RESPONSE TO FEBRUARY 16, 2018 REQUEST FOR ADDITIONAL INFORMATION, RESOURCE AGENCY LATE FILING, AND OTHER RELATED INFORMATION

ATTACHMENT U

DISTRICTS' ANALYSIS AND COMMENT ON USFWS ATTACHMENT 5: USE OF COMULATIVE ACRE-DAYS AS A FLOODPLAIN "MITIGATION" MEASURE: STILLWATER SCIENCES' REVIEW COMMENTS

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Stillwater Sciences' Review Comments on Attachment 5 to USFWS (2018) Recommendations on the FERC REA Notice for the Don Pedro Project

In their comment letter of January 29, 2018 to the Commission, the U.S. Dept. of Interior Fish and Wildlife Service (USFWS) provided several recommendations under Section 10 (j) of the Federal Power Act based upon lack of floodplain access due to "Natural Hydrograph Diminishment" due to U.S. Army Corps of Engineers (USACE) flood control rules as well as hydroelectric operations of the Don Pedro Project (USFWS 2018). In addition to discussions derived from the Tuolumne River Restoration Plan (McBain & Trush 2000) as well as generalized references to studies of flood bypasses of the Sacramento River (Sommer et al. 2001; Limm and Marchetti 2009), USFWS submitted an attachment presenting analysis of floodplain inundation duration under existing hydrology in comparison to historical ("without project") hydrology (Millsap and Gard 2018). The Districts' consider that the premise and analyses presented by USFWS (2015) and Millsap and Gard (2018) to be flawed and should not be given preference above the ILP studies developed by the Districts.

Survival benefits of floodplain inundation not supported

Central to the USFWS hypothesis presented in Attachment 5 that juvenile outmigrant survival is simply a function of floodplain inundation is an analysis purported to show a linkage between cumulative acre-days of floodplain inundation with indices of juvenile Chinook salmon survival derived from season-long passage totals at rotary screw trap (RST) locations at Waterford (RM 30) and Grayson (RM 5.2) on the lower Tuolumne River (USFWS 2015). ***Perhaps the most fundamental flaw in the analysis is that the USFWS presents no data actually comparing relative survival of juvenile Chinook salmon within in-channel and floodplain habitats.*** While it is acknowledged through existing studies in the FERC record that increased RST passage and other survival indices are related to variations in discharge (TID/MID 2005, Report 2004-7; W&AR-06, Attachment C), examination of the differences in fish survival within floodplain vs in-channel habitats would have to be accomplished using PIT-tagging or other mark-recapture techniques. Information presented by USFWS do not provide any indication as to whether or not a juvenile salmon captured at either RST resided on the floodplain or in the main channel. Further the USFWS presents no indication of travel time between the two RSTs which would be fundamental to establish floodplain residency. As described further below, USFWS (2015) misrepresents and misinterprets historical RST monitoring data in its attempt to justify additional extended periods of floodplain inundation outside of the flood control releases that regularly occur under current conditions on the Tuolumne River.

The following summarizes major issues with the USFWS analysis contained in Attachment 5 to the January 29 REA response:

1. **USFWS regression analyses violates standard statistical assumptions.** As the Districts noted in prior responses to this analysis filed with the Floodplain Hydraulics Study report (W&AR-21), the Districts have strong reservations regarding the suggested ad hoc regression analysis presented in Figure 2 of Millsap and Gard (2018). The USFWS (2015) re-analyzed in-channel rotary screw trap (RST) data from 1996–2009 based on a flow data transform to arrive at a floodplain inundation metric. Standard statistical analysis practices

described by Zar (2010) normally proceeds from exploratory analyses over a range of data transformations (e.g., log-flow, power law fits, flows within particular months) and then are presented consistent with standard practices (Zar 2010). In the case of the USFWS assessment, no such analysis is presented to show a suggested linkage between RST passage indices and measures of floodplain inundation. In addition, the regression presented in USFWS (2015) effectively shows just two groups of survival points, one at high and one at low inundation, which is insufficient for the purposes of constructing a generalized survival model (Zar 2010). Because there are a number of factors affecting RST passage (e.g., short term flow variability, turbidity spikes), introduction of other data in the future with intermediate inundation but either high or low RST passage would potentially result in entirely different relationships than shown by USFWS (2015).

2. **RSTs do not provide a measure of survival within floodplain habitats**. The RSTs on the lower Tuolumne River are necessarily deployed at in-channel locations and do not indicate residency or survival in floodplain habitats. Season long RST passage estimates cannot be disaggregated into portions attributed to specific rearing locations and for this reason there is no way to attribute the flow to floodplain benefits such as faster growth and greater survival vs simply faster outmigration transit times and survival between the RSTs. There is no way to discriminate which outmigrating fish reared on the floodplain (and for how long) and which reared in the channel. The Tuolumne River channel has been shown to have substantial in-channel rearing habitat (TID/MID 2017) with estimates of the potential for over 1.3 million ft^2 of usable rearing area riverwide at a flow of 1,000 cfs (W&AR-21, Table 5.2-1) with an associated carrying capacity of approximately 0.6 million juvenile salmon.
3. **No linkage between salmon growth and changes in relative RST passage presented**. One of the potential floodplain rearing mechanisms that could plausibly be hypothesized from the USFWS cited studies (e.g., Sommer et al 2001) is that increased growth results in increased swimming ability, predator avoidance, and higher in channel survival between the Waterford (RM 30) and Grayson (RM 5.2) RSTs. However, no data is presented showing increased growth benefits related to Tuolumne River floodplain residency or relating increased fish size with increased relative survival between the RSTs.

For the reasons discussed above it is unreasonable and unsupportable to attribute observed increases in the calculated RST survival indices to increased acre-days of potential floodplain residency rather than simple increases of in-channel flows such as those occurring during flood control releases as well as FERC-required spring pulse flows.

Floodplain inundation occurs regularly on the Tuolumne River

Although USFWS (2018) provides several references to support a presumption of greater salmon productivity by increasing current levels of floodplain access, comparisons to without project hydrology is inappropriate and the Districts' disagree with the rationale supporting the recommended floodplain habitat restoration projects or that their implementation will achieve the hypothesized benefits. Analysis of floodplain inundation for the WY 1971–2012 hydrology on the lower Tuolumne River was considered by the ILP floodplain study (TID/MID 2017). Area-duration-frequency analyses for the period above were conducted based on 2-D modeling floodplain habitat vs flow relationships. The results show that floodplain inundation events lasting

14 days or more occur frequently during the rearing period of Chinook salmon (February through May), expanding annually available habitat by a factor of four every two years and by a factor of 10 every four years (Figure 5.3-3 in TID/MID 2017, W&AR-21). This corresponds to an expansion of suitable fry habitat for those fry remaining in the river by a factor of 2 to 5 over these same 2-4 yr. return periods (See Figure 5.3-4). Because these return periods are within typical cohort return periods of Chinook salmon (Matella and Merenlender 2014), we conclude that the amounts and frequency of floodplain access currently provided are supportive of salmon populations.

Food resources are not limiting on the Tuolumne River

One of the primary hypotheses examined in the floodplain rearing studies discussed by USFWS (Sommer et al. 2001; Limm and Marchetti 2009; Jeffres et al 2008) above is that for juvenile fish to achieve greater growth due to floodplain access, there must be plentiful food sources on the floodplain, at least equal to, if not greater than, in-river food availability and quality. ***However, no data is presented comparing differences in food availability or salmon growth within in-channel and nearby floodplain habitats of the Tuolumne River.*** ILP studies reviewing existing information regarding salmonid life history specific to the Tuolumne River (W&AR-5) demonstrate abundant in-channel food resources supporting Chinook salmon rearing (e.g., TID/MID 1992, Appendix 16; TID/MID 1997, Report 96-4; TID/MID 2003, Report 2002-8). In this same study, reviews of the USFWS own fish condition assessments (Nichols et al. 2001, Nichols and Foote 2002) are presented that do not indicate food limitation on the Tuolumne River, therefore USFWS' hypothesized benefit of increased food supply due to floodplain access or the proposed floodplain lowering are unfounded.

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