

ATTACHMENT A - DRAFT COMBINED CRITERIA TABLES

Sacramento River Inflow

<p>2013 Draft Bay Delta Conservation Plan</p>	<p>BDCP alters the hydrographs of Sacramento more than current alterations exhibit.</p> <ul style="list-style-type: none"> • Sacramento River at Rio Vista flows reduced relative to unimpaired flow (UF) hydrograph in February through June from North Delta Intakes' diversions in W and AN years. • Average annual flows will decrease from 66% of UF to 56% of UF under BDCP. (Attachment 1) 	<p>2010 US Department of Interior Delta Flow Criteria Comments</p> <ul style="list-style-type: none"> • Providing flows that mimic the natural hydrograph will benefit native fishess in the Delta and should be used in determining magnitude and timing of needed flows for Delta ecosystem (p. 55). • Mimicking the natural hydrograph may provide flow regimes that change habitat conditions to benefit native fish and flush some nonnatives out of the system (as occurred on Putah Creek, pp. 25-26). 	<p>2010 State Water Board Delta Flow Criteria Report</p> <ul style="list-style-type: none"> • "It appears to be important to preserve the general attributes of the natural hydrograph to which the various salmon runs adapted over time (p. 115)." <ul style="list-style-type: none"> • All years, April through June, 75 percent of unimpaired flow for Sacramento River at Rio Vista to benefit FRCS. (Table 21, Category A, p. 132). • To reflect natural hydrograph variation, the State Water Board recommends that, when possible, the flow criteria be expressed as a % of UF. (p. 96). 	<p>2010 CDFG Biological Objectives and Flow Criteria Report</p> <ul style="list-style-type: none"> • Inflows should generally be provided from tributaries to the Delta watershed in proportion to their contribution to unimpaired flow in order to assure connection between Delta flow and upstream tributaries. • Flows should be at levels to maintain flow paths and east-west salinity gradients through the Delta. 	<p>2010 UC Davis Expert Panel Delta Flow Criteria Comments</p> <ul style="list-style-type: none"> • California flows and flow variability should reflect and support complexity, connectivity, and variability of habitat conditions for native species (p. 5). • General seasonality, magnitudes and directions of flow in UF record important for native species (p. 8). • Minimum flow past Peripheral Canal intake (approximately Flood between Freeport and Rio Vista) should be no less than 10,000 cfs in all months of all years (Table 3, p. 19). 	<p>2008 US Fish & Wildlife Service Delta Smelt Biological Opinion</p> <p>River flow transports Delta smelt to spawning migration sites and to low salinity zone rearing habitat (p. 191).</p> <p>Delta smelt are endemic to the Bay-Delta and live only one year, so regardless of annual hydrology, Delta must provide suitable habitat all year, every year (p. 191-192).</p> <p>CVP/SWP upstream reservoir operations reduced spring flows while releases for exports and flood control storage increased late summer/fall inflows (p. 199).</p>	<p>2009 NMFS Salmonid Biological Opinion</p> <p>"The Delta has thus become a conveyance apparatus to move water from the Sacramento side...to the southwestern corner of the Delta where the CVP and SWP pumping facilities are located. The Delta has become a stable freshwater body, which is more suitable for introduced and exotic freshwater species of fish, plants, and invertebrates than for the native organisms that evolved in a fluctuating and 'unstable' Delta environment." (p. 207, see also top of page)</p>	<p>October 2009 NMFS Salmonid Recovery Plan</p> <p>Assumes actions in 2009 NMFS Salmonid Biological Opinion as it supplements D-1641.</p> <p>Two other Sac River flow criteria recommended:</p> <ul style="list-style-type: none"> • Following first autumn flows exceeding 15,000 cfs at Wilkins Slough, maintain suitable rearing and migratory habitats for emigrating WRCS through Sac River and Delta through April 30. 	<p>2009 Department of Fish and Game Incidental Take Permit</p> <p>Assumes D-1641 flow and operational criteria.</p>
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<p>BDCP effects analysis projects survival rates for winter-run, spring-run, Sacramento fall-run decreasing by 2060 (Attachment 2). BDCP reports flow-fate studies of particle-tracking models show strong positive correlation with Delta outflow for particles injected at Sutter Slough and Cache Slough (Figures C.A-162 and 167, Section 5C.A.9.1, Attachment 5C.A of Appendix 5C).</p>	<p>Lower survival of juvenile salmon associated with decreased historical flow, increased water temperature and proportion of flow diverted through Delta Cross Channel and Georgiana Slough in Delta (p. 24). Survival of hatchery smolts between Sacramento and Suisun Bay positively correlated with flow, negatively correlated with water temperatures (p. 24).</p>	<p>• For all other runs of salmon, 75 percent of unimpaired flow measured on a 14-day running average for Sacramento River at Rio Vista (Table 21, Category B, p. 132). • 7-day pulse flows at Wilkins Slough of 20,000 cfs with storm events, November through January (Table 21, Category B, p. 132).</p>	<p>Smolt survival increased in Sacramento River at Rio Vista when flows reached between 20,000 cfs and 30,000 cfs.</p>	<p>Sacramento River at Freepoint flow prescriptions: • 6 of every 10 years, October through June: 10,000 cfs for adult salmon upstream migration (Table 3, p. 19). • 6 of every 10 years, March through June: 25,000 cfs for juvenile salmon outmigration (Table 3, p. 19). • 1 of every 10 years, January through May: 70,000 cfs flow for adult sturgeon upstream migration (Table 3, p. 19).</p>	<p>River flow is the most "significantly degraded of all the primary constituent elements" of Delta smelt habitat. River flow needed for transport, rearing and adult migration activities of Delta smelt larvae, juveniles, and adults (p. 199). Outflow (80% of which is from the Sacramento River) has strong effect on distribution of YOY Delta smelt and whether they can avoid entrainment to the south Delta pumps; to move out of central and south Delta before water temperatures reach lethal levels (p. 178, 199).</p>	<p>Average Delta survival rate of FRCS smolts by water year type and 1990 level of development: W = 0.83; AN = 0.61; BN = 0.41; D = 0.33; C = 0.12; Mean = 0.46. (Table 6-33, p. 384) Survival rates less now than in 1990 level of development estimates due to increasing upstream demands (p. 385). Acoustic tagging studies verify that survival is lower in interior Delta channels and that higher flows benefit salmonid survival downstream migration (p. 378)</p>	<p>• Provide pulse flows of at least 20,000 cfs measured at Freepoint periodically during WRCS emigration season to facilitate outmigration past Chippis Island (i.e., December through April).</p>	

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<p>BDCP projects over 80 to 90% of Sutter Slough-injected Sacramento River particles passing Chippis when Delta outflow exceeds 20,000 cfs and over 70 to 80% of Cache Slough/Liberty Island particles passing Chippis Island at flows of 20,000 cfs or greater (Figures C.A-162 and 167, p. 279 and 283, Attachment 5C.A, Appendix 5C of Chapter 5 Effects Analysis). Temperature findings here.</p>	<p>• Positive flows of 13,000 to 17,000 cfs, November through June below Freeport for outmigrating juvenile salmon to avoid Georgiana Slough entry (Table 21, Category B, p. 132). • Smolt survival increased with increasing Sacramento River flow at Rio Vista, with maximum survival observed at or above about 20,000 and 30,000 cfs from April through June (p. 53, 114).</p>	<p>• 7-day pulse flows at Wilkins Slough of 20,000 cfs with storm events until monitoring shows that most salmon smolts have emigrated, November through January (Table 15, p. 106). • Positive flows of 13,000 to 17,000 cfs, November through June below Freeport to help outmigrating juvenile salmon avoid Georgiana Slough entry (Table 15, p. 106).</p>	<p>• Sac River annual inflows reduced by 26% annually between 1986-2005 (p. 11). • To prevent bidirectional flows up the Sac River on food tides, 10,000 cfs min flow recommended when exports occurring at a peripheral conveyance (p. 18). • For sturgeon, 70,000 cfs could happen through natural reservoir spills in wet years. Flows could be reduced with Fremont Weir notch and ops (p. 18).</p>	<p>Delta smelt larvae <20 mm at great risk of entrainment, and not measured at either louvers or collection screens. Outflow (80% from Sac R) affects position of adult spawners relative to hydrodynamic influence of CVP/SWP diversions.</p>	<p>When Delta Cross Channel (DCC) gates are open, about 45 percent of Freeport flow is redirected into Delta interior through the DCC and Georgiana Slough. When DCC gates are closed, flows through it are prevented, and more water remains in the Sac River channel, increasing flows in Sutter and Steamboat Slough upstream of the DCC. (p. 213) Sac River loses about 15 to 20% of its flow to Georgiana Slough and the interior Delta. (p. 213)</p>	<p>When Delta Cross Channel (DCC) gates are open, about 45 percent of Freeport flow is redirected into Delta interior through the DCC and Georgiana Slough. When DCC gates are closed, flows through it are prevented, and more water remains in the Sac River channel, increasing flows in Sutter and Steamboat Slough upstream of the DCC. (p. 213) Sac River loses about 15 to 20% of its flow to Georgiana Slough and the interior Delta. (p. 213)</p>	<p>When Delta Cross Channel (DCC) gates are open, about 45 percent of Freeport flow is redirected into Delta interior through the DCC and Georgiana Slough. When DCC gates are closed, flows through it are prevented, and more water remains in the Sac River channel, increasing flows in Sutter and Steamboat Slough upstream of the DCC. (p. 213) Sac River loses about 15 to 20% of its flow to Georgiana Slough and the interior Delta. (p. 213)</p>	<p>When Delta Cross Channel (DCC) gates are open, about 45 percent of Freeport flow is redirected into Delta interior through the DCC and Georgiana Slough. When DCC gates are closed, flows through it are prevented, and more water remains in the Sac River channel, increasing flows in Sutter and Steamboat Slough upstream of the DCC. (p. 213) Sac River loses about 15 to 20% of its flow to Georgiana Slough and the interior Delta. (p. 213)</p>

