November 8, 2010

Ms. M. Kathleen Wood, Assistant Field Supervisor
United States Department of the Interior
Fish and Wildlife Service
Sacramento Fish and Wildlife Office
2800 Cottage Way, Room W-2605
Sacramento, California 95825-1846

Re: August 12, 2008 Draft Report, *Relationships Between Flow Fluctuations and Redd Dewatering and Juvenile Stranding For Chinook Salmon and Steelhead/Rainbow Trout Rearing In the Lower Yuba River*

Dear Ms. Wood:

This letter was originally intended to be mailed to you on December 15, 2008. For some unknown reason it appears that it never made it to you or anyone on the cc list. We discovered this in preparing documents for YCWA's FERC Relicensing Notice of Intent and Pre Application Document. We are sending it now so all parties have the information.

In response to your September 12 and September 29 letters, the Yuba County Water Agency (YCWA) is submitting the enclosed comments on the above draft report. These comments were prepared by Bill Mitchell of ICF Jones & Stokes.

Mr. Mitchell and ICF Jones & Stokes are in the process of conducting the Lower Yuba River redd dewatering and fry stranding study that the State Water Resources Control Board, in its water-rights Decision 1644, ordered YCWA to conduct. This study has been underway since 2004 and is being conducted in consultation with the California Department of Fish and Game, the National Marine Fisheries Service and the Fish and Wildlife Service. This study involves extensive mapping, site- and reach-specific habitat surveys, and field evaluations of bar stranding and off-channel stranding of juvenile salmon and steelhead during operational flow reductions. The enclosed comments are based on the results of this study to date, Mr. Mitchell's review of the above draft report, and his experience and knowledge regarding instream flow methods, redd dewatering and fish stranding.

As discussed in detail in the enclosed comments, the draft report does not provide any evidence for the critical assumptions in the methods used for redd dewatering portion of the draft report, and the available evidence indicates that these assumptions probably are not valid. The redd dewatering portion of the study also does not address the critical question of how potential redd dewatering impacts would vary as a function of hydrology and operations.

For the juvenile stranding portion of the draft report, the enclosed comments describe the problem of the draft report's attempting to quantify stranding effects based only on the areas of off-channel habitats that become physically isolated from the main river, without considering other important physical and biological factors affecting stranding potential. By taking this approach, the draft report ignores the critical fact that the presence and abundance of fish, and therefore the potential for stranding, in these habitats are highly variable and probably are determined by a complex interaction of flow dynamics, site characteristics, and fish densities and behavior. The enclosed comments also describe the deficiencies in the hydraulic modeling methods used in the study described in the draft report. Finally, the draft report incorrectly implies that fish stranding or isolation always is associated with adverse effects. Contrary to this implication, Mr. Mitchell's field work has found that this is not always the case and that some of these isolated habitats have supported juveniles for long periods of time until connectivity to the main river is restored.

For these reasons, we recommend that the draft report not be finalized, and that future redd dewatering and fry stranding work be conducted through the Lower Yuba River Accord River Management Team, in which the Fish and Wildlife Service has participated over the past several years.

Sincerely,

Curt Aikens
General Manager

cc:

Mark Gard, USFWS
Beth Campbell, USFWS
Kevin Goishi, PG&E
Chris Hurrala, PG&E
Gene Geary, PG&E
Neil Wong, PG&E
Tracy McReynolds, DFG
Brian Elrott, NMFS
Gary Reedy, SYRCL
Tom Johnson, YCWA
Alan Lilly, BKS
Paul Bratovich, HDR|SWRI
Tom Payne, TRPA
Greg Pasternack, UC Davis
Jim Lynch HDR|SWRI

Enclosure

ICF Jones & Stokes
an ICF International Company

December 15, 2008

Mr. Curt Aikens, General Manager
Yuba County Water Agency
1220 F Street
Marysville, CA 95901-4226

Subject: Comments on U.S. Fish and Wildlife Service's Draft Redd Dewatering and Juvenile Stranding Report

Dear Mr. Aikens:

As you requested, I have reviewed the U.S. Fish and Wildlife Service's (USFWS's) draft report, *Relationships between Flow Fluctuations and Redd Dewatering and Juvenile Stranding for Chinook Salmon and Steelhead/Rainbow Trout in the Yuba River*, and I have the following comments.

Background

ICF Jones & Stokes is in the process of conducting the Lower Yuba River Redd Dewatering and Fry Stranding Study on behalf of Yuba County Water Agency (YCWA). This study is being undertaken as a result of a State Water Resources Control Board order in 2001, which directs YCWA to undertake an analysis of the potential impacts of operational flow fluctuations on salmonid redds and juveniles in the Lower Yuba River. The study has been underway since 2004, and is being conducted in consultation with the California Department of Fish & Game, National Marine Fisheries Service, and USFWS. Copies of the approved study plan, annual reports and other updates have been furnished to YCWA and the resource agencies.

The Lower Yuba River Redd Dewatering and Fry Stranding Study involves extensive mapping, site- and reach-specific habitat surveys, and field evaluations of bar stranding and off-channel stranding (isolation) of juvenile salmon and steelhead during operational flow reductions. The following comments are based on the results of this study to date, my review of the Service's previous report *Flow-Habitat Relationships for Spring and Fall-Run Chinook Salmon and Steelhead/Rainbow Trout Spawning in the Yuba River*, and my experience and knowledge related to the topics of instream flow methods, redd dewatering, and fish stranding.

Redd Dewatering

General Comments

1) The Service used Effective Habitat Analysis (HABEF), one of the Physical Habitat Simulation (PHABSIM) programs of the Instream Flow Incremental Methodology, to analyze the relationships between flow fluctuations and redd dewatering in the Yuba River. Effective Habitat Analysis was used to predict the amount of "effective" spawning habitat (measured in terms of WUA) that would remain after a given flow reduction. In this case, effective spawning habitat is defined as spawning areas that retain sufficient depths and velocities to support the incubation of eggs and pre-emergent fry in the gravel. The validity of HABEF for predicting the effects of flow fluctuations on redd dewatering depends on the validity of the underlying assumptions of PHABSIM and the criteria used to evaluate the suitability of reduced flows for incubation.

2) Two critical assumptions of PHABSIM and, therefore, HABEF, are that spawning habitat is limiting for Chinook salmon and steelhead populations in the Yuba River, and that WUA accurately describes the availability of usable spawning habitat in the river at different flows. Both assumptions need to be met for HABEF to provide meaningful results for evaluating potential redd dewatering impacts. However, the Service does not provide evidence for the validity of these assumptions or offer any reasonable justification for the use of HABEF. Most of the data that I am aware of suggest that spawning habitat for Chinook salmon in the Yuba River is not limiting, and this conclusion is supported by the large proportion of unoccupied habitat depicted in the figures in Appendix J of the Service's spawning report. These figures also illustrate the weak correspondence between WUA and redd distribution, indicating that water velocity, depths, and substrate measured at the microhabitat scale are not the only variables affecting redd site selection. There is substantial evidence from other studies that redd site selection by adult salmon is only partially explained by water depth, velocity, and substrate size, and that other factors (e.g., channel morphology, hydraulic conductivity, subsurface flow patterns) contribute to site selection and resulting redd distribution patterns (e.g., Shirvell 1989, Geist and Dauble 1998). These patterns may not be strongly correlated with water depth and velocity measured at the scale of individual redds, thus limiting the ability of WUA to predict spawning habitat availability or use.

3) Another critical assumption of the Service's redd dewatering assessment is that survival of eggs and pre-emergent fry would be reduced if the tailspill of redds was exposed or if water velocity dropped below the lowest velocity where redds were found in the Yuba River. The Service provides little empirical support for the use of these criteria as indicators of reduced survival of eggs and fry. Based on the references cited by the Service and my own knowledge of the redd dewatering literature, it is evident that water

depths and velocities over redds are not reliable indicators of the suitability of the intragravel environment for eggs and fry. In addition, intragravel conditions can vary from site to site depending on gravel permeability, hydraulic gradient, bed geometry, and groundwater circulation patterns that may not be strongly correlated with water depths and velocities measured at individual redds (Geist and Dauble 1998).

4) The Service does not address the question of how potential redd dewatering impacts would vary as a function of hydrology and operations (frequency, timing, and magnitude of flow reductions) and the distribution, abundance, and sensitivity of specific developmental stages of eggs and pre-emergent fry. This is clearly an important step because it provides the necessary context for evaluating redd dewatering impacts under actual hydrologic, operational, and biological constraints.

Specific Comments

1) The methods described under *Habitat Suitability Criteria (HSC) Development* on page 13 are confusing. It is unclear why the difference between redd depth and tailspill depth would provide a meaningful measure of tailspill exposure, or how this variable is applied in HABEF. It is also unclear why only redd depths of less than two feet were used in the analysis.

2) The Service states on page 13 that "there was a significant correlation between the depth of redds and the difference between redd depth and tailspill depth for spring-run Chinook salmon (R^2=0.06, p=0.0015), fall-run Chinook salmon (R^2=0.74, p=2x 10^{-251}) and steelhead/rainbow trout (R^2=0.04, p=0.03) redds." The correlations for spring-run Chinook salmon and steelhead/rainbow trout may be statistically significant but these correlations indicate that the depth of redds explains only a very small fraction of the total variation in the differences between redd depths and tailspill depths. Because of this poor relationship, the use of average differences between redd depth and tailspill depth, and the restriction of the data to redds less than two feet, some discussion of the accuracy and precision of this method as it applies to the HABEF results should be provided.

Stranding

General Comments

1) My primary concern with the Service's stranding evaluation is that it claims to quantify stranding effects based only on the areas of off-channel habitats that become physically isolated from the main river without consideration of other physical and biological factors

affecting stranding potential. As we are finding in our study, the presence and abundance of fish, and therefore the potential for stranding, in these habitats are highly variable and are likely determined by a complex interaction of flow dynamics, site characteristics, and the timing and abundance of juvenile salmonids. For example, our field surveys have revealed that several large backwaters that we originally identified as potential stranding areas from aerial photographs are, in fact, inaccessible to juveniles except during extremely high flows. As described under *Study Site Selection* on page 3 and *Hydraulic and Structural Data Collection* on page 6, these photographs were also used by the Service to estimate the areas of large off-channel sites, which include sites where stranding is unlikely to occur within the range of study flows (up to 4,500 cfs). Although we have evaluated a relatively narrow range of flows thus far, our observations indicate that these sites and a number of other smaller sites have little or no potential for stranding fry because of the lack of a direct connection with the main river during the primary Chinook salmon and steelhead emergence and rearing periods.

2) The Service's methods for determining the stranding flows at particular sites lacks the resolution and scale to accurately describe the relationship between flow fluctuations and potential stranding area over the entire range of study flows. The Service used a combination of hydraulic modeling, field measurements, and stage-discharge relationships to estimate the stranding flow at particular sites. For each site, one of these methods was used to estimate the stranding flow at a single location identified as the "stranding point" or the lowest point at the connection between the stranding area and the main river (see *Hydraulic and Structural Data Collection* on page 6). For those sites where disconnection was not directly observed (stage-discharge relationships were used to estimate the standing flow), it is unclear how the stranding point was identified or how much surveying work was done to verify its location. For many sites, potential stranding areas cannot be accurately defined based only the connectivity of the site to the main river at a single point. Many of the sites that we have been monitoring lack a single, discrete connection with the main river (e.g., broad shoreline connections between the river and shallow depressions on low-gradient bars) or are physically complex channels that consist of a series of pools and hydraulic controls that become isolated at different flows depending on their elevation. A number of sites also have strong groundwater contributions that may affect the ability to estimate potential stranding areas based on a single stage-discharge relationship.

3) I am not an expert in hydraulic modeling, so I cannot provide a critical review of the methods used to develop and calibrate the hydraulic models for stranding flow estimation. However, it is disconcerting that the Service's study uses multiple methods (undoubtedly with differing levels of accuracy and precision) to assemble Figures 5 and 6 (representing the combined results of using all methods) without any comparison of the confidence in these predictions or comparison of how each method performs relative to each other.

4) Our current study recognizes the difficulties and inherent problems with the Service's approach by using direct field observations and monitoring of fish stranding in conjunction with GIS mapping to evaluate the effects of flow reductions on fish stranding. To illustrate the differences in how these two approaches characterize stranding, I compared our 2007 survey results with the Service's predictions for the same flow reductions. In April 2007, we identified 24 sites above Daguerre Point Dam and 13 sites below the dam that had become disconnected from the main river following a flow reduction of 1,300 to 900 cfs above Daguerre Point Dam and 1,400 to 900 cfs below the dam. These sites encompassed a total area of 26,348 ft^2 and 73,826 ft^2, respectively. In contrast, the Service predicts stranding areas of 1,246 ft^2 and 310,925 ft^2 for the same flow reductions (see Appendix C). These differences are probably due in part to significant channel changes in recent years (the Service did most of their field work before the January 2006 flow event), difficulties encountered by the Service in predicting the flow-stranding relationship without field verification, and inclusion of areas that are inaccessible to fish. One way to further to examine the predictive ability of the Service's stranding results is to review the Service's GIS maps of stranding areas and the estimated stranding flows for each area. These data could then be compared with our field results for comparable flow reductions.

5) The Service's assessment implies that fish stranding or isolation is always associated with adverse effects (e.g., mortality). However, we recently confirmed through field monitoring that this is not always the case. This year, we monitored several off-channel areas where juvenile salmon and steelhead had become isolated following peak winter flows, and found that some of these habitats support juveniles through the summer and possibly for long periods of time until access to the river is restored by high flows. This further illustrates the point that the effect of flow fluctuations on stranding requires more than just an assessment of habitat area. In fact, we believe the results of our study ultimately may demonstrate the unique opportunities that these habitats offer for habitat enhancement on the Yuba River.

Specific Comments

1) Under *Hydraulic and Structural Data Collection* on page 6, it is unclear how stranding areas were extrapolated from the photographic and field data collected at specific flows. It should also be clearly stated whether the stranding areas represent water surface areas before or after a given flow reduction.

2) To avoid misinterpretation, the Service should report the results of their stranding assessment in terms of "potential stranding area" rather than "stranding of juvenile salmonids" (see Figures 5 and 6).

I hope you find these comments helpful in responding to the Service's request. Feel free to contact me if you any questions.

Sincerely,

William T. Mitchell

William T. Mitchell
Fish Biologist