

State Water Project Incidental Take Permit Risk Assessment for Winter-run and Spring-run Chinook Salmon

Section 1: Overview

Date: 2/9/2021

Life Stages Present:

Winter-run Chinook Salmon (juvenile)

Winter-run Chinook Salmon (adult)

Spring-run Chinook Salmon (juvenile)

Advice to WOMT:

No advice is warranted.

The 2020 SWP Incidental Take Permit (ITP) Conditions of Approval (COA) for salmonids are unlikely to control exports for the week beginning 2/8/2021.

Although SaMT projects the potential for the first natural origin winter-run Chinook salmon (WR) or hatchery WR salvage to occur this week, SaMT does not anticipate a COA 8.6.1 (WR Single-year Loss Threshold) to be triggered. No natural origin WR or hatchery WR salvage has occurred during this Old and Middle River (OMR) management season (See Appendix 2 Salvage Data). Although possible, SaMT does not anticipate COA 8.6.3 (Mid- and Late-season Natural WR Daily Loss Threshold) to be triggered this week due to the current estimated distribution and life stages of WR and forecasted export operations. COA 8.6.4 (Daily Spring-run Chinook Salmon [SR] Hatchery Surrogate Loss Threshold) began 2/1/2021. However, no SR hatchery surrogate releases have occurred, and none are scheduled for the upcoming week.

Projected Meteorology, Hydrology, and Water Operation:

Mountain showers are expected late Monday night (2/8/2021) into Tuesday (2/9/2021) with widespread precipitation possible later in the week and into the weekend. The current system lacks significant moisture, and snow elevations are expected to be high. Beyond Thursday (2/11/2021) the forecast is uncertain. The current forecast calls for roughly 6 to 12 inches of snow for most locations and up to 2 feet for the highest ridges, for areas like Lassen National Park. In terms of rain, the Central Valley is forecast to see between 0.25 to 1.0 inches of rain, while the foothills range from about 0.40 to 2.0 inches of precipitation. The projected timing and amounts of precipitation may change as the forecast becomes more certain. There is even less certainty for the weekend but there is potential for additional precipitation from late Friday into Sunday (2/12-2/14/2021). These events are not projected to significantly affect overall hydrology and operations but may provide migration cues for salmonids.

The OMR daily index values are projected to be at or below the base level OMR flow requirement of -5,000 cfs under COA 8.3 (Onset of OMR Management) which has been in effect since 1/1/2021. Delta outflow under D-1641 is likely to control State Water Project (SWP) and Central Valley Project (CVP) operations for the week. DCC Gates are closed and anticipated to remain closed through mid-May 2021 as described in the PA and D-1641.

Projections at key locations are as follows:

- Freeport 10,000 to 16,000 cfs,
- Vernalis 1,100 to 1,600 cfs,
- Delta outflow index 7,000 to 10,000 cfs,
- Combined exports 3,650 to 6,400 cfs,
- Tracy 1,650 to 2,500 cfs,
- CCF 2,000 to 4,500 cfs, and
- OMR -3,000 to -5,000 cfs.

Note that flows are currently receding from the higher range toward the lower range of projected values as the flow pulse from the recent precipitation event recedes.

Salmonid Monitoring Data and Estimated Distribution:

For the previous week, the salmonid detection data from upstream to downstream monitoring stations are as follows (preliminary subject to revision): 2/6-2/8): 284 fall-run (FR), 6 SR, 2 WR, 2 WR adipose fin clipped (ad-clip); Tisdale RST (2/2-2/27): 1,636 FR, 1 late fall-run (LFR), 3 LFR ad-clip, 26 SR, 1 SR ad-clip, 23 WR, 64 WR ad-clip, 3 steelhead (SH) ad-clip; Knights Landing RST (2/2-2/8): 680 FR, 59 FR ad-clip, 14 SR, 5 SR ad-clip, 12 WR, 10 WR ad-clip, 2 SH ad-clip; Beach Seines (not sampled); Sacramento Trawl (1/31-2/2, 2/4-2/5): 145 FR, 2 SR, 1 CHN ad-clip, 1 SH, 14 SH ad-clip; Salvage (2/1-2/7): 4 FR, 12 LFR ad-clip, 4 SR ad-clip (San Joaquin River Restoration Program release), 12 SH ad-clip; and Chippis Island Trawl (1/31-2/2, 2/4): 2 LFR, 8 CHN ad-clip, 5 SH ad-clip.

SaMT estimates that 15-40% of the natural origin juvenile WR population has yet to enter the Delta, 60-85% are present in the Delta, and 0% have exited the Delta past Chippis Island. SaMT estimates that 95% of the Livingston Stone National Fish Hatchery (LSNFH) hatchery WR release have yet to enter the Delta, 5% are present in the Delta, and 0% have exited the Delta past Chippis Island.

SaMT estimates that 55-65% of the natural origin young-of-year SR population has yet to enter the Delta, 35-45% are present in the Delta, and 0% have exited past Chippis Island. There is uncertainty with projecting SR distribution due to low detection at the upriver, mid-river, and Delta sampling locations.

These estimated WR distributions are generally within the range of historic migration for natural origin WR and SR averaged over the period from brood year (BY) 2011 through BY 2019 as reported on SacPAS (<http://www.cbr.washington.edu/sacramento/>; Table 3). Table 3 also indicates that, while natural origin WR have not yet been salvaged, this week is within the known period for salvage to occur. Based on BYs 2011-2019, 31.5% of the average annual WR salvage (95% CI of 9.1%-50.4%) is estimated to have occurred by 2/7. For SR 0% of the average annual salvage is estimated to have occurred by 2/7.

Risk Assessment:

Winter-run Chinook Salmon:

Based on the current in-Delta distribution of juvenile WR, seasonal timing, and hydrological conditions forecasted over the next week, the overall risk of WR entrainment into the central Delta is still considered medium. The increase in exposure as WR move into and through the Delta is balanced by higher river flows at Freeport on the Sacramento River, which provide favorable routing conditions to the west Delta. While SaMT expects exports to increase slightly then drop, resulting in relatively stable OMRI, SaMT anticipates a medium

risk of routing into the south Delta towards the export facilities for fish already present in the central and south Delta. SaMT projects that the first salvage of natural origin WR and hatchery WR may occur this week. However, the risk of exceeding a JPE scaled WR daily loss threshold remains in the low category based on the low numbers of natural origin WR and older juvenile Chinook salmon believed to be in the central and south Delta. The overall WR entrainment risk remains medium.

Note that the final winter-run juvenile production estimate (JPE) for both natural WR (330,130 fish) and hatchery produced WR (97,888 fish) estimated to survive and enter the Delta has been approved by NMFS and CDFW and will be in effect for the remainder of the OMR management season. The COA 8.6.1 (WR Single-year Loss Threshold) threshold is 3,862 natural origin WR (50% threshold: 1,932 WR; 75% threshold: 2,897 WR) and 117 for LSNFH released WR (50% threshold: 59; 75% threshold: 88) released on 1/30/2021. The COA 8.6.3 (Mid- and Late-season Natural WR Daily Loss Threshold) daily threshold for February is 32.71 unclipped older juvenile Chinook salmon.

Spring-run Chinook Salmon:

Based on monitoring data, hydrological conditions, and seasonal timing, the SaMT estimates an overall low risk of entrainment for young-of-year SR into the interior Delta from the Sacramento River as well as an overall low risk of entrainment at the facilities. The distribution of SR into the Delta has increased as evidenced by detection at the sampling stations and is likely due to increased flow and turbidity. These same hydrologic conditions also provide conditions that are more favorable for western Delta routing through the Sacramento River, which balance the risk of routing into the central and south Delta. As previously mentioned, COA 8.6.4 (Daily SR Hatchery Surrogate Loss Threshold) began Monday, 2/1/2021. However, no SR hatchery surrogate releases are scheduled to occur over the next week; and thus, this condition will not control export operations this week. Historic salvage patterns from BY 2011-2019 (Table 3) indicate that 0% of annual SR salvage has occurred by 2/7.

Beginning on 10/21/2020, flows in Mill Creek have been greater than 95 cfs indicating river conditions that are consistent with downstream movement of yearling SR out of the tributaries and into the mainstem upper Sacramento River. Flows were also greater than 95 cfs in Deer Creek this week and have been since 12/26/2020. Monitoring in Butte Creek indicates young-of-year and yearling SR are moving downstream in this tributary towards the Sacramento River. Note that that three releases of brood year 2020 late fall-run Chinook salmon that function as surrogates for yearling SR have been made to date. These surrogates help to inform distribution of natural yearling SR within the Sacramento River and Delta systems. The yearling SR surrogates were released from the Coleman National Fish Hatchery into Battle Creek on 1/8/2021, 1/22/2021, and 1/29/2021, with a cumulative total of 189,076 fish. These fish have distributed throughout the system and have been detected in all the sampling stations indicating that there is risk of entrainment for natural origin yearling SR; however, there are no specific COAs for yearling SR in the SWP ITP.

Section 1-A: Sacramento River and Confluence

Assessment of risk of entrainment into the central Delta for WR and SR in the Sacramento River: (8.1.5.1 C ii, iii, iv and 8.1.5.1 B iii)

- Exposure Risk:
 - WR: Medium
 - SR: Low

- Routing Risk:
 - WR: Medium
 - SR: Medium
- Overall Entrainment Risk:
 - WR: Medium
 - SR: Low
- Change in risk of entrainment into the central Delta (increased/decreased risk compared to last week):
 - WR: Exposure risk is similar to last week based on the estimated percentage of the population expected to be in the Delta and is still considered to be medium this week. Currently, 60-85% of the juvenile natural origin WR population and 5% of hatchery WR are estimated to be present in the Delta. Precipitation this week may provide emigration cues for WR and SR. Routing risk is medium. Based on the current in-Delta distribution, seasonal timing, and forecast operations, overall risk of entrainment for juvenile WR into the central Delta is medium.
 - SR: Exposure risk remains similar to last week based on low numbers of juvenile SR in the mainstem Sacramento River system and their distribution primarily upstream of Knights Landing. Currently, 35-45% of the young-of-year SR population is estimated to be present in the Delta this week. Precipitation events as described above may increase SR distribution into the Delta. However, exposure risk is estimated to remain low based on current population distribution estimates. Routing risk for SR is similar to the effects described for WR based on forecasted Sacramento River flows at Freeport, resulting in a medium risk level. Based on the current in-Delta distribution, seasonal timing, and forecasted operations, overall risk of entrainment for juvenile SR into the central Delta remains low.

Section 1-B: Facilities Risk

CVP/SWP facilities entrainment risk for WR and SR in the central Delta over the next week (8.1.5.1 D iii, iv, v)

- Exposure Risk:
 - WR: Medium
 - SR: Low
- Reporting OMR/Export Risk: (Number and range of OMR bins will vary based on DSM2 Modeling)
 - Baseline OMR (-3,500 cfs)
 - WR: Medium
 - SR: Low
 - Scenario 1 OMR (-3,000 cfs)
 - WR: Medium
 - SR: Low
 - Scenario 2 OMR (-5,000 cfs)
 - WR: Medium
 - SR: Low
- Overall Entrainment Risk:
 - WR: Medium
 - SR: Low

- Change in risk of entrainment into the facilities (increased/decreased risk compared to last week):
 - WR: Exposure risk is anticipated to be higher this week and has been elevated to the medium category. This elevation in risk is supported by the increase in salmonid detection (including WR detection) at sampling stations, seasonal timing of WR maturation, and multiple releases of hatchery produced late fall-run and a production release of winter-run Chinook salmon into the upper Sacramento River system which may stimulate migration of natural origin salmonids. The range of the forecasted level of exports is predicted to generate an OMRI flow of -3,000 to -5,000 cfs, resulting in an elevation from low to medium risk of entrainment of WR into the export facilities for fish already present in the central and south Delta. No WR have been observed in salvage for water year 2021; however, SaMT projects that the first natural origin and hatchery origin WR salvage may occur this week.
 - SR: Exposure risk is similar to last week and remains low based on forecasted hydrology and distribution of the juvenile SR population and life stage. The range of exports forecasted over the upcoming week are the same as those described for WR. No SR have been observed in salvage for water year 2021, and based on fish distribution in the central and south Delta, overall risk of entrainment at the facilities remains in the low category.

Section 1-C: Annual Loss Threshold Risk

- Annual loss threshold risk and Alternative Actions (8.1.5.1. E I, ii, iii and 8.1.5.1 F I, ii)
 - Salvage loss at the SWP and CVP facilities compared to the estimated remaining population in Delta and upstream of the Delta: No salvage of CESA-listed Chinook salmon has occurred over the past week.
 - Define risk of hitting a threshold, 50%, or 75%, or 100%, and likelihood of exceeding a threshold:
 - Natural origin WR: 3,863 (1.17% of the final natural origin WR JPE)
 - Current Annual Loss: 0
 - 50% Threshold based on natural WR JPE: 1,931
 - Risk of exceeding threshold: Not likely.
 - 75% Threshold based on natural WR JPE: 2,897
 - Risk of exceeding threshold: Not likely.
 - 100% Threshold based on natural WR JPE: 3,862
 - Risk of exceeding threshold: Not likely.
 - Hatchery WR: 117 (0.12% of the Final LSNFH hatchery release JPE)
 - Current Annual Loss: 0.
 - 50% Threshold based on hatchery WR JPE: 59
 - Risk of exceeding threshold: Low but possible. Releases on 1/30/2021 have not yet reached the Delta.
 - 75% Threshold based on hatchery WR JPE: 88
 - Risk of exceeding threshold: Low but possible. Releases on 1/30/2021 have not yet reached the Delta.
 - 100% Threshold based on hatchery WR JPE: 117

- Risk of exceeding threshold: Low but possible. Releases on 1/30/2021 have not yet reached the Delta.

Section 1-D: Daily Loss Threshold Risk

- Daily loss threshold risk and Alternative Actions
 - Salvage loss at the SWP and CVP facilities compared to estimated remaining population in Delta and upstream of the Delta:
 - Daily loss thresholds hit and subsequent loss and associated operations:
 - COA 8.6.3: natural older juvenile Chinook salmon:
 - January: $0.0000635 * 330,130 = 20.963255$
 - February: $0.0000991 * 330,130 = 32.715883$
 - March: $0.000146 * 330,130 = 48.19898$
 - April: $0.0000507 * 330,130 = 16.737591$
 - May: $0.000077 * 330,130 = 25.42001$
 - Highest daily loss: 0
 - Natural origin WR:
 - Highest daily loss: 0
 - Hatchery origin WR:
 - Highest daily loss: 0
 - Hatchery origin YOY SR surrogates:
 - Hatchery origin SR:
 - Hatchery origin FR:

Section 2: Basis for Advice:

The 2020 [Incidental Take Permit for Long-Term Operation of the State Water Project in the Sacramento-San Joaquin Delta 2081-2019-066-00](#) (SWP ITP) states that advice to Water Operations Management Team (WOMT) shall be consistent with the Project Description, COA in the ITP, and the applicable ESA authorizations. This week's advice is based on the following COAs which are currently applicable:

List relevant COA number and title based on species/life stage, time of year, etc.

8.1.4 Collaborative Approach to Real-time Risk Assessment. Beginning no later than October 1 through the end of OMR Management (see Condition of Approval 8.8) the Smelt and Salmon Monitoring Teams shall meet weekly, or more often as required, to consider survey data, salvage data, and other pertinent biotic and abiotic factors and prepare risk assessments as described in Conditions of Approval 8.1.1, 8.1.2, 8.1.5.1 and 8.1.5.2.

The Smelt and Salmon Monitoring Teams shall prepare operations advice for the WOMT as required by Conditions of Approval 8.3.1, 8.3.3, 8.4.1, 8.4.2, 8.5.1, 8.5.2, 8.6.1, 8.6.2, 8.6.3, 8.6.4, 8.7, and 8.8, including advice on operations. The Smelt and Salmon Monitoring Teams shall each prepare risk assessments and operations advice. Within each team, staff jointly develop the risk assessment and supporting documentation to accompany operations advice (see Conditions of Approval 8.1.5.1 and 8.1.5.2). DWR and CDFW Smelt and Salmon Monitoring Team staff may conclude different operations advice is warranted, in which case the difference shall be noted and elevated as described in this Condition of Approval.

The Smelt and Salmon Monitoring Teams shall communicate their advice to WOMT. The WOMT shall then confer and attempt to reach a resolution and agreed-upon Project operations. If a resolution is reached, Permittee shall operate consistent with the decision regarding Project operations from WOMT. If the WOMT does not reach a resolution, the CDFW Director may require Permittee to implement an operational recommendation provided by CDFW. CDFW will provide its operational decision to Permittee in writing. Permittee shall implement the operational decision required by CDFW. Permittee shall ensure that its proportional share (see Condition of Approval 8.10) of the OMR flow requirement as a part of the operational decision is satisfied.

8.1.5 Real-time Risk Assessments. The Smelt and Salmon Monitoring Teams (Conditions of Approval 8.1.1 and 8.1.2) shall prepare weekly risk assessments, or more often as required, and operations advice (as required by Conditions of Approval 8.3.1, 8.3.3, 8.4.1, 8.4.2, 8.5.1, 8.5.2, 8.6.1, 8.6.2, 8.6.3, 8.6.4, and 8.7) during their discussions and analyses. The Smelt and Salmon Monitoring Teams shall provide the risk assessments and pertinent supporting information to the WOMT (Condition of Approval 8.1.3) within one business day of each meeting.

8.3.2 Salmonid Presence. After January 1 each year, if Conditions of Approval 8.3.1 or 8.3.3 have not already been triggered, the OMR Management season shall begin when the Salmon Monitoring Team first estimates that 5% of the WR or SR population is in the Delta whichever is sooner. Upon initiation of the OMR Management season, Permittee shall reduce exports to achieve, and shall maintain a 14-day average OMR index no more negative than -5,000 cfs, until the OMR Management season ends (see Condition of Approval 8.8). In the event that a salmon daily or single-year loss threshold is exceeded (Conditions of Approval 8.6.1, 8.6.2, 8.6.3, or 8.6.4) prior to the start of OMR Management season the requirements in those Conditions shall control operations.

8.6.1 Winter-run Single-year Loss Threshold. In each year, Permittee shall, in coordination with Reclamation, operate the Project to avoid exceeding the following single-year loss thresholds:

- Natural WR (loss = 1.17% of natural WR JPE)*
- Hatchery WR (loss = 0.12% of hatchery WR JPE)*

The loss threshold and loss tracking for hatchery WR does not include releases into Battle Creek.

Loss of WR at the CVP and SWP salvage facilities shall be calculated based on LAD criteria for run assignment.

Annual loss of natural and hatchery WR at the CVP and SWP salvage facilities shall be counted cumulatively beginning November 1 each calendar year through June 30 the following calendar year.

WR shall be identified based on the Delta Model LAD criteria. Loss shall be calculated for the South Delta Export Facilities using the 2018 CDFW loss equation (Attachment 6).

During the water year, if cumulative loss of natural or hatchery WR exceeds 50% of the annual loss threshold, Permittee shall restrict south Delta exports to maintain a 14-day average OMR index no more negative than -3,500 cfs through the end of OMR Management (see Condition of Approval 8.8). After 14 days of operations to maintain an OMR index no more negative than -3,500 cfs, Permittee may convene the Salmon Monitoring Team to conduct a risk assessment (Condition of Approval 8.1.5.1) and determine whether the risk of entrainment and loss of natural and hatchery WR is no longer present. Risks shall be measured against the potential to exceed the next single-year loss threshold. The results of this risk assessment and associated OMR advice shall be provided to WOMT according to Condition of Approval 8.1.3 and the decision-making process shall follow the process described in Condition of Approval 8.1.4.

The -3,500 cfs OMR flow operational criteria, adjusted and informed by this risk assessment, shall remain in effect until the end of OMR Management (Condition of Approval 8.8).

During the water year, if cumulative loss of natural or hatchery WR at the CVP and SWP salvage facilities exceeds 75% of the single-year loss threshold, Permittee shall restrict OMR to a 14-day moving average OMR flow index that is no more negative than -2,500 cfs through the end of OMR Management (Condition of Approval 8.7). After 14 days Permittee may convene the Salmon Monitoring Team to conduct a risk assessment (Condition of Approval 8.1.5.1) and determine whether the risk of entrainment and take of natural and hatchery WR is no longer present. The results of this risk assessment and associated OMR advice shall be provided to WOMT according to Condition of Approval 8.1.3 and the decision-making process shall follow the process described in Condition of Approval 8.1.4.

The -2,500 cfs OMR flow operational criteria adjusted and informed by this risk assessment shall remain in effect until the end of OMR Management (Condition of Approval 8.8).

During the water year, if natural or hatchery WR cumulative loss at the CVP and SWP salvage facilities exceeds the single-year loss threshold, Permittee shall immediately convene the Salmon Monitoring Team to review recent fish distribution information and operations and provide advice regarding future planned Project operations to minimize subsequent loss during that year. The Salmon Monitoring Team shall report the results of this review and advice to the WOMT (see Condition of Approval 8.1.3). Operational decisions shall be made following the process described in Condition of Approval 8.1.4 (Collaborative Real Time Risk Assessment).

If the single-year loss threshold is exceeded, Permittee and Reclamation shall also convene an independent panel to review Project operations and the single-year loss threshold prior to November 1, as described in Condition of Approval 8.2. The purpose of the independent panel is to review the actions and decisions contributing to the loss trajectory that lead to an exceedance of the single-year loss threshold, and make recommendations on modifications to Project implementation, or additional actions to be conducted to stay within the single-year loss threshold in subsequent years.

Permittee shall, in coordination with Reclamation, continue monitoring and reporting salvage at the CVP and SWP salvage facilities. Permittee and Reclamation shall continue the release and monitoring of yearling Coleman National Fish Hatchery (NFH) late fall-run and yearling SR surrogates. The Salmon Monitoring Team shall use reported real-time salvage counts along with qualitative and quantitative tools to inform risk assessments (see Condition of Approval 8.1.5.1).

8.6.3 Mid- and Late-season Natural Winter-run Chinook Salmon Daily Loss Threshold. To minimize entrainment, salvage, and take of natural WR during the peak and end of their migration through the Delta. Permittee shall restrict south Delta exports for five days to achieve a five-day average OMR index no more negative than - 3,500 cfs when daily loss of natural older juveniles at the SWP and CVP salvage facilities exceeds the following thresholds based on the JPE reported in January of the same calendar year:

- January 1 – January 31: 0.00635 % of the WR JPE*
- February 1 – February 28: 0.00991 % of the WR JPE*
- March 1 – March 31: 0.0146 % of the WR JPE*
- April 1 – April 30: 0.00507 % of the WR JPE*
- May 1 – May 31: 0.0077 % of the WR JPE*

All natural older juvenile Chinook salmon juveniles shall be identified based on the Delta Model length-at-date criteria. Loss shall be calculated for the South Delta Export Facilities using the equation provided in CDFW 2018 (Attachment 6). This Condition of Approval may be modified through the process described in Condition of Approval 8.6.6 and an amendment to this ITP.

8.6.4 Daily Spring-run Chinook Salmon Hatchery Surrogate Loss Threshold. To minimize entrainment of emigrating natural juvenile CHNSR from the Sacramento River and tributaries, including the Feather and Yuba rivers into the channels of the central Delta, south Delta, CCF, and the Banks Pumping Plant, Permittee shall restrict exports based on the presence of hatchery produced CHNSR surrogate groups at the CVP and SWP salvage facilities. CHNSR surrogate groups shall consist of all in-river fall- and spring-run surrogate release groups of Chinook salmon from the Coleman National Fish Hatchery, Feather River Hatchery, and the Nimbus Fish Hatchery. Each water year between February 1 and June 30 Permittee shall reduce south Delta exports for five consecutive days to achieve a five-day average OMR index no more negative than -3,500 cfs when:

- Feather River Hatchery coded wire tagged (CWT) CHNSR surrogates (includes both spring- and fall-run hatchery release groups) cumulative loss at the at the CVP and SWP salvage facilities is greater than 0.25% for each release group, OR*

- *Coleman National Fish Hatchery and Nimbus Fish Hatchery CWT fall-run release groups cumulative loss at the at the CVP and SWP salvage facilities is greater than 0.25% of the total in-river releases for each release group.*

This Condition of Approval may be modified through the process described in Condition of Approval 8.6.6 and an amendment to this ITP.

Discussion of Conditions of Approval

Provide sentence or two addressing criteria for each Condition of Approval listed in “Basis for Advice” section. Refer to data below where appropriate.

Per Conditions of Approval 8.1.4 and 8.1.5, SaMT has provided advice and accompanying risk assessment to WOMT.

Per Conditions of Approval 8.6.1 and 8.6.3 has increase the entrainment risk for natural origin and hatchery origin to medium SaMT does not project yearly or daily threshold triggers to be reached this week. Per Condition of Approval 8.6.4 SaMT, YOY SR surrogate releases have not occurred this OMR management season.

Section 3: Hydrology and Operations

Assessment of hydrologic, operational, and meteorological information. 8.1.5.1 A

Section 3-A: Water Operations C 8.1.5.1 A. i, iii:

- Antecedent Actions: *(e.g., DCC gate closure and actions such as integrated early winter pulse protection, etc.)*
DCC gates were closed 12/1/2020 and will remain closed until mid-May 2021 per Reclamation's PA description of DCC operations.
- Current Controlling Factor(s):
 - SWP: Delta Outflow
 - CVP: Delta Outflow
- Water Temperature:
 - Mossdale (MSD): 53.4°F on 2/7/2021
 - Number of days threshold exceeded: Not applicable until June.
 - Prisoners Point (PPT): 51.1°F on 2/7/2021
 - Number of days threshold exceeded: Not applicable until June.
- Tidal Cycle: *(Spring/Neap. Note if tidal cycle has potential to affect south Delta hydrology or X2)*
 - Not discussed
- Turbidity:
 - COA 8.3.1 Turbidity at FPT (3-day running average from Dec 1 to Jan 31): Not applicable
- Salinity (X2): 81km on 2/7/2021
- Hydraulic Footprint *(Provide brief description of hydrologic footprint and summary of relevant DSM2 results)*: Refer to the Reclamation Proposed Action Assessment for details.

DSM2 model interpretation entrainment in Delta strata regions:

- North Delta into Interior and Central Delta - Channels: 49 and 434
It is unlikely that listed salmonids will experience changes to rearing, foraging, sheltering, or migrating related to modeled OMR conditions this week (Channels 49 and 434).
- San Joaquin River and Central Delta into South Delta - Channels: 6, 21, 107, 124, and 160
Listed salmonids are present, but recent surveys suggest low densities. Changes in velocity and flows related to modeled OMR conditions this week may be detectable by fish that are rearing or foraging in these regions. Increased negative flows may increase transit rates towards the ocean for those that are present and migrating in the area (Channels 6, 21, 107, 124, and 160).
- South Delta into facilities - Channels: 81, 94, and 148
Modeled hydrodynamic effects related to modeled OMR conditions this week suggest changes to migrating salmonid transit times (Channels 81, 94, and 148). For example, transit times towards the ocean would be delayed for salmonids coming from the north; whereas transit times towards the export facilities would be faster for salmonids moving from the head of Old River. However, transit times towards the ocean for fish not entrained into the export facilities would be prolonged for fish moving through the Old and Middle river corridors from the south.

Section 3-B: Water Operations Outlook 8.1.5.1 A. ii:

- Outages:
 - SWP: None, no reported reductions in fish salvage counts
 - CVP: None, no reported reductions in fish salvage counts
- Exports : 2/9/2021
 - SWP: 3,700 cfs
 - CVP: 1,900 cfs
- Meteorological Forecast: *Precipitation, wind, air temperature. Are conditions (i.e. flow, turbidity, water temp) expected to change?*
 - Dry and cooler on Monday (2/8/2021). Threat of showers in mountains begins Tuesday, with widespread precipitation in the Valley possible later in the week, beginning Thursday. Considerable uncertainty among model ensembles regarding the timing and amounts of precipitation involved.
- Storm Event Projection: Although rain is expected this week, hydrological conditions are unlikely to provide an opportunity for a storm flex change in exports resulting in an OMR index more negative than -5,000 cfs OMR.

Section 3-C: Projected Conditions 8.1.5.1 A. iii:

- DCC Gates position: Closed 12/1/2020 until mid-May 2021 per Reclamation's PA DCC gate operations.
- Sacramento River flow at Freeport: 10,000- 16,000 cfs
- San Joaquin River flow at Vernalis: 1,100-,600 cfs
- QWEST: not discussed
- Old River at Bacon Island (OBI) Turbidity: *Is turbidity at Bacon Island (OBI) expected to change due to precipitation, wind, operations, or other factors?* Not discussed.
- Freeport Turbidity: *Is turbidity at Freeport (FPT) expected to change due to precipitation, wind, operations, or other factors?* Not discussed.
- Expected changes in South Delta Exports:
 - CCF: 2,000-4,500 cfs
 - Tracy: 1,600-2,500 cfs

Table 1: Comparison of OMR gauge and OMR Index

Date	Averaging Period	USGS gauges (cfs)	Index (cfs)
2/6/2021	Daily	-3,400	-2,800
2/6/2021	5-day	-2,300	-2,500
2/6/2021	14-day	-2,200	-2,400

Date	Averaging Period	USGS gauges (cfs)	Index (cfs)
2/8/2021	Daily	Not Applicable	-3,000
2/8/2021	5-day	Not Applicable	-2,800
2/8/2021	14-day	Not Applicable	-2,500

Section 4: Distribution and Biology

8.1.5.1.B Assessment of biological information for WR and SR.

Section 4-A: WR Population Status 8.1.5.1.B i

- Adult escapement estimate:
 - Estimate from carcass counts for adults contributing to BY 2020 is 6,195 natural origin total adults and 4,093 female spawners.
 - Adults that will contribute to BY 2021 have entered the Delta system and are appearing in the Keswick area.
- Redd distribution and fry emergence timing:
 - BY 2020 total passage at Red Bluff Diversion Dam through 1/28/2021 is 1,985,860 fish. Average historic passage (BY 2010-2019) as of 1/28 indicates 98.4% (one standard deviation of 2.0%) have passed Red Bluff Diversion Dam.
- Juvenile production estimate:
 - A final JPE has been provided by NMFS and CDFW for BY 2020 which estimates 330,130 natural-origin juvenile WR will reach the Delta. The final JPE also estimates that 97,888 LSNFH WR and 37,232 Battle Creek Jumpstart WR will reach the Delta.
- Livingston Stone National Fish Hatchery release:
 - A production release of 302,166 WR 100% marked and coded wire tagged was released on 1/30/2021 at Caldwell Boat Ramp in Redding, CA.
- Distribution of natural WR:
 - % of juveniles upstream of the Delta: 15-40%
 - % of juveniles in Delta: 60-85%
 - % of juveniles past Chipps Island: 0%
- Distribution of Livingston Stone National Fish Hatchery Sacramento River WR and Battle Creek WR:
 - % of juveniles upstream of the Delta: 95%
 - % of juveniles in Delta: 5%
 - % of juveniles past Chipps Island: 0%
- Change in risk of entrainment into the central Delta:
 - See Section 1-A: Sacramento River and Confluence

Section 4-B: SR Population Status 8.1.5.1.B ii

- Adult escapement estimate: Not available.
- Redd distribution and fry emergence timing: Adult SR are likely to have completed their spawning by mid-November. Egg incubation and fry emergence is currently occurring. BY 2020 total passage at Red Bluff Diversion Dam through 1/28/2021 is 157,409 fish See Table 3 for annual
- Hatchery release (in-river and downstream): No SR hatchery releases have occurred in the Sacramento River system at this time. SR egg collection at the Feather River Hatchery ended on 10/2/2020. Preliminary information from the Feather River Hatchery indicates issues potentially related to thiamine deficiency in returning adults which has impacted the final production goal. In addition, reduced numbers of tagged SR adults returned to the hatchery this fall and remained in-river to spawn which may also contribute to the low hatchery production this year.
- Distribution of natural SR:
 - % of juveniles upstream of the Delta: 55-65%
 - % of juveniles in Delta: 35-45%

- % of juveniles past Chipps Island: 0%
- Distribution of Feather River Fish Hatchery SR:
 - % of juveniles upstream of the Delta: Not applicable. Releases have not occurred.
 - % of juveniles in Delta: Not applicable. Releases have not occurred.
 - % of juveniles past Chipps Island: Not applicable. Releases have not occurred.
- Change in risk of entrainment into the central Delta:
 - See Section 1-A: Sacramento River and Confluence

Section 4-C: Additional Data Sources to Assess Sensitivity to Entrainment into the Central and South Delta

8.1.5.1.C & D

- In-Delta distribution of WR and SR: See Section 4-A: WR population status 8.1.5.1.B i and Section 4-B SR population status 8.1.5.1.B ii.
- Acoustic telemetry: *Summary of acoustic telemetry tracking*
 - Two groups of production LFR were released from Coleman National Fish Hatchery on 1/4/2021 and 1/5/2021. A subset of each group were acoustic tagged, 460 and 141 fish respectively. The first tag detected from the first release group at Tower Bridge occurred five days later (1/9/2021). As of 1/31/2021, 83 fish have been detected at the I-80/50 Bridge and 37 have been detected at the Benicia east and west sites. One fish was detected in Old River at Quimby Island on 1/20/2021.
 - Six groups of WR were released from LSNFH. A subset of three groups were acoustic tagged; 134,130, and 290 fish respectively. The first tag detection occurred at I-80/50 Bridge occurred five days later 2/5/2021. A total of 6 tagged fish have been detected at I-80/50 and 2 fish have been detected at Georgiana Slough.
- Trawls: *List all relevant trawl surveys and brief overview of data. Insert tables, PDFs or other information as attachment at end of document. Include interruptions to sampling or other relevant information (e.g. canceled surveys, dropped stations, etc.)*
 - See Appendix 1: SaMT Monitoring Program Data
- Rotary Screw Traps: *List all relevant rotary screw trap surveys and brief overview of data. Insert tables, PDFs or other information as attachment at end of document. Include interruptions to sampling or other relevant information (e.g. canceled surveys, dropped stations, etc.)*
 - See Appendix 1: SaMT Monitoring Program Data
- Seines: *List all relevant seine surveys and brief overview of data. Insert tables, PDFs or other information as attachment at end of document. Include interruptions to sampling or other relevant information (e.g. canceled surveys, dropped stations, etc.)*
 - See Appendix 1: SaMT Monitoring Program Data
- Additional hatchery release notifications: *List all relevant hatchery release notifications.*
 - *Note: This information may be deemed relevant as there is a potential emigration influence on CESA listed species present upstream of the Delta.*
 - 1/30/2021 LNFH 302,166 WR Sacramento River production released at Caldwell Park, Redding, CA
 - 2/1/2021 LNFH 53,620 WR Battle Creek jumpstart released at Wildcat Road Bridge, Manton, CA
- New monitoring (as required by Condition of Approval 7.5.1, 7.5.2, and 7.5.3): *Upstream monitoring results during transfer window, additional rotary screw trap monitoring updates, additional acoustic*

tag study results, genetic identification results, trap capture efficiency trial results, and pathology results if available and relevant

- Not applicable at this time.
- Anticipated emigration to continue into the Delta:
 - WR and SR are distributing and rearing downstream of their spawning grounds and throughout the Delta. Projected hydrological and meteorological environmental cues could trigger additional accelerated movement into and throughout the Delta.
- Flows in the Sacramento River predicted with upcoming storm events:
 - See Section 3-A: Water operations conditions 8.1.5.1 A. i, iii and the routing analysis below.
- DCC gate position:
 - Closed 12/1/2020 until mid-May 2021 per Reclamation’s PA description for DCC gate operations.
- Prediction of tidal interaction at Georgiana Slough (*Inflow to Delta from Sacramento River and the interaction of the muting of tidal effects around Georgiana Slough*):
 - See Section 3-A: Water operations conditions 8.1.5.1 A. i, iii and the routing analysis below.
- Precipitation in the forecast for the week and river flows affecting routing into central Delta:
 - See Section 3-B: Water Operations Outlook 8.1.5.1 A. ii: Storm Event Projection.
- Routing analysis:
 - STARS analysis was conducted on 2/7/2021 with results presented in Table 2 below. These results reflect the DCC gate closure through mid-May.

Table 2: STARS Model Output

Date: 2/7/2021	DCC	Georgiana Slough	Sacramento River	Sutter and Steamboat Sloughs
Proportion of Entrainment	0%	27%	46%	28%
Survival	Not Applicable	20%	54%	44%
Travel Time	Not Applicable	17.1 days	9.8 days	10.3 days

- Trend analysis: *Provide brief description of historic trends if relevant (e.g. salvage patterns, onset of spawning, etc.). Refer to data or publications as needed:*

Table 3: Historic Migration and Salvage Patterns for unclipped WR and SR averaged from BYs 2011-2019 as reported on SacPAS (http://www.cbr.washington.edu/sacramento/data/query_hrt.html) with associated 95% confidence interval. These values are provided for context only.

Date: 2/7/2021	RBDD RST	Tisdale RST	Knights Landing RST	Sac Trawl	Chipps Island Trawl	Salvage
WR	98.0% (96.3%,99.7%)	84.4% (60.9%,108.0%)	85.0% (61.4%,108.6%)	42.6% (11.6%,73.6%)	5.4% (0.5%,10.3%)	31.5% (9.1%,54.0%)
SR	22.3% (6.3%,38.2%)	35.2% (2.8%,67.5%)	24.4% (-2.5%,51.4%)	5.5% (-3.1%,14.1%)	0.0% (0.0%,0.0%)	0.0% (-0.0%,0.0%)

- Survival analysis (*e.g. Zeug and Cavallo CWT model*): Not available
- Tillotson entrainment model or other entrainment models as they become available: Not applicable
- Salvage trends in relation to OMRI: *Provide overview of salvage data and insert salvage table as attachment at end of document*: Not applicable as there has been no salvage of CESA listed salmon for water year 2021.
- Future export modifications: *Describe anticipated or potential changes to exports*: Not applicable at this time.

Notes: None

Appendix 1: SaMT Monitoring Program Data

Table 4: Fish Monitoring Data for the 2/8/2021 Meeting. The following table presents fish monitoring data summarized over the past week. Unless otherwise noted, reported sizes are fork length.

Location	GCID RST ¹	Tisdale RST	Knights Landing RST ²	Beach Seines	Sacramento Trawl ³	Chippis Is. Midwater Trawl	Mossdale Kodiak Trawl
Sample Date	2/6-2/8	2/2-2/7	2/2-2/8	Not Sampled	1/31-2/2, 2/4-2/5	1/31-2/2, 2/4	Not Sampled
Fall-run Chinook	284 juveniles	1,636	680		145		
Spring-run Chinook	6 juveniles	26	14		2		
Winter-run Chinook	2 juveniles	23	12				
Late Fall-run Chinook		1	0			2	
Chinook (ad-clip)	2 WR juveniles	1 SR, 64 WR, 3 LFR	59 FR, 5 SR, 10 WR		1	8	
Steelhead (wild)					1		
Steelhead (ad-clip)		3	2		14	5	
Green Sturgeon							
Flows (avg. cfs)	N/A	7,600	7,870	Not Applicable	Not Applicable	Not Applicable	Not Applicable
W. Temp. (avg. °F)	51.2	49.8	50.0	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Turbidity (avg. NTU)	5.1	16.4	17.8	Not Applicable	Not Applicable	Not Applicable	Not Applicable

FR = fall-run, WR = winter-run, SR = spring-run, LFR = late-fall-run

¹ GCID RST cone was raised on 1/25 in anticipation of high flows, heavy debris, and hatchery released Chinook salmon. Cone was lowered at 10:00 am on 2/6. Cone is sampling at 50% effort.

² Knights Landing RST traps were taken out of service to avoid debris. There was a Period of no trapping on 2/3. Trapping resumed on 2/3 at 12:30 pm. On 2/8 traps were modified to half cone sampling to avoid mortalities.

³ DatCall data reported in the 1/31/21-2/6/21 DJFMP sampling summary. Mossdale sampling have ceased due to COVID impacts.

Table 5: Delta Sturgeon Tagging and Monitoring,

Date	Comments
2/2/2021 2/4/2021	<ul style="list-style-type: none"> No new tags applied this past week. 32 juvenile GS, and 1 adult WS detected in the Sacramento River north of Sherman Lake.

GS = green sturgeon, WS = white sturgeon

Table 6: CDFW Adult Monitoring Surveys

Location	American River Carcass Survey ¹	Stanislaus River Carcass Survey
Sample Dates	Concluded for the season	Not Sampled
Live Fish	Not Available	Not Available
Redds	Not Available	Not Available
Carcasses	Not Available	Not Available
Ad-clipped	Not Available	Not Available
Spawn Condition	Not Available	Not Available
Flows (avg. cfs)	Not Available	Not Available
W. Temp (avg. °F)	Not Available	Not Available

¹ Due to continued high counts of fresh carcasses, CDFW extended the American River carcass survey to final day of 1/22/2021.

Appendix 2: Salvage Data

Table 7: SaMT Update. Prepared by Geir Aasen on 2/8/2021. These are preliminary results and are subject to revision.

Criteria	1-Feb	2-Feb	3-Feb	4-Feb	5-Feb	6-Feb	7-Feb	Trend ¹	Weekly Summary
Wild older juvenile CHN Loss	0	0	0	0	0	0	0	→	0.00
Wild Steelhead Loss	0	0	0	0	0	0	0	→	0.00
SWP daily export (acre-feet)	2,984	4,093	1,895	3,418	5,152	3,633	3,796	↗	3,567
CVP daily export (acre-feet)	3,310	3,304	3,293	3,728	3,726	3,730	3,745	↗	3,548
SWP reduced counts ²	None	None	None	None	None	None	None	Not Applicable	Not Applicable
CVP reduced counts	None	None	None	None	None	None	None	Not Applicable	Not Applicable

¹ Trend is the current value compared to the previous week.

² Reduced counts are the percentage of time that routine salvage sample times were less than 30 minutes per two hours of salvage and export operations.

Table 8: Chinook salmon weekly salvage and loss combined for both the SWP and the CVP fish collection facilities 2/1-2/7/2021. Race is determined by LAD on the date of capture. Hatchery origin fish are determined by the lack of adipose fin. Prepared by Geir Aasen on 2/8/2021. These are preliminary results and are subject to revision.

Category	Salvage ¹	Loss ²	Trend
Wild winter-run	0	0	→
Wild spring-run	0	0	→
Wild late Fall-run	0	0	→
Wild fall-run	4	3	↗
Weekly Total	4	3	Not Applicable
Hatchery winter-run	0	0	→
Hatchery spring-run	4	3	↗
Hatchery late Fall-run	12	11	↗
Hatchery fall-run	0	0	→
Weekly Total	16	14	Not Applicable

Table 9: Chinook salmon cumulative salvage and loss for combined for both the SWP and the CVP fish collection facilities WY 2021. Race is determined by LAD on the date of capture. Hatchery origin fish are determined by the lack of adipose fin. Prepared by Geir Aasen on 2/8/2021. These are preliminary results and are subject to revision.

Category	Salvage	Loss	Trend
Wild winter-run	0	0	→
Wild spring-run	0	0	→
Wild late Fall-run	0	0	→
Wild fall-run	4	3	↗
Season Total	4	3	
Hatchery winter-run	0	0	→
Hatchery spring-run	4	3	↗
Hatchery late Fall-run	16	14	↗
Hatchery fall-run	0	0	→
Season Total	20	17	Not Applicable

Table 10: Steelhead weekly salvage and loss combined for both the SWP and the CVP fish collection facilities. Hatchery origin fish are determined by the lack of adipose fin 2/1-2/7/2021. Prepared by Geir Aasen on 2/8/2021. These are preliminary results and are subject to revision.

Category	Salvage	Loss	Trend
Wild steelhead	0	0	→
Hatchery steelhead	12	8	↗
Weekly Total	12	8	Not Applicable

¹ Salvage is equal to the estimated number of fish collected by the CVP and SWP fish protective facilities per unit of time.

² State Water Project loss is equal to salvage multiplied by 4.33. Central Valley Project loss is equal to salvage multiplied by 0.68.

Table 11: Steelhead cumulative salvage and loss combined for both the SWP and the CVP fish collection facilities WY 2021. Hatchery origin fish are determined by the lack of adipose fin. Prepared by Geir Aasen on 2/8/2021. These are preliminary results and are subject to revision.

Category	Salvage ¹	Loss ²	Trend
Wild steelhead	4	3	→
Hatchery steelhead	16	11	↗
Season Total	20	14	Not Applicable

¹ Salvage is equal to the estimated number of fish collected by the CVP and SWP fish protective facilities per unit of time.

² State Water Project loss is equal to salvage multiplied by 4.33. Central Valley Project loss is equal to salvage multiplied by 0.68.