

**COMMENTS
ON LICENSEE REVISED STUDY PLAN
MERCED FALLS HYDROELECTRIC PROJECT NO. 2467-019
APPLICANT PACIFIC GAS & ELECTRIC COMPANY**

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December 21, 2009

E-filing

Kimberly D. Bose, Secretary
Federal Energy Regulatory Commission
888 First Street, NE Room 1-A
Washington D.C. 20426

Dear Ms. Bose:

The California Sportfishing Protection Alliance, Merced River Conservation Committee, Trout Unlimited, Friends of the River, Golden West Women Flyfishers, Northern California Council of Federation of Fly Fishers, and American Rivers (Conservation Groups) respectfully submit these comments, and the attached proposed studies, on the Revised Study Plan for the Merced Falls Project, P-2467, owned by licensee Pacific Gas & Electric Company (PG&E), and located on the Merced River, California.

Review of Relevant Documents

Conservation Groups have reviewed documents previously submitted under this docket, including the Licensee Proposed Study Plan¹, FERC Scoping Document 2², Licensee Revised Study Plan³, comments by Conservation Groups on Licensee Proposed Study Plan⁴, and comments by several resource agencies on the Licensee Proposed Study Plan⁵. Conservation Groups have also reviewed the submittal under this docket and P-2179 regarding re-establishing the fish passage facility at Merced Irrigation District's Crocker-Huffman diversion dam.⁶

In addition, Conservation Groups have reviewed numerous documents within the docket of the Merced River Hydroelectric Project (P-2179), owned and operated by licensee Merced Irrigation District (Merced ID). We shall not list all of the documents we have reviewed within that docket, but shall reference them as needed within these comments. We specifically, however, wish to refer to our Comments on Licensee Revised Study Plan under P-2179.⁷ Finally, we refer the Commission to our Comments on the Study Dispute Resolution Process under P-2179⁸, and Comments on the Study Dispute Panel Reports under P-2179⁹. Many of our comments in these last two documents bear directly on the Licensee Revised Study Plan under P-2467.

Relation of Merced Falls Project and Merced River Project and relation of their respective relicensings

Just as, operationally, the Merced Falls Project is bound up with and in many respects overwhelmed by the Merced River Project (P-2179), the relicensing of the Merced Falls Project is bound up with and has in many respects been overwhelmed by the relicensing of the Merced River Project. The scoping documents for each relicensing recognized the connections between the projects, and announced the intention of the Commission to prepare a single NEPA document for relicensing both projects. Conservation Groups have previously supported and continue to support issuance of a single NEPA document for the two proceedings. We also believe that better coordination of the proceedings is needed.

¹ 20090806-5051

² 20090806-3066

³ 20091204-5008

⁴ 20091104-5072

⁵ State Water Resources Control Board (20091105-5069 and 20091116-0188, the latter with Bioaccumulation Study Plan); California Department of Fish and Game (20091106-5007); National Marine Fisheries Service (20091105-5069).

⁶ 20091118-5023

⁷ 20090831-5138

⁸ 20091120-5016

⁹ 20091215-5129

A Study Plan Dispute Resolution process took place over the last two months within the ILP for the Merced River Project relicensing. While the Director's determination on this process has not been issued, the Study Dispute Panel¹⁰ and the Agency Panelist¹¹ both found that the Director's Study Plan Determination for the Merced River Project relicensing had erred in denying nexus between the Merced River Project and effects on hydrology and on anadromous salmonids in the Merced River. Unless the Director chooses not to recognize this error, a revised scoping document for the Merced River Project relicensing will be required. This would, in turn, require issuance of a revised scoping document for the Merced Falls Project relicensing, since the announced intention of the Commission is to issue a single NEPA document for both relicensings.

The existing licenses for the two projects are explicitly interconnected by Article 38 of the Merced Falls Project license:

“Article 38. Licensee, for the protection, propagation, and preservation of the fish and wildlife resources of the Merced River shall coordinate project operations with the project operations of the Merced Irrigation District's Project No. 2179 and shall, insofar as releases from Merced Irrigation District's Project No. 2179 permit, release past Merced Falls dam (RM 55) such minimum flows as have been designated in Articles 40, 41 and 42 of the license for Project No. 2179.”

PG&E, in its Pre-Application Document and in its Licensee Proposed Study Plan for the Merced Falls Project, adopted a narrow approach relating to scoping and project effects, similar to the approach adopted by Merced ID for the relicensing the Merced River Project. In brief, PG&E sought to restrict consideration of project effects under relicensing to the immediate area and current operation of its project.

In their respective comments on PG&E's Proposed Study Plan under P-2467, the National Marine Fisheries Service (NMFS), California Department of Fish and Game (DFG), and Conservation Groups made the argument that the Merced Falls Project was part of a single water and power complex. For instance, Conservation Groups stated:

Conservation Groups believe that revised study and information requests for Merced Irrigation District's (Merced ID or MID) Merced River Project (P-2179) are also applicable to P-2467, and that both projects, Crocker-Huffman Dam, and other non-FERC water diversion facilities should be considered as one integrated water and power complex on the Merced River that is operated by Merced ID.¹²

¹⁰ 20091202-3015

¹¹ 20091202-5060

¹² 20091104-5072 at p. 2. The “other non-FERC diversion facilities” referred to Merced ID's Northside Canal, whose intake is at Merced Falls Reservoir, within the P-2467 project boundary.

Further, we requested that the Commission “provide leadership and resolution of th[e] obvious disconnect in the execution of the respective studies for the two projects.”¹³

Conservation Groups still believe that viewing the Merced Falls Project as part of one integrated water and power complex on the Merced River is the correct approach, and is not only authorized but required under the comprehensive development clause of section 10(a) of the Federal Power Act.

Proposed studies and project nexus for the Merced Falls ILP

PG&E states its vision of the overall nexus issue on page 15 of its Revised Study Plan:

The Licensee documented in the PAD that the Project is a small run-of-river Project that simply passes inflows provided by MID’s upstream project, with the exception of water diverted into MID’s diversion canal located adjacent to the Project powerhouse intake. Further, the downstream Crocker-Huffman diversion dam presents a significant barrier to any potential upstream anadromous fish migrations and diverts a substantial portion of river flows into the Main Canal for irrigation. For these reasons, it is Licensee’s view that 16 of the recommended 18 studies (the ASSP) for downstream aquatic and water resources do not have any nexus to operations of the Project, nor will they inform development of license requirements (Criterion 5 of the Commission’s Study Request Criteria).

PG&E suggests several arguments in this paragraph that is both remarkably dense and remarkably perfunctory:

1) PG&E maintains that the limitations of its ability to control flows in the Merced River limit the Merced Falls Project’s effect on the water and aquatic resources downstream. This suggests that the Merced Falls Project, specifically, has no nexus, particularly to downstream anadromous fisheries.

2) PG&E argues that because Crocker-Huffman presents a “significant barrier to any potential upstream anadromous fish migrations,” studies of anadromous fish should further be disallowed. Exactly which studies the barrier nature of Crocker-Huffman would disallow is not specified, but for discussion here we will assume that this includes any study relating to fish passage (and perhaps others). This argument is not unique to Merced Falls, but rather repeats that argument that was made by Merced Irrigation District.

3) PG&E suggests that there is significance in the fact Crocker-Huffman diversion dam “diverts a substantial portion of river flows into the Main Canal for irrigation.” This would appear to repeat Merced ID’s contention that something about Crocker-Huffman prevents the Commission from setting license conditions to benefit fisheries downstream

¹³ Ibid.

of Crocker-Huffman. The Study Plan Determination for the Merced River Project put it as follows: “Therefore, MID’s independent operation of Crocker-Huffman inherently confounds direct Project effects. Because of this, any studies that attempt to correlate Project effects to downstream effects below Crocker-Huffman are prone to substantial error – unacceptable for forming reliable inferences on Project effects.”¹⁴ However, because PG&E does not elaborate, this may not be exactly what PG&E considers the significance of the large quantities of water diverted.

We shall not extensively discuss the third point raised by PG&E. It was addressed in the Study Dispute Resolution process under P-2179, in the reports both of the Study Dispute Panel and of the Agency Panelist. We have discussed the issue at length and in detail in our comment letters on the Study Dispute Resolution Process and the Study Dispute Panel Reports. PG&E got this wrong, like Merced ID got it wrong and like the Study Plan Determination for P-2179 got it wrong. The existence and operation of Crocker-Huffman does not eliminate nexus under Study Criterion 5 for either the Merced River Project or the Merced Falls Project, for either water or aquatic resources, downstream of Crocker-Huffman dam or upstream of the dam.

Regarding point 2, the Study Dispute Panel under P-2179 reported that there was evidence of anadromous fish upstream of Crocker-Huffman. Merced Falls is the first barrier upstream of Crocker-Huffman. As we stated in our Comments on the Proposed Study Plan under P-2467, Merced Falls dam may be directly blocking passage of anadromous fish upstream.¹⁵ As we stated in our comments on the Study Dispute Panel’s Report under P-2179, Merced Falls, Crocker-Huffman and the project dams and reservoirs of the Merced River Project cumulatively and collectively block fish passage of anadromous fish on the Merced River, notably to extensive riverine habitat upstream of Lake McClure. It is under that comprehensive standard that the role of each dam and reservoir should be judged in regard to fish passage. On this count, PG&E’s effort to exclude studies based on nexus also fails.

PG&E’s contention that the limited nature of its project prevents it from controlling flows in the Merced River is different. It is specific to the Merced Falls Project. While as a condition of its license, PG&E must pass through water to assist Merced ID in meeting Merced ID’s flow compliance requirements at Shaffer Bridge, 22.5 miles downstream of Merced Falls Dam, PG&E’s control is limited to the water that Merced ID releases into Merced Falls Reservoir. We shall discuss below what we see as the implication of this specific situation in the context of specific requested studies.

NMFS’s, DFG’s and Conservation Groups’ previous study requests under P-2467

In addition to comments, NMFS, DFG and Conservation Groups proposed eighteen studies to PG&E for inclusion in its ILP. These proposed study modifications (of

¹⁴ Merced River Project P-2179 Study Plan Determination 20090914-3021 at p. 3.

¹⁵ 20091104-5072 at p. 5.

Merced ID studies) and proposed study plans were virtually identical to those jointly filed by resource agencies and Conservation Groups in July, 2009 under P-2179 in response to Merced Irrigation District's Proposed Study Plan.

Given the timelines and the circumstances of the parallel proceedings, as well as the proposal to combine the processes, this is perhaps understandable.¹⁶ The concept that the Commission would look at the proposed studies and apportion responsibility was appealing, though perhaps optimistic. Conservation Groups proposed on December 15, under P-2179, that the Commission call a technical conference to review and decide on specific studies for the Merced River Project relicensings, and suggested that this might also include discussion of the studies under P-2467. We have not changed our minds over the last week in thinking that this is necessary and would be productive for all parties.

However, after considering the record of both proceedings, and re-reading the documents including especially the proposed study plans, Conservation Groups determined that we would not persist in simply referring to studies under P-2179 in response to PG&E's Revised Study Plan under P-2467. The perfunctory dismissal by PG&E does not mean that an equally perfunctory re-affirmation will do. Therefore, we have chosen to craft, to the degree that we are able, study proposals specific to the Merced Falls relicensing and, to the degree that they can be separated from those of Merced Irrigation District's, specific to the Merced Falls Project's impacts.

Studies previously proposed by Conservation Groups for Project P-2467 eliminated from further recommendation by Conservation Groups as not applicable to P-2467

Study 2.1, the requested *Hydrologic Alteration* study is already being performed by Merced ID in a form that is acceptable to Resource Agencies and Conservation Groups. There is no need for PG&E to duplicate or modify it.

¹⁶ Less understandable, and less excusable, is the fact that the study plans filed by all NMFS, DFG and Conservation Groups on November 4 and 5 under P-2467 were not the most current versions of some of those study proposals filed under P-2179, but were rather those that were submitted by all three entities under P-2179 on July 16, 2009. DFG and Conservation Groups updated and revised a number of the July proposals, and included those in respective filings on the Revised Study Plan under P-2179 on August 31 and 30, 2009, respectively. Also included in each filing was a chart (Attachment at pp. 1-2 of each filing) that showed where each most up-to-date proposed study plan or modification could be found. (See 20090831-5237 and 20090831-5138). Perhaps most significantly, the proposed Anadromy Salmonid Habitat study was revised August by DFG and Conservation Groups to be strictly a study of *O. mykiss*, and left study of salmon to several other proposed study plans, eliminating redundancy and clarifying focus and intent. Also revised in August were the following study plans: Water Quality, Reservoir Fish, Fish Entrainment, and Instream Flow.

Study 2.2, the requested *Water Balance/Operations Model*, was recommended for modification by the Study Dispute Panel under P-2179. In any case, it deals almost completely with operations by Merced ID, and the contested aspect (diversions downstream of Crocker-Huffman dam) is addressed in practice by Merced ID's releases from its project and from Crocker-Huffman. This is and should be a Merced ID study.

Study 2.3, the requested *Water Quality Monitoring* study, is, as presented previously by Conservation Groups, a Merced ID study. A different study for Merced Falls has apparently been agreed to by PG&E and the State Water Resources Control Board; to the degree that there is not agreement, a study specific to Merced Falls is called for.

Study 2.4, the requested *Water Temperature Model*, was recommended for modification by the Study Dispute Panel under P-2179. In any case, it deals almost completely with water resources whose management is addressed by Merced ID, and the contested aspect (diversions downstream of Crocker-Huffman dam) is addressed in practice by Merced ID's releases from its project and from Crocker-Huffman. This study, whether modified as requested by Conservation Groups or not, already includes modeling of the thermal impacts of Merced Falls reservoir, facilities and operation. This is and should be a Merced ID study.

Study 2.5, the requested *Bioaccumulation* study, has been replaced by a study specific to Merced Falls that we understand has been agreed to by the SWRCB.

Study 2.6, the requested *Reservoir Water Temperature Management Feasibility* study, deals with Merced ID facilities. There is no indication that similar study of the Merced Falls Dam would be productive. To the degree that this study is needed, this is and should be a Merced ID study.

Study 6.1, the requested *Riparian Habitat and Wetlands*, has been accepted by Resource Agencies and Conservation Groups in the form proposed by Merced ID.

Studies of anadromous fish in the lower Merced River

For the sake of conciseness, we address several studies collectively:

Study 3.1b, the requested *Anadromy Salmonid Habitat study*, addresses *O. mykiss* fish resources downstream of Crocker-Huffman diversion dam.¹⁷ The study seeks to establish baseline abundance and age class variety, and to assess life history, habitat utilization, and habitat types and locations.

¹⁷ We again call attention to the fact that the most up-to-date version of this study is the August 30, 2009 version that was filed under P-2179 by DFG and by the Conservation Groups; see footnote 16 in this comment letter, above.

Study 3.5, the *Anadromous Fish Passage Facilities* study, Part 2, “Migration Corridor Protection Plan”,¹⁸ proposes construction of a weir, PIT tagging, documentation of habitat conditions, carcass surveys, statistical evaluation of previously collected salmon and steelhead outmigrant data, collection of smolt survival vs. flow data, use of rotary screw traps to document timing and number of outmigrants, and development of a plan to protect anadromous fish in the Merced River.

Study 3.6, the *Anadromous Floodplain Rearing* study, proposes to implement an experimental pulse flow schedule to evaluate changes in survival of juvenile salmonids. It involves use of rotary screw traps, calibration of outmigrant survival using hatchery salmon, collection of predator species and evaluation of stomach contents, and collection of juvenile salmonids to evaluate disease and food availability.

Study 3.7, the *Chinook Salmon Egg Viability* study, seeks to measure the viability of salmon eggs at the Merced River Hatchery relative to water temperatures in the migration path of upmigrating salmon. It also seeks to evaluate straying rates of code-wire tagged Merced River smolts, and to evaluate the timing and occurrence of fall pulse flows by examining the number of eggs present in female Chinook that were pre-spawn mortalities.

Study 3.8, the *Instream Flow* study, requests a 1-D PHABSIM analysis of the Merced River between Crocker-Huffman Diversion and Shaffer Bridge.

Conservation Groups reaffirm that all of these studies of anadromous fish in the lower Merced River are needed to inform the combined NEPA analysis for the relicensing of Project 2179 and Project 2467.

However, since PG&E operates the Merced Falls Project to simply pass through the flows that are released from the Merced River Project directly upstream, and since PG&E plans to operate in the same manner under its new license, there are no actions that PG&E could take that would improve flows downstream of its project. The primary intent of the study of anadromous fish resources in the lower Merced River is to determine what changes in flows are needed to improve conditions for fishery resources. Provided that PG&E agrees to a license term that will compel PG&E to continue to operate the Project in run-of-the-river mode, and provided that PG&E agrees to a license term that maintains Article 38 of its existing license or an appropriate adaptation which explicitly retains the purpose and intent of that article, Conservation Groups believe that there are no new potential license conditions **for the Merced Falls Project** that would be informed by the *Anadromy Salmonid Habitat* study, *Anadromous Fish Passage Facilities* study, part 2, *Anadromous Floodplain Rearing* study, *Chinook Salmon Egg Viability* study, and *Instream Flow* study. These are studies that should be conducted by Merced Irrigation District, whose Merced River Project controls the flows in the lower Merced River.

¹⁸ See Section 6, Part 2 of this proposed study.

Study previously proposed by Conservation Groups for P-2467 that may appropriately be replaced by modification of a study proposed by PG&E

Study 3.1, the *Reservoir Fish Populations* study, as proposed by NMFS, DFG and Conservation Groups in response to PG&E's Proposed Study Plan, was inadequately revised. It proposed study of reservoirs owned by Merced ID. PG&E Study FA-S1 proposes to conduct sampling of reservoir fish in Merced Falls Reservoir, but PG&E's study plan does not state the time of year in which sampling will be conducted. Conservation Groups recommend that sampling be conducted in summer or fall. PG&E's study plan does not specify the time of day during which electrofishing will take place. Because daytime electrofishing at Caples Lake in 2008, during a fish rescue at a FERC-regulated project facility, captured only a small fraction of the number of fish captured in Caples Lake at night, Conservation Groups recommend that the study require nighttime electrofishing, to more adequately and accurately characterize the fishery in Merced Falls Reservoir.

Study 3.2, the *Fish Entrainment* study, as proposed by NMFS, DFG and Conservation Groups in response to PG&E's Proposed Study Plan, was also inadequately revised. It also proposed study of entrainment of fish within reservoirs owned by Merced ID. PG&E Study FA-S1 proposes to conduct a desktop analysis of entrainment into the project powerhouse from Merced Falls Reservoir, and to consult with relicensing participants if that analysis indicates that there may be significant entrainment into the project's turbine. Conservation Groups agree with that proposal, but also believe that a second contingency should be considered when a second-phase study is considered. If the *Upper River Fish Populations and Habitat* study and the *Anadromous Fish Passage* study, as proposed below, indicate that there is a reasonable likelihood that anadromous fish may be introduced into Merced Falls Reservoir, then the consultation with relicensing participants should also consider a study of entrainment into the Northside Canal as well as into the Merced Falls powerhouse. While the Northside Canal is an irrigation supply facility owned by Merced Irrigation District, the intake to the canal is within the Merced Falls project boundary. Should it become practical to study entrainment of anadromous fish from Merced Falls Reservoir, entrainment into all potential entrainment hazards within the project boundary should be studied.

Study previously proposed by Conservation Groups for both P-2179 and P-2467 that may be replaced by study suggested by Study Dispute Panel under P-2179

Study G1, the *Gravel Sediment Budget and Mobility*, proposes a suite of measures to analyze gravel mobility and availability in the lower Merced River. The November 17, 2009 Study Dispute Panel technical meeting held under P-2179 featured considerable discussion of this study and related issues. Merced ID pointed out that extensive information already existed about channel conditions in the lower Merced River. The Study Panel's Report¹⁹ recommends, at p. 21, a less intensive study than that proposed by Resource Agencies

¹⁹ 20091202-3015 at p. 21

and Conservation Groups to help determine responsibility for the condition of the channel. Conservation Groups support this approach. Conservation Groups believe that flow is an important factor in the condition of the channel, but there is also a contribution made by the Merced Falls facilities. Merced Falls Dam traps considerable fine sediment that is periodically dredged by PG&E. This process causes release of fines into the lower Merced River, and contributes to the armoring of the stream channel. There are likely other contributing elements caused by the Merced Falls Project. Therefore, Conservation Groups recommend that the Commission assign PG&E a portion of the responsibility for conducting the study recommended by the Study Dispute Panel.

Studies previously proposed by Conservation Groups for both P-2179 and P-2467 that may be phased, based on the outcome of revised studies proposed below

Study 3.3, the *Anadromous Conservation Hatchery* study, seeks to evaluate whether a Conservation Hatchery might assist in recovering anadromous salmonids to the upper Merced River. In the Study Plan Determination for P-2179²⁰, it was suggested that this study does not assess project effects, but rather examines possible PM&E measures. The Study Dispute Panel under P-2179 discussed this procedural issue at length. The Agency Panelist recommended in his report that this study be held pending the outcome of study to determine the availability of genetically suitable broodstock as determined by the genetic component of the *Upper River Fish Populations and Habitat* study.²¹ Conservation Groups also recognize that it is appropriate to evaluate the suitability of upstream habitat before considering whether specific facilities would assist in helping anadromous fish to reach that habitat. Therefore, we agree with the Agency Panelist under P-2179, and suggest that this study be phased, dependent on the results of the *Upper River Fish Populations and Habitat* study. We discuss below which licensee may be ascribed responsibility for studies of fish passage; responsibility for this phased study should follow from how overall responsibility for fish passage on the Merced River is allocated by the Commission.

Study 3.5, the *Anadromous Fish Passage Facilities* study, Part 1, “Fish Passage Facility Feasibility,²²” considers engineering solutions to achieve fish passage facilities past Crocker-Huffman, Merced Falls, McSwain and New Exchequer dams. As with the proposed *Anadromous Conservation Hatchery* study, Conservation Groups also recognize that it is appropriate to evaluate the suitability of upstream habitat before considering whether specific facilities would assist in helping anadromous fish to reach that habitat. Therefore, we suggest that this study also be phased, dependent on the results of the *Upper River Fish Populations and Habitat* study. We discuss below which licensee may be ascribed responsibility for studies of fish passage; responsibility for this phased study

²⁰ 20090914-3021 at p. 13

²¹ 20091202-5060 at p. 45

²² See Section 6, Part 1 of this proposed study.

should follow from how overall responsibility for fish passage on the Merced River is allocated by the Commission.

Revised new studies proposed by Conservation Groups

There are two studies previously recommended by Conservation Groups that are appropriate for the Commission to require of licensee PG&E under the Merced Falls Project ILP. These studies are Study 3.1a, the *Upper River Fish Population and Habitat* study, and Study 3.4, the *Anadromous Fish Passage* study.

Conservation Groups have revised these studies substantially, and submit them as an appendix to these comments.

As stated above and elsewhere, the Merced Falls Project blocks passage of anadromous fish. It blocks passage cumulatively and collectively, in concert with facilities owned by Merced ID, and it blocks fish directly, as the downstream-most complete barrier to fish passage on the Merced River.

As also stated above and elsewhere, Conservation Groups believe that the Commission should consider fish passage on the Merced River in the context of the comprehensive development clause of Section 10(a) of the Federal Power Act.

In the context of comprehensive development, it would be appropriate to assign to Merced Irrigation District a proportion of the responsibility for these studies that is commensurate with the benefit that Merced ID gains from its use of the waterway, when compared to the benefit gained by PG&E. How the Commission might choose to consider the past power benefit gained by PG&E because of its revenues from Project 2179, as compensation for PG&E's role in the construction of New Exchequer Dam, is for the Commission to contemplate.

Should the Director choose to discount Section 10(a) in the context of his consideration of these two proposed studies, then Conservation Groups maintain that PG&E should pay the entire cost for both of them.²³ It is flatly unacceptable to conduct no studies at all because it is difficult to decide which of the partly responsible parties should pay for them.

These studies, while they will *inform* PM&E measures, ***are studies of project effects***. As stated in Section 4 of the revised *Upper River Fish Population and Habitat* study:

A known effect of the Merced Falls project is that, in conjunction with facilities owned by the Merced Irrigation District, the project blocks passage to fish habitat in the Merced River upstream of Lake McClure. This study will allow relicensing participants to evaluate the effects of the blockage by characterizing and

²³ Even though we disagree with this approach.

quantifying the habitat to which passage is blocked. The significance of the project effect in blocking fish passage cannot be evaluated absent understanding of the restoration potential of upstream habitat. A project effect that blocks fish passage to habitat that is usable by anadromous salmonids needs to be mitigated, whereas a project effect that blocks passage to unsuitable habitat might not need to be mitigated.

Equally, as stated in Section 4 of the revised *Anadromous Fish Passage* study:

A known effect of the Merced Falls project is that, in conjunction with facilities owned by the Merced Irrigation District, the project blocks passage to fish habitat in the Merced River upstream of Lake McClure. This study will allow relicensing participants to evaluate the effects of the blockage by characterizing and quantifying the potential accessibility by restored salmonids to habitat to which passage is blocked. This significance of the project effect in blocking fish passage cannot be evaluated absent understanding of the potential accessibility of upstream habitat. A project effect that blocks fish passage to accessible habitat that is usable by anadromous salmonids needs to be mitigated, whereas a project effect that blocks passage to unsuitable or inaccessible habitat might not need to be mitigated.

Put differently, Conservation Groups have carefully and painstakingly revised these two proposed study plans to conform to the imperative that these studies evaluate project effects. The first study asks: does the project block passage to habitat that is *usable* by anadromous salmonids? The second study asks: does the project block passage to habitat that is *accessible* to anadromous salmonids? Whatever was previously contained within these studies that appeared to us to fall outside this framework has been, to the best of our ability, edited out.

The Chinook salmon and *O. mykiss* fisheries of the Merced River are in grave condition. The Commission has a responsibility to expansively examine options for improving these fisheries. Licensee PG&E should bear its fair share of the cost of study of how to turn the situation around. While PG&E cannot equitably be held accountable for most of the downstream effects of the combined water and power system owned by PG&E and Merced ID on the Merced River, it is surely equitable to hold PG&E accountable for its role in blocking passage of anadromous fish to whatever usable and accessible upstream habitat may exist.

A final consideration

In 1971, the Commission ordered PG&E to discontinue operation of the fish ladder at Merced Falls Dam. This was in response to a request from DFG, which had apparently also requested that Merced ID cease operation of the fish ladder at Crocker-Huffman Dam, although a copy of that request has not been produced within this proceeding. The immediate rationale for cessation of operation of both ladders was construction of an

artificial spawning channel downstream of Crocker-Huffman. There was also recognition that construction of McSwain Dam had caused inundation by McSwain Reservoir of most of the usable salmon spawning habitat downstream of New Exchequer Dam; New Exchequer, like old Exchequer Dam before it, completely blocked passage further upstream.

What remains today is somewhat of a regulatory conundrum. As noted above, passage past Merced Falls Dam in itself could be easily established, were there only usable habitat upstream. However, Merced ID has used the presence of Merced Falls to avoid exposure under Section 18, or, more simply, to avoid responsibility for passage past facilities of the Merced River Project.

An important consideration in this regard is the letter from DFG to Merced ID of November 17, 2009, which directs Merced ID to evaluate fish passage and Crocker-Huffman and to develop a plan for fish passage plan at that location.²⁴

The Commission should consider, in consultation with the California Department of Fish and Game, rescinding its 1971 order allowing non-operation of the fish ladder at Merced Falls Dam, and perhaps ordering re-operation of the ladder. From a regulatory standpoint, this would help clear the air on who is responsible for fish passage and its blockage on the Merced River.

Conclusion

Revised versions of Study 3.1a, the *Upper River Fish Population and Habitat* study, and Study 3.4, the *Anadromous Fish Passage* study, developed by Conservation Groups, are attached to this letter. These revised study plans have been, to the best of our abilities, tightened up and better focused on the fundamental issue of fish passage. We elected not to submit these revised study plans under P-2179 because it would simply have been too confusing. Should these revised study plans conflict with studies ordered under P-2179, we are of course prepared to modify them as needed. Should the Director choose to order, as Conservation Groups requested on December 15²⁵, a technical conference to consider studies under P-2179 (and perhaps under P-2467 as well), these revised study plans should serve to inform discussion to achieve a reasonable outcome.

Thank you for the opportunity to comment on the Licensee Revised Study Plan for the Merced Falls Project, and to submit revised and improved study plans for two proposed studies.

Respectfully submitted,

²⁴ 20091118-5023

²⁵ 20091215-5129



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American Rivers
Thriving By Nature

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**Revised CG Study Request 3.1a
(3.1a CG rev)
UPPER RIVER FISH POPULATIONS & HABITAT
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1.0 Project Nexus and Issue

A federally listed fish species, California Central Valley Steelhead trout DPS (FT), *Oncorhynchus mykiss*, and its designated critical habitat, along with the Central Valley fall/late-run Chinook salmon (*Oncorhynchus tshawytscha*), a listed Species of Concern, occur in the Merced River downstream of the Merced Falls Project.

Current conditions in the Merced River for the 3-mile reach between the PG&E's Merced Falls Reservoir and Merced Irrigation District's (Merced ID) Crocker-Huffman diversion dam and the 19.5 miles downstream of Crocker-Huffman diversion dam to Shaffer Bridge (RM 32.5) are directly affected by current project operations (Study Dispute Panel, 2009a).

The Project dam at Merced Falls blocks volitional passage of anadromous fishes, which are able to ascend the Merced River past Crocker-Huffman diversion dam during very limited river conditions (largely depending on flow). This issue was evaluated by the Dispute Resolution Panel for the Merced River Hydroelectric Project studies (Study Dispute Panel, 2009a, b). The Panel reported that there was evidence in the record that anadromous fish may ascend the Merced River to the Merced Falls Project dam.¹ This evidence includes: 1) some fall chinook salmon may surmount the dam during high flows (M. Cozart, pers. comm., 2000; cited in Stillwater Sciences, 2001); 2) presence of anadromous Pacific lamprey above Crocker Huffman dam and "assumed that the partially removed fish ladder at Crocker-Huffman provided limited passage for the lamprey observed above the dam" (Stillwater Sciences, 2007; 2008); 3) *O. mykiss* are known to be present upstream of Crocker-Huffman Dam, but were considered by Stillwater Sciences (2008) as "resident" since Crocker-Huffman Dam is a migration barrier to most fish species.

The California Department of Fish and Game CDFG (2009) notified Merced ID that the Department has determined that fish passage at the Crocker-Huffman Diversion Dam must

¹ "The above presents a dilemma for the Panel as some information in the record affirms that anadromous fish make it to the lowermost Commission licensed facility on the Merced River but not to the base of McSwain dam. The Panel's logic in addressing the following studies is: 1) flows measured at Shaffer Bridge originate in Lake McClure and pass through McSwain dam, Merced Falls dam and Crocker-Huffman diversion dam; and 2) information in the record suggests that anadromous fish do occur upstream of Crocker-Huffman diversion dam."

be restored. CDFG directed Merced ID to consult with CDFG to evaluate fish passage at Crocker-Huffman Diversion dam and to develop a Crocker-Huffman fish passage plan.

Prior to the construction of McSwain Dam (licensed under the current FERC Project License 2179), project works at PG&E's Merced Falls Dam included a fish ladder, now not operating. (FERC Project License 2467)².

Lindley *et al.* (2006) estimated there are 193 miles of salmonid habitat (primarily suitable for steelhead) upstream of Lake McClure, including an estimated 39 miles of historic spring-run Chinook salmon habitat.

In order to make informed decisions regarding restoration of anadromous species (Chinook salmon and *O. mykiss*) to the upper Merced River (upstream of Lake McClure) information and data is needed to determine: 1) presence of usable habitat for anadromous species; 2) suitable water quality conditions (temperature) for juveniles during summer seasons; 3) use of habitat over the life cycle of anadromous species; 4) characterization of available habitat by location; 5) presence of Merced River native *O. mykiss* populations; and 6) potential for predation on introduced anadromous species.

During the Technical Conference in the Merced ID Study Dispute Panel (Study Dispute Panel, 2009b), a representative from NMFS stated that NMFS "had brought to the Commission's attention a draft recovery plan that would be a proposal to put anadromous fish within the project and above the project. NMFS' intention is to explore these upper [Merced River] habitats, both their historical and current potential for the purpose of trying to decide whether or not to invoke a section 18 prescription at the appropriate point in the process. The information from the study would be used to inform any FPA section 18 prescription for the project, and its measures would need to be incorporated as conditions in the new license. NMFS commented that to do a proven job in making a section 18 decision, we (NMFS) need(s) to do further investigation of that habitat potential upstream."³ No previous studies collected this information that is needed to inform the Commission.

PG&E (2009b) has proposed a Fish Population Study in its Merced Falls Project reservoir. It has a limited geographic scope, and does not address the geographic scope, stated by FERC staff in SD-2 (FERC, 2009), including the upper Merced River.

² Until 1971, the fish ladder on Merced Falls Dam was operated to allow upstream access for anadromous species; however, operation of this ladder was discontinued in 1971 after the construction of Merced ID's McSwain Dam eliminated upstream spawning resources and CDFG requested that Merced ID's Crocker-Huffman Irrigation Diversion Dam ladder operation also be discontinued (letter to A.O. Clark, PG&E from A.E. Naylor, CDFG dated March 26 1971; letter to J.F. Roberts Jr., PG&E from K. Plumb, Federal Power Commission dated August 5, 1971)" (PG&E (2001a @ page 5-21)".

³ Study Dispute Panel (2009b) @ Page 39

This Study Request addresses the following issues as identified in Section 8 of the Applicant's Pre-Application Document (PG&E, 2009a):

- Issue AR-4. Effect of the Project on special-status fishes anadromous fishes, including spring- and fall-run Chinook salmon and steelhead in the Merced River, due to blockage of passage
- Issue TE-3. Effect of the Project on special status fish species.

2.0 Resource Agency and Tribal Management Goals

The Applicant should confer with Resource Agencies and American Indian Tribes that participated in development of this study proposal; Resource Agencies (NMFS and California Department of Fish and Game) have identified specific management goals relevant to this Study Request (i.e. re-establishment of ESA listed anadromous species in the upper Merced River and re-opening the Crocker-Huffman Diversion Dam fish ladder to improve anadromous fish passage). In particular, NMFS has identified an ESA restoration plan for anadromous *O. mykiss* that will put fish in and above the project boundaries, including anadromous species habitat in the upper Merced River (NMFS 2009a). General management and restoration goals for Steelhead trout, fall-run Chinook salmon, and spring-run Chinook salmon have been published (see Martin, 2007 for a summary).

3.0 Relevant Public Interest Consideration and Potential License Conditions

The requester is not a resource agency and states the public interest considerations in regard to the proposed study.

- Information and data is lacking on the potential for restoration of anadromous species in the upper Merced River. Limited information regarding the critical factors necessary for anadromous species' migration and maintenance in the upper Merced River exists in a single study, conducted over limited space and seasons (Stillwater Sciences, 2008). Additional information is needed to make an informed decision and develop informed FERC license articles, as well as to describe project effects in the NEPA analysis for relicensing the Merced River FERC projects.
- Study is needed to provide data, information, and alternatives to prescription of fishways as deemed necessary to protect threatened populations of fish, under the

ESA and Federal Power Act, § 18. The public interest served by providing this study is that sufficient information and data will be provided to the Secretaries of Commerce and Interior (acting on behalf of the public and protecting public fisheries interests) to evaluate the need/justification and alternatives to protect species of concern or threatened species and make recommendations, for the public benefit of anadromous fisheries and their recreational benefits of the Merced River.

- Southern Sierra Miwuk Nation tribal leaders have indicated that reconnection and restoration of anadromous fish species are important Tribal goals for the Merced River (Brochini, pers. comm.). The Tribal interests include fish and aquatic resources. Prehistoric and historic use of salmon and aquatic life by the indigenous tribes of the Merced River included 1) ceremonial purposes for salmon; 2) Salmon as a cultural wealth elevating factor in historic and prehistoric use; 3) Seasonal significance in the oral traditional calendar-signifying time; 4) essential trade item; 5) Salmon elevation of spawning as an indicator of elevation of village locations; and 6) Mythology of spawning introduction at higher elevations (indigenous planting). Study is needed to establish the feasibility of upper Merced River anadromous fish restoration for tribal purposes.

The applicant's proposed alternative studies are not sufficient to meet these stated information needs, which are necessary to evaluate the feasibility of restoring anadromous species to the upper Merced River:

- The applicant proposed a "fish population survey" in Merced Falls Dam impoundment and did not propose studies to evaluate anadromous fish in the broader "geographic scope" (PG&E, 2009b), outlined in the FERC Scoping Document 2 for the Merced Falls Hydroelectric Project (FERC, 2009). The applicant erroneously stated that anadromous fish do not occur in the Merced River upstream of the Crocker-Huffman Diversion Dam, and thus concluded that the Merced Falls Hydroelectric Project has no effect on the upstream migration of special-status fishes. Above Merced Falls Dam, all anadromous species have been extirpated, including historically present spring- and fall-run Chinook salmon (*Oncorhynchus tshawytscha*) and steelhead trout (*Oncorhynchus mykiss*) (Natural Resources Scientists, Inc. 2007; Martin, 2008; PG&E, 2009a). There are efforts in the San Joaquin River basin to re-introduce these fishes, and the Merced River may be re-populated and important to the re-establishment of this species. The San Joaquin River Restoration Plan includes the reintroduction of spring-run Chinook salmon by 2012.

The results of this Study Request will inform the Commission by providing information for the development of protection, mitigation and enhancement (PM&E) measures relating to

the effects of project structures, operations and maintenance. Potential measures include restoration of anadromous salmonids to the Merced River and tributaries upstream of Lake McClure. Development of PM&E measures is not part of the study.

4.0 Study Goals and Objectives

A known effect of the Merced Falls project is that, in conjunction with facilities owned by the Merced Irrigation District, the project blocks passage to fish habitat in the Merced River upstream of Lake McClure. This study will allow relicensing participants to evaluate the effects of the blockage by characterizing and quantifying the habitat to which passage is blocked. The significance of the project effect in blocking fish passage cannot be evaluated absent understanding of the restoration potential of upstream habitat. A project effect that blocks fish passage to habitat that is usable by anadromous salmonids needs to be mitigated, whereas a project effect that blocks passage to unsuitable habitat might not need to be mitigated.

The objective of the Study Request is to characterize and quantify fish habitat in the upper Merced River, including the South Fork Merced River and tributaries that are likely to provide spawning and/or juvenile rearing habitat for anadromous salmonids. Study elements will evaluate:

- Presence of suitable habitat for anadromous species;
- Availability of suitable water quality conditions (temperature) for juveniles during summer seasons;
- Use of habitat by existing species including resident *O. mykiss* for use in comparison with the life-cycle needs of anadromous species;
- Presence of upper Merced River native *O. mykiss* populations based upon genetic characteristics; and
- Potential for predation on introduced anadromous species.

5.0 Existing Information and Need for Additional Information

There are three historical references or studies of fishes in the upper Merced River. Fish observations were made by Kisanuki and Shaw (1992), prior to a series of river restoration efforts in Yosemite National Park. Stillwater Sciences (2007, 2008) conducted qualitative fishery surveys in the upper Merced River in October 2006 and October 2007. None of these studies address the objectives of the present proposed study, including a) presence of usable habitat for anadromous species; b) suitable water quality conditions (temperature) for juveniles during summer seasons, including presence of temperature

refugia; c) use of habitat over the life cycle of anadromous species; d) characterization of available habitat by location; e) presence of Merced River native *O. mykiss* populations; and f) potential for predation on introduced anadromous species.

The current baseline conditions for anadromous fish (Chinook salmon and *O. mykiss*) cannot be determined from the three cited studies. The studies were conducted in only one season (Fall), which is not a critical time period for thermal stress and refugia analyses for *O. mykiss* (Stillwater Sciences, 2008). The 1992 study did not use comparable modern sampling techniques or statistics to be compared with current study methodology, so that only general qualitative comparisons can be made (Kisanuki and Shaw, 1992, after Stillwater Sciences, 2008). Previous sampling was limited to the autumn, so that evaluation of the presence of usable habitat or use of habitat over time is not possible based on existing information. The studies have only evaluated the mainstem of the Merced River, and ignored a large amount of potentially available salmonid habitats in the South Fork, and tributary streams and creeks, tentatively identified as “historical habitat for spring-run Chinook and steelhead”, but not evaluated, by Lindley *et al.* (2006). Previous studies did not determine whether or not the *O. mykiss* in the upper Merced River were native or introduced strains, leaving a data gap as to whether the downstream projects have led to the extirpation of native Merced River genetic strains upstream.

In sum, while this information provided by the earlier studies is useful, it does not address all study reaches, focus of study (basin or reach), seasonal habitat use and availability, or many data needs to evaluate an anadromous fish restoration plan.

Potential historic fisheries habitat for *O. mykiss* has been modeled and evaluated by Lindley *et al.* (2006). This was a GIS-modeling study, using readily available environmental data, to estimate the historic population distributions of *O. mykiss*. Lindley *et al.* (2006) noted that numerous populations of *O. mykiss* above reservoirs in the Central Valley, but it is not at all clear “whether these populations are the residualized descendants of native anadromous populations, or are the descendants of rainbow trout that have been widely planted throughout California to enhance recreational trout fisheries.” The compelling argument for evaluating habitat for steelhead trout lies with a threat of extinction. Lindley *et al.* (2006) concludes that the extensive loss of habitat historically available to anadromous *O. mykiss* supports the status of *O. mykiss* as a species threatened with extinction. An important next step is to identify and secure the sources of current natural production of genetically appropriate *O. mykiss*, limited as they may be.

To provide sufficient information to meet the goals and objectives of the study proposal both qualitative and quantitative data will be collected. The study methods and analyses of either sampling regime are described in Section 6.

Data will be collected along three reaches along the mainstem Merced River in the same manner as in sampling sites along four reaches on the South Fork of the Merced River. Refugia sampling will also be conducted in tributaries of both the mainstem and South Fork of the Merced River. The mainstem Merced River sampling sites will be selected prior to selecting equivalent sampling sites on the South Fork of the Merced River. The sites in the mainstem are for the purposes of being able to compare study results, and changes in populations and other fish metrics to the previous Stillwater Sciences (2008) study.

Sampling will also be conducted in South Fork of the Merced, where no fisheries population or habitat studies have been previously conducted along with several, accessible creek or stream tributaries. Streams identified in Lindley *et al.* (2006) modeling efforts may or may not currently be suitable habitat, as conditions in the upper Merced Basin may have changed.⁴ Tributaries may be temperature refugia for over-summering *O. mykiss*. There may be isolated native strains of *O. mykiss* in genetically separated populations in small streams of the upper Merced River. Finally, stream passage conditions (physical barriers, flows, and temperatures) may limit access to *O. mykiss* in previously GIS-modeled habitat locations.

6.0 Study Methods and Analysis

6.1 Study Area

The study area includes the mainstem Merced River upstream of Lake McClure, the South Fork of Merced River, and selected tributaries. A list of all stream reaches to be studied is included in Attachment 1 located at the end of this study proposal. Specifically excluded from the study area are locations where access is unsafe (very steep terrain) and locations on private property for which the Applicant has not received specific approval from the landowner to enter the property to perform the study. This latter constraint will be minimal in the Upper Merced River Watershed, as a majority of the land holdings are in public ownership.

6.2 Study Methods – Study Elements

A. Presence of usable habitat for anadromous species

⁴ In Yosemite National Park, differences in species abundance and year class distributions apparently occurred between the 1992 study (Kisanuki and Shaw, 1992) and the 2008 study (Stillwater Sciences, 2008). It is logical to presume that such changes might occur in other non-studied Merced River tributaries: the South Fork, and smaller tributary streams.

B. Use of habitat over the life cycle of anadromous species

C. Characterization of available habitat by location

These three elements of the Study Request will be evaluated with species occurrence, distributions, habitat distribution, and location information and data. These data will be collected and analyzed with study methods, protocols, data forms and techniques as described in Section 6.3 and in Appendices 2 and 3. The purpose of the Representative Sampling is to describe the fish community inhabiting the sampled stream or reach (Meador, *et al.* 1993). Representative Sampling methods are divided into two levels: qualitative and quantitative (see Table 1). Qualitative sampling (referred to as Level I in this study proposal) is used to broadly characterize fish population composition. Quantitative sampling (Level II) is used to develop statistical metrics of fish populations. The purpose of “focused” sampling is a site-specific and detailed investigation regarding a specific information need. Focus sampling is described in Section 6.3.4.

Representative methods and analyses follow or are adapted from methods described in Zippin 1958; Van Deventer and Platts 1989; Rexstad and Burnham 1992; Moulton *et al.* 2002; Meador *et al.* 1993; Reynolds 1996; Jones and Stockwell, 1995; Temple and Pearsons 2007; and O’Neal 2007. All sampling methods will follow a detailed protocol to ensure both clarity and repeatability. Representative Sampling is described in detail below.

Fish sampling is predicated on the Applicant obtaining necessary federal and State of California permits for sampling. Required permits include a CDFG scientific collecting permit for streams that do not contain ESA listed species and permits for scientific collecting in Yosemite National Park and U.S. National Forests. Applicant should allow 135 days in the schedule for processing the scientific collecting permit. Currently, the Upper Merced River has no ESA listed species, because of historical conditions and historical anadromous fish blockage(s).

Two consecutive years of data will be collected with the first year being 2010 at all Level II sites unless CDFG, BLM, NOAA, SWRCB, and other interested relicensing participants (*e.g.*, Tribes, NGOs, and Private Citizens) and the applicant reach consensus that there are sites where a second year of data collection is not necessary .

After year 1, Level I site data will be reviewed by CDFG, BLM, NOAA, SWRCB, and other interested relicensing participants (*e.g.*, Tribes, NGOs, and Private Citizens) in consultation with the applicant. One year of Level II data will be collected on up to five Level I sites if these participants reach consensus on the need for additional data based on relative composition.

Licensee will consult with CDFG, BLM, NOAA, SWRCB, and other interested relicensing participants on technical issues that arise in carrying out the study.

6.3.1 Representative Sampling

As described above, Representative Sampling can be qualitative (referred to as Level I in this study proposal) or quantitative (Level II). Stream reaches with special-status species, more complex communities, or potential issues receive Level II sampling. Level I sampling is applied to all other reaches. A mixture of both sampling levels is implemented in larger streams that do not require numerous Level II sites. A description of site selection for either Level I or II sampling, and specific methods for each level are described below.

6.3.2 Representative Reach Sample Site Selection

Site selection for either Level I or Level II sampling is based upon several factors. These factors include spatial location, available habitat, habitat complexity, stream access, stream geomorphology and safety. Streams with greater homogeneity receive fewer number of sample sites. Those stream reaches with more complex communities or potential issues receive a higher number of sites. A breakdown of the number of sites by reach is presented in Attachment 1 to this study proposal. Applicant will identify in the field the specific locations for sampling and, prior to sampling, invite interested relicensing participants into the field to comment on the selected sites. Prior to field reconnaissance, effort will be made to identify as many of the sites as possible by existing video and habitat mapping photos.

6.3.3 Representative Sample Collection Methods

A detailed description of each sampling level is provided below. A summary with the rationale and comments on the method to be used in each reach is provided in Attachment 1.

Conduct Field Work – General Methods Overview

Representative Sampling will be performed using a combination of backpack electrofishing equipment and/or snorkeling methods. Backpack electrofishing will be conducted in water sufficiently shallow (less than 1.5 m maximum depth) to safely permit wading and to allow efficient fish capture. Applicant may choose to use barge electrofishing in large stream reaches where backpacking electrofishing or snorkeling would not be effective. Snorkeling will supplement electrofishing and be conducted in depths greater than 1.5 m. Where statistically-supported analyses are prescribed, multiple-pass depletion sampling (Moran 1951, Zippin 1958, and Reynolds 1996) using backpack electrofishing equipment will be utilized with a population estimate goal of less than a 10 percent error. Fish sampling will be scheduled during mid-summer through mid- to late-

fall when flows are typically lower, turbidity is low, and water temperatures are most suitable. Applicant may sample at other times in smaller streams if Applicant determines it is unlikely that sufficient flow for sampling would occur from mid-summer through late fall. Depending on elevation and flow control by Applicant, some streams may be suitable for sampling in mid-summer while others may not be suitable until mid- to late-fall. In some cases, releases may need to be regulated to facilitate safety and efficiency during electrofishing surveys.

In general, electrofishing field methods will be conducted following procedures identified by Meador *et al.* (1993), Reynolds (1996), Stangl (2001), and Temple and Pearsons (2007).

Table 1. Description of Representative Sampling methods, purpose, and information obtained by sample level.

| Sample Level | Representative Sampling Method | Purpose & Information Obtained |
|--------------|---|--|
| II | <p><i>Quantitative Assessment</i></p> <ul style="list-style-type: none"> • Closed sample unit – fine mesh block nets spanning both top and bottom of unit (not proposing to block between mesohabitat types). • Multiple Pass Depletion Methodology. • Length of the sample site will be sufficient enough to include usable habitat represented in the reach. River sampling sites will generally be 100 meters long. Some of the larger river sites may require reaches up to 300 meters. The specific locations of the sampling sites will be determined in the field in coordination with a Technical Working Group. • Sample Processing – All fish will be identified to species and counted. Measured length/weight will be collected on up to 50 individuals per species per site. <ul style="list-style-type: none"> • Habitat/channel metrics will be collected at each site. <ul style="list-style-type: none"> • Supplemental snorkeling – deepwater mesohabitats may be snorkeled as a supplement to electrofishing. Techniques: snorkeling of individual pool with 2-3 divers, each with a lane, snorkel 3 times in the same direction; wait one hour between passes). • Collect and analyze a subsample of scales on larger, less abundant trout for error-checking length-age indices. • Collect and analyze samples of <i>O. mykiss</i> for SNP genetics. | <ul style="list-style-type: none"> • Sample site relative abundance • Species composition • Species distribution • Sample site fish density, length frequency, and age structure (from existing length/age indices) by species • Error-check length-age indices with scale analysis • Condition factor (from up to 50 individuals per species) • Channel/habitat metrics (for purpose of post-stratification or extrapolation relative to the specific site; see text detail) |

| Sample Level | Representative Sampling Method | Purpose & Information Obtained |
|--------------|---|---|
| I | <p><i>Qualitative Assessment</i></p> <ul style="list-style-type: none"> • Open sample unit – block nets will not be employed. • Spot sampling units distributed over several selected mesohabitat types and several locations within the reach. Number of spots will depend on mesohabitat complexity and length of reach. • Sampling effort will not be random, but rather habitat selective • Catch Per Unit Effort (CPUE) – will be determined from electrofishing time. • Sample Processing – All fish will be identified to species and counted. Measured length will be collected on up to 50 individuals per species per site. • Channel and mesohabitats will be generally characterized. • Supplemental snorkeling – deepwater mesohabitats may be snorkeled as a supplement to electrofishing. | <ul style="list-style-type: none"> • Species composition • Species distribution • CPUE – Based on selective sampling of habitat • Sample site fish density, length frequency, and age structure (from existing length/age indices) by species • Channel/habitat generally characterized (e.g., mesohabitat, avg. depth, avg. width, substrate, max pool depth) |

6.3.3.1 Level II Sampling

Level II quantitative sampling is applied where a quantitative, closed-population assessment of the fish community is considered most important. These will predominantly be used in the mainstem and South Fork (not tributaries) of the Merced River.

Level II Backpack Electrofishing

At least three passes will be made at each site using backpack electrofishing units. Sample sites vary in length, but typically range between 100m and 300m. Upstream and downstream ends will be blocked with fine mesh nets. Applicant’s goal in determining site length is to have adequate length to include sufficient usable fluvial habitat represented in that reach (e.g. riffle, pool, glide). Exact site length will be determined in the field by the Applicant.

Block nets will span the full width and depth of the stream except where an upstream fish passage barrier obviates the need for head-end blocking or where only edge or stream

margin habitat is to be sampled. If necessary, salt blocks will be placed in the stream immediately above the electrofishing station to increase conductivity. Salt blocks will be used when fish are observed escaping the direct path of the electric field generated by the electrofishing unit at elevated settings.

For Level II electrofishing, crews will consist of at least two netters for each shocker. Applicant will follow Temple and Pearsons (2007), who recommend one backpack electroshock crew for streams less than 7.5 m wide and two backpack electrofish crews for streams 7.5 – 15 m wide. In wadeable streams wider than 15 m the number of electroshocking crews will be expanded as necessary to assure effective and accurate sampling.

Captured fish will be retained in aerated buckets and/or live cars until each pass is completed. As described above, fish will be sedated as necessary and with appropriate approvals. All fish will be identified to species and counted. Up to 50 individuals of each species will be measured to the nearest millimeter (fork length) and weighed by digital scale to the nearest gram. Effort will be made to evenly represent all size classes collected within the subsample of the measured species. The actual number of measured species will be determined through professional judgment based upon the size class homogeneity of the sample (i.e., number of size classes represented). Scale samples will be taken on a subsample of larger, less abundant game fish and special status fishes for validating length-age indices. Fin clip samples for *O. mykiss* will be taken according to the SNP sampling protocols. Captured fish will be released proximally below the sampling area following completion of each electrofishing pass. Mortalities and fish condition (spinal trauma, burning) will be noted and recorded prior to release. All data will be recorded on a standardized electrofishing form (see Attachment 2). All effort will be made to ensure sampling activities in the field will minimize potential injury or mortality to aquatic species.

General information and habitat/channel metrics will be collected at each sample site. General information will include site identification, crew members, number of shockers, date and time, air and water temperature, conductivity, weather conditions, and GPS location. Metrics collected at each meso-habitat unit within the sample site will include meso-habitat type, estimated average and maximum depth, estimated average wetted and bankfull width, dominant cover type, dominant and subdominant substrate. Habitat data collected will be consistent with that collected in habitat mapping studies (see Attachment 2).

D. Suitable water quality conditions (temperature) for juveniles during summer season

Temperature Monitoring

Data on annual temperature and profiles are an essential component of determining if adequate thermal refuge is present in the upper Merced River. Although historical records of the use of the upper Merced River strongly suggest that it was suitable habitat for anadromous species (see Martin, 2008), conditions of the watershed may have changed with its development and use. Dunham *et al* (2005) provide guidance and recommendations on the use of digital temperature recording loggers (thermographs), suitable for continuous, inexpensive stream temperature monitoring. Deployment of thermographs at 19 locations will give a complete watershed profile for temperature conditions for a selected water year.

Focused Sampling – Upper Merced River Watershed Thermal Refugia Assessment

The purpose of this study element is to determine trout and other native species microscale habitat use of mainstem Merced River, between Yosemite Valley to the park boundary (El Portal), and the lower South Fork Merced River (Hites Cover) as thermal refugia from the mainstem and South Fork of the Merced River. To achieve this goal, two snorkel surveys will be conducted. The first survey will be conducted in mid- to late-June when water temperatures are less than 17°C, depending upon water year runoff. The second survey will be conducted when water temperatures in the same location greater than 20°C (likely late July or early August). Effort will be made to minimize the time elapsed between each survey to reduce the potential influence of external variables (e.g., fishing pressure). In general, snorkeling survey field methods will be conducted following procedures identified by Cannon and Kennedy (2003), Dolloff *et al.* (2005), O’Neal (2007), Hankin and Reeves (1988), and Slaney and Martin (1987).

The snorkel survey will involve two closed population snorkel assessments occurring in near-Yosemite Valley reach and the lower reach (Park kiosk-El Portal reach) and the South Fork Hite’s cove site. Block nets will be setup at the top and bottom of each sample site during midday. Study site size will have adequate length to include multiple habitat types that have a high probability of fish use (e.g. undercut banks, pools, areas of velocity refuge). Exact site length will be determined in the field.

Two to three divers (as determined by the wetted stream channel width at each site) will snorkel the sample site and record species composition and abundance. Fish will be identified, counted, and visually categorized into pre-defined length-classes (0-2 in., >2-4 in., >4-6 in., >6-8 in., >8-10 in., >10-12 in., >12-14 in., etc.). Visual estimates of length will be made in English units and later converted to metric units to avoid error. Maximum

sight distance for accurate determination of fish species will be recorded on the field data form. Two to three replicate snorkel surveys will be performed using the same diving team to assess efficiency, obtain an estimate of survey variance, and determine a level of confidence for use in abundance estimation (Slaney and Martin 1987; Hankin and Reeves 1988). Data will be recorded and analyzed as previously recommended in CG's Requested Study (CG, 2009). In addition to data collected on snorkel data sheet, observations of fish habitat use during the snorkel survey will be included. Site information and habitat metrics will be collected prior to snorkeling.

The goal of data analysis will be to describe notable differences in relative population abundance and habitat use between the two surveys. The description will include an assessment of changes in stream temperature between surveys. Description and results from the study will be included within the Fish Population report as an appendix.

Microscale water temperature profiles will be collected in large pool habitats to evaluate thermal refugia potential of mainstem and South Fork habitats, during these surveys.

The applicant will review the sampling design and protocols from previous Merced River fish studies incorporate, and report all methods and evaluations into the current study effort

E. Presence of Merced River native *O. mykiss* populations

Assess the condition genetic origin (i.e, native or introduced) of resident rainbow trout (*O. mykiss*) at 3 mainstem sites, 1 South Fork Site, and 3 isolated tributary creeks. The condition of genetic origins will be determined genetic markers (Single Nucleotide Polymorphism or SNP) from DNA extracted from fin clips (Aguilar and Garza, 2008) to determine genetic status (origin) of *O. mykiss*. Genetic analyses protocols will follow Aguilar and Garza (2008), which require fin clip specimens from 25 individual fish at each location, and dry storage in clean paper envelopes. DNA is extracted from fin clips with a commercially available kit (DNeasy, QIAGEN), and 20–60 ng of DNA is used as a template in subsequent polymerase chain reaction (PCR) amplifications

F. Potential for predation on introduced anadromous species.

Using species composition and density information, evaluate relative presence of known aggressive predatory fish species, such as introduced black bass, smallmouth bass, and brown trout. Assess the potential for predation on potentially introduced native anadromous species. Compare peak linear densities of potential predators and potential introduced native anadromous species, using relative densities, and CPUE distributional data. The techniques and methods for field work and evaluation is described in Section 6.2 A-C, above.

6.4 Consultation and Communication

Applicant will engage in the following consultation:

- As soon as possible, advise FERC and relicensing participants via email if potential changes in approach to perform the study might be needed and discuss alternatives.
- Consultation with CDFG and NOAA Fisheries regarding scientific collection permits, as appropriate.
- Prior to sampling, invite interested relicensing participants into the field to comment on the selected sampling sites.

Applicant will also file with FERC and post on its Relicensing Website quarterly progress reports (first report due three months after FERC's Study Plan Determination). Each report will summarize work performed in the last quarter and key findings, and will study data that have been organized, compiled, and subject to QA/QC procedures. The final report will adhere to reporting standards according to the PAD Communication Guidelines.

The Applicant will consult with interested relicensing participants if the Applicant believes a modification to the study proposal is needed. In addition, the Applicant will invite interested relicensing participants in the field to comment on study sites.

6.5 Schedule

Applicant anticipates the schedule to complete the study is as follows in two consecutive years, with the first year being in 2010:

| | |
|--------------------------------|----------------------------------|
| Planning & Site Selection..... | Winter-Early Spring of Each Year |
| Field Work | May-June & November of Each Year |
| Data QA/QC & Analysis..... | November & December of Each Year |
| Report Preparation..... | January – February of Each Year |

The justification and rationale for requesting a two-year study is based upon the following factors. Generally, variability in physical, chemical, and biological conditions in the aquatic environment, as well as fish population responses, has been shown to consist of seasonal variability and annual variability. With regard to annual sampling, the Stillwater Sciences study (2008) of the upper Merced River showed annual trends between the two annual Fall samplings, as this was the only season sampled (lower flows had very different distributional patterns). In contrast, in the lower Merced River where seasonal and annual sampling occurred, the study showed number of individual fish observed in each survey varied from season-to-season and year-to-year. Overall, more fish were observed during the fall seasons than summer and spring seasons combined. However, this was highly

variable between the two survey years; during the 2006 (high-flow year) fall surveys, the lowest number of individual fish were observed (559), while during fall 2007 (low-flow year), the greatest number of individual fish were observed (13,823). This latter observation could just be an artifact of sampling, i.e. it is easier to count fish under lower (compressed habitat) flow conditions. Fish population monitoring studies (such as being proposed) tend to be multiple-year studies to document long-term trends or environmental conditions, and should be designed to document both seasonal and annual trend information and data. Finally the FERC ILP schedule will only allow a two-year time period to collect data, so that is a limiting constraint on collection of annual cyclic data.

6.6 Consistency of Methodology with Generally Accepted Scientific Practices

Electrofishing and snorkeling are widely accepted methods for sampling fish populations in stream habitats. The other study methods, condition of genetic origin, assessment of predator potential, and temperature monitoring are: 1) used by Resource Agencies in the evaluation of *O. mykiss* management in California, 2) scientific technique used in previous environmental study in the upper Merced River (Stillwater Sciences, 2009), or 3) the most widespread method for monitoring water temperatures (Dunham *et al.*, 2005), respectively. The methods discussed above are consistent with the study methods followed in several other relicensings in, and outside of, California.

7.0 Products

After data are collected, tabulated, and quality checked the data will be made available to the relicensing participants in an Excel format or other format as appropriate.

Products will include but not be limited to the following:

- 1) Known distribution map (not continuous) for each species in the sampled stream reaches;
- 2) Detailed description of each sample site location and summary of habitat;
- 3) Length frequency or size class histograms of sampled fish;
- 4) Summation of data collection for each Study Element A- F;
- 5) Analysis and Report of each Study Element A – F;
- 6) Incidental observations of other species;
- 7) Copies of field data sheets upon request.

Presented products will include maps of study areas and tables and graphics of study results. Both written and presented products will be consistent with and include the analyses outlined in Section 6.0, above.

Applicant should make study results available for collaborative development of possible PM&E measures.

The final stream fish population study report will be prepared in a format that can easily be incorporated into the Applicant's application for a new license.

8.0 Level of Effort and Cost

A preliminary estimate for the study cost in 2010 dollars is as follows:

2010 Cost Estimate Based upon 55 Level II and 278 Level I evaluations

| | |
|---------------------------|------------------|
| Planning & Site Selection | \$ 37,000 |
| Field Work | \$240,000 |
| Genetic Analysis | \$ 20,000 |
| Data QA/QC & Analysis | \$ 65,000 |
| Report Preparation | <u>\$ 37,000</u> |
| TOTAL | \$399,000 |

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ATTACHMENT 1

Fish Population Sampling Level by Reach for the Merced River Hydroelectric Project

Fish population sampling-level by project-affected reach for the Merced River Hydroelectric Project.

| Stream | River Reaches: | Level II | # of Sites | Level I | Target Spot # Per Site | Comment or Rationale |
|---|--|----------|------------|---------|------------------------|---|
| Mainstem Merced River (below South Fork to below El Portal) | <i>Below South Fork Junction (UF2-F1 to UF2-F3) (Between RM 92 to RM 97.5)</i> | | | • | 20 | Current study should re-occupy study sites from Stillwater Sciences (2008), sampling the same habitat types and distributions (see Stillwater Sciences, 2008 for station nomenclature and locations). Snorkel spot-check if Level I does not completely represent habitats. |
| | <i>From South Fork Junction to Near Redbud Picnic(RM 99.7 to RM 102 (UF1-F1 to UF1-F3)</i> | • | 2 | • | 40-60 | Current study should re-occupy study sites from Stillwater Sciences (2008), sampling the same habitat types and distributions (see Stillwater Sciences, 2008 for station nomenclature and locations). Two sites should have expanded Level II evaluations. |
| Mainstem Merced River (El Portal to Yosemite Valley) | <i>From Near Redbud Picnic (RM102.5 to RM 126)</i> | • | 3 | • | 60 | Stillwater Sciences (2008) had 9 sites with Fall 2006 & Fall 2007. These should be re-sampled for comparisons, and expanded for seasonality for Level 1. Three sites should have expanded Level II evaluations. |

| | | | | | | |
|-----------------|--|--|--|---|-------|---|
| Moss Creek | <i>Rancheria Flat, below El Portal</i> | | | • | 20-30 | Level I at two to three geographically separated locations. Sites may be different lengths depending on homogeneity of reach. Sample near confluence with Merced River, and then two or three locations MC Canyon below Twin Bridges. Snorkel spot-check if Level I does not completely represent habitats. |
| Indian Creek | <i>El Portal</i> | | | • | 20-30 | Level I at two to three geographically separated locations. Sites may be different lengths depending on homogeneity of reach. Sample near confluence with Merced River, and then two or three locations above and below Chinquapin Falls. |
| Crane Creek | <i>El Portal</i> | | | • | 20-30 | Level I at two to three geographically separated locations. Sites may be different lengths depending on homogeneity of reach. Sample near confluence with Merced River, and then two or three locations above and below Foresta Falls. |
| Avalanche Creek | <i>Above NPS Park Kiosk</i> | | | • | 20-30 | Level I at two to three geographically separated locations. Sites may be different lengths depending on homogeneity of reach. Sample near confluence with Merced River, and then between Highway 41 and Merced River |
| Grouse Creek | <i>Above NPS Park Kiosk</i> | | | • | 20-30 | Level I at two to three geographically separated locations. Sites may be different lengths depending on homogeneity of reach. Sample near confluence with Merced River, and then between Highway 41 and Merced River |

| Stream | River Reaches: | Level II | # of Sites | Level I | Target Spot # Per Site | Comment or Rationale |
|--------------------------|--|----------|------------|---------|------------------------|--|
| South Fork, Merced River | Savage's Trading Post to Hite's Cove | ● | 2 | ● | 60 | Level 1 is reconnaissance survey, using approach of Stillwater Sciences (2008), followed by Level II |
| | Hite's Cove to Devil Creek Junction | ● | 2 | ● | 60 | Level 1 is reconnaissance survey, using approach of Stillwater Sciences (2008), followed by Level II |
| | Devil Creek Junction to Peach Tree Bar | ● | 2 | ● | 60 | Level 1 is reconnaissance survey, using approach of Stillwater Sciences (2008), followed by Level II |

| Stream | River Reaches: | Level II | # of Sites | Level I | Target Spot # Per Site | Comment or Rationale |
|---------------|--|----------|------------|---------|---------------------------|---|
| | Peach Tree Bar to Granite or Zip Creek | ● | 2 | ● | 60 | Level I is reconnaissance survey, using approach of Stillwater Sciences (2008), followed by Level II. Upper limit of sampling stations determined by “currently limiting barriers”. |
| Devil Creek | <i>Devil Creek to Peachtree Bar</i> | | | ● | 20-30 | Level I at two to three geographically separated locations. Sites may be different lengths depending on homogeneity of reach. Sample near confluence with South Fork, and then two or three locations upstream, limited by depth of canyon. |
| Granite Creek | <i>Above Peachtree Bar</i> | | | ● | 20-30 | Level I at two to three geographically separated locations. Sites may be different lengths depending on homogeneity of reach. Sample near confluence with South Fork, and then two or three locations upstream, limited by depth of canyon. |
| Iron Creek | <i>Along FS Road 4S17</i> | | | ● | 20-30 | Level I at two to three geographically separated locations. Sites may be different lengths depending on homogeneity of reach. |

| Stream | River Reaches: | Level II | # of Sites | Level I | Target Spot # Per Site | Comment or Rationale |
|--------------|-------------------------------------|----------|------------|---------|---------------------------|---|
| Alder Creek | <i>Below Highway 41</i> | | | ● | 20-30 | Level I at two to three geographically separated locations. Sites may be different lengths depending on homogeneity of reach. |
| Bishop Creek | <i>At South Fork Trail crossing</i> | | | ● | 20-30 | Level I at two to three geographically separated locations. Sites may be different lengths depending on homogeneity of reach. |
| Rush Creek | <i>At FS Road 4S17</i> | | | ● | 20-30 | Level I at two to three geographically separated locations. Sites may be different lengths depending on homogeneity of reach. |
| Big Creek | <i>Near Wawona</i> | | | ● | 20-30 | Level I at two to three geographically separated locations. Sites may be different lengths depending on homogeneity of reach. |

ATTACHMENT 2

Level II Representative Sampling Field Data Form

ATTACHMENT 3

Level I Representative Sampling Field Data Form

Revised Study Request 3.4
(3.4 CG rev)
ANADROMOUS FISH PASSAGE¹
21 December 2009

1.0 Project Nexus and Issue

A federally listed fish species, California Central Valley Steelhead trout DPS (FT), *Oncorhynchus mykiss*, and its designated critical habitat, along with the Central Valley fall/late-run Chinook salmon (*Oncorhynchus tshawytscha*), a listed Species of Concern, occur in the Merced River downstream of the Merced Falls Project.

Current conditions of the fishery in the Merced River for the 3-mile reach between the PG&E's Merced Falls Reservoir and Crocker-Huffman diversion dam and the 19.5 miles downstream of Crocker-Huffman diversion dam to Shaffer Bridge (RM 32.5) are directly affected by project operations (Study Dispute Panel, 2009 a, b)

The Project dam at Merced Falls blocks volitional passage of anadromous fishes, which are able to ascend the Merced River past Crocker-Huffman diversion dam during very limited river conditions (depending largely on flow). This issue was evaluated by the Dispute Resolution Panel for the Merced River Hydroelectric Project studies (Study Dispute Panel, 2009a). The Panel reported that there was evidence in the record that anadromous fish may ascend the Merced River to the Merced Falls Project dam.² This evidence includes: 1) some fall chinook salmon may surmount Crocker-Huffman dam during high flows (M. Cozart, pers. comm., 2000; cited in Stillwater Sciences, 2001); 2) presence of anadromous Pacific lamprey above Crocker-Huffman dam; Stillwater Sciences (2008) "assumed that the partially removed fish ladder at Crocker-Huffman provided limited passage for the lamprey observed above the dam"; 3) *O. mykiss* are known to be present upstream of Crocker-Huffman Dam, but were considered by Stillwater Sciences (2008) as "resident" since Crocker-Huffman Dam was presumed to be a migration barrier to most fish species.

¹ Conservation Groups have edited this Revised Study Plan, previously submitted separately to encompass both the P-2179 and P-2467 Projects.

² "The above presents a dilemma for the Panel as some information in the record affirms that anadromous fish make it to the lowermost Commission licensed facility on the Merced River but not to the base of McSwain dam. The Panel's logic in addressing the following studies is: 1) flows measured at Shaffer Bridge originate in Lake McClure and pass through McSwain dam, Merced Falls dam and Crocker-Huffman diversion dam; and 2) information in the record suggests that anadromous fish do occur upstream of Crocker-Huffman diversion dam."

Prior to the construction of McSwain Dam (licensed under the current FERC Project License 2179), project works at PG&E's Merced Falls Dam included a fish ladder (FERC Project License 2467)³.

On November 17, 2009, the California Department of Fish and Game (CDFG, 2009) notified Merced Irrigation District that fish passage at the Crocker-Huffman Diversion Dam must be restored. CDFG directed Merced ID to consult with CDFG to evaluate fish passage at Crocker-Huffman Diversion dam and develop a Crocker-Huffman fish passage plan.⁴

Today, the fish ladder at Merced Falls Dam is non-functional.

Since 1966, Merced Irrigation District's McSwain and New Exchequer dams have totally blocked volitional fish passage since they were constructed without fish bypass facilities

Cumulatively, the dams on the Merced River have eliminated and blocked access to approximately 99% of the river's original spawning and rearing habitats for steelhead trout (*O. mykiss*) (Martin, 2008). Schick *et al.* 2005 estimate that about 92% of fall- and late fall-run Chinook salmon spawning habitat has been eliminated in the Merced River.

The Anadromous Fish Passage study will provide the Resource Agencies with a qualitative and quantitative assessment of potential upstream and downstream anadromous fish migration barriers, including natural barriers and man-made barriers that are not specific to dams.

The Upper River Fish Populations and Habitat study seeks to evaluate habitat for anadromous salmonids upstream of Lake McClure. The Anadromous Fish Passage study seeks to evaluate the accessibility of habitat for anadromous salmonids once they have reached the Merced River upstream of the Lake McClure reservoir pool, recognizing that if they are transported there rather than arriving volitionally, options for the location of their initial release into the upper river may exist. For this element of the present study, it will be assumed that anadromous salmonids are able to reach the upper Merced River upstream of the Lake McClure reservoir pool.

³ Until 1971, the fish ladder on Merced Falls Dam was operated to allow upstream access for anadromous species; however, operation of this ladder was discontinued in 1971 after the construction of Merced ID's McSwain Dam eliminated upstream spawning upstream spawning habitat and CDFG requested that Merced ID's Crocker-Huffman Irrigation Diversion Dam ladder operation also be discontinued (letter to A.O. Clark, PG&E from A.E. Naylor, CDFG dated March 26 1971; letter to J.F. Roberts Jr., PG&E from K. Plumb, Federal Power Commission dated August 5, 1971)" PG&E (2001a @ page 5-21)". CDFG (2009) notified Merced ID that the Department has determined that fish passage at the Crocker-Huffman Diversion Dam must be restored. CDFG directed Merced ID to consult with CDFG to evaluate fish passage at Crocker-Huffman Diversion dam and develop a Crocker-Huffman fish passage plan.

⁴ CDFG (2009)

The Anadromous Fish Passage study will develop a fish passage assessment and provide estimates of potential fish passage production utilizing two independent modern salmonid population and habitat models (SHIRAZ-DHSVM and RIPPLE).

Finally, this study will evaluate the potential for a trap-and-haul program to move upmigrating anadromous fish from downstream of the Merced Falls project (and perhaps downstream of Merced Irrigation District's Crocker-Huffman diversion dam) to an appropriate location upstream of the Lake McClure reservoir pool, and to move downstream migrants to the lower Merced River.

This study will inform the Resources Agencies and the Commission on the availability of fish passage feasibility options, and provide scientific evidence to demonstrate how the Agencies (and FERC) exercise (and support) the Agencies' Section 18 authority. The data and study will be used to inform the Commission of ESA and MSA consultation and restoration alternative needs for the Merced River projects. The information obtained from this study will be used by PG&E and resource agencies to evaluate the potential effects of the Project on migratory anadromous fish, and will be used to evaluate various management options when balancing resource uses.

This Study Request addresses the following preliminary issues as identified in Section 6 of the Applicant's Pre-Application Document (PAD) (PG&E, 2009a):

- Issue AR-4: Effects of the Project on special status anadromous fishes, including spring- and fall-run Chinook salmon, and steelhead in the Merced River, due to blockage of passage.
- Issue TE-3: Effect of the project on special status fish species.

2.0 Resource Agency and Tribal Management Goals

The Applicant should confer with NMFS, USFWS, SWRCB, CDFG, Tribes, and NGO organizations that participated in development of this revised study request. At this time, the NMFS has identified specific resource management goals and objectives relevant to this revised study proposal (NMFS 2009a; 2009b; 2009c; 2009d, 2009e). CDFG filed a letter with FERC which states the Department's intent to restore fish passage at the Crocker-Huffman Diversion Dam (CDFG, 2009). Southern Sierra Miwuk Nation tribal leaders have indicated that reconnection and restoration of anadromous fish species throughout the Merced River are important Tribal goals for the Merced River (Brochini, pers. comm.). In addition, general management and restoration goals for steelhead trout, fall-run Chinook salmon, and spring-run Chinook salmon have been published (see Martin, 2007 for a summary)⁵.

⁵ These plans are also identified in the PG&E PAD (PG&E, 2009a) @ Table 6.4-1 & 6.4.2.

NMFS' (2009e) current steelhead recovery plan for the Merced River states: "a recovery scenario for the Merced River includes the maintenance of a steelhead spawning population in the upper reach of the lower Merced River (and) ... includes the reintroduction of steelhead within Project boundaries and upstream of New Exchequer reservoir on the mainstem Merced River and on the South Fork Merced River."

NMFS (2009e) is also concerned with the status and condition of fall- and late fall-run Chinook salmon, whose Merced River population has steeply declined in the last four years. NMFS anticipates that consultation will be necessary under the Endangered Species Act and MSA for the effects of the Merced Falls and Merced River projects on listed steelhead.

3.0 Relevant Public Interest Consideration and Potential License Conditions

The requester is not a resource agency and states the public interest considerations in regard to the proposed study:

Study and analysis is needed to provide data, information, and alternatives to protect and enhance the beneficial uses of the upper Merced River, including coldwater habitat, fisheries, water contact recreation, migration of aquatic organisms, & spawning habitat. Data collected will be used in National Environmental Policy Act (NEPA) environmental impact assessment(s), Water Quality Certification, §401, Clean Water Act, and Federal Power Act § 18 consultation or prescription in the public interest.

Study and analysis is needed to provide data, information, and alternatives to prescription of fishways as deemed necessary to protect threatened populations of fish, under the ESA and Federal Power Act, § 18. The study will serve the public interest by providing information and data to the Secretaries of Commerce and Interior to evaluate alternatives to protect species of concern and threatened anadromous fish species. The study will add to the record that will form the basis for the secretaries to make fisheries management recommendations for the public benefit, enhancing ecosystems that are part of the public trust and recreation in the Merced River and the Pacific Ocean.

The applicant's proposed alternative studies are not sufficient to meet these stated information and data needs, and they are inconsistent with the geographic scope of the Project for anadromous fish issues (FERC, 2009). The applicant is proposing no studies to address anadromous fish passage (PG&E, 2009b). The study will be used to inform the Commission and relicensing participants on the feasibility of restoring anadromous fish to the Upper Merced River.

4.0 Study Goals and Objectives

A known effect of the Merced Falls project is that, in conjunction with facilities owned by the Merced Irrigation District, the project blocks passage to fish habitat in the Merced River upstream of Lake McClure. This study will allow relicensing participants to evaluate the effects of the blockage by characterizing and quantifying the potential accessibility by restored salmonids to habitat to which passage is blocked. This significance of the project effect in blocking fish passage cannot be evaluated absent understanding of the potential accessibility of upstream habitat. A project effect that blocks fish passage to accessible habitat that is usable by anadromous salmonids needs to be mitigated, whereas a project effect that blocks passage to unsuitable or inaccessible habitat might not need to be mitigated.

The objectives of the Study Request are to characterize and quantify the potential accessibility of fish habitat to anadromous fish in the upper Merced River, including the South Fork Merced River and tributaries that are likely to provide spawning and/or juvenile rearing habitat for anadromous salmonids. Study elements will:

- Document the location, nature, and characteristics of natural and man-made barriers to anadromous fish migration in the upper Merced River and its tributaries
- Develop a fish passage assessment model to evaluate various combinations of alternative fish passage program elements and goals for the Merced River.
- Evaluate The feasibility of a “trap and haul” fish bypass alternative to restore Merced River connectivity and to increase dangerously restricted spawning and rearing habitats for Central Valley steelhead trout and for Central Valley Chinook salmon.

5.0 Existing Information and Need for Additional Information

Crocker-Huffman Diversion Dam and Merced Falls Dam have non-functional or partially functional fish ladders, whose use was discontinued with apparent approval by CDFG in the early 1970's. At that time, an artificial spawning channel was constructed by Merced Irrigation District near Crocker-Huffman dam with the intention of benefitting fall- and late fall-run Chinook salmon. (McSwain, 1977). Unfortunately, the spawning channel proved to be non-functional as well, and a mitigation hatchery was constructed during the 1980's (Merced River Hatchery) for fall- and late fall-run Chinook salmon.

The Anadromous Fish Restoration Program (USF&WS, 2002) commissioned a study of the feasibility of reintroduction of anadromous salmonids above the Crocker-Huffman Diversion Dam. The primary objective for this feasibility study was to examine the biological and physical issues associated with re-establishing migratory passage and fish protection at Crocker-Huffman Dam, as well as to investigate the biological production

potential of the habitat between Crocker-Huffman and Merced Falls dams for anadromous salmonids. An additional objective was to assess the implications for, and interactions of, such a reintroduction action in conjunction with ongoing and future planned operations of the California Department of Fish and Game's (CDFG) Merced River Hatchery and a private hatchery (Calaveras Trout Farm). The investigation examined the opportunities and constraints of anadromous salmonid reintroduction upstream of Crocker-Huffman Dam. Vogel (2007) found that there were benefits and constraints on providing fish passage above Crocker-Huffman Diversion Dam to improve spawning and rearing habitats for anadromous salmonids.

The opportunities for suitable habitat and conditions in the reach between Merced Falls Dam and Lake McSwain Dam, as well as the reach between Lake McSwain and the New Exchequer Dam, are probably more limited than the reach evaluated in Vogel (2007). At the present time, there are clearly four barriers to volitional anadromous fish migration in the Merced River: a) Crocker-Huffman Diversion Dam (partially operable fish ladder at RM 52), b) Merced Falls Dam (inoperable fish ladder at RM 55), c) McSwain Dam (no fish ladder at RM 56.1), and d) New Exchequer Dam (no fish ladder at RM 62.4). One historic fish blockage, the Cascade Diversion Dam on the mainstem of the Merced River near Yosemite Valley, was removed in 2003 by the National Park Service.

Although the reach between Merced Falls Dam and Crocker-Huffman Diversion Dam may have limited opportunities to create "tailwater" *O. mykiss* habitat for spawning and rearing, fish passage past Crocker-Huffman Diversion Dam and Merced Falls Dam is technically relatively simple, while passage past McSwain Dam (and reservoir) and New Exchequer Dam (and reservoir) are serious and formidable challenges. However, without the Merced River Hydroelectric Projects in place, anadromous fish passage could be achieved with relative simplicity by simply making existing fish ladders at Crocker-Huffman and Merced Falls dams operational (short term) or reconstructing them if necessary (long term) to modern standards. Further, but for the Merced River Hydroelectric Projects, there would be less available water to divert (only by the Crocker-Huffman Diversion Dam, which was the historic condition prior to 1925), and the Merced River would return to a more natural "run-of-the-river" hydrology, which would improve connectivity and habitat quantity/quality for steelhead trout.

There is a 25-ft water waterfall/cascade on the mainstem near the North Fork at RM 86 (Stanley and Holbek 1984) that is a mandatory portage for small watercraft, but based on historical accounts it was probably not enough of a barrier to have posed a meaningful obstacle to migration of anadromous salmonids. Further evaluation of the degree to which this waterfall would or could prevent upstream passage of anadromous salmonids is needed. Evaluation of other, less formidable natural barriers in the Merced River and its tributaries upstream of Lake McClure is needed to quantify the amount of habitat that would be available to anadromous fish once they reached the current of upper Merced River and its tributaries, and to inform decisions relating to location of possible release and

capture facilities in a trap-and-haul program, which may rely, in part, on the availability of road access to areas with river flow.

Information and data is lacking on the potential for restoration of anadromous species in the upper Merced River. There is no known study of fish passage past natural or man-made barriers in the upper Merced River, and there has been no study of the feasibility of a trap-and-haul program to restore anadromous salmonids to the upper Merced River.

6.0 Study Methods and Analysis

6.1 Study Area

An investigation of natural and man-made barriers will be made in the mainstem of the Merced River upstream of Lake McClure and selected tributaries, from near the Highway 49 Bridge crossing of the upper end of Lake McClure at Bagby at RM 79.5 to Yosemite Valley, and in the South Fork of the Merced River and selected tributaries from the mouth to four miles downstream of Wawona. The SHIRAZ or Ripple Model will encompass the same geographic area. The analysis of trap-and-haul options will include consideration of this same geographic area upstream of Bagby, but will additionally include the Merced River, and all reservoirs that are located on the river, from upstream-most end of Lake McClure at full pool downstream to Snelling at RM 49.

The study area is consistent with the Commission's SD2 determination of geographic scope (FERC, 2009) for threatened and endangered species.

6.2 General Concepts

The following general concepts apply to the study:

- Personal safety is an important consideration of each fieldwork team. If Applicant determines the information cannot be collected in a safe manner, Applicant will notify FERC and Relicensing Participants as soon as possible via email to discuss alternative approaches to perform the study.
- Applicant shall make a good faith effort to obtain permission to access private property where needed well in advance of performance of the study. If access is not granted or river access is not feasible or safe, Applicant will notify FERC and Relicensing Participants as soon as possible via email to determine if Relicensing Participants can assist in gaining access or to discuss alternative approaches to perform the study.
- The schedule for each proposed study is reasonably flexible to accommodate unforeseen problems that may affect the schedule. If a schedule changes, Applicant will notify FERC and Relicensing Participants as soon as possible via email to discuss

alternative approaches to perform the study.

- Field crews may make minor modifications to the study proposal in the field to accommodate actual field conditions and unforeseen problems. When modifications are made, Applicant's field crew will follow the protocols in this study proposal. If minor modifications are made, Applicant will provide a detailed description of the conditions that led to the decision to modify the study to FERC and Relicensing Participants as soon as possible via email to discuss alternative approaches to perform the study.
- Applicant's performance of the study does not presume Applicant is responsible in whole or in part for resource management measures that may arise from that study.
- The estimated level of effort and cost is not a firm commitment by Applicant to expend all the funds. If the study costs more, Applicant is committed to completing the study. If the study costs less, Applicant is not committed to expending the remaining funds on other Relicensing studies or resource management measures.
- Field crews will be trained as appropriate to identify all special-status amphibians, reptiles, and fish that may be encountered coincidentally. Training will include instruction in diagnostic features and habitat associations of special-status species. Field crews will also be provided with laminated identification sheets showing special-status species, compared to other common species.
- All special-status species observations will be submitted to the California Natural Diversity Database.
- Field crews will include a list of native and non-native species that may be encountered using the sampling methods described in the plan and their State and Federal (if any) status. Crews will make sure there are codes for all these species on the data forms.

6.3 Study Methods

Step 1 – Identify and Qualitatively Assess Potential Upstream and Downstream Anadromous Fish Species' Migration Barriers. This investigation will be made in the mainstem of the Merced River upstream of the Highway 49 Bridge crossing of Lake McClure and selected tributaries, and in the South Fork of the Merced River and selected tributaries. In this step, Applicant will identify potential barriers (e.g., natural falls, tributary junctions, road crossings, shallow riffles, and diversions or dam structures) for steelhead trout and Chinook salmon.

From early and late winter flow conditions (coincidental with steelhead trout and spring-run Chinook salmon spawning migration) and spring/early summer conditions (smolt passage and spring-run Chinook salmon), the areas of the streams tributary will be examined for all adult anadromous fish barriers or to 0.5 mile upstream from the confluence with the the Merced River or its South Fork, whichever is less. To perform the work, Applicant will determine if fish barriers in the study area have already been assessed. If so, the assessment will be summarized (e.g., barrier type, fall height, plunge

pool depth, photographs, field biologist observations). If not, Applicant will use existing field mapping, aerial photographs and the Projects' helicopter video to examine the tributaries. If these sources provide adequate coverage, the potential for barriers will be summarized including pertinent photographs. If existing material is not adequate, Applicant will visit the tributary to perform the assessment. Appropriate photographs and descriptions, including GIS location, will be made for all sites visited (*e.g.*, description of the confluence; and location, fall height, plunge pool depth, and description and photographs of any potential fish barriers). In this step, Applicant will use best professional judgment in identifying a potential barrier to upstream and downstream migrations of anadromous fish species.

Step 2 – Consult with relicensing participants. In this step, Applicant will consult with relicensing participants regarding the results of Step 1, and in particular identify any potential barriers to upstream or downstream movements of anadromous fish species, along with a summary of the recommendations and opinions of agencies and tribe consultations found in

Step 3 – Quantitative Fish Barrier Study. If there are substantive qualitatively identified potential barriers to anadromous fish migration, quantitative assessments will be done, including the following:

- Determination of jump heights and plunge pool depth at barriers;
- Development of a simple hydraulic model to assess stage discharge relationships in mainstem rivers at tributary confluences. •

The following additional information will be employed as method(s) in which to conduct the quantitative assessment:

- Leaping and swimming capabilities of the fish based on the literature (Powers and Orsborn 1985; Hoar and Randall 1978; and Bell 1991) and fish size and water temperature information from the Fish Population Technical Study Plan and the Water Temperature Modeling Study Plan;
- Physical and hydraulic characterization of potential barriers based on measurements from the field;
- Fish passage assessment methodology outlined in Powers and Orsborn (1985) and Thompson (1972) modified, where necessary, for the specific species (*e.g.*, trout, salmon).

Seasonal and annual flow monitoring will be included in the assessment to characterize the seasonality, magnitude, and frequency of flows at the barrier over a range of the two water years.

Step 4 – Develop a fish passage assessment model that incorporates variables to represent fish passage program conditions and interactions. The model will provide a prediction or

estimate of the abilities of Chinook salmon or steelhead trout to ascend reaches of the upper Merced River that may have full, partial, or no impediment to spawning migration, if those species are introduced into the upper Merced River.

Two Salmonid population and habitat models have been proven useful in evaluating fish passage suitability: a) “Salmon Habitat Integrated Resource Analysis model (SHIRAZ; Scheuerell *et al.*, 2006) in combination with the Distributed Hydrology Soil Vegetated Model (DHSVM; Bartz *et al.*, 2006) and b) the RIPPLE Population Model (Stillwater Sciences, 2006).

The SHIRAZ model is a mechanistic model that uses: 1) user-defined stock(s) and associated life-history trajectories; 2) a network of user-defined spatial units (e.g. reaches or sub-watersheds); 3) the initial and final time step (i.e., year) for the simulation; 4) a set of habitat indicators represented in functional relationships that affect fish survival; 5) the initial number of individuals alive at each life stage for each stock and the proportion of each life stage occupying each spatial unit; 6) a matrix of movement probabilities to realistically represent downstream migration patterns (the SHIRAZ model structure allows the user to specify these constants or rely on ideal free distribution theory); 7) stray rates to non-natal reaches/sub-watersheds; 8) age-specific maturation rates; 9) and a harvest strategy that can be either a constant escapement goal or constant exploitation rate (Bartz, *et al.*, 2006; Scheuerell, *et al.*, 2006).

The RIPPLE Population Model (Stillwater Sciences, 2006) is a GIS-based model that initiates with a with geology model, upon which a habitat module including aquatic features relating to fisheries habitat. A fish population model is then placed over the previous model features, which then produces the number of fish that would be supported under the prescribed conditions. In this approach, a carrying capacity and density-independent mortality for each life stage, estimated from field data or literature, are used to develop life-stage-specific stock-production relationships. The model identifies critical life-stages, and compares relative changes in population size between alternative management scenarios (e.g., various instream flows, fish passage, potential enhancements). The model also serves as a framework for integrating available data and can either be used predicatively or as a means of identifying critical data gaps.

The SHIRAZ model is being used extensively by NMFS in the northwestern states, including Washington and Oregon. The RIPPLE model has been employed in Rock Creek, Umpqua Basin Oregon. Either model can be used to inform the Commission and relicensing participants of potential changes in existing populations under alternative management scenarios (habitat enhancements, fish passage) or environmental condition (instream flows). The models integrate environmental conditions (instream flows, passage, life-histories) to assess fish population success, under different environmental scenarios.

The choice of models shall be made in consultation with Resource Agencies and relicensing participants. Criteria for model selection should include a) assessment of

suitable data inputs from upper Merced River; b) acceptance by relicensing participants; and c) applicability of model outputs to inform the Commission and relicensing participants. The information and results of the model simulations can be used by Resources Agencies to plan and evaluate restoration actions in ESA recovery plans, in environmental assessments under NEPA, and under Section 18 of the Federal Power Act.

Step 5– Evaluate the feasibility of a “trap and haul” program on the Merced River, Identify possible locations and conceptual design for facilities and operations to provide upstream and downstream migration of steelhead trout and Chinook salmon. Evaluate upstream spawning adult capture and release, and downstream juvenile smolt migrant capture and release.

Step 6 – Consult with Relicensing Participants Regarding Quantitative Fish Barrier, Fish Passage Assessment Model, and “Trap and Haul” or other alternatives. Applicant will consult with Relicensing Participants regarding Steps 3 through 5. The Agencies and Tribe will judge the adequacy of the study information and recommendations; where indicated, the participants will evaluate the adequacy of data and data collection, data presentation, and QA/QC,

Step 7 – Prepare Report. - Applicant will prepare a report that includes the following sections: 1) Study Goals and Objectives; 2) Methods and Analysis; 3) Discussion; and 4) Description of Variances from the FERC-approved study proposal, if any. Data will be provided on CD in Microsoft Excel spreadsheets. Applicant will make the report available to relicensing participants when completed. The report will be included in the License Application as appropriate. Besides the reports described above, the study results will be displayed in Geographic Information System (GIS) maps that show locations of any identified potential barriers to upstream or downstream anadromous fish species movement.

6.4 Consultation and Communication

This study proposal includes two study-specific agency and tribe consultations:

- Consult with Agencies and Tribe regarding potential upstream and downstream migration barriers in the mainstem and South Fork, Merced River (Step 2).
- Consult with Agencies and Tribe regarding Quantitative Fish Barrier Study (Step 3); Fish Passage Assessment Model (Step 4), and “Trap and Haul” or other alternatives (Step 6).

Applicant will file with FERC and post on its Relicensing Website periodic reports as required by the FERC in the Study Plan Determination. Applicant will coordinate with FERC and other relicensing participants as described in Steps 2 and 6.

6.5 Schedule

The schedule to complete the study proposal is:

Mainstem Migration Barrier Assessment (Step 1).....April-May & November 20xx
Consultation (Step2)..... October 20xx – December, 20xx
Quantitative Fish Barrier Study (Step 3).....April-May & November 20xx + 1 year
Fish Passage Assessment Model (Step 4).....April through September 20xx
Trap and Haul feasibility (Step 5).....April through September 20xx
Consult with relicensing participants on steps 3 thru 6 (Step 6).....September 20xx + 1
Report Preparation (Step7).....September – December 20xx + 1 year

It is anticipated that the study will be completed in December 20xx + 1 year.

6.6 Consistency of Methodology with Generally Accepted Scientific Practices

Mainstem Migration Barrier Assessment (Step 1) & Quantitative Fish Barrier Study (Step 3) are consistent with those used in recent relicensings in California (e.g., Yuba Bear Fish Passage Study 2.3.4 <http://www.eurekasw.com/NID/default.aspx>). Fish Passage Assessment Model (Step 4) to develop feasibility of restoration alternatives under changing environmental scenarios has been used by Resource Agencies in development of recovery strategies for depleted anadromous fish (Bartz *et al*, 2006). Trap and Haul (Step 5) study is an assessment of options, constraints, and feasibility of restoration of fish passage in the upper Merced River; trap and haul is used in the Pacific Northwest to provide passage for anadromous salmonids to otherwise inaccessible habitat upstream of dams.

This study is consistent with the goals, objectives, and methods outlined for recent FERC hydroelectric relicensing studies in California, and uses well-recognized scientific methodologies and protocols from US Fish & Wildlife Service, California Department of Fish and Game, and National Marine Fisheries Service.

7.0 Products

After data are collected, tabulated, and quality checked the data will be made available to the Relicensing Participants in an Excel format or other format as appropriate.

Products will include but not be limited to the following:

An overall Projects Report will be prepared. Data will be provided on CD in Microsoft Excel spreadsheets. Besides the report, the study results will be displayed in Geographic Information System (GIS) maps that show locations of any identified potential barriers to upstream or downstream anadromous fish species movement.

8.0 Level of Effort and Cost

A preliminary estimate for the study cost in 2010 dollars is as follows:

2010 Cost Estimate Based upon Efforts and Costs of study elements

| Step in Study | Study Task | Estimate person time | Cost |
|----------------------|---|-----------------------------|------------------|
| Step 1 | Field Survey of Barriers in River | 6 person-months | \$45,000 |
| Step 2 | Consultation process | 1/2 person-months | \$ 4,000 |
| Step 3 | Quantitative fish barrier study (collaboratively determined) | 18 person- months | \$135,000 |
| | | | |
| Step 4 | Fish passage assessment model | 14 person-months | \$105,000 |
| | | | |
| Step 5 | Trap and Truck / Alternatives / Facilities Operation | 12 person-months | \$85,000 |
| Step 6 | Consult with relicensing participants | ½ person month | \$5,000 |
| Step 7 | Report Preparation | 6 person-months | \$45,000 |
| | TOTAL STUDY COST | | \$424,000 |

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