

CFW H3+ Operations Criteria **REVISED**

The Table included below summarizes the new and existing water operations criteria for CFW H3+ operational scenario adopted in the July 2017 CFW Certified Final EIR (SWRCB-109, SWRCB-108). This information is also found within Table 3.3-1 located in Revised BA (DWR-1142), Table 3.3-1 of NMFS CFW BO Appendix A2 (SWRCB-106), and Table 6.1-2 in the USFWS CFW BO (SWRCB-105).

The exact definition of the CFW H3+ spring outflow criteria is provided in the Section 5.3.2.3.2 *Effects of Spring Outflow* of the CFW ITP application (DWR-1036 page 5-28). The Table below reflects the CFW H3+ spring outflow criteria that was proposed, modeled, adopted by DWR in the Certified Final EIR, and included in the NMFS CFW BO and USFWS CFW BO.

Parameter	Criteria	Source of the Criteria
New Criteria Included in the Proposed Action		
North Delta bypass flows ²⁸	<ul style="list-style-type: none"> • Bypass Flow Criteria (specifies bypass flow required to remain downstream of the North Delta intakes): <ul style="list-style-type: none"> ○ October, November: Minimum flow of 7,000 cfs required in river after diverting at the North Delta intakes. ○ December through June: see below ○ July, August, September: Minimum flow of 5,000 cfs required in river after diverting at the North Delta intakes. • Pulse Protection: <ul style="list-style-type: none"> ○ Low-level pumping of up to 6% of total Sacramento River flow at Freeport such that bypass flow never falls below 5,000 cfs. No more than 300 cfs can be diverted at any one intake. ○ Low level pumping maintained during the pulse protection period. ○ Pulse is determined based on the real-time monitoring of juvenile fish movement as described in Section 3.3.3.1 <i>North Delta Diversion</i> ○ If the initial pulse begins and ends before Dec 1, the bypass flow criteria for 	<ul style="list-style-type: none"> • New operational criteria used in CFW H3+ • These criteria are included within the NMFS and USFWS biological opinions, and CDFW Incidental Take Permit for California WaterFix • CalSim II assumptions included in DWR-1069 Table 2 and Sub-Table A

²⁷ In coordination with NMFS, USFWS, and CDFW, several updates to CFW operational criteria were made during the ESA and CESA consultation processes. An analysis was performed (model results submitted to USFWS on 5/5/17) to determine if the updated operational criteria would result in additional effects outside of those analyzed in this BA. The modeling results confirmed the effects of the operational updates are within the range analyzed in the BA. As a result, the PA effects analysis in Chapters 5 and 6 are representative of potential project effects and no additional analysis is necessary.

²⁸ Sacramento River flow upstream of the intakes to be measured flow at Freeport. Bypass flow is the Sacramento River flow quantified downstream of the Intake # 5. Sub-daily north Delta intakes' diversion operations will maintain fish screen approach and sweeping velocity criteria

Parameter	Criteria	Source of the Criteria
	<p>the month (Oct-Nov) when the pulse occurred would take effect. On Dec 1, the Level 1 rules defined below apply unless a second pulse occurs.</p> <ul style="list-style-type: none"> • Post-pulse Criteria (specifies bypass flow required to remain downstream of the North Delta intakes): <ul style="list-style-type: none"> ○ December through June: once the pulse protection ends, post-pulse bypass flow operations will not exceed Level 1 pumping unless specific criteria have been met to increase to Level 2 or Level 3. If those criteria are met, operations can proceed as defined in Table 3.3-2. Allowable diversion will be greater of the low-level pumping or the diversion allowed by the post-pulse bypass flow rules in Table 3.3-2. The specific criteria for transitioning between and among pulse protection, Level 1, Level 2, and/or Level 3 operations, will be developed and based on real-time fish monitoring and hydrologic/behavioral cues upstream of and in the Delta as discussed in Section 3.3.3.1, <i>North Delta Diversion</i>. During operations, adjustments to the default allowable diversion level specified in Table 3.3-2 are expected to be made to improve water supply and/or migratory conditions for fish by making real-time adjustments to the diversion levels at the north Delta intakes. These adjustments are expected to fall within the operational bounds analyzed for the BA and will be managed under real time operations (RTOs). 	

<p>South Delta operations^{29 30}</p>	<ul style="list-style-type: none"> • October, November³²: To be determined based on real time operations and protection of the D-1641 San Joaquin River 2-week pulse. • December: OMR flows will not be more negative than an average of -5,000 cfs when the Sacramento River at Wilkins Slough pulse (same as north Delta diversion bypass flow pulse defined in Table 3.3-2) triggers³¹, and no more negative than an average of -2,000 cfs when the delta smelt USFWS (2008) BiOp action 1 triggers. No OMR flow restriction prior to the Sacramento River pulse or delta smelt action 1 triggers. 	<ul style="list-style-type: none"> • New operational criteria used in CWF H3+ • These criteria are included within the NMFS and USFWS biological opinions, and CDFW Incidental Take Permit for California WaterFix • CalSim II assumptions included in DWR-1069 Tables 3 and 4
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²⁹ The criteria do not fully reflect the complexities of CVP/SWP operations, dynamic hydrology, or spatial and temporal variation in the distribution of aquatic species. As a result, the criteria will be achieved by operating within an initial range of real time operational criteria from January through March and in June. This initial range, including operational triggers, will be determined through future discussion, including a starting point of -1250 to -5000 cfs based on a 14-day running average, and will be informed by the Adaptive Management Program, including real time monitoring. Further, the 3-day averaging period may be modified through future discussion. Modifications to the 3-day average period and the range of operating criteria may be needed, in part, because: 1) the water year type is forecasted in February but not finalized until May and 2) 0 cfs, or positive, OMR in wet and above normal years may be attained coincident with unimpaired flows.

³⁰ OMR measured through the currently proposed index-method (Hutton 2008) with a 14-day averaging period consistent with the current operations (USBR 2014).

³¹ December Sacramento River pulse determined by flow increases at Wilkins Slough of greater than 45% within 5- day period and exceeding 12,000 cfs at the end of 5-day period, and real-time monitoring of juvenile fish movement. Preliminary discussions with engineers indicates ramping down can begin within an hour of the trigger and full ramp down could be complete within approximately 12 hours. The Wilkins Slough trigger will be reviewed through future discussion, which will be informed by the Adaptive Management Program, including real time monitoring.

³² As a result of formal consultation with USFWS and NMFS, and as a result of DFW's issuance of the Draft 2081(b) ITP, DWR and Reclamation have included clarifications to the CWF operations flow criteria contained in Table 3.3-1 table. Although the October/November south Delta operational criteria were updated for the PA (see criteria described in the left column), for CALSIM modeling purposes in the effects analysis for the BA, the operational criteria listed here were used in the PA scenario to compare against the NAA, which has no OMR flow restrictions in October or November. As described in footnote 27, an analysis (model results submitted to USFWS on 5/5/17) was performed which indicated that the effects of the updated operational criteria are consistent with the effects analyzed in this BA; therefore, it was determined no changes to the CALSIM II modeling assumptions or performance of additional analysis was necessary.

Parameter	Criteria	Source of the Criteria
	<ul style="list-style-type: none"> • January, February ³³: OMR flows will not be more negative than a 3-day average of 0 cfs during wet years, -3,500 cfs during above-normal years, or -4,000 cfs during below-normal to critical years, except -5,000 in January of dry and critical years. • March ³⁴: OMR flows will not be more negative than a 3-day average of 0 cfs during wet or above-normal years or -3,500 cfs during below-normal and dry year and -3,000 cfs during critical years. • April, May ³⁵: Allowable OMR flows depend on gaged flow measured at Vernalis, and will be determined by a linear relationship. If Vernalis flow is below 5,000 cfs, OMR flows will not be more negative than -2000 cfs. If Vernalis is 6,000 cfs, OMR flows will not be less than +1000 cfs. If Vernalis is 10,000 cfs, OMR flows will not be less than +2,000 cfs. If Vernalis is 15,000 cfs, OMR flows will not be less than +3,000 cfs. If Vernalis is at or exceeds 30,000 cfs, OMR flows will not be less than 6,000 cfs. • June: Similar to April and May, allowable flows depend on gaged flow measured at Vernalis (except without interpolation). If Vernalis is less than 3,500 cfs, OMR flows will not be more negative than -3,500 cfs. If Vernalis exceeds 3,500 cfs up to 10,000 cfs, OMR flows will not be less than 0 cfs. If Vernalis exceeds 10,000 cfs up to 15,000 cfs, OMR flows will not be less than +1,000 cfs. If Vernalis exceeds 15,000 cfs, OMR flows will not be less than +2,000 cfs. • July, August, September: No OMR flow constraints ³⁶. • OMR criteria under 2008 USFWS and 2009 NMFS BiOps or the above, whichever results in 	<ul style="list-style-type: none"> • New operational criteria used in CWF H3+ • These criteria are included within the NMFS and USFWS biological opinions, and CDFW Incidental Take Permit for California WaterFix • CalSim II assumptions included in DWR-1069 Tables 3 and 4

³³ Water year type based on the Sacramento 40-30-30 index to be based on 50% forecast per current approaches; the first update of the water year type to occur in February. CALSIM II modeling uses previous water year type for October through January, and the current water year type from February onwards

³⁴ Water year type as described in the above footnote.

³⁵ When OMR target is based on Vernalis flow, will be a function of 5-day average measured flow.

³⁶ The PA operations include a preference for south Delta pumping in July through September months to provide limited flushing flows to manage water quality in the south Delta.

Parameter	Criteria	Source of the Criteria
	more positive, or less negative OMR flows, will be applicable ³⁷ .	
HOR gate operations	<ul style="list-style-type: none"> • October 1–November 30: RTO management – with the current expectation being that the HOR gate will be operated to protect the D- 1641 pulse flow. • January-March 31, and June 1-15: RTO will determine exact operations to protect salmon fry when migrating. During this migration, operation will be to close the gate subject to RTO for purposes of water quality, stage, and flood control considerations. • April-May: Initial operating criterion will be to close the gate 100% of time subject to RTO for purposes of water quality, stage, and flood control considerations (Section 3.3.3, <i>Real-Time Operational Decision-Making Process</i>). Reclamation, DWR, NMFS, USFWS, and DFW will actively explore the implementation of reliable juvenile salmonid tracking technology that may enable shifting to a more flexible real time operating criterion based on the presence/absence of listed fishes. • June 16 to September 30, December: Operable gates will be open. 	<ul style="list-style-type: none"> • New operational criteria used in CWF H3+ • These criteria are included within the NMFS and USFWS biological opinions, and CDFW Incidental Take Permit for California WaterFix • CalSim II assumptions included in DWR-1069 Table 1

³⁷ Change in CVP/SWP pumping from the south Delta will occur to comply with OMR targets and will be achieved to the extent exports can control the flow. The OMR targets would not be achieved through releases from CVP/SWP reservoirs. The combined CVP/SWP export rates from the proposed north Delta intakes and the existing south Delta intakes will not be required to drop below 1,500 cfs to provide water supply for health and safety needs, critical refuge supplies, and obligation to senior water rights holders.

Parameter	Criteria	Source of the Criteria
Spring Outflow	<p>March, April, May: Initial operations will maintain the March–May average delta outflow that would occur with existing facilities under the operational criteria described in the 2008 USFWS BiOp and 2009 NMFS BiOp (U.S. Fish and Wildlife Service 2008; National Marine Fisheries Service 2009).³⁹</p> <p>Consistent with description provided in the Section 5.3.2.3.2 <i>Effects of Spring Outflow</i> of the CWF 2081(b) ITP application (DWR-1036), March outflow targets are determined based on the Eight River Index and achieve the targets with export curtailments down to a minimum of 1,500-cfs exports; the March outflow target is capped at 44,500 cfs at an Eight River Index of 4,217 TAF and greater (Table 5.3-1 of the CWF 2081(b) ITP application and Table 6.1-4 of USFWS CWF BiOp). For Apr-May, the 2009 NMFS BiOp action IV.2.1 (San Joaquin River i-e ratio) will be used to constrain total Delta exports per current operational practices, up to a maximum outflow target of 44,500 cfs (National Marine Fisheries Service 2009).</p>	<ul style="list-style-type: none"> • New operational criteria used in CWF H3+ • Further modified in CDFW Incidental Take Permit for California WaterFix Condition of Approval 9.9.4.3; and, subject to the clarification letter provided by CDFW to DWR dated Oct 18, 2017 (https://www.waterboards.ca.gov/waterights/water_issues/programs/bay_delta/california_waterfix/exhibits/exhibit107/docs/20171018cdfw_clarificationmemo.pdf). • CalSim II assumptions included in DWR-1069 Tables 1 and 6
Key Existing Delta Criteria ⁴⁰ (CalSim II assumptions included in DWR-1142 Appendix 5A Section 5.A.5.2)		
Delta Cross Channel Gates	<ul style="list-style-type: none"> • Operating criteria as required by NMFS (2009) BiOp Action IV.1 and D-1641, and DCC closure for downstream flood control will be based on Sacramento River flow at Freeport, upstream of the NDD facilities. 	<ul style="list-style-type: none"> • Existing D-1641 and 2009 NMFS BiOp Action IV.1 requirements. • Existing criteria related to DCC closure for scouring concerns at high Sacramento River flows measured upstream of the NDD facilities, at Freeport gage. • These criteria are included within the NMFS and USFWS biological opinions, and CDFW Incidental Take Permit for California WaterFix
Fall Outflow	<ul style="list-style-type: none"> • No change. September, October, November: implement the USFWS 2008 BO Fall X2 requirements in wet (W) and above normal (AN) year types. 	<ul style="list-style-type: none"> • Existing 2008 USFWS BiOp “Action 4: Estuarine Habitat During Fall” (Fall X2) requirements (U.S. Fish and Wildlife Service 2008). • These criteria are included within the NMFS and USFWS biological opinions, and CDFW Incidental Take Permit for California WaterFix

³⁹If best available science resulting from collaborative scientific research program shows that Longfin Smelt abundance can be maintained in the absence of spring outflow, and DFW concurs, an alternative operation for spring outflow could be developed to follow flow constraints established under D-1641. Any changes in the PA will be implemented consistent with the CWF AMP, including coordination with USFWS and NMFS

⁴⁰ All the CALSIM II modeling assumptions are described in Appendix 5.A, *CALSIM Methods and Results*.

Parameter	Criteria	Source of the Criteria
Winter and summer outflow	<ul style="list-style-type: none"> No change. Flow constraints established under D-1641 will be followed if not superseded by criteria listed above. 	<ul style="list-style-type: none"> Existing SWRCB D-1641 Delta outflow and February – June X2 criteria. These criteria are included within the NMFS and USFWS biological opinions, and CDFW Incidental Take Permit for California WaterFix
Rio Vista minimum flow standard ⁴¹	<ul style="list-style-type: none"> September through December: flows per D-1641 	<ul style="list-style-type: none"> Existing D-1641 Criteria These criteria are included within the NMFS and USFWS biological opinions, and CDFW Incidental Take Permit for California WaterFix
Export to inflow ratio	<ul style="list-style-type: none"> Operational criteria are the same as defined under D-1641, and applied as a maximum 3-day running average. The D-1641 export/inflow (E/I) ratio calculation was largely designed to protect fish from south Delta entrainment. For the PA, Reclamation and DWR propose that the NDD be excluded from the E/I ratio calculation. In other words, Sacramento River inflow is defined as flows downstream of the NDD and only south Delta exports are included for the export component of the criteria. 	<ul style="list-style-type: none"> Existing D-1641 Criteria Combined export rate is defined as the diversion rate of the Banks Pumping Plant and Jones Pumping Plant from the south Delta channels. Delta inflow is defined as the sum of the Sacramento River flow downstream of the proposed north Delta diversion intakes, Yolo Bypass flow, Mokelumne River flow, Cosumnes River flow, Calaveras River flow, San Joaquin River flow at Vernalis, and other miscellaneous in-Delta flows. These criteria are included within the NMFS and USFWS biological opinions, and CDFW Incidental Take Permit for California WaterFix

⁴¹ Rio Vista minimum monthly average flow in cfs (7-day average flow not be less than 1,000 below monthly minimum), consistent with the SWRCBD-1641

Table 3.3-2. Proposed North Delta Diversion Bypass Flow Requirements (These criteria are included within the NMFS and USFWS biological opinions, and CDFW Incidental Take Permit for California WaterFix) (CalSim II assumptions included in DWR-1069 Table 2 and Sub-Table A)

<i>Dual Conveyance Scenario with 9,000 cfs North Delta Diversion (includes Intakes 2, 3 and 5 with a maximum diversion capacity of 3,000 cfs at each intake)</i>
<p>1. North Delta Diversion Bypass Flows</p> <p>These parameters define the criteria for modeling purposes and provide the real-time operational criteria levels as operations move between and among the levels. Actual operations will be based on real-time monitoring of hydrologic conditions and fish presence/movement as described in Section 3.3.3.1, <i>North Delta Diversions</i>.</p>
<p><u>Low-Level Pumping (Dec-Jun)</u></p> <p>Diversions of up to 6% of total Sacramento River flow such that bypass flow never falls below 5,000 cfs. No more than 300 cfs can be diverted at any one intake.</p>
<p><u>Initial Pulse Protection</u></p> <p>Low level pumping as described in Table 3.3-1 will be maintained through the initial pulse period. For modeling, the initiation of the pulse is defined by the following criteria: (1) Sacramento River flow at Wilkins Slough increasing by more than 45% within a five-day period and (2) flow on the fifth day greater than 12,000 cfs.</p> <p>The pulse (and low-level pumping) continues until either (1) Sacramento River flow at Wilkins Slough returns to pre-pulse flow level (flow on first day of pulse period), or (2) Sacramento River flow at Wilkins Slough decreases for 5 consecutive days, or (3) Sacramento River flow at Wilkins Slough is greater than 20,000 cfs for 10 consecutive days.</p> <p>After pulse period has ended, operations will return to the bypass flow table (Sub-Table A).</p> <p>If the initial pulse period begins and ends before Dec 1st in the modeling, then any second pulse that may occur before the end of June will receive the same protection, i.e., low level pumping as described in Table 3.3-1.</p>
<p><u>Post-Pulse Operations</u></p> <p>After initial pulse(s), allowable diversion will go to Level I Post-Pulse Operations (see Sub-Table A) until 15 total days of bypass flows above 20,000 cfs occur. Then allowable diversion will go to the Level II Post-Pulse Operations until 30 total days of bypass flows above 20,000 cfs occur. Then allowable diversion will go to the Level III Post-Pulse Operations.</p>
<p>Sub-Table A. Post-Pulse Operations for North Delta Diversion Bypass Flows</p>
<p>Implement following bypass flow requirements sufficient to minimize any increase in the upstream tidal transport at two points of control: (1) Sacramento River upstream of Sutter Slough and (2) Sacramento River downstream of Georgiana Slough. These points are used to minimize any increase in upstream transport toward the proposed intakes or into Georgiana Slough.</p> <p>Allowable diversion will be greater of the low-level pumping or the diversion allowed by the following bypass flow rules.</p>

Level I Post-Pulse Operations			Level II Post-Pulse Operations			Level III Post Pulse Operations		
If Sacramento River flow is over...	But not over...	The bypass is...	If Sacramento River flow is over...	But not over...	The bypass is...	If Sacramento River flow is over...	But not over...	The bypass is...
Dec–Apr								
0 cfs	5,000 cfs	100% of the amount over 0 cfs	0 cfs	5,000 cfs	100% of the amount over 0 cfs	0 cfs	5,000 cfs	100% of the amount over 0 cfs
5,000 cfs	15,000 cfs	Flows remaining after constant low level pumping	5,000 cfs	11,000 cfs	Flows remaining after constant low level pumping	5,000 cfs	9,000 cfs	Flows remaining after constant low level pumping
15,000 cfs	17,000 cfs	15,000 cfs plus 80% of the amount over 15,000 cfs	11,000 cfs	15,000 cfs	11,000 cfs plus 60% of the amount over 11,000 cfs	9,000 cfs	15,000 cfs	9,000 cfs plus 50% of the amount over 9,000 cfs
17,000 cfs	20,000 cfs	16,600 cfs plus 60% of the amount over 17,000 cfs	15,000 cfs	20,000 cfs	13,400 cfs plus 50% of the amount over 15,000 cfs	15,000 cfs	20,000 cfs	12,000 cfs plus 20% of the amount over 15,000 cfs
20,000 cfs	no limit	18,400 cfs plus 30% of the amount over 20,000 cfs	20,000 cfs	no limit	15,900 cfs plus 20% of the amount over 20,000 cfs	20,000 cfs	no limit	13,000 cfs plus 0% of the amount over 20,000 cfs
May								
0 cfs	5,000 cfs	100% of the amount over 0 cfs	0 cfs	5,000 cfs	100% of the amount over 0 cfs	0 cfs	5,000 cfs	100% of the amount over 0 cfs
5,000 cfs	15,000 cfs	Flows remaining after constant low level pumping	5,000 cfs	11,000 cfs	Flows remaining after constant low level pumping	5,000 cfs	9,000 cfs	Flows remaining after constant low level pumping
15,000 cfs	17,000 cfs	15,000 cfs plus 70% of the amount over 15,000 cfs	11,000 cfs	15,000 cfs	11,000 cfs plus 50% of the amount over 11,000 cfs	9,000 cfs	15,000 cfs	9,000 cfs plus 40% of the amount over 9,000 cfs

Level I Post-Pulse Operations			Level II Post-Pulse Operations			Level III Post Pulse Operations		
If Sacramento River flow is over...	But not over...	The bypass is...	If Sacramento River flow is over...	But not over...	The bypass is...	If Sacramento River flow is over...	But not over...	The bypass is...
17,000 cfs	20,000 cfs	16,400 cfs plus 50% of the amount over 17,000 cfs	15,000 cfs	20,000 cfs	13,000 cfs plus 35% of the amount over 15,000 cfs	15,000 cfs	20,000 cfs	11,400 cfs plus 20% of the amount over 15,000 cfs
20,000 cfs	no limit	17,900 cfs plus 20% of the amount over 20,000 cfs	20,000 cfs	no limit	14,750 cfs plus 20% of the amount over 20,000 cfs	20,000 cfs	no limit	12,400 cfs plus 0% of the amount over 20,000 cfs
Jun								
0 cfs	5,000 cfs	100% of the amount over 0 cfs	0 cfs	5,000 cfs	100% of the amount over 0 cfs	0 cfs	5,000 cfs	100% of the amount over 0 cfs
5,000 cfs	15,000 cfs	Flows remaining after constant low level pumping	5,000 cfs	11,000 cfs	Flows remaining after constant low level pumping	5,000 cfs	9,000 cfs	Flows remaining after constant low level pumping
15,000 cfs	17,000 cfs	15,000 cfs plus 60% of the amount over 15,000 cfs	11,000 cfs	15,000 cfs	11,000 cfs plus 40% of the amount over 11,000 cfs	9,000 cfs	15,000 cfs	9,000 cfs plus 30% of the amount over 9,000 cfs
17,000 cfs	20,000 cfs	16,200 cfs plus 40% of the amount over 17,000 cfs	15,000 cfs	20,000 cfs	12,600 cfs plus 20% of the amount over 15,000 cfs	15,000 cfs	20,000 cfs	10,800 cfs plus 20% of the amount over 15,000 cfs
20,000 cfs	no limit	17,400 cfs plus 20% of the amount over 20,000 cfs	20,000 cfs	no limit	13,600 cfs plus 20% of the amount over 20,000 cfs	20,000 cfs	no limit	11,800 cfs plus 0% of the amount over 20,000 cfs

Level I Post-Pulse Operations			Level II Post-Pulse Operations			Level III Post Pulse Operations		
If Sacramento River flow is over...	But not over...	The bypass is...	If Sacramento River flow is over...	But not over...	The bypass is...	If Sacramento River flow is over...	But not over...	The bypass is...
Bypass flow requirements in other months:								
If Sacramento River flow is over...			But not over...			The bypass is...		
Jul-Sep								
0 cfs			5,000 cfs			100% of the amount over 0 cfs		
5,000 cfs			No limit			A minimum of 5,000 cfs		
Oct-Nov								
0 cfs			7,000 cfs			100% of the amount over 0 cfs		
7,000 cfs			No limit			A minimum of 7,000 cfs		