



MERCED IRRIGATION DISTRICT

November 18, 2013

Jeanine Townsend
Clerk to the Board
State Water Resources Control Board
PO Box 2000
State Water Resources Control Board
Sacramento, CA 95814-0100

Re: Bay Delta Water Quality Control Plan Revisions – Information Submittal from the Merced Irrigation District

Dear Ms. Townsend,

Over the last several months, District staff has had a number of discussions with staff for the State Water Resources Control Board (the Board or SWRCB) regarding Phase 1 of the Board's ongoing process to update its Bay Delta Water Quality Control Plan. During those discussions, District staff has stressed the importance of the differences in impacts that we expect to see as compared to the impacts described in the draft Substitute Environmental Document supporting revisions to the Bay Delta Water Quality Control Plan (the SED). During discussions, Board staff has requested a variety of documents and information, and therefore this letter comes to you with a number of documents that we feel would be helpful to review and consider when updating the SED. Merced ID appreciates the opportunity to provide the Board with this information, and we would welcome follow up questions or clarifications from the Board or your staff. Note that some of these studies contain multiple exhibits and are very voluminous, so I am not including hard copies with this letter. For your convenience, each of the studies mentioned below can be accessed from Merced ID's FERC relicensing website located at: <http://www.eurekasw.com/MID/default.aspx>. If you would like assistance in retrieving this information, or if you would like hard copies of any of this information, or all of it, please let me know and I will make sure to get it to you.

As you know, Merced ID has conducted numerous studies as part of its FERC relicensing effort that address habitat and fish population conditions and requirements in the Merced River, and we appreciate the opportunity to present information from those studies to you with this letter. By presenting this information, Merced ID does not waive any of its legal rights that it may have relating to the Water Quality Control Planning process or how those objectives might be developed and/or imposed. The results of these studies address issues such as reservoir and stream fish populations and habitat needs in the context of water management in the Merced River, and the influence of temperature and flow conditions in the Merced River watershed on resident and anadromous fish populations.

Importantly, Merced ID has conducted a variety of studies and prepared related documents that collectively will better inform the Board and its staff regarding many conclusions presented in its SED by

providing more specific, detailed, pertinent information about fish populations and related habitat conditions in the lower Merced River.

These studies include:

- Technical Memorandum 02-02 - Water Balance-Operations Model
- Technical Memorandum 02-03 - Water Quality
- Technical Memorandum 02-04 - Water Temperature Model
- Technical Memorandum 02-05 - Reservoir Water Temperature Management Feasibility
- Technical Memorandum 03-01 - Reservoir Fish Pop
- Technical Memorandum 03-02 - Fish Entrainment
- Technical Memorandum 03-04 - Instream Flow
- Technical Memorandum 03-05 - Instream Flow Below Crocker-Huffman
- Technical Memorandum 03-06 - Chinook Salmon Egg Viability
- Technical Memorandum 03-07 – Anadromous juvenile rearing evaluation
- Technical Memorandum 06-01 - Riparian Habitat and Wetlands
- Applicant prepared draft biological assessment of project effects on listed Central Valley steelhead DPS
- Applicant prepared draft essential fish habitat evaluation
- Evaluation of downstream migration of Chinook salmon in the lower Merced River (SWRCB mandated study)
- Evaluation of upstream migration of adult Chinook salmon in the lower Merced River (SWRCB mandated study)

Issues addressed in the studies listed above include:

- Reservoir population (fish population status and habitat, project related conditions; reservoir elevation fluctuation, population composition and relative abundance, operation influences on spawning and rearing)
- Instream flow-habitat (anadromous salmonid habitat availability relative to flow and temperature under various operating scenarios; habitat availability by reach in the lower Merced River relative to flow and temperature for various species-lifestages)
- Chinook salmon egg viability (In-river evaluation of influence of temperature on egg survival – spawning through emergence; empirically measured effects of extant temperatures on Chinook salmon egg-fry survival in the lower Merced River)
- Anadromous salmonid rearing evaluation (juvenile salmonid rearing habitat composition and attributes in the lower Merced River; rearing habitat distribution and flow and channel related attributes of rearing habitat utilized in the lower Merced River)
- Chinook salmon adult migration (Temporal distribution and composition of the anadromous salmonid adult spawner migrating population into the lower Merced River; flow, temperature, age and hatchery composition, steelhead presence; flow, time, temperature relationships to adult migration into the lower Merced River)
- Juvenile salmon emigration (Temporal distribution and composition of juvenile anadromous salmonids emigrating from the lower Merced River)
- Water quality and temperature monitoring
- Temperature modeling (Reservoir and Merced River)
- Instream habitat survey and mapping (video and ground)
- Operations modeling (flow and temperature relative to operation scenarios)

- Applicant prepared draft biological assessment (assess habitat function relative to project effects on listed Central Valley steelhead)
- EFH evaluation (assess habitat function relative to project effects on Chinook salmon)

Highlights of the study results set out above are provided in the following sections in order to provide the Board and your staff with information acquired by Merced ID that is pertinent to the understanding of the relationship between the proposed increases in flow during the February through May period and the fish populations dependent upon habitat conditions within Lake McClure and in the Merced River downstream of Crocker-Huffman Dam.

Reservoir Fish Population Evaluation

Merced ID has conducted an extensive survey of the fish populations in Lake McClure and McSwain Reservoir as part of the FERC relicensing process. Evaluations addressed effects of operations on bass nest survival, cold-water fish habitat and tributary spawning. Evaluations focused on changes in reservoir water surface elevations during the black bass spawning and nursery period (March – June) and tributary spawning (October—June) and the cold-water pool volume after June. Some of the important results of these studies include:

- Bass spawning in Lake McClure occurs at depths ranging from 5 to 10 ft
- Current operations result in elevation increases during most years during bass spawning season; elevation changes that result in desiccation of the shallowest nests (5 ft) are rare
- Bass nest survival under current operations is between 98 and 100 percent
- Current operations result in maintenance of connectivity with tributary spawning streams
- Summer cold-water pool (expressed as cold water pool at the end of June) is directly related to storage during the runoff period

Bass nesting surveys on Lake McClure showed that the reservoir offered good conditions for bass reproduction. The current operations have minor effect on bass spawning and nursery. The survey found that operations generally increased the reservoir stage during the bass nesting period. Potential nest dewatering events appeared to be rare, with little potential overall effect. Analysis of potential nest dewatering events over thirteen years of historical data showed that nest survival was 100 percent during all years except 1998 and 2005 when nest survival was 98% and 95% respectively. Given the criteria from Lee (1999) (i.e., maximum reduction in elevation of 6 ft during 30 day period), the bass nesting assessment suggests that black bass in Lake McClure should be able to independently subsist.

The survey also observed bass spawning to occur within areas less than 10 ft deep (5—10 ft). Merced ID focused its evaluation on the shallow, more susceptible range of bass nesting and determined that changes in elevation greater than 5 ft during the bass nesting period are rare. Merced ID found that bass spawning in Lake McClure was between 5 and 10 ft below the water surface. These results show that a 15 ft reduction in water surface elevation (identified in the SED as appropriate for evaluation of effects on bass nesting) would eliminate essentially all successful bass spawning.

Historic Project operations show a consistent increasing reservoir elevation from January through July. In August through September, the reservoir elevation descends and stabilizes by October. Given the size of the reservoir, flow fluctuations are typically not rapid, but gradual over time. The relatively high reservoir elevations early in the year provided access to tributaries for spawning. The increasing reservoir elevations also ensure that the nests of spawning warm-water fishes are not dewatered. The gradual decrease in reservoir elevations, after bass spawning (August—September), also suggests that fish stranding or isolation is unlikely. High reservoir elevation in June and July inundated terrestrial vegetation and improved habitat structure. Overall, habitat does not appear to be a limiting factor to fishes in Lake McClure

Bass Nesting Survey

Successful black bass productivity was also highlighted during the bass nesting survey. The survey found that operations generally increased the reservoir stage during bass nesting period in both 2010 and from historical records. Potential nest dewatering events appeared to be rare, with little potential overall effect. Lee (1999) stated that if nesting success is over 60 percent, then a population of bass would be able to independently subsist. Analysis of potential nest dewatering events over thirteen years of historical data showed that nest survival was 100 percent during all years except 1998 and 2005 where nest survival was 98% and 95% respectively. Given the criteria from Lee (1999), the bass nesting assessment suggests that black bass in Lake McClure should be able to independently subsist.

Spawning Habitat

Surveyors found that there were many low-gradient areas in Lake McClure that offered spawning habitat for warm-water fish. The six tributaries to Lake McClure that were surveyed for fish also documented spawning gravels that could be used by both cold-water and warm-water species. Rainbow trout and black bass were present within many of the tributaries and may use this habitat. Spawning for many species in the tributaries generally occurs during the spring time (March to May). During this period, spring run-off in the tributaries occurs. Also, project operations show that the reservoir water elevation increases. As a result of the runoff and increasing reservoir elevations, access to the tributaries is improved and benefits fishes that spawn in tributary habitat

Modeling of the proposed flow strategy using the operations model and reservoir temperature model developed by Merced ID as part of the FERC Merced River Hydroelectric relicensing, shows that the cold-water pool will be dramatically reduced as a result of the flow standard (Figure 1). In as much as the volume of cold-water in these reservoirs is defined as the effects criteria for evaluating cold-water fisheries, it is clear from the model results that increased flow during the February—May period would result in significant adverse effects on the cold-water fisheries. Overall, decreased storage in Lake McClure during the February through May period will result in lowering of the reservoir elevation relative to the current situation that typically sees increases in the reservoir elevation. A reduction in elevation of 5 to 10 ft during a 30 day period between March and June would dewater most nesting sites, as observed in the above mentioned surveys. As a result of the proposed standard, will decrease black bass survival (decrease access and spawning in tributaries by both cold-water and warm-water fishes, decrease summer-fall cold-water fish habitat in the reservoir and decrease the amount of cold-water available for release downstream of New Exchequer Dam.

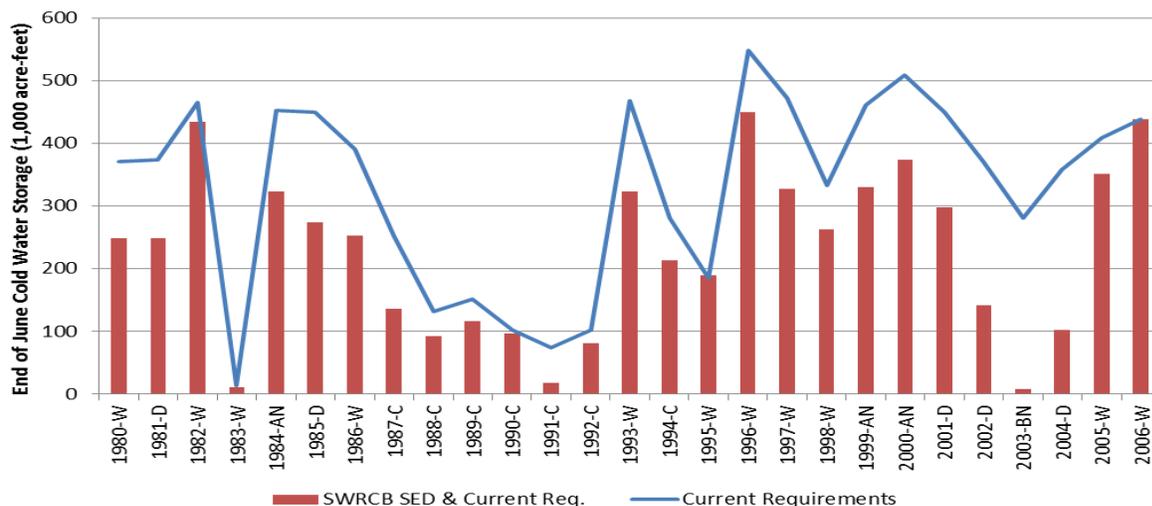


Figure 1. Comparison of coldwater pool available in Lake McClure in June when current requirements are followed all year and when a 40 percent of unimpaired flow is released during February through June and current requirements are followed from July through January.

Merced River Anadromous Fish Populations

Merced ID has conducted studies assessing relationships among anadromous salmonid habitat and flow and temperature that include results that will assist the SWRCB update evaluation of these relationships relative to SED alternatives. Pertinent studies include TMs 2-2, 2-4, 2-5, 3-5, 3-6, 3-7, and results of the juvenile outmigration and adult upstream migration studies.

For example, results of these studies show that increased flows and associated decreased storage during the February—June period will increase black bass access to juvenile salmonids, decrease the availability of juvenile salmonid habitat, increase temperatures during the juvenile rearing period and increase temperatures during the fall spawning period.

Key specific findings include:

Results of Merced ID’s instream flow study (TM 3-5) show that Chinook salmon fry habitat availability is bimodal and peaks between 74 and 126 cfs at the low end and between 3,800 and 4,000 cfs at the high end. Similarly, Chinook salmon juvenile habitat availability peaks between 100 and 150 cfs at the low end and 5,000 and 5,600 cfs at the high end (Table 1). Habitat availability declines sharply between the peak and about 800 cfs, and then begins to increase slowly with increased flow. However, habitat availability doesn’t regain the levels provided at the low flow peaks until flows are well above 2,000 cfs for fry and over 5,000 cfs for juveniles (Figure 2).

Merced ID identified similar relationships between flow and steelhead rearing habitat availability (Figure 3).

Increasing flows above peak fry and juvenile rearing availability increases connectivity with bass habitat increasing predation potential while decreasing rearing habitat availability (Figure 4)

Increased flow during February—June has a net effect of increasing temperatures during the warmer months (June through November), while increasing temperatures in the uppermost reach of the Merced River (at Crocker Huffman Diversion Dam) during May and June, but decreasing temperatures at Shaffer Bridge (Tables 2 and 3). However, temperatures at Shaffer Bridge still exceed EPA criteria from 40 to 70 percent of the time from March through June (Figure 5).

Table 1. Results of Merced ID IFIM study (TM 3.5) showing flows providing peak habitat availability by sub-reach in the lower Merced River.

Sub-Reach ¹	Upper and Lower Peak of Bimodal WUA Curve	Peak Fry habitat discharge (Feb—March)	Peak Juvenile habitat discharge (Feb-June)
Sub-reach 1	Lower	75 cfs	150 cfs
	Upper	3,800 cfs	5,000 cfs
Sub-reach 2	Lower	74 cfs	100 cfs
	Upper	4,000 cfs	5,603 cfs
Sub-reach 3	Lower	126 cfs	126 cfs
	Upper	4,000 cfs	5,000 cfs

¹Sub-reach 1, from the Shaffer Bridge (RM 32.8) upstream to the Highway 59 Bridge (RM 42.0).

Sub-reach 2, from the Highway 59 Bridge (RM 42.0) upstream to Snelling Road (RM 46.4).

Sub-reach 3, from the Snelling Road (RM 46.4) upstream to Crocker-Huffman Diversion Dam (52.0)

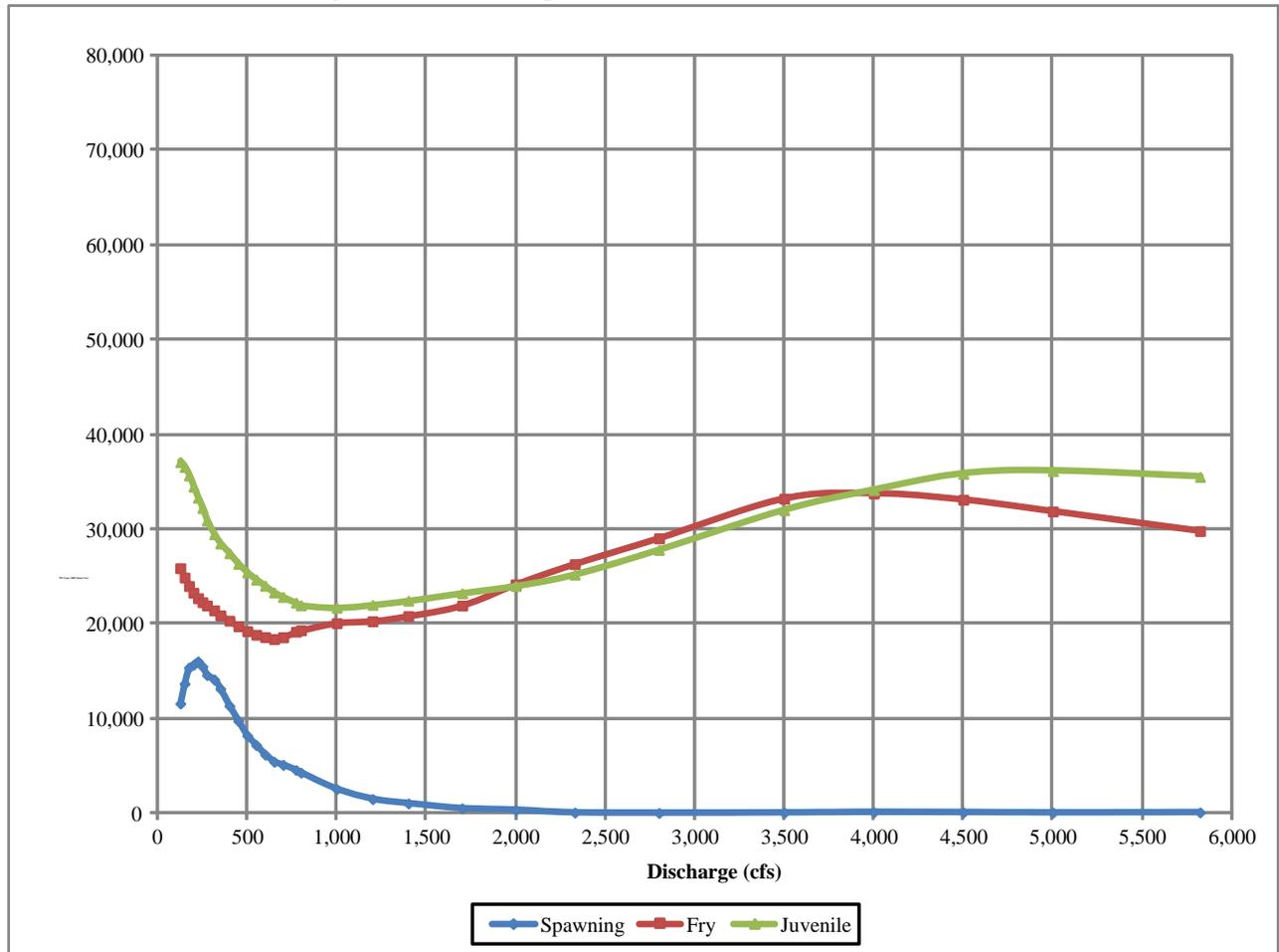


Figure 2. WUA for Chinook salmon in sub-reach 3.

Table 2. Percent of days EPA criteria are exceeded by month under current operations

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
EPA Criteria (°C) ¹	13	13	13/14	16	16	16/18	18	18	18	18/13	13	13
New Exchequer	3%	0%	0%	0%	0%	0%	0%	0%	0%	32%	71%	57%
Crocker-Huffman	0%	10%	42%	6%	14%	18%	6%	15%	19%	62%	91%	14%
Snelling	0%	13%	51%	29%	41%	70%	74%	90%	82%	83%	91%	12%
Highway 59	0%	18%	59%	42%	52%	74%	79%	97%	88%	88%	91%	11%
Shaffer	1%	30%	69%	63%	69%	81%	94%	100%	96%	91%	92%	10%

Table 3. Percent of Days EPA Criteria are Exceeded by Month under increased flows during February—June (CDFG 05122012, see text below)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
EPA Criteria (°C) ¹	13	13	13/14	16	16	16/18	18	18	18	18/13	13	13
New Exchequer	5%	0%	0%	0%	0%	0%	0%	1%	29%	68%	100%	65%
Crocker-Huffman	0%	3%	17%	0%	2%	18%	32%	38%	43%	73%	98%	26%
Snelling	0%	5%	24%	0%	13%	39%	72%	89%	82%	83%	97%	22%
Highway 59	1%	9%	38%	5%	22%	51%	89%	100%	90%	90%	97%	21%
Shaffer	1%	20%	58%	39%	58%	71%	97%	100%	99%	94%	96%	18%

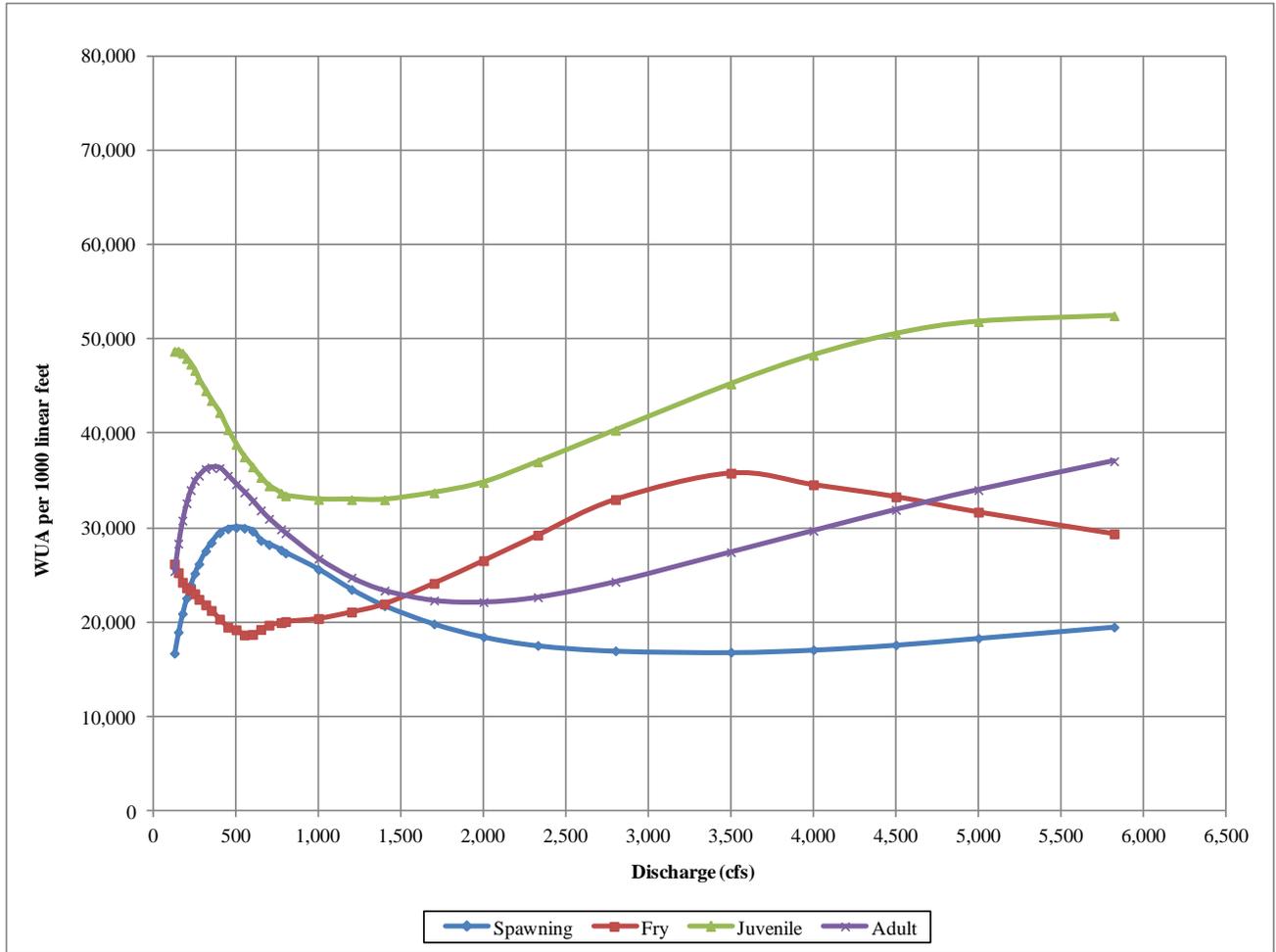


Figure 3. WUA for steelhead in sub-reach 3.

Merced River Temperature

As part of FERC Study 2.5, Merced ID evaluated several management scenarios that were developed in collaboration with FERC Relicensing Participants, including the SWRCB, to assess the feasibility of meeting EPA criteria for protection of salmonids. The evaluation included operating the Merced ID facilities to maintain flow downstream of Crocker Huffman Diversion Dam to the San Joaquin River at 40 percent of the unimpaired flow from February through June (CDFG052512). The results of this evaluation and others were compared with temperature regimes resulting from operating under existing minimum flows, and existing water deliveries (Case 1).

Figure 5 illustrates that the 7DADM temperature (i.e., EPA criteria) of water released from New Exchequer Dam is typically less than EPA criteria until September under CDFG052512 operations or October under Case 1 operations. Temperature of water released from New Exchequer typically exceeds EPA criteria between 60 and 80 percent of the time from October through December under Case 1 and more frequently under CDFG052512 operations. Generally, release temperatures under CDFG052512 are higher from June through November due to higher minimum flow requirements that deplete available cold-water resources. This is a fundamental tradeoff of reservoir temperature management - higher releases can decrease temperatures in some months, but also deplete cold-water resources that tends to increase release temperatures in future months. Release temperatures are lower under CDFG052512 from

January through April. Release temperatures in October and November either exceed, or are within 1 or 2 degrees of EPA criteria. This illustrates that attempting to meet EPA criteria in October and November is problematic. In most years, additional releases in October and November will not prevent or reduce exceedence of EPA criteria because the temperature of water in the reservoir exceeds EPA criteria. However, the egg viability study, reported in TM 3.6, shows that current temperatures support relatively high Chinook salmon survival from spawning through fry emergence in spite of temperatures that exceed EPA criteria.

Although Merced ID has not determined the effective habitat available under CDFG052412, given that the flows during February through June are higher than those providing peak habitat for the targeted salmonid life stages, the slight improvement in temperature frequency likely is nullified by decreased habitat availability due to the higher flows.

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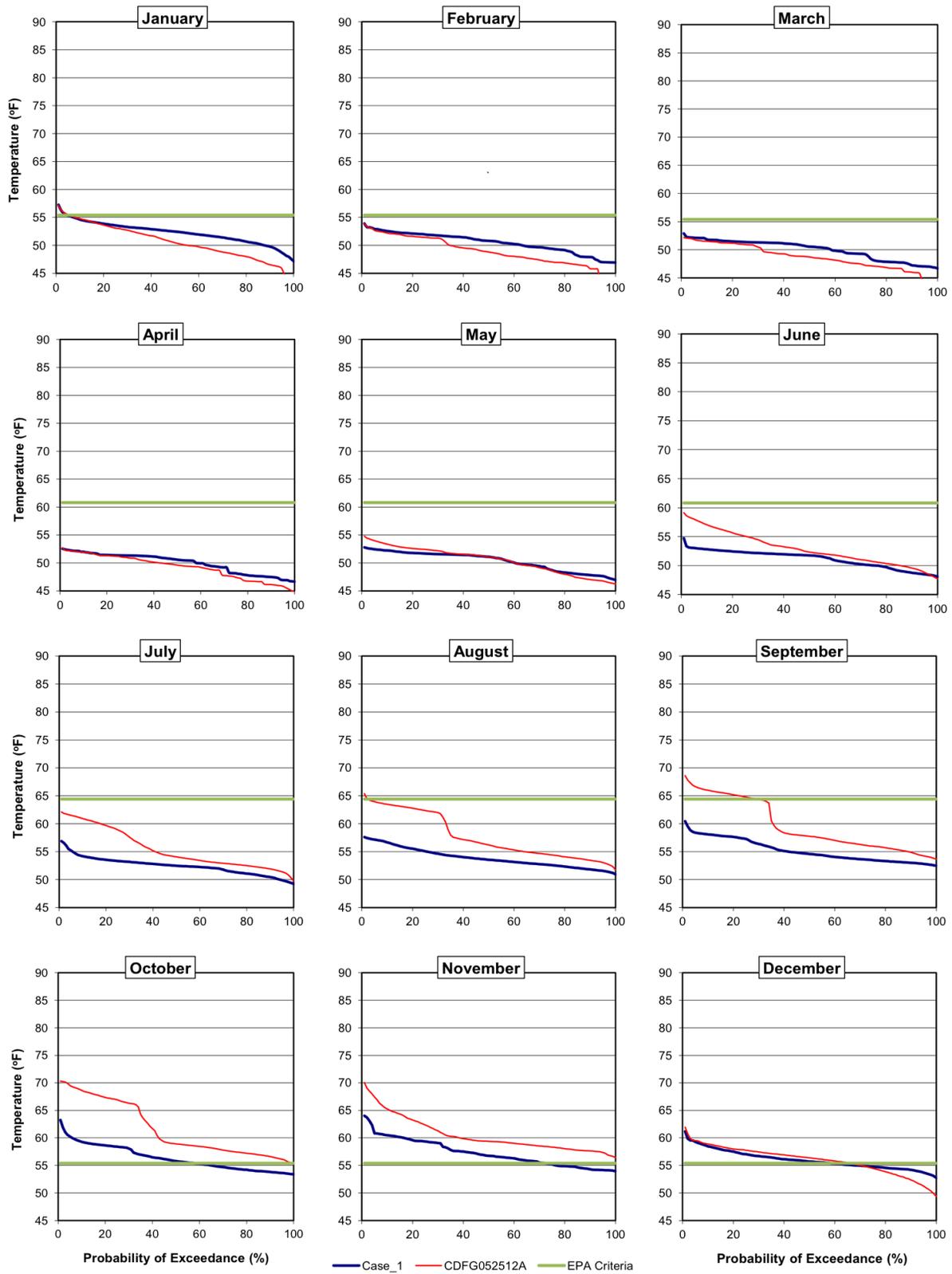


Figure 4. Monthly probability of Exceedence for EPA criteria at New Exchequer Dam.

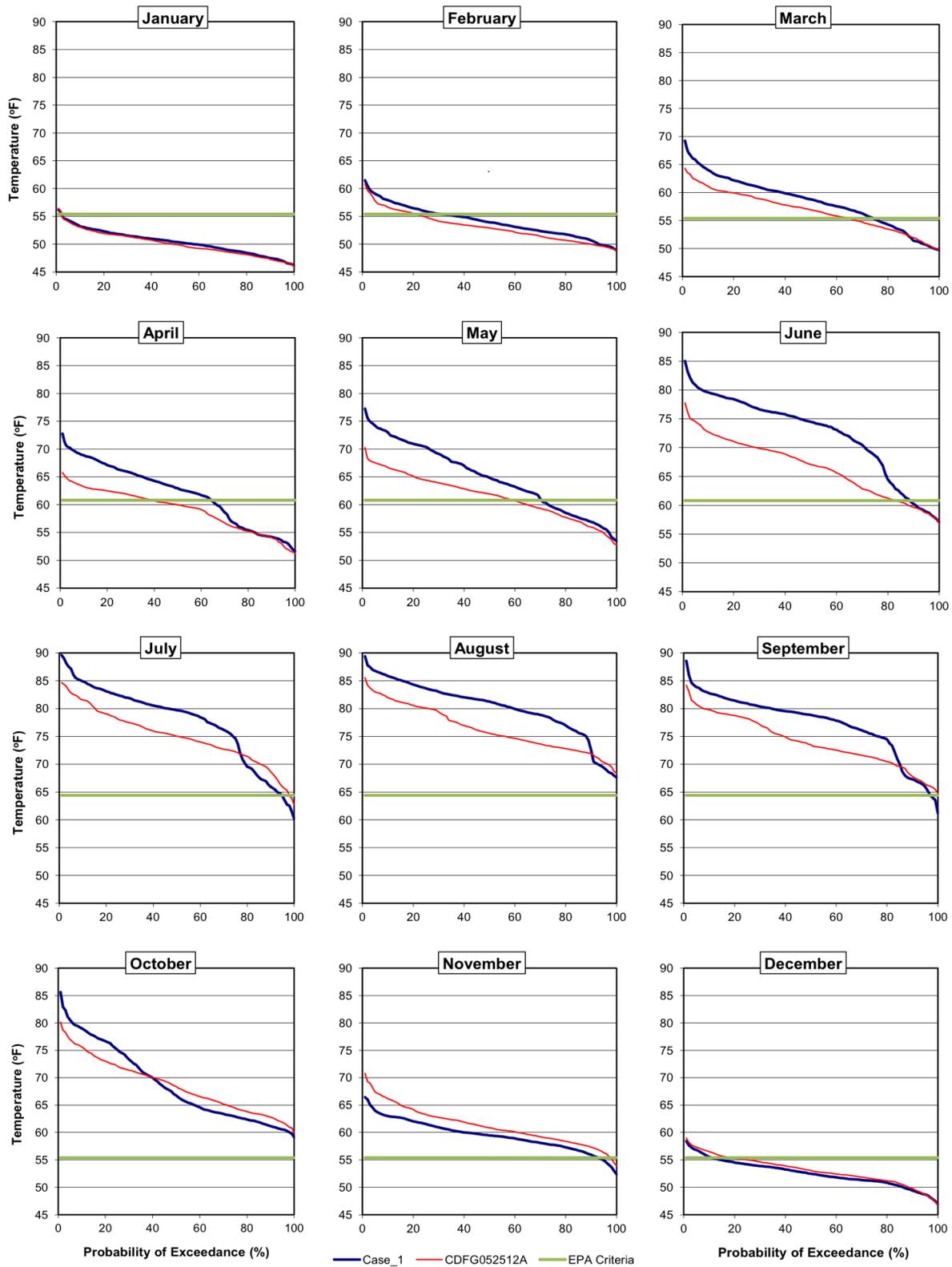


Figure 5. Monthly probability of Exceedence of EPA criteria at Shaffer Bridge.

Flow-Habitat Connectivity for Bass

Merced Id evaluated the relationship between flow and connectivity of the riverine, salmon habitat, and off-channel black bass habitat (predator bass habitat, PBH). The evaluation conducted as a part of the

IFIM study found that, of the 79 total potential bass habitat units identified, 12 Category II PBH units were hydraulically connected to the main channel at or below a flow of 1,270 cfs. Only PBH unit 34 connects to the main channel above this discharge, at 2,200 cfs, within about 200 cfs of the normal maximum flood. Nine units had connections occur at discharges of 700 cfs or higher and infrequent connectivity (i.e., less than 40 percent of the time for each month on record). Three units were identified as having connections established at discharges less than 369 cfs, and a range of inundation frequency from 18 percent in the summer to 77 percent in May.

Based on historical gage data from WY 1969 to 2006, 2,236 cfs is the approximate maximum discharge released from the Crocker-Huffman Diversion Dam during normal water year flow conditions. "Normal water year" was defined as one with the maximum discharge having a 2-year recurrence interval. A total of 12 of the 79 PBH units were found to be intermittently connected to the main channel at discharges near or below the normal maximum Project discharge of 2,236 cfs. Figure 6 shows the river discharge and sequence at which Category II PBH unit hydraulic controls are overtopped for discharges up to 3,000 cfs.

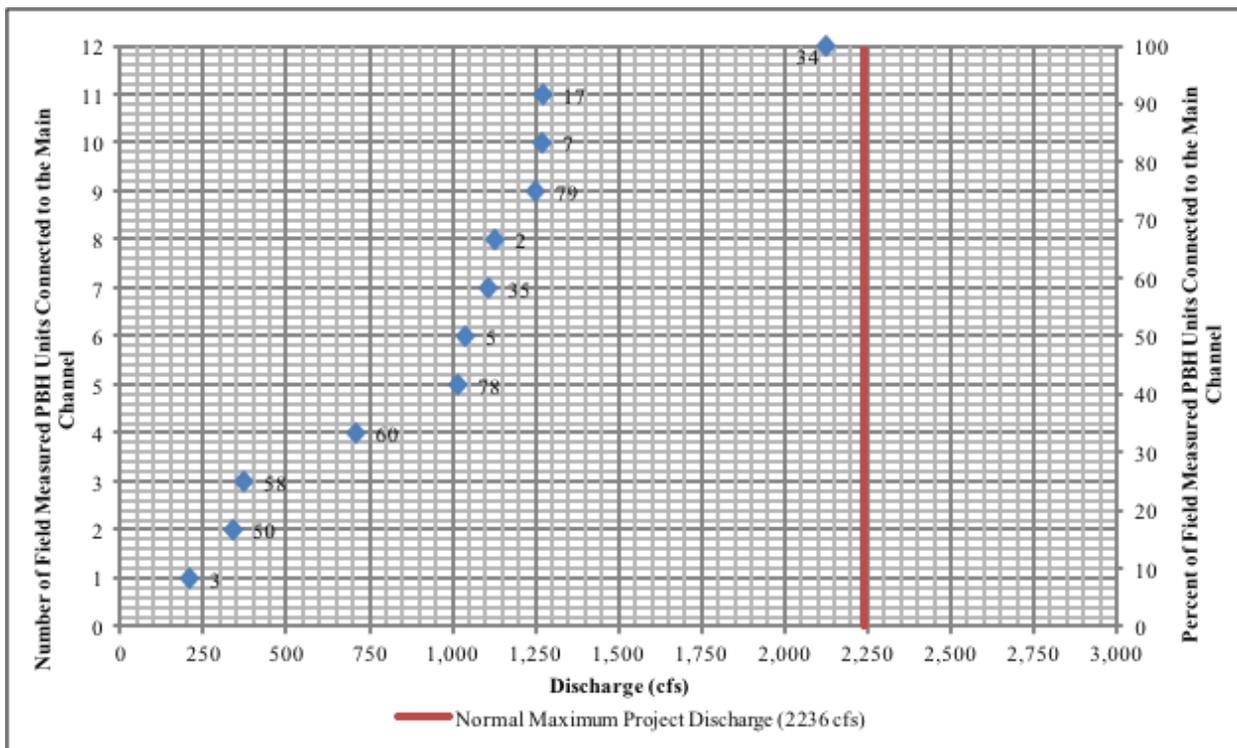


Figure 6. River discharge at which Category II PBH unit hydraulic controls are overtopped.

The 2012 Merced ID Study 3.7 observations and the 2008 Stillwater Sciences surveys indicate that predatory species, such as bass, are common in main stem habitats as well as in off-channel habitats in the Lower Merced River.

Merced ID has conducted a variety of studies that monitor the functioning of habitats under current conditions. These studies included an egg viability study, ordered by FERC to empirically evaluate survival of Chinook salmon eggs exposed to current conditions that routinely exceed EPA criteria. Merced ID has also monitored the timing, composition and abundance of Chinook salmon adult arriving at the Merced River during the fall upstream spawning migration. Merced ID also monitored the timing, composition and abundance of juvenile salmonids emigrating from the spawning reach of the river and ultimately emigrating from the river.

Spawning and incubation habitat conditions were determined to be properly functioning based on a relatively high rate of survival from egg to fry.

Fry and juvenile rearing within the natal reach of the river also appeared to be properly functioning based on the abundance of fry and juvenile Chinook salmon observed leaving the natal reach in context of the precedent spawner population.

Emigration, however, does not appear to be properly functioning based on less than 5 percent of the fish leaving the natal stream being observed ultimately leaving the river.

The apparent low survival from the upstream trap to the downstream trap was consistently low throughout the entire survey period, under varying conditions of temperature and flow, which suggests that the reason for the enormous disparity is constant regardless of timing, flow or temperature.

The juvenile rearing surveys (TM 3-7) and the adult Chinook salmon migration evaluation, as well as the RST surveys showed that large numbers of numerous fish species known to prey on juvenile Chinook salmon co-occur throughout the river throughout the emigration period. Given the breadth of the ecology of the numerous potential predators observed in the Merced River, implementing a flow or temperature scenario that would realistically reduce predation exposure and potential appears unlikely.

Again, Merced ID appreciates the opportunity to provide you with this information. As I mentioned above, each of the studies mentioned in this letter can be accessed from Merced ID's FERC relicensing website located at: <http://www.eureka-sw.com/MID/default.aspx>. Of course, if you would like assistance in retrieving this information, or if you would like hard copies of any of this information, or all of it, please let me know and I will make sure to get it to you.

If you or your staff would like to discuss any of this information further, or if you would like any additional information that you feel may be helpful to your process, please feel free to contact me either by email at bkelly@mercedid.org, or at 209-722-5761.

Very truly,



Bryan Kelly
Deputy General Manager, Water Resources