and (2) OMR flows would be reduced over the evaluation period and substantially more negative relative to the Existing Conditions/No Project/No Action Condition in October and November of wetter water year types and most months of critically dry water years.

- Similar juvenile rearing conditions in the Yolo Bypass based on modeling results indicating a similar frequency and duration of floodplain inundation.

In conclusion, in consideration of potential impacts to juvenile Central Valley steelhead, Alternative C would result in similar juvenile rearing and outmigration conditions for steelhead in the Yolo Bypass and Delta Region, relative to the Existing Conditions/No Project/No Action Condition.

Green Sturgeon and White Sturgeon in the Delta Region

Relative to the Existing Conditions/No Project/No Action Condition, Alternative C would generally be expected to provide:

- Similar juvenile rearing and emigration conditions based on modeling results indicating: (1) similar long-term average and average by water year type Delta outflows from March through July; and (2) similar probabilities of Delta outflows exceeding 50,000 cfs providing for strong year classes of sturgeon.

In conclusion, in consideration of potential impacts to green sturgeon in the Delta, Alternative C would result in similar conditions for sturgeon, relative to the Existing Conditions/No Project/No Action Condition.

American Shad in the Delta Region

Relative to the Existing Conditions/No Project/No Action Condition, Alternative C would generally be expected to provide:

- Similar egg and larval conditions in the Delta based on modeling results indicating: (1) slight upstream movements in mean monthly X2 location during June of all water year types and equivalent X2 locations during April and May of most water year types; and (2) slightly lower (during April), equivalent (during May) and slightly higher (during June) exceedance probabilities of X2 location being located at or downstream of RKm 75 during April through June.

In conclusion, in consideration of potential impacts to American shad in the Delta, Alternative C would result in similar conditions for American shad, relative to the Existing Conditions/No Project/No Action Condition.

Striped Bass in the Delta Region

Relative to the Existing Conditions/No Project/No Action Condition, Alternative C would generally be expected to provide:

- Similar egg and larval conditions in the Delta based on modeling results indicating: slight upstream movements in meant monthly X2 location during June of all water year types and equivalent X2 locations during April and May of most water year types.

In conclusion, in consideration of potential impacts to striped bass in the Delta, Alternative C would result in similar conditions for striped bass, relative to the Existing Conditions/No Project/No Action Condition.

12C.5.2.13 Suisun, San Pablo and San Francisco Bays

Fish species of primary management concern, including Chinook salmon, steelhead, river lamprey, Pacific lamprey, green sturgeon, white sturgeon, and splittail utilize the bays as a migration corridor and/or for juvenile rearing. Potential increases in Delta outflow during the summer and fall and reductions in Delta outflow during the spring would not result in substantial changes to migration or rearing habitat for these fish species in the bays. Striped bass and American shad also utilize the bays for migration and rearing, however, changes in X2 location were evaluated during the striped bass and American shad spawning and initial rearing period to evaluate potential changes in larval transport and rearing habitat in the Bay-Delta (see the Delta Region, above). Potential effects on delta smelt and longfin smelt migration and rearing in the Bay-Delta also were analyzed through evaluation of changes in X2 location (see the Delta Region, above).

12C.6 Impacts Associated with Alternative D Relative to the Existing Conditions/No Project/No Action Condition

12C.6.1 Extended Study Area – Alternative D Relative to the Existing Conditions/No Project/No Action Condition

12C.6.1.1 San Luis Reservoir

Reservoir storage model results (Appendix 6B Water Resources System Modeling) were examined for San Luis Reservoir during April through November for coldwater fish species; reductions in average monthly surface elevations greater than 6 feet (Appendix 12F Reservoir Water Surface Elevation Summary Tables) were examined during March through June for warmwater species.

Coldwater Fish Species

Relative to the Existing Conditions/No Project/No Action Condition, Alternative D would generally be expected to provide:

- Similar habitat conditions for coldwater fish species, based on reservoir storage conditions, based on modeling results indicating: (1) similar or slightly increased long-term average monthly storage in most months, with substantially higher storage in October and November; (2) generally increased average monthly storage during wet, above normal, and below normal water years, particularly from September through November; and (3) generally lower average monthly storage in drier water year types with substantial reductions in storage during dry water years.

However, it is unlikely that coldwater fish habitat is limiting in San Luis Reservoir; therefore, it is unlikely that changes in reservoir storage under Alternative D would have a population level effect on coldwater fish species in San Luis Reservoir, relative to the Existing Conditions/No Project/No Action Condition.

Warmwater Fish Species

Relative to the Existing Conditions/No Project/No Action Condition, Alternative D would generally be expected to provide:

- Similar or slightly less suitable warmwater fish nesting conditions, based on modeling results indicating slight changes in the frequency of monthly water surface elevation reductions of 6 feet or more, with a more substantial increase in the frequency of water surface reductions in March under Alternative D.

It is unlikely that a small difference in the number of years with monthly water surface elevation reductions of greater than 6 feet under Alternative D would have a population level effect on bass and other warmwater fish in San Luis Reservoir, relative to the Existing Conditions/No Project/No Action Condition.

12C.6.2 Secondary Study Area – Alternative D Relative to the Existing Conditions/No Project/No Action Condition

Model results examined for Alternative D were the same as those described for the No Project Alternative for each waterway and facility included in the Secondary Study Area.

12C.6.2.1 Trinity Lake

Reservoir storage model results (Appendix 6B Water Resources System Modeling) were examined for Trinity Lake during April through November for coldwater fish species; reductions in average monthly surface elevations greater than 6 feet (Appendix 12F Reservoir Water Surface Elevation Summary Tables) were examined during March through June for warmwater species.

Coldwater Fish Species

Relative to the Existing Conditions/No Project/No Action Condition, Alternative D would generally be expected to provide:

- Similar amounts of habitat for coldwater fish species based on modeling results for reservoir storage conditions indicating similar long-term average monthly storage, and higher average monthly storage October and November of critical water year types.

However, it is unlikely that coldwater fish habitat is limiting in Trinity Lake; therefore, it is unlikely that changes in reservoir storage under Alternative D would have a population level effect on coldwater fish species in Trinity Lake, relative to the Existing Conditions/No Project/No Action Condition.

Warmwater Fish Species

Relative to the Existing Conditions/No Project/No Action Condition, Alternative D would generally be expected to provide:

- Similar warmwater fish nesting conditions, based on modeling results indicating minor differences in the frequency of monthly water surface elevation reductions of 6 feet or more during the evaluation period.

It is unlikely that a small difference in the number of years with monthly water surface elevation reductions of greater than 6 feet under Alternative D would have a population level effect on bass and other warmwater fish in Trinity Lake, relative to the Existing Conditions/No Project/No Action Condition.

12C.6.2.2 Trinity River

Flow and water temperature model results were examined for the Trinity River below Lewiston Dam, at Douglas City, and at North Fork for all species (Appendix 6B Water Resources System Modeling, Appendix 7E River Temperature Modeling, and Appendix 12E Fisheries Impact Water Temperature Assessment Summary Tables). For most species and life stages, only modeled flows and water temperatures were available; and the analyses of habitat conditions for these species and life stages were based primarily on the water temperature results. Model results for early life-stage mortality were also examined for fall-run Chinook salmon (Appendix 12H Early Life-Stage Salmon Mortality Modeling). In general, average monthly flows and water temperatures would differ only slightly and would be similar under Alternative A and the Existing Conditions/No Project/No Action Condition; and the potential for Project-related changes in aquatic habitat conditions and impacts on aquatic resources in the Trinity River are described below.

Coho Salmon

Relative to the Existing Conditions/No Project/No Action Condition, Alternative D would generally be expected to provide:

- Similar adult immigration and holding conditions, based on modeling results indicating: (1) similar or slightly (<5%) lower long-term average monthly flows during the evaluation period, and similar average monthly flows during most water year types, except for December of wet water years when average monthly flows would be up to 8.9 percent lower and October of critically dry years when flows may be increased by 9.1 percent; and (2) similar, or slightly lower (particularly from October through December) or slightly higher (during September and January) average monthly probabilities of exceeding the lowest water temperature index values.
- Similar adult spawning and embryo incubation conditions based on modeling results indicating: (1) similar or slightly lower long-term average monthly flows during the evaluation period, and similar average monthly flows during most water year types, except during October of critically dry years when flows would be higher, wet water years when average monthly flows in December would be lower, and during above normal and below normal water years, when flows would be substantially lower during March and February, respectively; and (2) similar probabilities of exceeding specified water temperature index values, with generally lower monthly probabilities of exceedance in March, May, and October through December with slightly higher probabilities of exceedance in October, January and April immediately below Lewiston Dam.
- Similar juvenile rearing and emigration conditions based on modeling results indicating: (1) similar or slightly lower long-term average monthly flows over the entire year, and similar average monthly flows during most water year types, except during October of critically dry years when flows would be higher, wet water years when average monthly flows would be lower in December, and during above normal and below normal water years when flows would be substantially lower during March and February, respectively; and (2) generally higher probabilities of exceeding the lowest index values throughout much of the year below Lewiston Dam and somewhat lower probabilities of exceedance of the higher index values at the downstream locations from June through October.
- Similar smolt emigration conditions based on modeling results indicating: (1) similar long-term average monthly flows during the evaluation period, and equivalent average monthly flows during most water year types, except for above normal and below normal water years, when flows would be

substantially lower during February and March; and (2) similar or lower probabilities of exceeding specified water temperature index values throughout the evaluation period.

In conclusion, in consideration of potential impacts to all life stages of Coho salmon in the Trinity River, Alternative D would result in generally similar conditions for coho salmon, relative to the Existing Conditions/No Project/No Action Condition.

Spring-Run Chinook Salmon

Relative to the Existing Conditions/No Project/No Action Condition, Alternative D would generally be expected to provide:

- Similar or slightly improved adult immigration and holding conditions, based on modeling results indicating: (1) similar long-term average monthly flows during the evaluation period, and equivalent average monthly flows during all water year types; and (2) similar, or lower monthly probabilities of exceeding specified water temperature index values, and therefore more suitable water temperatures, particularly from June through September.
- Similar or improved adult spawning and egg incubation conditions based on modeling results indicating: (1) equivalent long-term average monthly flows during the evaluation period, and equivalent or slightly higher average monthly flows during all water year types except in October of critical water years when flows would be increased; and (2) generally lower probabilities of exceeding specified water temperature index values, and therefore more suitable water temperatures, with higher exceedance probabilities in September.
- Similar or improved juvenile rearing and emigration conditions based on modeling results indicating: (1) similar or slightly lower long-term average monthly flows over the entire year, and similar average monthly flows during most water year types, except for October of critically dry years when flows would be higher, December of wet water years when average monthly flows would be lower, and during above normal and below normal water years when flows would be substantially lower during February and March; and (2) similar probabilities of exceeding specified water temperature index values throughout most of the year, with slightly lower probabilities of exceedance from July through September.
- Similar or improved smolt emigration conditions based on modeling results indicating: (1) similar or slightly lower long-term average monthly flows over the entire year, and similar average monthly flows during most water year types, except for October of critically dry years when flow would be higher, December of wet water years when average monthly flows would be lower, and during above normal and below normal water years when flows would be substantially lower during February and March; and (2) similar probabilities of exceeding specified water temperature index values throughout most of the year, with lower probabilities of exceedance from June through September.

In conclusion, in consideration of potential impacts to all life stages of spring-run Chinook salmon in the Trinity River, Alternative D would result in similar or more suitable conditions for spring-run Chinook salmon, relative to the Existing Conditions/No Project/No Action Condition.

Fall-Run Chinook Salmon

Relative to the Existing Conditions/No Project/No Action Condition, Alternative D would generally be expected to provide:

- Similar or improved adult immigration and holding conditions, based on modeling results indicating: (1) equivalent long-term average monthly flows during the evaluation period, and equivalent average monthly flows during most water year types except during wet water years when average monthly flows would be lower in December and in October of critically dry years when flows would be higher; and (2) similar, or lower monthly probabilities of exceeding specified water temperature index values, and therefore more suitable water temperatures, throughout the evaluation period.
- Similar adult spawning conditions based on modeling results indicating: (1) similar long-term average monthly flows during the evaluation period, and similar average monthly flows during most water year types, except in October of critically dry years when flows would be higher, December of wet water years when average monthly flows would be lower, and during above normal and below normal water years, when flows would be substantially lower during February and March; and (2) similar probabilities of exceeding specified water temperature index values throughout most of the year, with generally lower probabilities of exceedance during October and June.
- Similar embryo incubation conditions based on modeling results indicating: (1) similar total annual early life-stage mortality; and (2) similar probabilities of exceeding specified water temperature index values, with lower probabilities, and therefore more suitable water temperatures, during October.
- Similar or slightly improved juvenile rearing and emigration conditions based on modeling results indicating: (1) similar long-term average monthly flows over the entire year, and similar average monthly flows during most water year types, except in October of critically dry years when flows would be higher, December of wet water years when average monthly flows would be lower, and during above normal and below normal water years when flows would be substantially lower during February and March; and (2) similar probabilities of exceeding specified water temperature index values throughout most of the year, with slightly lower probabilities of exceedance from June through September.
- Similar smolt emigration conditions based on modeling results indicating: (1) similar long-term average monthly flows over the evaluation period, and similar average monthly flows during most water year types, except for February and March of above normal and below normal water years when flows would be substantially lower; and (2) similar probabilities of exceeding specified water temperature index values throughout much of the evaluation period, with slightly lower probabilities of exceedance during June and July.

In conclusion, in consideration of potential impacts to all life stages of fall-run Chinook salmon in the Trinity River, Alternative D would result in similar conditions for fall-run Chinook salmon, relative to the Existing Conditions/No Project/No Action Condition.

Steelhead (Winter-run and Summer-run)

Relative to the Existing Conditions/No Project/No Action Condition, Alternative D would generally be expected to provide:

- Similar adult immigration and holding conditions for winter-run steelhead, based on modeling results indicating: (1) similar long-term average monthly flows during the evaluation period, and similar average monthly flows during most water year types, except in October of critically dry water years when flows would be higher, December of wet water years when average monthly flows would be lower, and during above normal and below normal water years, when flows would be substantially

lower during February and March; and (2) similar, or slightly lower (particularly during August and October) average monthly probabilities of exceeding specified water temperature index values and slightly higher exceedance probabilities in April and September.

- Similar or slightly improved adult immigration and holding conditions for summer-run steelhead based on modeling results indicating: (1) equivalent long-term average monthly flows during the evaluation period, and equivalent average monthly flows during all water year types; and (2) similar or lower probabilities of exceeding specified water temperature index values throughout the evaluation period.
- Similar adult spawning and egg incubation conditions based on modeling results indicating: (1) similar long-term average monthly flows during the evaluation period, and similar average monthly flows during most water year types, except in October of critically dry years when flows would be higher, during December of wet water years when average monthly flows would be lower, and during above normal and below normal water years, when flows would be substantially lower during February and March; and (2) similar probabilities of exceeding specified water temperature index values throughout the evaluation period although there may be slightly increased or reduced probabilities of exceedance depending on the location and month.
- Similar juvenile rearing and emigration conditions based on modeling results indicating: (1) similar long-term average monthly flows over the entire year, and similar average monthly flows during most water year types, except in October of critically dry years when flows would be higher, December of wet water years when average monthly flows would be lower, and during above normal and below normal water years when flows would be substantially lower during February and March; and (2) generally equivalent probabilities of exceeding specified water temperature index values throughout most of the year with slightly lower probabilities of exceedance from June through September.
- Similar smolt emigration conditions based on modeling results indicating: (1) similar long-term average monthly flows over the evaluation period, and similar average monthly flows during most water year types, except for February and March of above normal and below normal water years when flows would be substantially lower; and (2) similar probabilities of exceeding specified water temperature index values although there may be slightly increased or reduced probabilities of exceedance depending on the location and month.

In conclusion, in consideration of potential impacts to all life stages of steelhead (winter-run and summer-run) in the Trinity River, Alternative D would result in similar conditions for steelhead, relative to the Existing Conditions/No Project/No Action Condition.

Green Sturgeon

Relative to the Existing Conditions/No Project/No Action Condition, Alternative D would generally be expected to provide:

- Similar adult immigration and holding conditions based on modeling results indicating: (1) equivalent long-term average monthly flows during the evaluation period, and equivalent average monthly flows during most water year types, except for October of critically dry water years when flows would be higher, and particularly during above normal and below normal water years, when flows would be substantially lower during February and March; and (2) similar probabilities of exceeding specified

water temperature index values although there may be slightly increased or reduced probabilities of exceedance depending on the month.

- Similar adult spawning conditions based on modeling results indicating: (1) equivalent long-term average monthly flows during the evaluation period, and equivalent average monthly flows during all water year types; and (2) similar or slightly reduced probabilities of exceeding the specified water temperature index value throughout the evaluation period.
- Similar juvenile rearing and emigration conditions based on modeling results indicating: (1) similar long-term average monthly flows over the entire year, and similar average monthly flows during most water year types, except in October of critically dry water years when flows would be higher, December of wet water years when average monthly flows would be lower, and during February and March of above normal and below normal water years when flows would be substantially lower; and (2) equivalent probabilities of exceeding specified water temperature index values throughout most of the year, with slightly lower probabilities of exceedance during August.

In conclusion, in consideration of potential impacts to all life stages of green sturgeon in the Trinity River, Alternative D would result in similar conditions for green sturgeon, relative to the Existing Conditions/No Project/No Action Condition.

White Sturgeon

Relative to the Existing Conditions/No Project/No Action Condition, Alternative D would generally be expected to provide:

- Similar adult immigration and holding conditions based on modeling results indicating: (1) equivalent long-term average monthly flows during the evaluation period, and equivalent average monthly flows during most water year types, except for December of wet water years when average monthly flows would be lower, and during February and March of above normal and below normal water years, when flows would be substantially lower; and (2) equivalent average monthly probabilities of exceeding the specified water temperature index value.
- Similar adult spawning conditions based on modeling results indicating: (1) similar long-term average monthly flows during the evaluation period, and similar average monthly flows during most water year types, except during February and March of above normal and below normal water years, when flows would be substantially lower; and (2) equivalent average monthly probabilities of exceeding the specified water temperature index value.
- Similar juvenile rearing and emigration conditions based on modeling results indicating: (1) similar long-term average monthly flows over the entire year, and similar average monthly flows during most water year types, except in October of critically dry water years when flows would be higher, December of wet water years when average monthly flows would be lower, and during February and March of above normal and below normal water years when flows would be substantially lower; and (2) equivalent probabilities of exceeding the specified water temperature index value throughout most of the year, with lower probabilities of exceedance during August.

In conclusion, in consideration of potential impacts to all life stages of white sturgeon in the Trinity River, Alternative D would result in similar conditions for white sturgeon, relative to the Existing Conditions/No Project/No Action Condition.

Pacific Lamprey

Relative to the Existing Conditions/No Project/No Action Condition, Alternative D would generally be expected to provide:

- Similar or less suitable adult immigration conditions based on modeling results indicating similar or slightly lower long-term average monthly flows during the evaluation period, and similar average monthly flows during most water year types, except for above normal and below normal water years, when flows would be substantially lower during March and February, respectively.
- Similar adult spawning and egg incubation conditions based on modeling results indicating: (1) similar long-term average monthly flows during the evaluation period, and similar average monthly flows during most water year types, except during February and March of above normal and below normal water years, when flows would be substantially lower; and (2) similar probabilities of water temperatures within the specified range although there may be slightly increased or reduced probabilities depending on the location and month.
- Similar ammocoete rearing and emigration conditions based on modeling results indicating: (1) similar long-term average monthly flows over the entire year, and similar average monthly flows during most water year types, except in October of critically dry water years when flows would be higher, December of wet water years when average monthly flows would be lower and during February and March of above normal and below normal water years when flows would be substantially lower; and (2) equivalent average monthly probabilities of exceeding the specified water temperature index value.

In conclusion, in consideration of potential impacts to all life stages of Pacific lamprey in the Trinity River, Alternative D would result in generally similar conditions for Pacific lamprey, relative to the Existing Conditions/No Project/No Action Condition.

12C.6.2.3 Klamath River downstream of the Trinity River

Potential impacts to fisheries and aquatic resources in the Klamath River downstream of the Trinity River under Alternative D relative to the Existing Conditions/No Project/No Action Condition would be similar to those discussed under Alternative A relative to the Existing Conditions/No Project/No Action Condition, above.

12C.6.2.4 Shasta Lake

Reservoir storage model results (Appendix 6B Water Resources System Modeling) were examined for Shasta Lake during April through November for coldwater fish species; reductions in average monthly surface elevations greater than 6 feet (Appendix 12F Reservoir Water Surface Elevation Summary Tables) were examined during March through June for warmwater species.

Coldwater Fish Species

Relative to the Existing Conditions/No Project/No Action Condition, Alternative D would generally be expected to provide:

- Similar or larger amounts of habitat for coldwater fish species, based on coldwater pool storage conditions, based on modeling results indicating: (1) similar levels of long-term average monthly storage and (2) similar average monthly storage by water year type during all months of the evaluation period, except in dry and critical water years when storage would be substantially higher.

However, it is unlikely that coldwater fish habitat is limiting in Shasta Lake; therefore, it is unlikely that changes in reservoir storage under Alternative D would have a population level effect on coldwater fish species in Shasta Lake, relative to the Existing Conditions/No Project/No Action Condition.

Warmwater Fish Species

Relative to the Existing Conditions/No Project/No Action Condition, Alternative D would generally be expected to provide:

- Similar or improved warmwater fish spawning and early life stage conditions, based on modeling results indicating similar or slightly reduced frequencies of monthly water surface elevation reductions of 6 feet or more during the evaluation period.

It is unlikely that a small difference in the number of years with monthly water surface elevation reductions of greater than 6 feet under Alternative D would have a population level effect on bass and other warmwater fish in Shasta Lake, relative to the Existing Conditions/No Project/No Action Condition.

12C.6.2.5 Sacramento River

Flow and water temperature model results were examined for the Sacramento River below Keswick Reservoir and at several points downstream, including the proposed Delevan Pipeline Intake/Discharge Facilities for all species (Appendix 6B Water Resources System Modeling, Appendix 7E River Temperature Modeling, and Appendix 12E Fisheries Water Temperature Assessment Summary Tables). The flow and water temperature results were used in combination with a number of other model outputs and indicators to assess potential changes in aquatic habitats for each species and life stage present, as detailed in Appendix 12B Fisheries Impact Assessment Methodology. For several species and life stages, only modeled flows and water temperatures were available; and the analyses of habitat conditions for these species and life stages were based primarily on the water temperature results. The potential for Project-related changes in aquatic habitat conditions and impacts on aquatic resources in the Sacramento River are described below.

Winter-run Chinook Salmon

Relative to the Existing Conditions/No Project/No Action Condition, Alternative D would generally be expected to provide:

- Similar adult immigration and holding conditions, based on modeling results indicating: (1) generally higher long-term average monthly flows during the early part of the evaluation period (December through February) and similar or lower average monthly flows during the later months (March through July) at Keswick Dam, particularly in drier water years; (2) similar or lower long-term average monthly flows during most months below RBDD, particularly in drier water year types; (3) similar long-term average monthly flows during most months with potential flow reductions in drier water year types at Verona, Freeport, and Rio Vista, although flows may be increased in June and July; and (4) similar, or slightly higher (particularly during April and May at downstream locations) average monthly probabilities of exceeding specified water temperature index values and lower exceedance probabilities in August and September.

- Improved spawning conditions based on modeling results indicating: (1) similar average monthly spawning habitat availability (WUA) during the entire April through August spawning period with slight increases in some months of dry water years; and (2) generally lower probabilities of exceeding specified water temperature index values, and therefore more suitable water temperatures, particularly during the months with the warmest water temperatures (July and August) although the 56°F index may be exceeded more often at the more downstream locations in June and July.
- Improved embryo incubation conditions based on modeling results indicating: (1) similar or slightly reduced total annual early life stage mortality, particularly in critical water year types when mortality would be substantially less; and (2) generally lower probabilities of exceeding specified water temperature index values, and therefore more suitable water temperatures, particularly during the months with the warmest water temperatures (July and August) although the 56°F index may be exceeded more often at the more downstream locations in June and July.
- Improved juvenile rearing and outmigration conditions based on modeling results indicating: (1) generally similar or lower long-term average monthly flows during most of the evaluation period, except from October through February when flows would be higher below Keswick Reservoir, particularly in drier water years; (2) generally higher long-term average flows would occur from June through November and similar or lower average flows from December through May in the lower Sacramento River (Verona, Freeport and Rio Vista), particularly in drier water years; (3) generally similar fry and juvenile rearing habitat availability (WUA)) in the upper Sacramento River; (4) a similar frequency and duration of floodplain inundation in the Sutter and Yolo bypasses; and (5) generally similar or lower, and therefore more suitable, monthly probabilities of exceeding specified water temperature index values, except in April when monthly probabilities would be slightly higher, particularly at the more downstream locations.
- Similar or improved production potential (SALMOD) based on modeling results indicating long-term average total annual winter-run Chinook salmon production would increase by 3.3 percent, while average total annual production would increase by less than 1 percent during wet water years, would increase during above normal water years by 10.6 percent, during below normal water years by 3.5 percent, and during dry and critical water years by 3.1 and 4.8 percent, respectively.
- Improved conditions pertaining to early life stage survival and abundance of spawners based on (IOS) modeling results indicating: (1) over the 81-year evaluation period, long-term average annual egg to fry survival would increase by 3 percent, and average annual egg to fry survival by water year type would decrease during wet and above normal water years by 1 percent and would increase during below normal water years by 2 percent, during dry water years by 5 percent and during critical water years by 13 percent; (2) overall, long-term average annual fry to smolt survival would be similar and average annual fry to smolt survival by water year types would be similar except during critical water years when fry to smolt survival would increase by 7 percent; and (3) long-term average annual female spawner abundance would increase by 11 percent, and average annual female spawner abundance by water year type would increase during wet water years by 14 percent, 21 percent during above normal water years, 5 percent during below normal water years, 7 percent during dry water years and increase by 11 percent during critical water years.

In conclusion, in consideration of potential impacts to all life stages of winter-run Chinook salmon in the Sacramento River, Alternative D would result in more suitable conditions for winter-run Chinook salmon, relative to the Existing Conditions/No Project/No Action Condition.

Spring-run Chinook Salmon

Relative to the Existing Conditions/No Project/No Action Condition, Alternative D would generally be expected to provide:

- Similar adult immigration and holding conditions, based on modeling results indicating: (1) similar or lower long-term average monthly and average monthly flows by water year type during most of the evaluation period in the upper Sacramento River except in February when flows may be higher below Keswick Reservoir; (2) generally higher long-term average monthly and average monthly flows by water year type from June through September in the lower Sacramento River, particularly in drier water years, with similar or reduced flows from February through May; and (3) similar, or slightly higher (particularly during April and May in the lower river) and lower (particularly during August and September) average monthly probabilities of exceeding specified water temperature index values (i.e., improved water temperature conditions).
- Improved spawning conditions based on modeling results indicating (1) generally similar or higher long-term average monthly flows and average monthly flows by water year type in the upper Sacramento River above RBDD from October to February, with similar or reduced flows in September, March, and April; and (2) similar or lower probabilities of exceeding specified water temperature index values, and therefore more suitable water temperatures, particularly during the primary spawning months (i.e., September and October).
- Improved embryo incubation conditions based on modeling results indicating slightly reduced total annual early life stage mortality, except during dry and critical water years when mortality would be substantially decreased; and (2) similar or lower probabilities of exceeding specified water temperature index values, particularly in September and October.
- Similar or improved juvenile rearing conditions based on modeling results indicating: (1) similar or higher long-term average monthly flows and average monthly flows by water year type from October through February, with similar or reduced flows from March through September below Keswick Reservoir; (2) generally similar flows below RBDD from June through December, with similar or reduced flows during the rest of the year, particularly in drier water year types; (3) a similar frequency and duration of floodplain inundation in the Sutter and Yolo bypasses; and (4) similar or lower, and therefore more suitable, monthly probabilities of exceeding specified water temperature index values, particularly during the months with the warmest water temperatures (July through October).
- Similar or improved smolt emigration conditions based on modeling results indicating: (1) similar or reduced long-term average monthly flows and average monthly flows by water year type, particularly from January through May below RBDD; (2) similar or reduced long-term average monthly flows and average monthly flows by water year type, particularly from January through May, and similar or increased flows during October, November, and June in the lower Sacramento River; and (2) similar or lower, and therefore more suitable, monthly probabilities of exceeding specified water temperature index values below RBDD and below the Feather River confluence except during April and May when probabilities of exceedance are higher at the Feather River, and with higher monthly probabilities of exceeding specified water temperature index values at Freeport.

- Similar or improved production potential based on (SALMOD) modeling results indicating long-term average annual spring-run Chinook salmon production would increase by 3.5 percent, while average total annual production would increase during wet water years by 1.6 percent, during above normal and below normal water years by less than 1 percent, during dry water years by 8.8 percent, and during critical water years by 6.8 percent.

In conclusion, in consideration of potential impacts to all life stages of spring-run Chinook salmon in the Sacramento River, Alternative D would result in more suitable conditions for spring-run Chinook salmon, relative to the Existing Conditions/No Project/No Action Condition.

Fall-run Chinook Salmon

Relative to the Existing Conditions/No Project/No Action Condition, Alternative D would generally be expected to provide:

- Similar or improved adult immigration and holding conditions, based on modeling results indicating: (1) similar or lower long-term average monthly and average monthly flows by water year type from June through September, and similar or increased flows from October through December in the upper Sacramento River; (2) generally increased long-term average monthly flows and flows by water year type from July through November in the lower Sacramento River; and (3) lower, and therefore more suitable, monthly probabilities of exceeding specified water temperature index values during much of the evaluation period.
- Similar spawning conditions based on modeling results indicating: (1) generally similar spawning habitat availability (WUA) from September through November, with slight differences (both increases and decreases) in spawning habitat availability depending on the reach and month; and (2) generally similar probabilities of exceeding specified water temperature index values, except during October when exceedance probabilities are lower and therefore water temperatures are more suitable.
- Similar or improved embryo incubation conditions based on modeling results that indicate: (1) slightly reduced levels of annual early life stage mortality, particularly in drier water year types; and (2) generally similar probabilities of exceeding specified water temperature index values, except during October when exceedance probabilities are lower and therefore water temperatures are more suitable.
- Similar juvenile rearing and outmigration conditions based on modeling results indicating: (1) generally lower long-term average monthly flows from December through May and higher average monthly flows from June through November at all locations evaluated; (2) generally reduced fry rearing habitat availability (WUA) from December through January and similar or improved juvenile rearing habitat availability, particularly in June, from Keswick Dam to Battle Creek; (3) a similar frequency and duration of floodplain inundation in the Sutter and Yolo bypasses; and (4) similar monthly probabilities of exceeding specified water temperature index values in many months, with lower exceedance probabilities (more suitable water temperatures) from July through October and higher exceedance probabilities (less suitable water temperatures) during April and May.
- Similar or improved production potential based on (SALMOD) modeling results indicating long-term average total annual fall-run Chinook salmon production would increase by 2.5 percent, while average total annual production would decrease during wet water years by 8 percent, and would

increase during above normal water years by 5.6 percent, during dry water years by over 5 percent, and during critical water years by over 12 percent.

In conclusion, in consideration of potential impacts to all life stages of fall-run Chinook salmon in the Sacramento River, Alternative D would result in similar or more suitable conditions and less-than-significant impacts, relative to the Existing Conditions/No Project/No Action Condition.

Late fall-run Chinook Salmon

Relative to the Existing Conditions/No Project/No Action Condition, Alternative D would generally be expected to provide:

- Similar adult immigration and holding conditions, based on modeling results indicating: (1) similar or higher long-term average monthly flows and average monthly flows by water year type from October through February below Keswick Reservoir, particularly during wetter water year types, and similar or reduced flows during March and April, particularly in drier water year; (2) similar or higher long-term average monthly flows and average monthly flows by water year type from October through December below RBDD, with similar or reduced flows from January through April below RBDD; (3) similar or higher long-term average monthly flows and average monthly flows by water year type during October and November with similar or reduced flows from December through April in the lower Sacramento River; and (4) similar monthly probabilities of exceeding specified water temperature index values, but with lower exceedance probabilities (more suitable water temperatures) during October and higher exceedance probabilities (less suitable water temperatures) during April, particularly at the more downstream locations.
- Similar spawning conditions based on modeling results indicating: (1) similar or lower spawning habitat availability (WUA) in January and February with similar or slightly higher spawning habitat availability in March and April; and (2) similar probabilities of exceeding specified water temperature index values, with more suitable water temperatures during May.
- Similar embryo incubation conditions based on modeling results that indicate: (1) similar annual early life stage mortality, and (2) similar probabilities of exceeding specified water temperature index values, with more suitable water temperatures during May.
- Similar or improved juvenile rearing and outmigration conditions based on modeling results indicating: (1) similar or lower long-term average monthly flows and average monthly flows by water year type from April through September, and similar or increased average monthly flows from October through December below RBDD; (2) generally higher long-term average monthly flows and average monthly flows by water year type in the lower Sacramento River; (3) increased fry rearing habitat availability (WUA) in April and May, particularly in drier water year types with slightly decreased fry rearing habitat availability in June with generally similar juvenile rearing habitat availability from Keswick Dam to Battle Creek; (4) a similar frequency and duration of floodplain inundation in the Sutter and Yolo bypasses; (5) similar or slightly reduced juvenile rearing habitat availability (WUA) from November through February and slightly increased juvenile rearing habitat availability from March through October; and (6) similar monthly probabilities of exceeding specified water temperature index values, with more suitable water temperatures from July through October and less suitable water temperatures during April.

- Similar or improved production potential based on (SALMOD) modeling results indicating: long-term average annual late fall-run Chinook salmon production would increase by 2.4 percent, while average total annual production by water year type would increase during above normal water years and below normal water years by 1 percent, during dry water years by 2 percent, and during critical water years by over 10 percent.

In conclusion, in consideration of potential impacts to all life stages of late fall-run Chinook salmon in the Sacramento River, Alternative D would result in similar or improved conditions for late fall-run Chinook salmon, relative to the Existing Conditions/No Project/No Action Condition.

Steelhead

Relative to the Existing Conditions/No Project/No Action Condition, Alternative D would generally be expected to provide:

- Similar adult immigration and holding conditions, based on modeling results indicating: (1) similar or increased long-term average monthly flows during much of the evaluation period below Keswick Reservoir, except during August, September, and March when average monthly flows could be lower; (2) similar or lower average monthly flows during the evaluation period at RBDD, particularly in February and March and in drier water year types, with slightly higher flows from October through December in wetter water year types; (3) similar or increased long-term average monthly flows and average monthly flows by water year type in the lower Sacramento River from August through November and lower average monthly flows from December through March, particularly in drier water year types; and (4) generally lower monthly probabilities of exceeding specified water temperature index values in the upper Sacramento River, particularly from August through November, and higher monthly probabilities of exceeding specified water temperature index values in the lower Sacramento River in November, February, and March.
- Similar spawning conditions based on modeling results indicating: (1) similar spawning habitat availability (WUA) from December through April; and (2) similar monthly probabilities of exceeding specified water temperature index values.
- Similar embryo incubation conditions based on modeling results indicating similar probabilities of exceeding specified water temperature index values.
- Similar juvenile rearing conditions based on modeling results indicating: (1) similar or increased long-term average monthly flows from October through February and similar or lower monthly flows from March through September below Keswick Dam and at Bend Bridge; (2) similar or lower average monthly flows from January through September at RBDD, particularly in drier water year types, and similar or higher monthly flows from October through December; (3) a similar frequency and duration of floodplain inundation in the Sutter and Yolo bypasses; and (4) lower monthly probabilities of exceeding specified water temperature index values, and therefore more suitable water temperature conditions in August and September.
- Similar or less suitable smolt emigration conditions based on modeling results indicating: (1) similar or lower average monthly flows from January through May at RBDD, particularly in drier water year types, and similar or higher monthly flows from October through December; (2) generally higher long-term average monthly flows and average monthly flows by water year type in the lower Sacramento River during October and November, with similar or lower monthly flows from

December through March, particularly in drier water year types; and (3) similar or higher monthly probabilities of exceeding specified water temperature index values, and therefore less suitable water temperature conditions from February through May with lower monthly probabilities of exceedance in October and November at RBDD.

In conclusion, in consideration of potential impacts to all life stages of steelhead in the Sacramento River, Alternative D would result in similar conditions for steelhead, relative to the Existing Conditions/No Project/No Action Condition.

Green Sturgeon

Relative to the Existing Conditions/No Project/No Action Condition, Alternative D would generally be expected to provide:

- Similar or improved adult immigration and holding conditions, based on modeling results indicating: (1) generally similar or lower long-term average monthly flows during much of the evaluation period, except during February when flows may be increased below Keswick Reservoir; (2) generally similar or lower long-term average monthly and average monthly flows by water year type from February through May and similar or higher monthly flows in June and July below the proposed Delevan Pipeline Intake Facilities and at Rio Vista; and (3) generally similar or lower, and therefore more suitable, average monthly probabilities of exceeding specified water temperature index values except in April when probabilities of exceedance may be higher.
- Similar spawning egg incubation conditions based on modeling results indicating: (1) similar or lower long-term average monthly and average monthly flows by water year type below Keswick Dam and RBDD; (2) similar or lower long-term average monthly and average monthly flows by water year type from March through May, and similar or higher flows from June through September at Wilkins Slough; and (3) generally reduced probabilities of exceeding specified water temperature index values.
- Similar or improved juvenile rearing and outmigration conditions based on modeling results indicating: (1) similar or increased long-term average monthly flows from October through February, and similar or lower monthly flows from March through September below Keswick Dam and at Bend Bridge; (2) similar or lower average monthly flows from January through September at RBDD, particularly in drier water year types, and similar or higher monthly flows from October through December; and (3) lower, and therefore more suitable, monthly probabilities of exceeding specified water temperature index values at all locations evaluated from July through September.

In conclusion, in consideration of potential impacts to all life stages of green sturgeon in the Sacramento River, Alternative D would result in similar or more suitable conditions for green sturgeon, relative to the Existing Conditions/No Project/No Action Condition.

White Sturgeon

Relative to the Existing Conditions/No Project/No Action Condition, Alternative D would generally be expected to provide:

- Similar or less suitable adult immigration and holding conditions, based on modeling results indicating: (1) similar or lower long-term average monthly and average monthly flows by water year type during most of the evaluation period, except in November when flows may be higher below the

Delevan Intake and at Rio Vista; and (2) equivalent monthly probabilities of exceeding specified water temperature index values.

- Similar spawning and egg incubation conditions, based on modeling results indicating: (1) generally lower long-term average and average by water year type monthly flows from February through May; and (2) generally similar probabilities of exceeding specified water temperature index values, and therefore less suitable water temperatures.
- Similar or more suitable juvenile rearing and outmigration conditions based on: (1) similar or higher average monthly flows and average monthly flows by water year type during June through November, and lower average monthly flows during December through May below the proposed Delevan Pipeline Intake Facilities and at Wilkens Slough and Freeport; and (2) lower monthly probabilities of exceeding specified water temperature index values, and therefore more suitable water temperature conditions from June through September.

In conclusion, in consideration of potential impacts to all life stages of white sturgeon in the Sacramento River, Alternative D would result in similar conditions for white sturgeon, relative to the Existing Conditions/No Project/No Action Condition.

River Lamprey

Relative to the Existing Conditions/No Project/No Action Condition, Alternative D would generally be expected to provide:

- Similar adult immigration conditions, based on modeling results indicating: (1) generally lower long-term average monthly and average monthly flows by water year type below Keswick Dam except from October through February when flows may be higher (lower in October for dry and critical water year types); and (2) generally lower long-term average monthly and average monthly flows by water year type below the proposed Delevan Pipeline Intake Facilities and at Freeport, except in June and September through November when flows may be higher.
- Similar spawning and egg incubation conditions, based on modeling results indicating: (1) similar or lower long-term average and average by water year type monthly flows below Keswick Dam and below RBDD, although flows may be higher in February below Keswick Dam; (2) similar or lower long-term average and average by water year type monthly flows from February through May, with similar or higher average monthly flows in June and July below the proposed Delevan Pipeline Intake Facilities,; and (3) generally higher probabilities of water temperatures occurring within specified water temperature ranges, and therefore more suitable water temperatures, except below the proposed Delevan Pipeline Intake Facilities where the probability of suitable water temperatures would be lower.
- Similar ammocoete rearing and emigration conditions based on modeling results indicating: (1) similar or increased long-term average monthly flows from October through February, and similar or lower monthly flows from March through September below Keswick Dam; (2) similar or lower average monthly flows from December through May, and similar or increased flows from June through November at RBDD, particularly in drier water year types, and similar or higher monthly flows from October through December below the proposed Delevan Pipeline Intake Facilities and at Rio Vista; and (3) similar monthly probabilities of exceeding specified water temperature index

values, except in July and August when monthly probabilities would be lower and therefore more suitable water temperatures would occur, at Freeport.

In conclusion, in consideration of potential impacts to all life stages of river lamprey in the Sacramento River, Alternative D would result in similar conditions for river lamprey, relative to the Existing Conditions/No Project/No Action Condition.

Pacific Lamprey

Relative to the Existing Conditions/No Project/No Action Condition, Alternative D would generally be expected to provide:

- Similar adult immigration conditions, based on modeling results indicating: (1) similar or lower long-term average monthly and average monthly flows by water year type below Keswick Dam except in January and February when flows may be higher, particularly in drier water year types (2) generally lower long-term average monthly and average monthly flows by water year type below the proposed Delevan Pipeline Intake Facilities and at Freeport, except in June when flows may be higher.
- Similar spawning and egg incubation conditions, based on modeling results indicating: (1) similar or lower long-term average and average by water year type monthly flows below Keswick Dam and below RBDD, although flows may be higher in January and February below Keswick Reservoir; (2) similar or lower long-term average and average by water year type monthly flows from January through May, with similar or higher average monthly flows from June through August below the proposed Delevan Pipeline Intake Facilities; and (3) similar or higher probabilities of occurring within specified water temperature ranges, and therefore more suitable water temperatures, except below Delevan where temperatures would be less suitable.
- Similar ammocoete rearing and emigration conditions based on modeling results indicating: (1) similar or increased long-term average monthly flows from October through February and similar or lower monthly flows from March through September below Keswick Dam; (2) similar or lower average monthly flows from December through May and similar or increased flows from June through November at RBDD, particularly in drier water year types, and similar or higher monthly flows from October through December below the proposed Delevan Pipeline Intake Facilities and at Rio Vista; and (3) similar monthly probabilities of exceeding specified water temperature index values, except in July and August when monthly probabilities would be lower and therefore more suitable water temperatures would occur, at Freeport.

In conclusion, in consideration of potential impacts to all life stages of Pacific lamprey in the Sacramento River, Alternative D would result in similar conditions for Pacific lamprey, relative to the Existing Conditions/No Project/No Action Condition.

Hardhead

Relative to the Existing Conditions/No Project/No Action Condition, Alternative D would generally be expected to provide:

- Similar adult and other life stage conditions, based on modeling results indicating: (1) similar or increased long-term average monthly flows from October through February and similar or lower monthly flows from March through September below Keswick Dam; (2) similar or higher average

monthly flows and average monthly flows by water year type from June through November, and similar or lower average monthly flows from December through May below the proposed Delevan Pipeline Intake Facilities and at Freeport; and (3) similar or lower probabilities of water temperatures occurring within the specified range May through September, and therefore, potentially less suitable water temperatures.

- Similar spawning conditions, based on modeling results indicating: (1) generally similar or lower long-term average monthly flows and average monthly flows by water year type below Keswick Reservoir, below the proposed Delevan Pipeline Intake Facilities and at Freeport, except in June when flows may be increased below the proposed Delevan Intake, and at Freeport; and (2) higher probabilities of occurring within specified water temperature ranges, and therefore more suitable water temperatures below the Delevan Intake in April and May.

In conclusion, in consideration of potential impacts to all life stages of hardhead in the Sacramento River, Alternative D would result in similar conditions for hardhead, relative to the Existing Conditions/No Project/No Action Condition.

Sacramento Splittail

Relative to the Existing Conditions/No Project/No Action Condition, Alternative D would generally be expected to provide:

- Similar spawning and egg/larval life stage conditions, based on modeling results indicating: (1) a similar frequency that water temperatures are within the range specified for splittail in the Sacramento River (that is, 45 through 75°F); and (2) a similar frequency and duration of floodplain inundation in the Sutter and Yolo bypasses.

In conclusion, in consideration of potential impacts to all life stages of splittail in the Sacramento River, Alternative D would result in similar conditions for splittail, relative to the Existing Conditions/No Project/No Action Condition.

American Shad

Relative to the Existing Conditions/No Project/No Action Condition, Alternative D would generally be expected to provide:

- Similar adult spawning and other life stage conditions, based on modeling results indicating: (1) generally similar or lower long-term average monthly and average monthly flows by water year type, except in June when average monthly flows may be higher at Verona and Freeport; and (2) slightly higher probabilities of water temperatures occurring within the specified water temperature range, particularly in April below the Feather River confluence.
- Similar or improved larvae, fry, and juvenile emigration conditions, based on modeling results indicating: (1) generally higher long-term average and average by water year type monthly flows below the proposed Delevan Pipeline Intake Facilities and at Verona and Freeport, particularly in drier water year types; and (2) similar or higher probabilities of water temperatures occurring within the specified water temperature range, except in September and October when water temperatures would be less suitable at Freeport.

In conclusion, in consideration of potential impacts to all life stages of American shad in the Sacramento River, Alternative D would result in similar conditions for American shad, relative to the Existing Conditions/No Project/No Action Condition.

Striped Bass

Relative to the Existing Conditions/No Project/No Action Condition, Alternative D would generally be expected to provide:

- Similar or improved adult spawning and other life stage conditions, based on: (1) generally lower long-term average monthly and average monthly flows by water year type, except in June when average monthly flows may be higher below the Delevan Intake and at Verona; and (2) higher probabilities of water temperatures occurring within the specified water temperature range, particularly in April at the Delevan Intake.
- Similar or improved larvae, fry, and juvenile emigration conditions, based on: (1) similar or higher average monthly flows and average monthly flows by water year type from June through November, and similar or lower average monthly flows from December through May below the proposed Delevan Pipeline Intake Facilities and at Verona; and (2) generally higher probabilities of water temperatures occurring within the specified water temperature range except in October when the probability may be lower below the Feather River confluence.

In conclusion, in consideration of potential impacts to all life stages of striped bass in the Sacramento River, Alternative D would result in similar or improved conditions for striped bass, relative to the Existing Conditions/No Project/No Action Condition.

Largemouth Bass

Relative to the Existing Conditions/No Project/No Action Condition, Alternative D would generally be expected to provide:

- Similar or improved adult and other life stage conditions, based on modeling results indicating: (1) similar or increased long-term average monthly flows from October through February and similar or lower monthly flows from March through September below Keswick Dam; and (2) similar or higher average monthly flows and average monthly flows by water year type from June through November, and similar or lower average monthly flows from December through May below the proposed Delevan Pipeline Intake Facilities and at Freeport.
- Similar spawning conditions, based on modeling results indicating similar monthly probabilities of water temperatures occurring within the specified water temperature range below Keswick Dam and at Freeport, with higher probabilities of occurring within the range, and therefore more suitable temperatures, below the proposed Delevan Pipeline Intake Facilities during April.

In conclusion, in consideration of potential impacts to all life stages of largemouth bass in the Sacramento River, Alternative D would result in similar conditions for largemouth bass, relative to the Existing Conditions/No Project/No Action Condition.

12C.6.2.6 Clear Creek

Potential impacts to fisheries and aquatic resources in Clear Creek under Alternative D relative to the Existing Conditions/No Project/No Action Condition would be similar to those discussed under Alternative A relative to the Existing Conditions/No Project/No Action Condition, above.

12C.6.2.7 Lake Oroville

Reservoir storage model results (Appendix 6B Water Resources System Modeling) were examined for Lake Oroville during April through November for coldwater fish species; reductions in average monthly surface elevations greater than 6 feet (Appendix 12F Reservoir Water Surface Elevation Summary Tables) were examined during March through June for warmwater species.

Coldwater Fish Species

Relative to the Existing Conditions/No Project/No Action Condition, Alternative D would generally be expected to provide:

- Similar amounts of habitat for coldwater fish species based on modeling results for reservoir storage conditions indicating similar or higher long-term average monthly storage, particularly during drier water year types.

However, it is unlikely that coldwater fish habitat is limiting in Lake Oroville; therefore, it is unlikely that changes in reservoir storage under Alternative D would have a population level effect on coldwater fish species in Lake Oroville, relative to the Existing Conditions/No Project/No Action Condition.

Warmwater Fish Species

Relative to the Existing Conditions/No Project/No Action Condition, Alternative D would generally be expected to provide:

- Similar warmwater fish nesting conditions, based on modeling results indicating minor differences in the frequency of monthly water surface elevation reductions of 6 feet or more during the evaluation period.

It is unlikely that a small difference in the number of years with monthly water surface elevation reductions of greater than 6 feet under Alternative D would have a population level effect on bass and other warmwater fish in Lake Oroville, relative to the Existing Conditions/No Project/No Action Condition.

12C.6.2.8 Feather River

Flows in the Low Flow Channel below the Fish Barrier Dam were modeled consistent with the terms of the FERC Settlement Agreement. As shown in Appendix 6B Water Resources System Modeling, modeled results for long-term average flows, and average flows by water year type, were equivalent for Alternative D, relative to the Existing Conditions/No Project/No Action Condition. Although these results are not repeated for the discussions below, the model results for the Low Flow Channel below the Fish Barrier Dam were considered along with the information presented below and were incorporated into the impact determinations for the following species: spring-run Chinook salmon, fall-run Chinook salmon, steelhead, green sturgeon, white sturgeon, river lamprey, Pacific lamprey, and hardhead.

Flow and water temperature model results were examined for the Feather River at several points downstream of Lake Oroville (Appendix 6B Water Resources System Modeling, Appendix 7E River

Temperature Modeling, and Appendix 12E Fisheries Water Temperature Assessment Summary Tables). For several species and life stages, only modeled flows and water temperatures were available; and the analyses of habitat conditions for these species and life stages were based primarily on the water temperature results. Model results for spawning habitat availability (WUA) were also examined for Chinook salmon and steelhead (Appendix 12N Weighted Usable Area Analysis). The potential for Project-related changes in aquatic habitat conditions and impacts on aquatic resources in the Feather River are described below.

Spring-run Chinook Salmon

Relative to the Existing Conditions/No Project/No Action Condition, Alternative D would generally be expected to provide:

- Similar adult immigration and holding conditions, based on modeling results indicating: (1) generally similar or slightly lower long-term average monthly flows and average monthly flows by water year type during the evaluation period below the Thermalito Afterbay outlet and at the mouth of the Feather River in all but drier water year types when flows may be substantially lower except in in August and September when flows may be increased; and (2) similar or higher monthly probabilities of exceeding specified water temperature index values, except in August when the exceedance probability may be lower.
- Similar spawning conditions based on modeling results indicating: (1) similar or lower long-term average monthly flows and average monthly flows by water year type during the evaluation period below the Thermalito Afterbay outlet, except in September when flows may be increased and in below normal water years when flows may be increased during some months; and (2) similar probabilities of exceeding specified water temperature index values during most of the evaluation period, except in September and October, when exceedance probabilities of the lower index values may be higher below the Thermalito Afterbay outlet.
- Similar embryo incubation conditions based on modeling results indicating similar probabilities of exceeding specified water temperature index values during most of the evaluation period.
- Similar juvenile rearing and outmigration conditions based on modeling results indicating: (1) generally similar or lower long-term average monthly flows occurring from October through April, particularly in drier water years, and similar or higher average monthly flows from May through September, particularly in wetter water years and in August and September of most water year types; and (2) similar monthly probabilities of exceeding the specified water temperature index values during most of the year except from May through September when exceedance probabilities may be higher or lower depending on the index value and month.
- Similar or less suitable smolt emigration conditions, based on modeling results indicating: (1) similar or lower long-term average monthly flows and average monthly flows by water year type occurring during most of the evaluation period, except in June, when average monthly flows would be higher in wetter water year types; and (2) generally similar monthly probabilities of exceeding specified water temperature index values during most of the evaluation period below the Thermalito Afterbay outlet and at the mouth of the Feather River.

In conclusion, in consideration of potential impacts to all life stages of spring-run Chinook salmon in the Feather River, Alternative D would result in similar conditions for spring-run Chinook salmon, relative to the Existing Conditions/No Project/No Action Condition.

Fall-run Chinook Salmon

Relative to the Existing Conditions/No Project/No Action Condition, Alternative D would generally be expected to provide:

- Similar adult immigration and holding conditions, based on modeling results indicating: (1) generally similar or lower long-term average monthly flows except in August and September of drier water year types and November and December of below normal water years when flows may be higher below the Thermalito Afterbay outlet and at the mouth of the Feather River; and (2) similar monthly probabilities of exceeding specified water temperature index values, with slightly lower monthly probabilities of exceedance during August, and slightly higher probabilities during July, September, and October.
- Similar spawning conditions based on modeling results indicating: (1) similar or lower average monthly flows from October through December except in November and December of below normal water years when flows may be higher below the Thermalito Afterbay outlet; (2) generally similar spawning habitat availability (WUA) in the reach below Thermalito, although spawning habitat availability may be increased or decreased depending on the month and water year type; and (3) similar or slightly lower probabilities of exceeding specified water temperature index values in the Low Flow Channel and higher probabilities of exceedance during October below the Thermalito Afterbay outlet.
- Similar embryo incubation conditions based on modeling results indicating: (1) similar annual long-term average early life stage mortality; and (2) similar or slightly lower probabilities of exceeding specified water temperature index values in the Low Flow Channel and higher probabilities of exceedance during October below the Thermalito Afterbay outlet.
- Similar juvenile rearing and outmigration conditions based on modeling results indicating: (1) similar or lower long-term average monthly flows occurring during most months of the evaluation period below the Thermalito Afterbay outlet and at the mouth of the Feather River, particularly in drier water year types, except during May and June and in above normal water years and November and December of below normal water years when average monthly flows may be higher; and (2) similar monthly probabilities of exceeding specified water temperature index values during most of the evaluation period.

In conclusion, in consideration of potential impacts to all life stages of fall-run Chinook salmon in the Feather River, Alternative D would result in similar conditions for fall-run Chinook salmon, relative to the Existing Conditions/No Project/No Action Condition.

Steelhead

Relative to the Existing Conditions/No Project/No Action Condition, Alternative D would generally be expected to provide:

- Similar adult immigration and holding conditions, based on modeling results indicating: (1) generally similar or lower long-term average monthly flows except in August and September of drier water year

types and November and December of below normal water years when flows may be higher below the Thermalito Afterbay outlet and at the mouth of the Feather River; and (2) equivalent or lower monthly probabilities of exceeding specified water temperature index values during most of the evaluation period at all Feather River locations evaluated except during April and August when probabilities of exceedance may be higher.

- Similar or improved spawning and incubation conditions based on modeling results indicating: (1) similar or lower long-term average flows and monthly flows by water year type except in May and June of above normal water years and below normal water years when flows may be slightly higher in some months; (2) similar long-term average spawning habitat availability (WUA) during the entire adult spawning period, except in December when spawning habitat availability may be increased in some water year types; and (3) equivalent probabilities of exceeding specified water temperature index values except in April, when exceedance probabilities may be slightly increased.
- Similar juvenile rearing and outmigration conditions based on modeling results indicating: (1) generally similar or lower long-term average monthly flows occurring from October through April, particularly in drier water years, and similar or higher average monthly flows from May through September, particularly in wetter water years and in August and September of most water year types; and (2) generally similar monthly probabilities of exceeding specified water temperature index values at all Feather River locations evaluated during much of the evaluation period, although exceedance probabilities may be higher or lower below the Thermalito Afterbay depending on the index value and month.
- Similar smolt emigration conditions based on: (1) generally similar or lower long-term average monthly flows and average monthly flows by water year type below the Thermalito Afterbay outlet and at the mouth of the Feather River, except in May and June of above normal water years and below normal water year types when average monthly flows would be higher in some months; and (2) generally similar monthly probabilities of exceeding specified water temperature index values during most of the evaluation period, except during April and October when exceedance probabilities may be higher and November and December when exceedance probabilities may be lower.

In conclusion, in consideration of potential impacts to all life stages of steelhead in the Feather River, Alternative D would result in similar conditions for steelhead, relative to the Existing Conditions/No Project/No Action Condition.

Green Sturgeon

Relative to the Existing Conditions/No Project/No Action Condition, Alternative D would generally be expected to provide:

- Similar adult immigration and holding conditions, based on modeling results indicating: (1) similar or lower long-term average monthly flows and average monthly flows by water year type at Shanghai Bend and at the mouth of the Feather River, except for below normal water year types when average monthly flows would be higher in some months and during August and September of drier water year types when flows would be higher; and (2) similar or higher monthly probabilities of exceeding specified water temperature index values except during August and September when exceedance probabilities may be lower.

- Similar adult spawning and embryo incubation conditions based on modeling results indicating: (1) similar or slightly higher long-term average monthly flows during the evaluation period below the Thermalito Afterbay outlet, and generally lower average monthly flows by water year type during most water year types below the Thermalito Afterbay outlet, except during August of dry and critical water year types when higher average monthly flows would occur; and (2) higher monthly probabilities of exceeding specified water temperature index values below the Thermalito Afterbay in June, July, and September with lower probabilities of exceedance in August.
- Similar or less suitable juvenile rearing conditions based on modeling results indicating: (1) similar or lower long-term average monthly flows except in August and September of drier water year types and November and December of below normal water years when flows may be higher below the Thermalito Afterbay outlet and at the mouth of the Feather River; and (2) similar monthly probabilities of exceeding specified water temperature index values below the Thermalito Afterbay outlet and at the mouth of the Feather River, with higher probabilities of exceedance during June and September.
- Similar juvenile emigration conditions based on modeling results indicating: (1) similar or lower long-term average monthly flows during the evaluation period below the Thermalito Afterbay outlet and at the mouth of the Feather River, and generally higher average monthly flows by water year type during August and September of drier water years and in May and June of above normal years; and (2) generally similar monthly probabilities of exceeding specified water temperature index values with higher probabilities of exceedance during June below the Thermalito Afterbay outlet and in September at the mouth of the Feather River.

In conclusion, in consideration of potential impacts to all life stages of green sturgeon in the Feather River, Alternative D would result in similar conditions for green sturgeon, relative to the Existing Conditions/No Project/No Action Condition.

White Sturgeon

Relative to the Existing Conditions/No Project/No Action Condition, Alternative D would generally be expected to provide:

- Similar adult immigration and holding conditions, based on: (1) similar or slightly lower long-term average monthly flows and average monthly flows by water year type during the evaluation period at the mouth of the Feather River, except during below normal water years when flows may be higher in some months; and (2) equivalent monthly probabilities of exceeding specified water temperature index values.
- Similar or less suitable adult spawning and egg incubation conditions based on modeling results indicating: (1) similar or slightly lower long-term average monthly flows and average monthly flows by water year type during the evaluation period, particularly during dry water year types; and (2) similar or lower monthly probabilities of exceeding specified water temperature index values.
- Similar juvenile rearing and outmigration conditions based on modeling results indicating: (1) similar or lower long-term average monthly flows except in August and September of drier water year types and November and December of below normal water years when flows may be higher below the Thermalito Afterbay outlet and at the mouth of the Feather River; and (2) similar monthly

probabilities of exceeding specified water temperature index values during most months at all locations evaluated with higher probabilities of exceedance during June and September.

In conclusion, in consideration of potential impacts to all life stages of white sturgeon in the Feather River, Alternative D would result in similar conditions for white sturgeon, relative to the Existing Conditions/No Project/No Action Condition.

River Lamprey

Relative to the Existing Conditions/No Project/No Action Condition, Alternative D would generally be expected to provide:

- Similar adult immigration conditions, based on modeling results indicating similar or lower long-term average monthly flows and average monthly flows by water year type during the evaluation period, except in June and September and in some months of below normal water years when flows may be higher below the Thermalito Afterbay outlet and at the mouth of the Feather River.
- Similar spawning and egg incubation conditions, based on modeling results indicating: (1) generally lower long-term average monthly flows below the Thermalito Afterbay outlet and at the mouth of the Feather River, except in May and June and in below normal water years when flows may be higher; and (2) generally similar or slightly higher and lower probabilities (depending on month) of water temperatures occurring within the specified water temperature range at all Feather River locations evaluated.
- Similar ammocoete rearing and emigration conditions based on modeling results indicating: (1) similar or lower long-term average monthly flows except in August and September of drier water year types and November and December of below normal water years when flows may be higher below the Thermalito Afterbay outlet and at the mouth of the Feather River; and (2) similar or higher probabilities of exceeding the specified water temperature index at all Feather River locations evaluated, except during August and September when probabilities of exceeding the index would be slightly lower at the mouth of the Feather River.

In conclusion, in consideration of potential impacts to all life stages of river lamprey in the Feather River, Alternative D would result in similar conditions for river lamprey, relative to the Existing Conditions/No Project/No Action Condition.

Pacific Lamprey

Relative to the Existing Conditions/No Project/No Action Condition, Alternative D would generally be expected to provide:

- Similar adult immigration conditions, based on modeling results indicating generally lower long-term average monthly flows and average monthly flows by water year type during the evaluation period below the Thermalito Afterbay outlet, except in above normal and below normal water years when flows may be higher in some months below the Thermalito Afterbay outlet and at the mouth of the Feather River.
- Similar spawning and egg incubation conditions, based on modeling results indicating: (1) generally lower long-term average monthly flows and average monthly flows by water year type during the evaluation period, except in above normal and below normal water years when flows may be higher in some months and August of drier water years when flows may be higher below the Thermalito

Afterbay outlet and at the mouth of the Feather River; and (2) generally similar probabilities of water temperatures occurring within the specified water temperature range at all Feather River locations evaluated, except in March when probabilities of temperatures occurring within the range are lower.

- Similar ammocoete rearing and emigration conditions based on modeling results indicating: (1) similar or lower long-term average monthly flows except in August and September of drier water year types and November and December of below normal water years when flows may be higher below the Thermalito Afterbay outlet and at the mouth of the Feather River; and (2) similar or higher probabilities of exceeding the specified water temperature index at all Feather River locations evaluated, except during August and September when probabilities of exceeding the index would be slightly lower at the mouth of the Feather River.

In conclusion, in consideration of potential impacts to all life stages of Pacific lamprey in the Feather River, Alternative D would result in similar conditions for Pacific lamprey, relative to the Existing Conditions/No Project/No Action Condition.

Hardhead

Relative to the Existing Conditions/No Project/No Action Condition, Alternative D would generally be expected to provide:

- Similar adult and juvenile life stage conditions based on modeling results indicating: (1) similar or lower long-term average monthly flows except in August and September of drier water year types and November and December of below normal water years when flows may be higher below the Thermalito Afterbay outlet and at the mouth of the Feather River; and (2) similar probabilities of water temperatures occurring within the specified water temperature range during the evaluation period at all Feather River locations evaluated, except during May when the probability may be lower and September when the probability would be higher.
- Similar adult spawning conditions, based on modeling results indicating: (1) generally similar long-term average monthly flows and average monthly flows by water year type during the evaluation period, except during drier water year types when flows may be lower below the Thermalito Afterbay outlet and at the mouth of the Feather River; and (2) generally similar probabilities of water temperatures occurring within the specified water temperature range at all Feather River locations evaluated.

In conclusion, in consideration of potential impacts to all life stages of hardhead in the Feather River, Alternative D would result in similar conditions for hardhead, relative to the Existing Conditions/No Project/No Action Condition.

Sacramento Splittail

Relative to the Existing Conditions/No Project/No Action Condition, Alternative D would generally be expected to provide:

- Similar or less suitable spawning conditions, based on modeling results indicating: (1) similar or slightly lower long-term average monthly flows and average monthly flows by water year type at the mouth of the Feather River, particularly in drier water year types; and (2) similar monthly probabilities of water temperatures occurring within the specified water temperature range.

In conclusion, in consideration of potential impacts to all life stages of splittail in the Feather River, Alternative D would result in similar conditions for splittail, relative to the Existing Conditions/No Project/No Action Condition.

Striped Bass

Relative to the Existing Conditions/No Project/No Action Condition, Alternative D would generally be expected to provide:

- Similar adult spawning and other life stage conditions, based on modeling results indicating: (1) generally similar long-term average monthly flows and average monthly flows by water year type during the evaluation period, except during drier water year types when flows may be lower below the Thermalito Afterbay outlet and at the mouth of the Feather River; and (2) similar monthly probabilities of water temperatures occurring within the specified water temperature range at all Feather River locations evaluated, except in June when the probability may be lower below the Thermalito Afterbay.
- Similar larvae, fry, and juvenile rearing emigration conditions, based on modeling results indicating: (1) similar or lower long-term average monthly flows except in August and September of drier water year types and November and December of below normal water years when flows may be higher below the Thermalito Afterbay outlet and at the mouth of the Feather River; and (2) similar probabilities of water temperatures occurring within the specified water temperature range except during April, July, and October when the probability of being within the specified range below the Thermalito Afterbay outlet would be higher and August and September when the probability would be lower and at the mouth of the Feather River where the probability of being within the range would be higher in August and October and slightly lower in June, July, and September.

In conclusion, in consideration of potential impacts to all life stages of striped bass in the Feather River, Alternative D would result in similar conditions for striped bass, relative to the Existing Conditions/No Project/No Action Condition.

American Shad

Relative to the Existing Conditions/No Project/No Action Condition, Alternative D would generally be expected to provide:

- Similar adult spawning and other life stage conditions, based on modeling results indicating: (1) generally similar long-term average monthly flows and average monthly flows by water year type during the evaluation period, except during drier water year types when flows may be lower below the Thermalito Afterbay outlet and at the mouth of the Feather River; and (2) generally similar or slightly higher probabilities of water temperatures occurring within the specified water temperature range at all Feather River locations evaluated.
- Similar larvae, fry, and juvenile emigration conditions, based on modeling results indicating: (1) similar or lower long-term average and average monthly flows by water year type occurring during most water year types during the evaluation period except during August and September of drier water year types when average monthly flows may be higher at all Feather River locations evaluated; and (2) similar probabilities of water temperatures occurring within the specified water temperature range at all Feather River locations evaluated.

In conclusion, in consideration of potential impacts to all life stages of American shad in the Feather River, Alternative D would result in similar conditions for American shad, relative to the Existing Conditions/No Project/No Action Condition.

Largemouth Bass

Relative to the Existing Conditions/No Project/No Action Condition, Alternative D would generally be expected to provide:

- Similar adult and other life stage conditions, based on modeling results indicating similar or lower long-term average and average monthly flows by water year type occurring during most water year types during the evaluation period except during August and September of drier water year types when average monthly flows may be higher at all Feather River locations evaluated.
- Similar spawning conditions, based on based on modeling results indicating: (1) generally similar long-term average monthly flows and average monthly flows by water year type during the evaluation period, except during drier water year types when flows may be lower below the Thermalito Afterbay outlet and at the mouth of the Feather River; and (2) similar monthly probabilities of water temperatures occurring within the specified water temperature range for all Feather River locations evaluated.

In conclusion, in consideration of potential impacts to all life stages of largemouth bass in the Feather River, Alternative D would result in similar conditions for largemouth bass, relative to the Existing Conditions/No Project/No Action Condition.

12C.6.2.9 Sutter Bypass

Potential impacts to fisheries and aquatic resources in the Sutter Bypass under Alternative D relative to the Existing Conditions/No Project/No Action Condition would be similar to those discussed under Alternative A relative to the Existing Conditions/No Project/No Action Condition, above.

12C.6.2.10 Folsom Lake

Reservoir storage model results (Appendix 6B Water Resources System Modeling) were examined for Folsom Lake during April through November for coldwater fish species; reductions in average monthly surface elevations greater than 6 feet (Appendix 12F Reservoir Water Surface Elevation Summary Tables) were examined during March through June for warmwater species.

Coldwater Fish Species

Relative to the Existing Conditions/No Project/No Action Condition, Alternative D would generally be expected to provide:

- Similar conditions for coldwater fish species based on modeling results for reservoir storage conditions indicating similar or higher long-term average monthly storage, and similar or higher average monthly storage by water year type occurring during most months of the evaluation period, particularly in drier water year types.

However, it is unlikely that coldwater fish habitat is limiting in Folsom Lake; therefore, it is unlikely that changes in reservoir storage under Alternative D would have a population level effect on coldwater fish species in Folsom Lake, relative to the Existing Conditions/No Project/No Action Condition.

Warmwater Fish Species

Relative to the Existing Conditions/No Project/No Action Condition, Alternative D would be expected to provide:

- Similar warmwater fish nesting conditions, based on modeling results indicating minor differences in the frequency of monthly water surface elevation reductions of 6 feet or more during the evaluation period.

It is unlikely that a small difference in the number of years with monthly water surface elevation reductions of greater than 6 feet under Alternative D would have a population level effect on bass and other warmwater fish in Folsom Lake, relative to the Existing Conditions/No Project/No Action Condition.

12C.6.2.11 American River

Flow and water temperature model results were examined for the American River at several points downstream of Lake Natoma (Appendix 6B Water Resources System Modeling, Appendix 7E River Temperature Modeling, and Appendix 12E Fisheries Water Temperature Assessment Summary Tables). For several species and life stages, only modeled flows and water temperatures were available; and the analyses of habitat conditions for these species and life stages were based primarily on the water temperature results. Model results for spawning habitat availability (WUA) were also examined for Chinook salmon and steelhead (Appendix 12N Weighted Usable Area Analysis). The potential for Project-related changes in aquatic habitat conditions and impacts on aquatic resources in the American River are described below.

Fall-run Chinook Salmon

Relative to the Existing Conditions/No Project/No Action Condition, Alternative D would generally be expected to provide:

- Similar adult immigration and holding conditions based on modeling results indicating: (1) generally similar or higher long-term average monthly flows during the evaluation period except in September when flows may be lower, and slightly higher average monthly flows by water year type during most water year types at all locations evaluated in the American River, except in September when flows may be lower; and (2) generally similar or lower monthly probabilities of exceeding specified water temperature index values, although slightly higher probabilities of exceedance would occur during September.
- Similar spawning conditions based on modeling results indicating: (1) generally similar or slightly higher long-term average monthly flows during the evaluation period, and similar or slightly higher average monthly flows by water year type at all locations evaluated in the American River; (2) similar spawning habitat availability (WUA) from October through December; and (3) lower monthly probabilities of exceeding specified water temperature index values in October.
- Similar embryo incubation conditions based on modeling results indicating: (1) similar annual early life stage mortality; and (2) similar or lower monthly probabilities of exceeding specified water temperature index values, particularly in October.
- Similar juvenile rearing and emigration conditions based on modeling results indicating: (1) similar or slightly higher long-term average monthly flows, and slightly higher average monthly flows by water

year type from January through May and lower monthly flows in June, particularly in drier water year types; and (2) generally similar or reduced monthly probabilities of exceeding specified water temperature index values, except at the mouth of the American River where exceedance probabilities are higher in April and June.

In conclusion, in consideration of potential impacts to all life stages of fall-run Chinook salmon in the American River, Alternative D would result in similar conditions for fall-run Chinook salmon in the American River and less-than-significant impacts, relative to the Existing Conditions/No Project/No Action Condition.

Spring-run Chinook Salmon

Relative to the Existing Conditions/No Project/No Action Condition, Alternative D would generally be expected to provide:

- Similar non-natal juvenile rearing conditions based on modeling results indicating: (1) similar or slightly increased long-term average monthly flows during the evaluation period, and generally higher average monthly flows by water year type, particularly in drier water year types; and (2) generally similar monthly probabilities of exceeding specified water temperature index values.

Rearing conditions in the American River for non-natal juvenile spring-run Chinook salmon would be similar under Alternative D, relative to the Existing Conditions/No Project/No Action Condition.

Steelhead

Relative to the Existing Conditions/No Project/No Action Condition, Alternative D would generally be expected to provide:

- Similar or less suitable adult immigration and holding conditions based on modeling results indicating: (1) similar or slightly increased long-term average monthly flows during the evaluation period, and generally higher average monthly flows by water year type, particularly in drier water year types; and (2) generally similar monthly probabilities of exceeding specified water temperature index values, except in December and March when the probabilities of exceedance may be higher.
- Similar spawning and egg incubation conditions based on modeling results indicating: (1) similar or slightly increased long-term average monthly flows during the evaluation period, and generally slightly increased average monthly flows by water year type, except in drier water year types when flows may be increased; (2) similar spawning habitat availability (WUA); and (3) similar monthly probabilities of exceeding specified water temperature index values, although water temperatures may be slightly less suitable in March.
- Less suitable juvenile rearing and emigration conditions based on modeling results indicating: (1) generally similar or lower long-term average monthly flows from June through September and similar or slightly higher average flows from October through May, particularly in drier water year types although flows may be increased in April and May of critically dry years; and (2) similar or lower monthly probabilities of exceeding specified water temperature index values, particularly during August and September, with higher probabilities of exceedance in June and July at the more downstream locations.
- Similar smolt emigration conditions based on modeling results indicating: (1) similar or slightly higher long-term average monthly flows during the evaluation period, particularly in drier years,

except in June when flows may be decreased and in April and May of critically dry water years when flows would be substantially increased; and (2) similar monthly probabilities of exceeding specified water temperature index values, except in March and April when the probabilities of exceedance may be increased.

In conclusion, in consideration of potential impacts to all life stages of steelhead in the American River, Alternative D would result in similar or less suitable conditions for steelhead in the American River, relative to the Existing Conditions/No Project/No Action Condition.

Green Sturgeon

Relative to the Existing Conditions/No Project/No Action Condition, Alternative D would generally be expected to provide:

- Similar adult immigration and holding conditions based on modeling results indicating: (1) generally lower long-term average monthly flows from June through October with similar or increased flows for the remainder of the evaluation period, particularly in drier water year types; and (2) generally similar monthly probabilities of exceeding specified water temperature index values with a lower probability of exceedance in October.
- Similar or more suitable spawning and egg incubation conditions, based on modeling results indicating: (1) generally similar or lower long-term average monthly flows, particularly from June through August and in in drier water year types, although flows may be increased in April and May of critically dry years; and (2) lower monthly probabilities of exceeding specified water temperature index values in July and August with a higher probability of exceedance in June.
- Similar juvenile rearing and emigration conditions based on modeling results indicating: (1) generally similar or lower long-term average monthly flows from June through September and similar or slightly higher average flows from October through May, particularly in drier water year types although flows may be increased in April and May of critically dry years; and (2) generally similar or reduced probabilities of exceeding specified water temperature index values, except in June and September when the probabilities of exceedance may be higher.

In conclusion, in consideration of potential impacts to all life stages of green sturgeon in American River, Alternative D would result in similar conditions for green sturgeon in the American River, relative to the Existing Conditions/No Project/No Action Condition.

River Lamprey

Relative to the Existing Conditions/No Project/No Action Condition, Alternative D would generally be expected to provide:

- Similar adult immigration conditions based on modeling results indicating similar or higher long-term average monthly flows during the evaluation period, except in September, May and June when flows may be decreased, although flows may be increased in April and May of critically dry water years.
- Similar or less suitable spawning and egg incubation conditions based on modeling results indicating: (1) similar or slightly higher long-term average monthly flows during the evaluation period, except in June and July and in critically dry years when flows may be decreased substantially and in April and May of critically dry water years when flows may be increased substantially; and (2) similar or reduced probabilities of remaining within the specified water temperature range.

- Similar or improved ammocoete rearing and emigration conditions based on modeling results indicating: (1) generally similar or lower long-term average monthly flows from June through September and similar or slightly higher average flows from October through May, particularly in drier water year types although flows may be increased in April and May of critically dry years; and (2) generally similar or lower probabilities of exceeding specified water temperature index values.

In conclusion, in consideration of potential impacts to all life stages of river lamprey in the American River, Alternative D would result in similar conditions for river lamprey, relative to the Existing Conditions/No Project/No Action Condition.

Pacific Lamprey

Relative to the Existing Conditions/No Project/No Action Condition, Alternative D would generally be expected to provide:

- Similar adult immigration and holding conditions, based on modeling results indicating similar or slightly higher long-term average monthly flows during the evaluation period, except in June of drier water year types when flows may be decreased and in April and May of critically dry water years when flows may be increased substantially.
- Similar spawning and egg incubation conditions, based on modeling results indicating: (1) similar or slightly higher long-term average monthly flows during the evaluation period, except from June through August of drier water year types when flows may be decreased and in April and May of critically dry water years when flows may be increased substantially; and (2) generally similar or reduced probabilities of remaining within the specified water temperature range, except in August when the probability may be increased.
- Similar or improved ammocoete rearing and emigration conditions based on modeling results indicating: (1) generally similar or lower long-term average monthly flows from June through September and similar or slightly higher average flows from October through May, particularly in drier water year types although flows may be increased in April and May of critically dry years; and (2) generally similar or lower probabilities of exceeding specified water temperature index values.

In conclusion, in consideration of potential impacts to all life stages of Pacific lamprey in the American River, Alternative D would result in similar or improved conditions for Pacific lamprey in the American River and less-than-significant impacts, relative to the Existing Conditions/No Project/No Action Condition.

Hardhead

Relative to the Existing Conditions/No Project/No Action Condition, Alternative D would generally be expected to provide:

- Similar adult and other life stage conditions based on modeling results indicating: (1) generally similar or lower long-term average monthly flows from June through September and similar or slightly higher average flows from October through May, particularly in drier water year types although flows may be increased in April and May of critically dry years; and (2) generally similar or reduced probabilities of occurring within the specified water temperature range, except in August when the probability of water temperatures within the specified range would be higher.

- Similar or less suitable spawning conditions based on modeling results indicating: (1) generally similar long-term average monthly flows during the evaluation period, except in June when flows may be decreased in drier water year types and in April and May of critically dry water years when flows may be increased; and (2) slightly reduced probabilities of occurring within the specified water temperature range, particularly in May and June.

In conclusion, in consideration of potential impacts to all life stages of hardhead in the American River, Alternative D would result in similar conditions for hardhead, relative to the Existing Conditions/No Project/No Action Condition.

Sacramento Splittail

Relative to the Existing Conditions/No Project/No Action Condition, Alternative D would generally be expected to provide:

- Similar spawning conditions based on modeling results indicating: (1) similar long-term average monthly flows during the evaluation period, although flows may be increased in April and May of critically dry water years; and (2) equivalent probabilities of remaining within specified water temperature ranges.

In conclusion, in consideration of potential impacts to all life stages of splittail in the American River, Alternative D would result in similar conditions for splittail, relative to the Existing Conditions/No Project/No Action Condition.

Striped Bass

Relative to the Existing Conditions/No Project/No Action Condition, Alternative D would generally be expected to provide:

- Similar adult spawning, embryo incubation, and initial rearing conditions based on modeling results indicating: (1) generally similar long-term average monthly flows during the evaluation period, except in June when flows may be decreased in drier water year types and in April and May of critically dry water years when flows may be increased; and (2) generally higher probabilities of remaining within the specified water temperature range in April and May and lower probabilities of water temperatures within the specified range in June.
- Similar larvae, fry, and juvenile rearing and emigration conditions based on modeling results indicating: (1) generally similar or lower long-term average monthly flows from June through September and similar or slightly higher average flows from October through May, particularly in drier water year types although flows may be increased in April and May of critically dry years; and (2) similar or lower probabilities of remaining within the specified water temperature range, with higher probabilities in April, May, and October.

In conclusion, in consideration of potential impacts to all life stages of striped bass in the American River, Alternative D would result in similar conditions for striped bass, relative to the Existing Conditions/No Project/No Action Condition.

American Shad

Relative to the Existing Conditions/No Project/No Action Condition, Alternative D would generally be expected to provide:

- Similar adult spawning, embryo incubation, and initial rearing conditions based on modeling results indicating: (1) generally similar long-term average monthly flows during the evaluation period, except in June when flows may be decreased in drier water year types and in April and May of critically dry water years when flows may be increased; and (2) generally similar or higher probabilities of remaining within the specified water temperature range, except in May at Watt Avenue.
- Similar larvae, fry, and juvenile rearing and emigration conditions based on: (1) similar or lower long-term average monthly flows during the evaluation period, and lower average monthly flows by water year type during most water year types from July through September with similar or higher flows in October and November; and (2) similar probabilities of water temperatures occurring within the specified water temperature range, except in October when the probabilities would be lower.

  In conclusion, in consideration of potential impacts to all life stages of American shad in the American River, Alternative D would result in similar conditions for American shad, relative to the Existing Conditions/No Project/No Action Condition.

Largemouth Bass

Relative to the Existing Conditions/No Project/No Action Condition, Alternative D would generally be expected to provide:

- Similar or less suitable adult and other life stage conditions based on modeling results indicating similar or lower long-term average monthly flows from June through September and similar or slightly higher average flows from October through May, particularly in drier water year types although flows may be increased in April and May of critically dry years.
- Similar spawning conditions based on similar probabilities of remaining within the specified water temperature range.

In conclusion, in consideration of potential impacts to all life stages of largemouth bass in the American River, Alternative D would result in similar conditions for largemouth bass, relative to the Existing Conditions/No Project/No Action Condition.

12C.6.2.12 Sacramento-San Joaquin Delta and Yolo Bypass

Delta Smelt in the Delta Region

Relative to the Existing Conditions/No Project/No Action Condition, Alternative D would generally be expected to provide:

- Similar adult conditions (December through May), based on modeling results indicating: (1) similar monthly probabilities of water temperatures at Freeport occurring within the specified water temperature range; and (2) similar mean monthly percent entrainment at the SWP and CVP export facilities.
- Similar egg and embryo conditions (February through May), based on modeling results indicating similar monthly probabilities of water temperatures at Freeport occurring within the specified water temperature range.
- Similar conditions for larvae (March through June), based on modeling results indicating: (1) similar monthly probabilities of water temperatures at Freeport occurring within the specified water

temperature range; (2) similar or slightly lower long-term average and average by water year type monthly Delta outflows, except in below normal and dry years when Delta outflow is decreased and in June when Delta outflows may be slightly increased; and (3) similar abiotic habitat index values based on Delta outflows.

- Similar or slightly improved juvenile conditions (May through July), based on modeling results indicating: (1) similar monthly probabilities of water temperatures at Freeport occurring within the specified water temperature range; (2) similar overall mean monthly percent juvenile entrainment at the SWP and CVP export facilities; and (3) when X2 is between RKm 65 and 80, long-term average and average by water year type X2 location would move downstream by up to 1 km.

In conclusion, in consideration of potential impacts to all life stages of delta smelt in the Delta, Alternative D would result in similar conditions for Delta Smelt, relative to the Existing Conditions/No Project/No Action Condition.

Longfin Smelt in the Delta Region

Relative to the Existing Conditions/No Project/No Action Condition, Alternative D would generally be expected to provide:

- Similar adult conditions based on modeling results that indicate: (1) OMR flows would be similar (not substantially more negative) relative to the Existing Conditions/No Project/No Action Condition from December through June, except in January and February of critically dry years when OMR flows would be more negative, although OMR flows would be less negative in December of critically dry years; and (2) a similar index of relative adult abundance.

- Similar larvae and juvenile conditions based on modeling results indicating: (1) OMR flows would be similar (not substantially more negative) relative to the Existing Conditions/No Project/No Action Condition from December through June, except in January and February of critically dry years when OMR flows would be more negative, although OMR flows would be less negative in December of critically dry years; (2) when X2 is between RKm 65 and 80, long-term average and average by water year type X2 location would move downstream by up to 1 km; and (3) similar monthly exceedance probabilities of X2 location occurring at or downstream of RKm 75.

In conclusion, in consideration of potential impacts to all life stages of longfin smelt in the Delta, Alternative D would result in similar conditions for Longfin Smelt, relative to the Existing Conditions/No Project/No Action Condition.

Sacramento Splittail in the Delta and Yolo Bypass

Relative to the Existing Conditions/No Project/No Action Condition, Alternative D would generally be expected to provide:

- Similar or less suitable adult upstream migration, spawning, egg, and larval conditions based on modeling results indicating: (1) similar or reduced long-term average monthly flows in the Yolo Bypass, particularly during February and March; and (2) similar frequencies and duration of inundation events in the Yolo Bypass.

- Similar juvenile rearing and emigration conditions based on modeling results indicating similar long-term average monthly flows and average monthly flows by water year type in the Yolo Bypass.

In conclusion, in consideration of potential impacts to all life stages of Sacramento splittail in the Delta Region including the Yolo Bypass, Alternative D would result similar conditions for splittail, relative to the Existing Conditions/No Project/No Action Condition.

Winter-run Chinook Salmon in the Delta and Yolo Bypass

Relative to the Existing Conditions/No Project/No Action Condition, Alternative D would generally be expected to provide:

- Similar Delta conditions, based on IOS modeling results indicating similar monthly through-Delta survival probabilities.
- Similar juvenile rearing conditions in the Yolo Bypass based on modeling results indicating a similar frequency and duration of floodplain inundation.

In conclusion, in consideration of potential impacts to juvenile winter-run Chinook salmon, Alternative D would result in similar juvenile rearing and outmigration conditions for winter-run Chinook salmon in the Yolo Bypass and Delta Region, relative to the Existing Conditions/No Project/No Action Condition.

Spring-run Chinook Salmon in the Delta and Yolo Bypass

Relative to the Existing Conditions/No Project/No Action Condition, Alternative D would generally be expected to provide:

- Similar juvenile outmigration conditions, based on DPM modeling results indicating similar monthly Delta survival probabilities.
- Similar juvenile rearing conditions in the Yolo Bypass based on modeling results indicating a similar frequency and duration of floodplain inundation.

In conclusion, in consideration of potential impacts to spring-run Chinook salmon, Alternative D would result in similar juvenile rearing and outmigration conditions for spring-run Chinook salmon in the Yolo Bypass and Delta Region, relative to the Existing Conditions/No Project/No Action Condition.

Fall-run and Late Fall-run Chinook Salmon in the Delta and Yolo Bypass

Relative to the Existing Conditions/No Project/No Action Condition, Alternative D would generally be expected to provide:

- Similar juvenile outmigration conditions based on DPM modeling results indicating similar monthly Delta survival probabilities.
- Similar juvenile rearing conditions in the Yolo Bypass based on modeling results indicating a similar frequency and duration of floodplain inundation.

In conclusion, in consideration of potential impacts to juvenile and fall and late fall-run Chinook salmon, Alternative D would result in similar juvenile rearing and outmigration conditions for fall- and late fall-run Chinook salmon in the Yolo Bypass and Delta Region, relative to the Existing Conditions/No Project/No Action Condition.

Steelhead in the Delta and Yolo Bypass

Relative to the Existing Conditions/No Project/No Action Condition, Alternative D would generally be expected to provide:

- Similar or less suitable juvenile rearing and emigration conditions in the Delta (October through July) based on modeling results indicating: (1) generally slightly lower long-term average and average by water year type monthly Delta outflow during most months, particularly during drier water year types, but with higher Delta outflow during July of most water year types; and (2) generally OMR flows would be reduced over the evaluation period and substantially more negative relative to the Existing Conditions/No Project/No Action Condition in October and November of wetter water year types and most months of critically dry water years.
- Similar juvenile rearing conditions in the Yolo Bypass based on modeling results indicating a similar frequency and duration of floodplain inundation.

In conclusion, in consideration of potential impacts to juvenile Central Valley steelhead, Alternative D would result in similar juvenile rearing and outmigration conditions for steelhead in the Yolo Bypass and Delta Region, relative to the Existing Conditions/No Project/No Action Condition.

Green Sturgeon and White Sturgeon in the Delta Region

Relative to the Existing Conditions/No Project/No Action Condition, Alternative D would generally be expected to provide:

- Similar juvenile rearing and emigration conditions based on modeling results indicating: (1) similar long-term average and average by water year type Delta outflows from March through July; and (2) similar probabilities of Delta outflows exceeding 50,000 cfs providing for strong year classes of sturgeon.

In conclusion, in consideration of potential impacts to sturgeon in the Delta, Alternative D would result in similar conditions for sturgeon, relative to the Existing Conditions/No Project/No Action Condition.

American Shad in the Delta Region

Relative to the Existing Conditions/No Project/No Action Condition, Alternative D would generally be expected to provide:

- Similar egg and larval conditions in the Delta based on modeling results indicating: (1) slight downstream movements in mean monthly X2 location during the evaluation period of most water year types; and (2) similar exceedance probabilities of X2 location being located at or downstream of RKm 75 from April through June.

In conclusion, in consideration of potential impacts to American shad in the Delta, Alternative D would result in similar conditions for American shad, relative to the Existing Conditions/No Project/No Action Condition.

Striped Bass in the Delta Region

Relative to the Existing Conditions/No Project/No Action Condition, Alternative D would generally be expected to provide:

- Similar egg and larval conditions in the Delta based on modeling results indicating slight downstream movements in mean monthly X2 location during the evaluation period of most water year types.

In conclusion, in consideration of potential impacts to striped bass in the Delta, Alternative D would result in similar conditions for striped bass, relative to the Existing Conditions/No Project/No Action Condition.

12C.6.2.13 Suisun, San Pablo, and San Francisco Bays

Fish species of primary management concern, including Chinook salmon, steelhead, river lamprey, Pacific lamprey, green sturgeon, white sturgeon, and splittail, utilize the bays as a migration corridor and/or for juvenile rearing. Potential increases in Delta outflow during the summer and fall and reductions in Delta outflow during the spring would not result in substantial changes to migration or rearing habitat for these fish species in the bays. Striped bass and American shad also utilize the bays for migration and rearing, however, changes in X2 location were evaluated during the striped bass and American shad spawning and initial rearing period to evaluate potential changes in larval transport and rearing habitat in the Bay-Delta (see the Delta Region, above). Potential effects on delta smelt and longfin smelt migration and rearing in the Bay-Delta also were analyzed through evaluation of changes in X2 location (see the Delta Region, above).