TABLE OF CONTENTS

Page

List of Tables

List of Figures

List of Maps

List of Attachments

4.0 CUMULATIVE EFFECTS ANALYSIS

The regulations implementing the National Environmental Policy Act (NEPA) define a cumulative effect as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions" (40 CFR § 1508.7). Cumulative effects can result from individually minor but collectively significant actions taking place over a period of time, including hydropower development.

The action under consideration is the issuance of a new license for the Middle Fork American River Project (MFP or Project), which includes changes in operation and maintenance activities; modification of existing Project facilities, and construction of new Project facilities and Project recreation facilities and features. Project maintenance activities include routine maintenance activities at existing Project facilities; routine and heavy maintenance at existing Project recreation facilities; maintenance at existing recreation facilities and trails added to the MFP; and post-construction maintenance activities at new Project facilities and Project recreation facilities and features. These Project maintenance activities are collectively analyzed.

As shown on Map 4-1, other projects/actions considered in this cumulative effects analysis include:

- Sacramento Municipal Utility District's (SMUD) Upper American River Project (UARP) (FERC Project No. 2101) that influences flow into Hell Hole Reservoir and along the South Fork Rubicon River, a tributary to the Rubicon River entering downstream of Hell Hole Reservoir;
- El Dorado Water and Power Authority's (EDWAPA) water rights application to store water in SMUD's UARP reservoirs and redivert water at SMUD's Whiterock Penstock and Folsom Reservoir;
- El Dorado County Water Agency (EDCWA) Central Valley Project (CVP) Water Service Contract of up to 15,000 acre feet (ac-ft) as described in EDCWA's Final Environmental Impact Report (EIR) for the project (EDCWA 2011);
- Proposals by EDCWA and/or EDWAPA to enter into a contract with PCWA to exchange delivery of EDCWA and/or EDWAPA water entitlements in Folsom Reservoir to PCWA's customers in return for PCWA's delivery of an equivalent amount of its MFP water entitlements to El Dorado County customers from its American River Pump Station;
- Georgetown Divide Public Utility District's (GDPUD) Stumpy Meadows Project (non-Federal Energy Regulatory Commission [FERC or Commission] project), which affects flows in Pilot Creek, a tributary to the Rubicon River entering downstream of Hell Hole Reservoir;

- Foresthill Public Utility District's (FPUD) Sugar Pine Dam Project, which diverts water from Shirttail Creek (a tributary to the North Fork American River) to provide consumptive water to the community of Foresthill;
- Pacific Gas & Electric's (PG&E) Drum-Spaulding Project (FERC No. 2310) that influences flow into the North Fork American River from the Towle Diversion on Canyon Creek and the Lake Valley Diversion on the North Fork of the North Fork American River;
- Operations and maintenance of recreational facilities on Auburn Project Lands (also referred to as Auburn State Recreation Area [ASRA] by United States Bureau of Reclamation [USBR or Reclamation] and Bureau of Land Management [BLM]) in the Middle Fork American River and North Fork American River downstream of Oxbow Powerhouse (peaking reach);
- Placer County Water Agency's (PCWA) Pulp Mill Canal Diversion Dam Project that diverts water for consumptive use from Canyon Creek (a tributary to the North Fork American River). PCWA's water rights allow for the diversion of up to 40 cubic feet per second (cfs) from Canyon Creek;
- PCWA's operation of the American River Pump Station that diverts water from the North Fork American River near the city of Auburn to provide up to 35,500 ac-ft of consumptive water (under full build-out) from the MFP to meet PCWA's consumptive demand;
- United States Department of Agriculture-Forest Service (USDA-FS or Forest Service) Eldorado National Forest (ENF) implementation of its ENF Land and Resource Management Plan (LRMP) (USDA-FS 1988) which maintains recreation facilities and provides for recreational opportunities on Forest Service lands in the vicinity of the MFP;
- USDA-FS Tahoe National Forest (TNF) implementation of its TNF LRMP (USDA-FS 1990) which maintains recreation facilities and provides for recreational opportunities on Forest Service lands in the vicinity of the MFP;
- Operations of Folsom Reservoir by the USBR to provide releases for downstream water uses and to protect aquatic resources in the Lower American River and the Delta;
- USBR's Congressionally-authorized Auburn Dam and Reservoir Project that if built would inundate lands along the Middle Fork American River and North Fork American River downstream of Oxbow Powerhouse (peaking reach); and
- National Marine Fisheries Service's (NMFS) Biological Opinion and Conference Opinion on the Long-Term Operations of the Central Valley Project and California State Water Project (OCAP BiOP) and Public Draft Recovery Plan for Central Valley Winter-run and Spring-run Chinook Salmon and Steelhead (Draft Recovery Plan) which defines lower American River flow and temperature management standards, improvements to an existing temperature control structure on Folsom Dam, and, in the future, evaluates potential passage at Nimbus and Folsom dams to restore Central Valley (CV) steelhead

(*Oncorhynchus mykiss*) to native habitat within the American River basin, upstream of Folsom Reservoir.

4.1 TARGET RESOURCES

The target resources considered for inclusion in the cumulative impacts analysis of Alternative 1 were identified based on: a review of the technical information developed in support of PCWA's Application for New License (also referred to as Final License Application [FLA]) (PCWA 2011a); comments received during formal scoping meetings; comments received on the Draft and Final License Application, as appropriate; PCWA's response to the Federal Energy Regulatory Commission's (FERC) Additional Information Requests (PCWA 2011b; PCWA 2011c); discussions with resource agencies, Native American Tribes, local and regional authorities, non-governmental organizations, local communities and businesses, and members of the public; preliminary conditions and recommendations filed by the resource agencies (USDA-FS 2011; CDFG 2011; DOI 2011); and analysis included in this Supplemental Filing (Section 3).

For this analysis, target resources that may be affected cumulatively by the incremental actions of Alternative 1 in combination with other past, present, and reasonably foreseeable future actions include: water use (hydrology); water quality (water temperature); aquatic resources (resident fish, native amphibians, and anadromous fish); recreation resources; and air quality.

4.1.1 Geographic Scope

The geographic scope for the cumulative impact analysis defines the physical limits or boundaries of the effects on target resources from implementation of Alternative 1 when considering effects from other projects/actions. The geographic scope appropriate for evaluating cumulative effects of Alternative 1 is the North Fork American River from Folsom Reservoir upstream to the confluence of the Middle Fork American River, the Middle Fork American River, Rubicon River, and associated tributaries (Map 4-1). The rationale for limiting the geographic scope of this analysis to upstream of Folsom Reservoir is that Folsom Reservoir (independently operated by the USBR) has sufficient storage capacity (approximately 975,000 ac-ft) to control the timing and volume of discharge from Folsom Dam under Alternative 1 and the No-Action Alternative. Therefore, any shift in the timing or volume of flows downstream of Folsom Dam is considered to be under the management of the USBR, and not a consequence of the operation of the MFP. However, this analysis does include an evaluation of the effect from changes in MFP operations under Alternative 1 in combination with other projects/actions on the timing, volume, and temperature of flows into Folsom Reservoir.

4.1.2 Temporal Scope

The temporal scope for the cumulative impact analysis defines the length of time analyzed when evaluating resource effects of Alternative 1 in the context of past, present, and reasonably foreseeable future actions. Evaluations of past and future

actions are limited by the amount of available information for each target resource and by information defining future projects and actions. Based on the anticipated term of the new license for the MFP, the temporal scope used for the analysis of reasonably foreseeable future actions is 50 years.

4.2 CUMULATIVE EFFECTS ON WATER RESOURCES

4.2.1 Water Use (Hydrology)

Other water projects/actions, in addition to the MFP, that affect hydrology in the North and Middle Fork American River watersheds include: SMUD's UARP; EDWAPA's Water Rights Application; EDCWA's CVP Water Service Contract; GDPUD's Stumpy Meadows Reservoir; FPUD's Sugar Pine Project; PG&E's Drum-Spaulding Project; PCWA's Pulp Mill Canal Diversion Dam Project; and PCWA's American River Pump Station Project. These projects have resulted or will result in modification to the timing and magnitude of natural flows in the bypass and peaking reaches associated with the MFP. Information on the hydrologic effects of operations of the MFP (that include the hydrology effects of these projects) is provided in Section 3.3 – Water Use. Additional information is provided in PCWA's Application for New License (PCWA 2011d) and in PCWA's Pre-Application Document (PAD) (PCWA 2007). A summary of these project effects is described below.

PCWA's MFP operations, as modified under Alternative 1, affect flows in the bypass and peaking reaches and water surface elevation/storage in Project reservoirs. In addition, increased water delivery from the MFP (to meet future consumptive demand under full build-out) will modify operations and affects instream flows and reservoir elevations. These changes are evaluated using the MFP Operations Simulation Model (Model) (refer to Section 3.1 – Analytical Approach for a description of the model runs). The Model incorporates both existing and future operations of the MFP and other water projects/actions in the Middle Fork American River Watershed (Watershed), as described in the following:

- SMUD's UARP historical operations will be altered by the issuance of a new FERC license. The No-Action Alternative and Alternative 1 model runs incorporate the revised flow measures for the UARP, as described in the 2007 Settlement Agreement between stakeholders and SMUD and FERC's Final Environmental Impact Statement (FEIS) for the UARP (FERC 2008).
- EDWAPA's water rights application to store water for consumptive uses in SMUD's UARP reservoirs will not change SMUD's rate of diversion from the upper Rubicon River or South Fork Rubicon River. Therefore, modeling of UARP Settlement Agreement flows adequately describes the project's impact in the Watershed.
- The potential exchange of water entitlements between (1) EDCWA and/or EDWAPA and (2) PCWA where EDCWA and/or EDWAPA diverts water from PCWA's American River Pump Station in exchange for the delivery of an equal amount of EDCWA and/or EDWAPA water to PCWA customers out of Folsom

Reservoir, would not result in an increase in total diversions above the Lower American River, nor would it result in a change in the operation of PCWA's MFP. Therefore, the Model already incorporates this potential exchange of water entitlements.

- GDPUD's Stumpy Meadows Reservoir Project historical diversions from Pilot Creek are included in the No-Action Alternative and Alternative 1 model runs. Future Stumpy Meadows Project operations are not expected to differ from historic operations.
- FPUD's Sugar Pine Dam Project historical diversions are incorporated in model runs for both the No-Action Alternative and Alternative 1. Future Sugar Pine Dam Project operations are not expected to differ from historic operations.
- PG&E's Drum-Spaulding Project historical operations (under the existing FERC license conditions) are included in the No-Action Alternative and Alternative 1 model runs. The Drum-Spaulding Project is currently undergoing FERC relicensing, however, it is unknown at this time, or to what extent, the existing license conditions will change.
- PCWA's Pulp Mill Canal Diversion Dam Project is included in the No-Action Alternative and Alternative 1 model runs. Future operations of the diversion are not expected to differ from historic operations.
- PCWA's American River Pump Station Project operations are included in the No-Action Alternative, Alternative 1– Existing Demand model run, and the Alternative 1– Future Demand model run.

Under Alternative 1, new instream flow releases were developed in the bypass and peaking reaches to maintain and/or enhance fish and aquatic resources, geomorphic channel processes, riparian resources, and whitewater recreational opportunities (USDA-FS 2011; CDFG 2011; DOI 2011). These changes in MFP operations, in combination with other projects/actions in the North and Middle Fork American River watersheds, contribute to an incremental improvement in beneficial uses from current conditions.

The timing and magnitude of average monthly flow entering Folsom Reservoir under Alternative 1, in combination with other projects/actions, is similar to the No-Action Alternative (Figure 4-1). Figure 4-1 compares model runs of average monthly inflow into Folsom Reservoir in different water years under the No-Action Alternative and Alternative 1 – Future Demand. Unimpaired inflow into Folsom Reservoir is included in Figure 4-1 for reference. Overall, past development in the Watershed has substantially altered inflow below the confluence of the North Fork American River and Middle Fork American River (inflow into Folsom Reservoir, Figure 4-1). In addition, if the Auburn Dam and Reservoir Project was constructed, the peaking reach would be inundated and Folsom Reservoir inflow would be substantially altered. Implementation of measures in Alternative 1 in combination with other projects/actions in the Watershed will have a negligible effect on flows entering Folsom Reservoir from current conditions.

4.2.2 Water Quality (Temperature)

Overall, operations of the MFP substantially reduce summer instream temperatures in the Rubicon River, Middle Fork American River, and North Fork American River compared to pre-project (unimpaired) conditions. Maps 7.5-3a and 7.5-3b in PCWA's Application for New License (PCWA 2011e) illustrate modeled August water temperature in these rivers prior to the construction of the MFP (unimpaired conditions) and under the No-Action Alternative.

Two projects, in addition to the MFP, have the potential to cumulatively affect water temperature in the Rubicon River. SMUD's UARP has the potential to affect temperature in the South Fork Rubicon River thereby influencing temperature in the Rubicon River below the confluence of the South Fork Rubicon River. GDPUD's Stumpy Meadows Project has the ability to affect temperature in Pilot Creek and, therefore, affect temperature in the Rubicon River below the confluence of Pilot Creek.

In developing new instream flow conditions in Alternative 1 for the MFP, summer water temperatures in the Rubicon River, at several locations under the No-Action Alternative and Alternative 1, were compared to evaluate potential cumulative impacts. In developing Alternative 1, the resource agencies considered the effects of the SMUD and GDPUD projects on flows and resulting water temperatures in the Rubicon River, with particular emphasis on rainbow trout, hardhead, and foothill yellow-legged frog (FYLF) habitat. PCWA's water temperature model was used to identify potential cumulative effects on these resources and the instream flows were modified such that those included in Alternative 1 maintain water temperatures relative to these species. Table 3.5-3b shows that during the drier water year types, when Project flows could have the largest effect on summer water temperature, Alternative 1 maintains water temperatures similar to existing conditions (PCWA 2011f).

In the North Fork American River, below the confluence of the Middle Fork American River, several projects/actions may affect the temperature of water flowing into Folsom Reservoir. These include modified operation of the MFP under Alternative 1, increases in consumptive water deliveries from the MFP to meet future demand, PCWA's Pulp Mill Diversion, PG&E's Drum Spaulding Project and operations of Sugar Pine Dam by FPUD. The water temperature model developed for the MFP in the North Fork American River incorporates accretion flows and current hydrologic and water temperature effects of other projects in the Watershed.

The mean monthly water temperatures of Folsom Reservoir inflow under Alternative 1, in combination with other projects/actions in the North and Middle Fork American River watersheds, are similar compared to the No-Action Alternative in wet years and slightly cooler in dry years (Figure 4-2). Figure 4-2 compares model runs of average monthly temperatures of Folsom Reservoir inflows in two different water year types (wet and dry) under the No-Action Alternative and Alternative 1– Future Demand. Results of the model demonstrate that the water temperatures of Folsom Reservoir inflow are maintained or slightly enhanced (cooler) under Alternative 1 and remain substantially cooler than water temperatures under unimpaired conditions.

4.3 CUMULATIVE EFFECTS ON AQUATIC RESOURCES

4.3.1 Resident Fish and Native Amphibians

Resident fish (e.g., rainbow trout, hardhead) and FYLF distribution and abundance in the Rubicon River downstream of the confluence with the South Fork Rubicon River and downstream of Pilot Creek could be cumulatively affected by changes in instream flows considering implementation of Alternative 1, SMUD's UARP, and GDPUD's Stumpy Meadows Project.

Instream flows included under Alternative 1 consider the effects of the UARP and Stumpy Meadows Projects on hydrology and are designed to maintain the current distribution of cold-water fish and warmer water FYLF and hardhead in the Rubicon River. The distribution of water temperature in the Rubicon River will remain similar under Alternative 1 (Section 4.2.2); therefore, the distribution of fish and FYLF will be similar under Alternative 1 as compared to baseline conditions (No-Action Alternative).

Under Alternative 1, higher minimum instream flows in the Rubicon River are proposed in the winter and spring to enhance aquatic resources (including resident fish). Also, higher minimum instream flows are included in the wet and above normal years during the summer (years when water temperature modeling indicated that minimum flows would not alter temperature conditions due to high accretions). These instream flow recommendations for the MFP were developed and analyzed in Section 3.5 – Fish and Aquatic Resources. The analysis included the incremental contribution of UARP higher instream flow releases in the South Fork Rubicon River and the effects of Stumpy Meadows Project on Pilot Creek. The analysis shows that fish habitat in the Rubicon River is maintained, and FYLF are maintained with implementation of the instream flows included in Alternative 1. In addition, the Fish Population Monitoring Plan (FPMP) (PCWA 2011g) and Foothill Yellow-Legged Frog Monitoring Plan (FYLFMP) (PCWA 2011h) include monitoring fish (e.g., fish species composition, abundance, condition factor, and population age class structure data) and FYLF (e.g., abundance, distribution, and timing of initiation of breeding) in the bypass and peaking reach during the term of the new license. Overall, the cumulative effect of Alternative 1, considering other projects/actions in the Watershed, maintains aquatic resources.

4.3.2 Anadromous Fish

The Sacramento – San Joaquin drainage, which includes the American River and tributaries that drain the west slope of the Sierra Nevada, historically contained the richest native fish fauna of the Sierra Nevada, with 22 taxa (Moyle et al. 1996). Fourteen of these native fishes (including four runs of Chinook salmon) historically may have occurred in the streams associated with the MFP. Table 4-1 lists these native fish, their potential to occur in the Watershed, and their current management status.

Three native anadromous species (winter steelhead, Pacific lamprey, and Chinook salmon) historically migrated into the Watershed. Both steelhead and Chinook salmon reportedly ascended the Middle Fork American River past the Rubicon River

confluence, and the Rubicon River as far as the Pilot Creek confluence, which is approximately 5 miles upstream of the Middle Fork American River confluence (Yoshiyama, et al. 1996). There are no catadromous or other migratory species present. In addition, the Watershed does not include essential fish habitat as defined under the Magnuson-Stevens Fishery Conservation and Management Act.

No anadromous species are currently present in bypass or peaking reaches associated with the MFP. Anadromous species were extirpated in the vicinity of the MFP as a result of the construction of impassable dams on the lower American River (Nimbus and Folsom dams were constructed by the USBR in approximately 1955 and 1956, respectively). Additionally, two new fish passage barriers (unrelated to the MFP) are present in the peaking reach including Tunnel Chute (RM22.9), which was created by miners in the 1880s and Ruck-a-Chucky rapids (RM10.8), which was created by a landslide in the 1940s. Therefore, anadromous fish are not present upstream of Folsom Reservoir or affected by operations of the MFP.

Under Alternative 1, the timing and magnitude of flows from the MFP into Folsom Reservoir are similar to the No-Action Alternative (Section 4.2.1). In addition, the temperature of water inflow into Folsom Reservoir under Alternative 1 is similar to the No-Action Alternative (Section 4.2.2). Therefore, operation of the MFP under Alternative 1, in combination with other past, present, and reasonably foreseeable projects will not affect anadromous fish populations.

The NMFS's OCAP BiOP and Draft Recovery Plan describe future evaluation of potential passage at Nimbus and Folsom dams to restore CV steelhead to native habitat within the American River Basin, upstream of Folsom Reservoir. There are a number of actions that would need to be completed prior to reintroduction of CV steelhead above Folsom Dam, including planning and scheduling, permitting, evaluations, and funding. These include, but are not limited to:

- Evaluation of potential habitat in all three forks of the American River above Folsom and Nimbus dams;
- Development of fish passage pilot plan;
- Development of a 3-year pilot program;
- Implementation of the pilot program, including construction and collection of handling facilities, adult release sites above dams, trapping of juvenile downstream migrating fish, etc.; and
- Pilot Program Effectiveness Monitoring and Evaluation.

However, to date, most of the actions associated with this evaluation have not been implemented. Elements of the potential reintroduction are "virtually untested" and "prototype" (NMFS 2009, pg. 666). The results of the pilot program will be used to determine the feasibility of long-term passage alternatives and evaluate whether comprehensive fish passage programs should be pursued. During the pilot program, CV steelhead introduced above Folsom Reservoir would likely be designated as an

experimental population under Section 10 [16 U.S.C. 1539] (a)(1)(j) of the Endangered Species Act (ESA). PCWA is committed to collaborate with the NMFS regarding potential reintroductions into the American River Basin, including the Fish Passage Committee. PCWA will comply with Condition #3 of NMFS' Section 10(j) Recommendations (NMFS 2011), requiring PCWA to annually file with the Commission a report on the status of reintroduction of ESA listed species into the American River Watershed. Further, NMFS stated that the new License Order conditions may need to be reevaluated if a viable population of CV steelhead is established in reaches of the North Fork American River or Middle Fork American River affected by MFP operations and the population is determined to be essential for the continued existence of CV steelhead.

4.4 CUMULATIVE EFFECTS ON RECREATION

Alternative 1 in combination with actions taken by ENF and TNF on Forest Service lands and USBR and BLM on Auburn Project Lands cumulatively affect recreation resources in the Middle Fork American River and North Fork American River watersheds, as described in the following.

4.4.1 Eldorado and Tahoe National Forests

Alternative 1 in combination with actions taken by USDA-FS has the potential to affect recreation resources in the Watershed on Eldorado and Tahoe National Forests. The Eldorado and Tahoe National Forests include approximately 603,701 acres and 829,204 acres, respectively, of which the MFP occupies approximately 1,306 acres within the ENF and 1,746 acres within the TNF.

USDA-FS maintains recreation facilities and provides recreation opportunities on Eldorado and Tahoe national forests, in accordance with the ENF LRMP and the TNF LRMP.

Implementation of Alternative 1 as described in the Recreation Plan (USDA-FS 2011; CDFG 2011) will enhance recreation opportunities in the Eldorado and Tahoe National Forests, as summarized in the following:

- Increased recreational boating opportunities in the bypass and peaking reaches;
- Provides information that will allow recreational visitors to better utilize existing opportunities;
- Improved stream-based angling experience (enhances aquatic habitat and aquatic species);
- Greater access to Project reservoirs;
- Facilitates trip planning by providing publicly available real-time flow and reservoir water surface elevation information, and brochures and maps;
- Enhanced recreation opportunities by providing additional group camping;

- Relieves congestion and improves recreational experience at Indian Bar Rafter Access; and
- Improves dispersed recreation opportunities (new facilities and trail signage).

Based on provisions in the Recreation Plan, PCWA in cooperation with the USDA-FS will enhance the current level of recreational facility development and recreation opportunities within Eldorado and Tahoe National Forests in the future. PCWA is currently finalizing a collection agreement with the ENF and TNF regarding funding resource agency administrative oversight activities, routine operation and maintenance activities, heavy maintenance activities, and activities associated with modification and enhancement of Project recreation facilities on forest lands. Therefore, Alternative 1 in combination with other actions taken by the ENF and TNF will cumulatively enhance recreation in the national forests.

4.4.2 Auburn Project Lands (Peaking Reach)

Alternative 1 in combination with actions taken by USBR and BLM has the potential to affect recreation resources in the Middle Fork American River and North Fork American River downstream of Oxbow Powerhouse (peaking reach). The peaking reach bisects Auburn Project Lands, which consist of federal lands and private lands reserved for the Auburn Dam and Reservoir Project (totaling 41,000 acres) that was Congressionally-authorized in 1965. Construction of the Auburn Dam and Reservoir Project, initiated by the USBR in 1967, was halted in the 1980s. In 2008, the State Water Resources Control Board (State Water Board) revoked the USBR's water rights permits for the Auburn Dam and Reservoir Project. However, the Auburn Dam and Reservoir Project remains a Congressionally-authorized project.

The Auburn Project Lands include USBR fee title lands (26,000 acres), and other lands (15,000 acres) owned by BLM, USDA-FS, United States Army Corps of Engineers (USACE), and private land owners (USBR 1992). Land use planning and resource management on all federal lands within Auburn Project Lands has been granted to the USBR in accordance with interagency agreements (PCWA 2011i). The Auburn Project Lands boundary is shown on Map 4-1.

In 1977, the USBR entered into an interim agreement with California State Parks to assume responsibility for management of public use on Auburn Project Lands. California State Parks continues management of public use on these lands at the direction and discretion of USBR. Funding to manage public use and provide recreational opportunities and service within the Auburn Project Lands is provided in part from USBR, State of California, and user fees. Funding by USBR and the State of California has declined in recent years.

In 1978, the USBR developed a General Plan for the Auburn Project Lands, which designated that the area be managed as a reservoir-based recreation area, following construction of the Auburn Dam and reservoir. In 1979, the State of California incorporated Auburn Project Lands into the State park system as Auburn State Recreation Area (ASRA) (USBR 1992). Lands reserved for the Auburn Dam and

Reservoir Project (Auburn Project Lands), as managed by California State Parks, are referred to in this document as ASRA.

In 1992, due to the delays in constructing Auburn Dam and Reservoir Project, the USBR developed an Interim Management Plan (IRMP), which was designed to guide use of ASRA, consistent with its "interim status" as a river-based recreation area. In 2006, USBR and California State Parks began collaborating on a joint Updated General Plan and Resource Management Plan for ASRA. However, in a letter dated May 11, 2010, California State Parks notified the stakeholders involved in the planning process that the "planning process to develop a new General Plan and Interim Resource Management Plan (GP/IRMP) for ASRA and the Auburn Dam Project Lands has been suspended indefinitely at the request of the U.S. Bureau of Reclamation (Reclamation)". California State Parks also stated in the letter that, "Reclamation had indicated that it would not be prudent to proceed with the preparation of the GP/IRMP until the future management is resolved, therefore the GP/IRMP process is suspended" (DPR 2010). Currently, public use in ASRA is managed in accordance with the Interim Resource Management Plan.

Implementation of the Alternative 1 will maintain and enhance stream-based recreation opportunities and experience along the peaking reach and on Auburn Project Lands, as summarized in the following:

- The resource agencies instream flow and reservoir minimum pool conditions (USDA-FS 2011; CDFG 2011; DOI 2011) in Alternative 1 contain a provision that formalizes a release schedule that maintains existing whitewater boating in the Tunnel Chute Run in all water years and enhances recreational boating opportunities on downstream runs in wet and above normal water years, as described in Section 3.9 – Recreation Resources .
- The resource agencies instream flow and reservoir minimum pool conditions increases minimum instream flows in the peaking reach compared to the No-Action Alternative in most water-year types. In addition, the resource agencies conditions include a reduction in the ramping rate of Oxbow Powerhouse flow releases and a provision to reduce flow fluctuations from November through February. Reducing the magnitude of flow fluctuations will improve food production for fish (aquatic macroinvertebrates), increase effective spawning habitat, reduce potential stranding, benefit young-of-the-year fish, and increase the abundance of fish in the peaking reach. Alternative 1 will enhance the fishery and; therefore, enhance the angling experience compared to the No-Action Alternative.
- Alternative 1 reduces the ramping rate of Oxbow Powerhouse compared to the No-Action Alternative. Reducing the ramping rate will enhance recreation in the peaking reach by slowing the rate at which flows change; thereby, providing recreationists more time to modify their activities to changing flow conditions.

- The Recreation Plan also contains measures to enhance recreation experience at the Indian Bar Rafting Access by relieving congestion in the unloading area and at the boat ramps, and by improving sanitation conditions.
- The Recreation Plan contains measures to: (1) provide real-time flow information to the public from two stream gages on the peaking reach; and (2) provide the public with a matrix showing when recreation flows released from Oxbow Powerhouse will arrive at Fords Bar, Ruck-a-Chucky Recreation Area, Mammoth Bar, Poverty Bar, the Confluence, Birdsall Access, and Oregon Bar Access Point.
- PCWA is currently finalizing a collection agreement with the ENF regarding: (1) funding resource agency administrative oversight activities and routine operation and maintenance activities at the Indian Bar Rafter Access; and (2) providing funding for installation of sanitation facilities and safety signage and administrative oversight and operation and maintenance activities at Cache Rock.
- PCWA also entered into an agreement with the USBR and BLM regarding funding for annual operation, maintenance, and administration of Project-affected federal lands and facilities along the peaking reach. These lands are currently managed by USBR for recreation purposes and to provide for the health and safety of the public engaging in recreational activities at those lands and facilities (DOI 2011).

For most recreational users in the peaking reach, Alternative 1 maintains the existing stream-based recreation opportunities while enhancing the overall recreational experience. However, the early scheduled flow releases from Oxbow Powerhouse increases both recreational boating opportunities and experience (Class II recreational boating) in the lower portion of the peaking reach. Therefore, Alternative 1 in combination with other actions will cumulatively enhance recreation in the peaking reach.

4.5 CUMULATIVE EFFECTS ON GLOBAL CLIMATE CHANGE (GREENHOUSE GAS EMISSIONS)

Global climate change is the common nomenclature used to describe an increase in the average temperature of the Earth's atmosphere and oceans, and its projected continuation. The causes of global change have been linked to both natural processes and human actions. According to the Intergovernmental Panel on Climate Change (IPCC), increasing greenhouse gas (GHG) concentrations resulting from human activity, such as fossil fuel combustion and deforestation without adequate revegetation, have been largely responsible for human-induced global warming (IPCC 2007). Increases in the concentrations of GHGs in the atmosphere decrease the amount of solar radiation reflected back into space, intensifying the natural "greenhouse effect" and resulting in the increase of global average temperatures. The most common GHGs are carbon dioxide (CO_2) and water vapor, but there are also several others, including methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and

sulfur hexafluoride (SF_6), as described in PCWA's Application for New License (PCWA 2011h).

The potential heat trapping ability of each GHG varies substantially. To account for these differences in warming effect, GHGs are defined by their global warming potential (GWP). The GWP value for a GHG depends on the time span over which it is calculated and on how the gas concentration decays in the atmosphere over time. For that reason, slightly different GWP values appear in scientific literature. This assessment is based on the use of the widely accepted California Climate Action Registry (CCAR) GWP values for a 100-year period. Under this methodology, the GWP of CO_2 is set to 1, the GWP of CH_4 is 21, and the GWP of N_2O is 310 (CCAR 2009). In this analysis, GHGs are reported as carbon dioxide equivalents (CO_2 eqv) to measure their relative potency. CO_2 eqv takes into account the relative potency of the non-CO_2 GHGs and converts quantities to an equivalent amount of CO_2, so that all emissions are reported as a single quantity.

This analysis focuses on the potential incremental (cumulative) effects of Alternative 1 on GHG emissions within California considering legislation developed in the state to address global warming from past and current projects and reasonably foreseeable future projects. At present, the State of California is the controlling legal authority on GHG emissions within the Project area. The following compares GHG emission between Alternative 1 and the No-Action Alternative in context with overall GHG emission in California.

The MFP, under the No-Action Alternative, generates electricity via renewable, hydroelectric power. Hydroelectric power from the MFP is produced at five Project powerhouses with a total installed capacity of 223.7 megawatts (MW) and an annual average energy production of 1,039,078 megawatt-hours (MWh)[1] under the No-Action Alternative. PCWA owns and operates the MFP and is an independent generator (wholesaler of electricity) that sells electricity to California's electrical retailers via the California electricity grid.

Conventional hydroelectric generation is a reliable, efficient, economical, and less-polluting source of energy resulting in low air emissions. Energy from the MFP is used to meet California's energy demand, renewable energy goals, and provide a source of energy with low GHG emissions (PCWA 2011j) for a description of applicable GHG statutes and programs). The MFP hydroelectric facilities do not produce net emissions of GHGs, rather the MFP produces an "offset" in terms of the GHGs that would otherwise be generated on the grid. Existing MFP generation results in a total offset of 342,777 metric tons (or tonnes) CO_2 eqv annually (Table 4-2).

[1]Generation from French Meadows, Middle Fork, Ralston, and Oxbow powerhouses is averaged over a 40-year period of record (1967–2006). Hell Hole Powerhouse began operation in 1983; therefore, annual net generation is averaged over a 24-year period of record (1983–2006). The total average annual energy production represents the sum of the average net generation for the five Project powerhouses based on their respective period of record (PCWA 2011k).

Under Alternative 1, annual electric generation from the MFP will decrease by an average of 5.12% due to higher instream flow releases anticipated under the new license. This equates to an annual generation loss of 53,201 MWh and results in an overall annual average energy production of 985,877 MWh.

Under Alternative 1, the reduction in generation decreases total GHG offset by 17,550 metric tons CO_2 eqv annually (from 342,777 metric tons CO_2 eqv to 325,226 metric tons CO_2 eqv) (Table 4-2). Attachment 4-1 provides a description of the methodology used to determine the effect of this loss in generation on GHGs. Despite this reduction, the net beneficial effect of the MFP is considerable in terms of GHGs emissions.

The slight reduction in net GHG emissions offsets under Alternative 1 has a negligible effect on global climate change for several reasons. PCWA is an independent generator (wholesaler of electricity) of power produced from the MFP. Electric energy retailers will have to replace the loss of generation. It is unknown what source will provide the replacement generation as this is dependent on a retailer's individual system-wide generation portfolio. However, any replacement generation acquired by the retailers must be consistent with the legislative mandates adopted by the State of California requiring reductions in statewide GHG emissions from current levels. These include:

- **Assembly Bill 32** (AB 32) that codifies California's goal of reducing statewide emissions of GHGs by 2020 to 1990 levels. This reduction will be accomplished through an enforceable statewide cap on global warming emissions; and
- **Executive Order S-3-05** that establishes GHG emission reduction targets: by 2010, reduce GHG emissions to 2000 levels; by 2020, reduce GHG emissions to 1990 levels; and by 2050, reduce GHG emissions to 80% below 1990 levels.

Despite the loss of generation associated with implementation of Alternative 1, the MFP will continue to produce electric energy with low GHG emissions and operation of the MFP will continue to provide a valuable offset for GHGs. The MFP's continued operation, even considering the loss of generation, helps California move toward a lower carbon future and meet the goals of AB 32 and Executive Order S-3-05. In addition, electric retailers will have to replace any loss of generation from the MFP with an alternative source that has low GHG emissions to comply with current legislative requirements. Therefore, impacts of Alternative 1 on GHG emissions and the resulting effect on global warming, when considering other projects/actions, are negligible.

Under Alternative 1, several construction projects will be implemented to modify existing facilities or develop new facilities to improve operations and maintenance of the MFP, enhance environmental resources, and/or provide for implementation of new environmental programs and measures. GHG emissions resulting from the construction activities associated with Alternative 1 are provided in Section 3.15 – Air Quality and Appendix E – Construction Air Quality Emissions Model. In summary, short-term construction activities associated with implementation of Alternative 1 account for a total of 717 metric tons CO_2 eqv emissions (15 projects) or an average of 143 metric tons per year in the five years that construction activities are conducted for the MFP (Table 3.15-

4). By comparison, California's 2008 CO_2 eqv emissions from fuel combustion activities were estimated at 408,000,000 metric tons CO_2 eqv (CARB 2010). Short-term construction activities associated with Alternative 1 represent a fraction of the state's estimated 2008 emissions (0.00018%). In addition, construction emissions will be temporary and intermittent, and will cease upon completion of work; therefore, impacts of MFP construction activities on global climate change are negligible.

4.6 UNAVOIDABLE ADVERSE EFFECTS

No unavoidable cumulative adverse effects have been identified under Alternative 1.

LITERATURE CITED

California Air Resources Board (CARB). 2010. California Greenhouse Gas Inventory for 2000-2008 – by IPCC Category. Available online at: http://www.arb.ca.gov/cc/inventory/data/tables/ghg_inventory_ipcc_00-08_sum_2010-05-12.pdf

California Climate Action Registry (CCAR). 2009. General Reporting Protocol, Version 3.1. (http://www.climateregistry.org/tools/protocols/general-reporting-protocol.html)

California Department of Fish and Game (CDFG). 2011. Response to Notice of Ready for Environmental Analysis, Federal Power Act Section 10(j) and 10(a) Recommendations, Middle Fork American River Project (FERC Project No. 2079-069). Filed with FERC August 5, 2011.

California Department of Parks and Recreation (California State Parks or DPR). 2010. Letter to General Plan/Interim Resource Management Plan (GP/IRMP) Participants dated May 11.

El Dorado County Water Agency (EDCWA). 2011. Central Valley Project Water Supply Contracts Under Public Law 101-514 (Section 206): Proposed Contract Between the U.S. Bureau of Reclamation and the El Dorado County Water Agency, and Proposed Subcontracts Between the El Dorado County Water Agency and the El Dorado Irrigation District, and Between the El Dorado County Water Agency and the Georgetown Divide Public Utility District Final Environmental Impact Report. January 2011.

Intergovernmental Panel on Climate Control (IPCC). 2007. IPCC Assessment Reports, Climate Change 1990, 1995, 2001, 2007 (Reports 1-4). Available online at: http://www.ipcc.ch/publications_and_data/publications_and_data_reports.htm

Moyle, P.B., R.M. Yoshiyama, and R.A. Knapp. 1996. Status of Fish and Fisheries. In Sierra Nevada Ecosystem Project: Final Report to Congress, vol. II, Assessments and scientific basis for management options. Davis: University of California, Centers for Water and Wildland Resources.

Placer County Water Agency (PCWA). 2007. Placer County Water Agency – Middle Fork American River Project – Pre-Application Document. Supporting Document F, Section 4.0.

____. 2011a. Application for New License. Filed with FERC February 23, 2011.

____. 2011b. Middle Fork American River Project (FERC Project No. 2079), Response to the Commission's Memo Requesting Additional Information. Filed with FERC May 13, 2011.

____. 2011c. Response to the Commission's Request for Additional Generation Information. Filed with FERC June 15, 2011.

____. 2011d. Application for New License. Section 7.3 – Water Use. Volume 3, Exhibit E, Book 1. Filed with FERC February 23, 2011.

____. 2011e. Application for New License. Section 7.5 – Fish and Aquatic Resources. Maps 7.5-3a and 7.5-3b. Volume 3, Exhibit E, Book 1. Filed with FERC February 23, 2011.

____. 2011f. Application for New License. AQ 4 – Water Temperature Technical Study Report. Addendum 1. Volume 3, Exhibit E, Book 5, Supporting Document B. Filed with FERC February 23, 2011.

____. 2011g. Application for New License. Fish Population Monitoring Plan. Volume 3, Exhibit E, Book 4, Supporting Document A. Filed with FERC February 23, 2011.

____. 2011h. Application for New License. Foothill Yellow-Legged Frog Monitoring Plan. Volume 3, Exhibit E, Book 4, Supporting Document A. Filed with FERC February 23, 2011.

____. 2011i. Application for New License. Section 7.1 – General Description of the River Basin. Attachment 7.1-1. Volume 3, Exhibit E, Book 1. Filed with FERC February 23, 2011.

____. 2011j. Application for New License. Section 7.15 – Air Quality. Volume 3, Exhibit E, Book 1. Filed with FERC February 23, 2011.

____. 2011k. Application for New License. Section 3.0 – No-Action Alternative. Table 3-16. Volume 3, Exhibit E. Book 1. Filed with FERC February 23, 2011.

Sacramento Municipal Utility District (SMUD). 2007. Relicensing Settlement Agreement for the Upper American River Project and Chili Bar Hydroelectric Project. January.

United States Bureau of Reclamation (USBR). 1992. Auburn State Recreation Area Interim Management Plan.

United States Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service (NMFS). 2009. Biological Opinion and Conference Opinion on the Long-Term Operations of the Central Valley Project and California State Water Project (OCAP BiOP).

____. 2011. United States Department of Commerce's, National Oceanic and Atmospheric Administration's, National Marine Fisheries Service's, Southwest Region's, Federal Power Act COMMENTS, Preliminary § 18 PRESCRIPTIONS, § 10(j) Recommended CONDITIONS, § 10(a) RECOMMENDATIONS, and Notice of INTERVENTION for the Middle Fork American River Hydroelectric Project, Federal Energy Regulatory Commission Project No. 2079, California.

United States Department of Agriculture-Forest Service (USDA-FS). 1988. Eldorado National Forest Land and Resource Management Plan.

____. 1990 Tahoe National Forest Land and Resource Management Plan.

____. 2011. Preliminary Section 4(e) Terms and Conditions, Middle Fork American River Project, FERC No. 2079. Filed with FERC August 5, 2011.

United States Department of the Interior (DOI). 2011. Middle Fork American River Project, FERC No. 2079-069, Department of the Interior's Response to Commission's June 7, 2011, Notice that Project is Ready for Environmental Analysis. Filed with FERC August 5, 2011.

United States Environmental Protection Agency (EPA). 2011. Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2009. (http://epa.gov/climatechange/emissions/usinventoryreport.html)

____. 2009. Emissions and Generation Resource Integrated Database (eGRID). Available online at: http://www.epa.gov/egrid

United States Federal Energy Regulatory Commission (FERC). 2008. Final Environmental Impact Statement for Hydropower License. Upper American River Hydroelectric Project—FERC Project No. 2101-084—California Chili Bar Hydroelectric Project—FERC Project No. 2155-024—California. March.

Yoshiyama, R. M., E. R. Gerstung, F. W. Fisher, and P. B. Moyle. 1996. Historical and present distribution of Chinook salmon in the Central Valley drainage of California. Sierra Nevada Ecosystem Project: Final Report to Congress, Vol. III. Davis, CA: University of California, Center for Water and Wildland Resources.

TABLES

Table 4-1. Fish Native to the Middle Fork American River Watershed.[1]

Name	Habitat	Presence	Management Status[2]
Lampreys, *Petromyzontide*			
Pacific lamprey, *Lampetra tridentata*	Anadromous, foothills, lowlands	Extirpated (Nimbus/Folsom)	
Salmon, *Salmonidae*			
Chinook salmon, *Oncorhynchus tshawytscha*			
Chinook salmon, Spring-run	Anadromous, foothills, lowlands	Extirpated (Nimbus/Folsom)	ST, FT
Chinook salmon, Winter-run	Anadromous, foothills, lowlands	Extirpated (Nimbus/Folsom)	SE, FE
Chinook salmon, Fall-run	Anadromous, lowlands	Extirpated (Nimbus/Folsom)	CSC, FSS
Chinook salmon, Late fall-run	Anadromous, foothills, lowlands	Extirpated (Nimbus/Folsom)	CSC, FSS
Trout, *Salmonidae*			
Resident rainbow trout, *O. mykiss irideus*	Foothills, High elevations	Present	
Winter steelhead, *O. mykiss irideus*	Anadromous, foothills, lowlands	Extirpated (Nimbus/Folsom)	FT
Minnows, *Cyprinidae*			
Sacramento hitch, *Lavinia exilicauda excilicauda*	Lowlands, foothills	Presence not documented	
California roach, *Lavinia symmetricus*	Foothills	Present	
Sacramento blackfish, *Orthodon microlepidotus*	Lowlands	Presence not documented	
Hardhead, *Mylopharodon conocephalus*	Lowlands, foothills	Present	CSC, FSS
Sacramento pikeminnow, *Ptychocheilus grandis*	Lowlands, foothills	Present	
Sacramento speckled dace, *Rhinichthys osculus ssp.*	Lowlands, foothills	Present	

Table 4-1. Fish Native to the Middle Fork American River Watershed (continued).[1]

Name	Habitat	Presence	Management Status[2]
Suckers, *Catostomidae*			
Sacramento sucker, *Catostomous occidentalis*	Lowlands, foothills, high elevations	Present	
Surf Perches, *Embiotocidae*			
Sacramento tule perch, *Hysterocarpus t. traski*	Lowlands, foothills	Presence not documented	
Sculpins, *Cottidae*			
Prickly sculpin, *Cottus asper*	Lowlands, foothills	Present	
Riffle Sculpin, *Cottus gulosus*	Foothills, high elevations	Present	

[1]Table adapted from Moyle et al. 1996

[2]Status

FT = Federal Threatened
FE = Federal Endangered
ST = State Threatened
SE = State Endangered
CSC = CDFG Species of Special Concern
FSS = USFS Sensitive Species
FSC = USFWS Species of Concern

Table 4-2 Estimated Annual Hydroelectric Generation Offsets - Greenhouse Gas Emissions.

Greenhouse Gas Emissions (Existing)	GWP Coefficient	Emission Factors		Generation Offset		
		GHG	GWP	Generation	GHG	CO_2 eqv
		lbs/MW-hr	lbs/MW-hr	MW-hrs/yr	tonnes/yr	tonnes/yr
Carbon Dioxide (GHG - CO_2)	1	724.12	724.12	1,039,078	341,294	341,294
Methane (GHG - CH_4)	21	0.0302	0.63	1,039,078	14.23	299
Nitrous Oxide (GHG - N_2O)	310	0.0081	2.51	1,039,078	3.82	1,183
Carbon Dioxide Equivalents (CO_2 eqv)			727.27	1,039,078		**342,777**

Greenhouse Gas Emissions (With Project)	GWP Coefficient	Emission Factors		Generation Offset		
		GHG	GWP	Generation	GHG	CO_2 eqv
		lbs/MW-hr	lbs/MW-hr	MW-hrs/yr	tonnes/yr	tonnes/yr
Carbon Dioxide (GHG - CO_2)	1	724.12	724.12	985,877	323,820	323,820
Methane (GHG - CH_4)	21	0.0302	0.63	985,877	13.51	284
Nitrous Oxide (GHG - N_2O)	310	0.0081	2.51	985,877	3.62	1,123
Carbon Dioxide Equivalents (CO_2 eqv)			727.27	985,877		**325,226**

Decrease in Total GHG Offsets	**-17,550**

Source: CCAR 2009, PG&E 2011

Notes:

Global Warming Potentials (GWP) per CCAR Table C.1; IPCC Second Assessment Report (SAR) requirement

GHG Emission Factors per CCAR Table C.2

GWP factors = GWP x GHG factors (respectively)

Estimated Alternative 1 generation =	985,877	MW-hrs/yr
Less existing pre-project generation =	1,039,078	MW-hrs/yr
Estimated change in generation =	(53,201)	MW-hrs/yr

Generation offset is increase in GHG emissions elsewhere due to loss of hydroelectric generation output under Alternative 1

Offset units are metric tonnes (1,000 kilograms or 2,204.6 pounds)

FIGURES

Figure 4-1. Average Monthly Flow Into Folsom Reservoir Under the Alternative 1 Future Demand and Existing Environmental Baseline by Water Year Type.

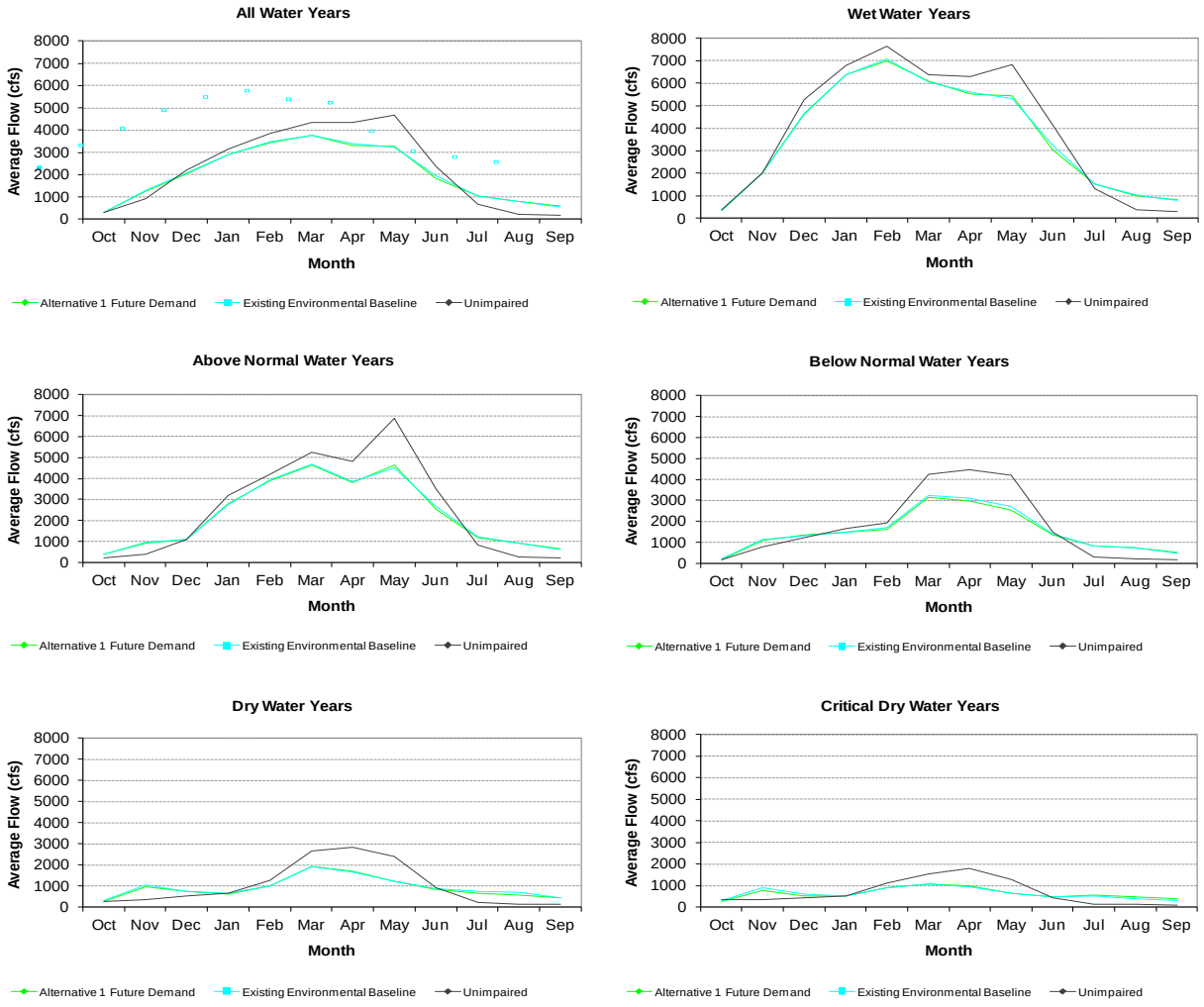
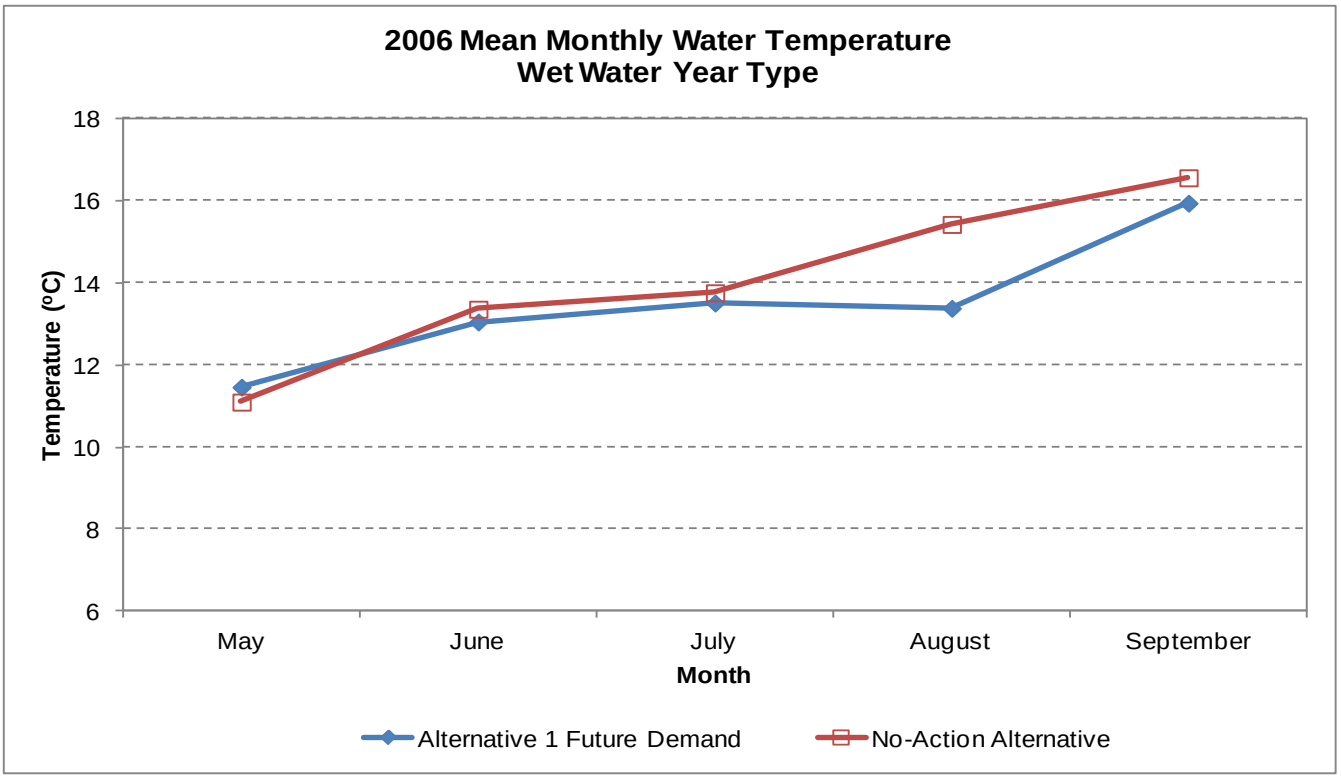
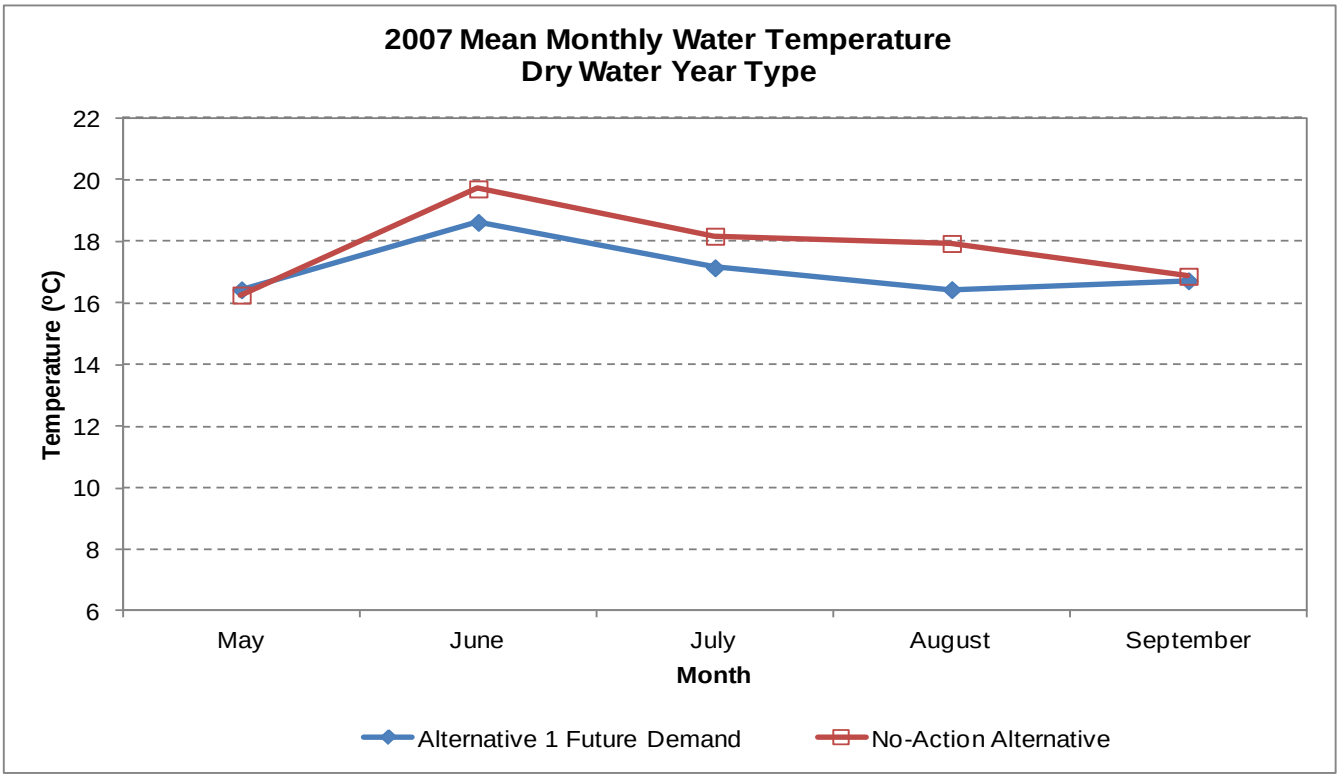
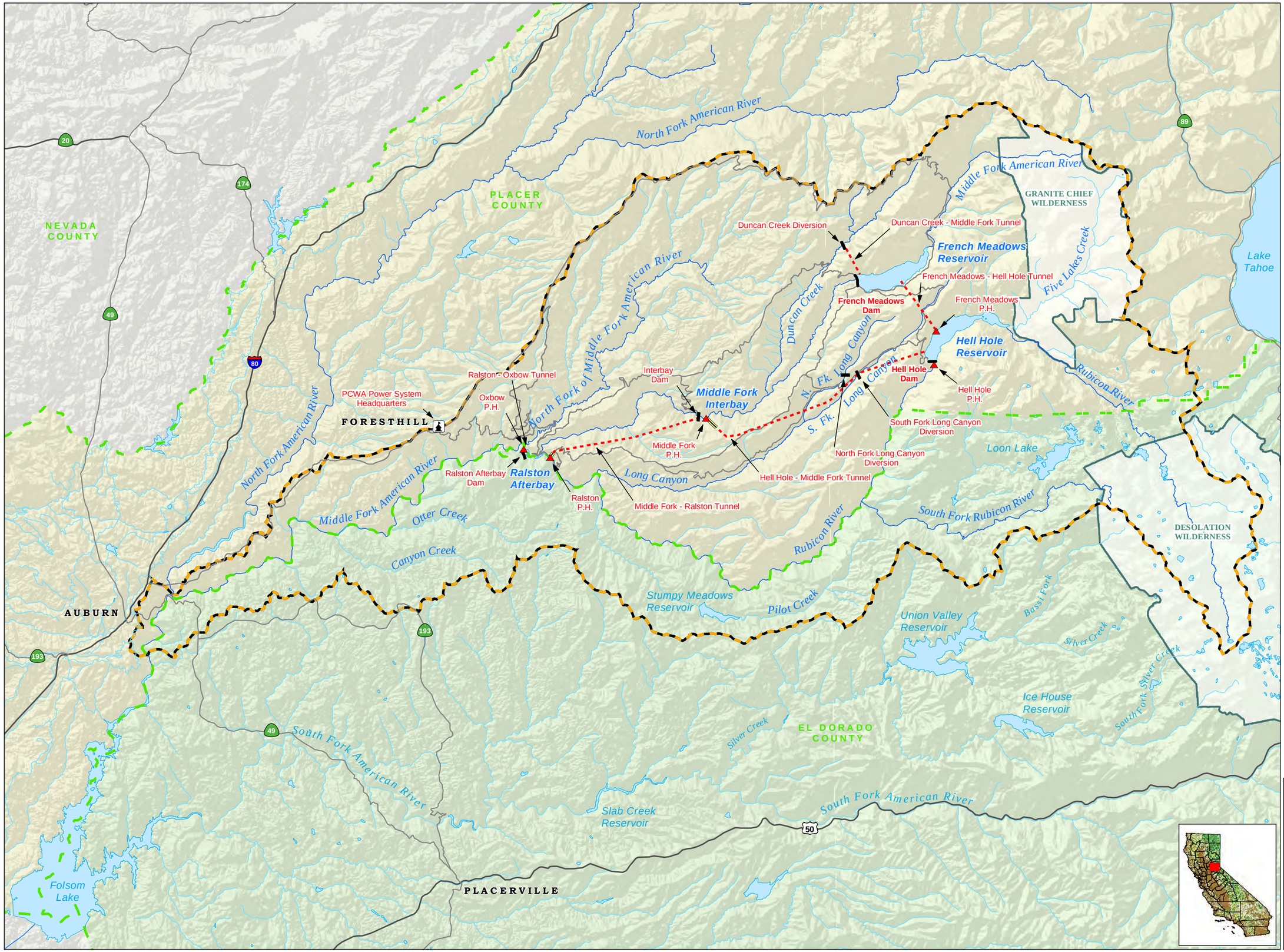


Figure 4-2. North Fork American River Modeled Mean Monthly Water Temperate at the Folsom Reservoir High Water Mark in a Wet Water Year Type (2006) and Dry Water Year Type (2007) Under Alternative 1 and the No-Action Alternative.





MAPS



Project Facilities*

- Powerhouse
- Dam
- Tunnel
- Penstock

* All MFP facilities labeled in red.

Transportation

- Major Road
- Minor Road

Hydrography

- Watercourse
- Water Body

Designated Boundary

- County Boundary
- Wilderness Area
- Middle Fork American River Watershed**

**Modified from Calwater Ver. 2.2 to represent drainage above high-water mark of Folsom Lake

PCWA

Placer County Water Agency
Middle Fork American River Project

Map 4-1

Principal Project Facilities and Geographic Setting

Date: 2/15/11

Projection: CA State Plane, Zone 2
Datum: NAD 83

C:\GIS\ENTRIX\3116501\map\GeneralMaps\PCWA_MFAR_17i11i_04.mxd

ATTACHMENT 4-1

Methodology to Determine Effect of Loss of Generation on Greenhouse Gases

The following describes the methodology used to determine the effect of this loss in generation on GHGs. A loss of generation capacity would have to be made up for by other electric energy retailers (i.e., purchased on the market) to meet demand. Electricity purchased on the California grid could include a variety of generation sources, including non-renewable (fossil fuel) sources, which generate GHGs, as well as renewable sources with negligible GHG emissions. To estimate the equivalent amount of GHGs produced by replacement electric generation, the methodology presented in the California Climate Action Registry (CCAR 2009) was used. This methodology is based on a database for GHGs associated with electric production (Emissions and Generation Resource Integrated Database, or eGRID) developed for the United States Environmental Protection Agency (EPA). The eGRID database is a globally recognized source of emissions data for electric power generated in the United States. eGRID is widely used for many other applications, such as EPA's Power Profiler and Carbon Footprint Tools, indirect emissions under the World Resources Institute, the Climate Registry, California Climate Action Registry, EPA Climate Leaders protocols, and many non-governmental organization tools and methodologies.

The eGrid divides the United States into regions and sub-regions. The region for California (CAMX) is a sub-region within the Western Electricity Coordination Council (WECC) area. The eGrid contains the most recent emissions operating data for California from all electricity providers, including coal and gas-fired power plants, cogeneration, biomass, solar, geothermal, nuclear, wind, hydroelectric, and other sources. Emissions are reported for three GHGs: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O). The eGRID provides total output emission rates, as pounds per megawatt hour (lb/MWh), for CO_2, CH_4, and N_2O. The total output emission rates are the appropriate value to use for carbon foot printing and to assign an emissions value from the consumption of purchased electricity (EPA 2011). These output emissions rates were then converted to carbon dioxide equivalents, using the global warming potential (GWP) factors presented in CCAR (2009) and as described previously.