Federal Action

2019 Final Biological Assessment – Chapter 4 Proposed Action
Bureau of Reclamation
October 21, 2019

No relevant text.

2024 Final Biological Assessment – Chapter 3 Proposed Action
Bureau of Reclamation
October 23, 2024

3.7.4.5.3 Winter-Run Chinook Salmon Annual Loss Threshold
If the cumulative loss of natural or hatchery winter-run Chinook salmon in a brood year exceeds 75% of the annual loss thresholds, then DWR and Reclamation will adjust south Delta exports to maintain a 7-day average of the OMR value no more negative than the -2,500 cfs for seven consecutive days, to be assess on the seventh day of the averaging period after initiating operational changes in response to the OMR trigger, when the Winter-Run Chinook Salmon Machine Learning Model and associated OMR Conversion Tool predict that the change to -2,500 cfs will shift the model output to a classification of absence with a minimum probability of absence prediction of 0.559 for 1 of 30 sub-models for any of the 7 most recent prediction days. These prediction values are calculated based on length-at-date and will be updated once genetic analysis is fully adopted.

Action 5 – Attachment 2 Adaptive Management Program
Bureau of Reclamation
December 3, 2025

Winter-Run Chinook Salmon Annual Loss Threshold (p. 276)
Reclamation and DWR will manage OMR to avoid exceeding the following annual loss thresholds:

- Natural winter-run Chinook salmon (loss = 0.5% of JPE)
- Hatchery winter-run Chinook salmon (loss = 0.12% of JPE)

JPEs and annual loss thresholds will be calculated for natural winter-run Chinook and for each of the hatchery winter-run Chinook Salmon populations from LSNFH and Battle Creek. The JPE for natural and hatchery winter-run Chinook salmon will be calculated at least annually by the JPE SubTeam, as described in Appendix- Winter-Run Juvenile Production Estimate, and transmitted to WOMT and SHOT. Hatchery releases of winter-run Chinook salmon will be tracked individually, and cumulative loss will be summed across release groups with the same JPE and annual loss threshold. Loss shall be calculated for the export facilities using the 2018 CDFW loss equation (Attachment R).

Annual loss of natural and hatchery winter-run Chinook salmon at the CVP and SWP salvage facilities will be counted for each Brood Year, starting July 1 of the calendar year through June 30 of the following calendar year. If cumulative loss of natural or hatchery winter-run Chinook salmon in a brood year exceeds 50% of the annual loss thresholds, then DWR and Reclamation will adjust south Delta exports to maintain a 7-day average of the OMR value no more negative than -3,500 cfs for 7 consecutive days, to be assess on the seventh day of the averaging period after initiating operational changes in response to the OMR trigger. Once exceeded, each winter-run observed in salvage would trigger another operation to an OMR limit of -3,500 cfs for 7 days.

If the cumulative loss of natural or hatchery winter-run Chinook salmon in a brood year exceeds 75% of the annual loss thresholds, then DWR and Reclamation will adjust south Delta exports to maintain a 7-day average of the OMR value no more negative than the -2,500 cfs for seven consecutive days, to be assess on the seventh day of the averaging period after initiating operational changes in response to the OMR trigger, when the Winter-Run Chinook Salmon Machine Learning Model and associated OMR Conversion Tool predict that the change to -2,500 cfs will shift the model output to a classification of absence with a minimum probability of absence prediction of 0.559 for 1 of 30 sub-models for any of the 7 most recent prediction days. These prediction values are calculated based on length-at-date and will be updated once genetic analysis is fully adopted.

Adaptive Management Action 1 – Winter-run Old and Middle River Flows Management (p. 26-27)

a) *Brief Description:* Onramping and offramping Old and Middle River Flows (OMR) management for winter-run Chinook Salmon is currently informed by the Salmon Monitoring Team (SaMT). The SaMT is a technical advisory team made up of technical staff from the US Bureau of Reclamation (Reclamation), the Department of Water Resources (DWR), the National Marine Fisheries Service (NMFS), the California Department of Fish and Wildlife (CDFW), and the State Water Resources Control Board (SWRCB) that synthesizes recent field monitoring data and historical long-term monitoring data, along with expert opinion to inform the Water Operation Management Team (WOMT). Specifically, the SaMT will evaluate real-time data, including the Salmonid Distribution Table, and the weekly loss threshold table, which classifies the winter-run Chinook salmon population as the percent in the Delta. This information is used to implement the winter-run weekly loss thresholds and to minimize the effects of water operations on winter-run Chinook Salmon.

Proposed Action (PA) Sections 3.7.4.1 and 3.7.4.5.3 describe the use of winter-run Chinook Salmon weekly and annual loss thresholds to trigger actions aimed to minimize entrainment and loss of juvenile out-migrants. However, it is anticipated that the criteria associated with the Winter-Run Chinook Salmon Machine Learning Model will need to be reassessed using the genetics-based run-identification loss dataset currently available (Section 3.7.4.1) and a larger effort to develop a real-time assessment tool for the SaMT to recommend OMR management actions to minimize entrainment into the south Delta well before salvage events occur.

b) *Assigned AM Bin:* **Bin 2**

i.The development of a model explicitly predicting daily winter-run Chinook Salmon migration timing using historical long-term monitoring data and environmental variables is necessary to reduce uncertainty in the weekly Salmonid Distribution Table and the estimated percent of winter-run present in the Delta. This model needs to be made readily available as a transparent prediction tool that leverages recent biotic and abiotic data to predict current and near-future migration timing and provided to the SaMT to inform their discussions prior to WOMT. This effort should be completed and implemented no later than 2026.

ii.The explicit rate of winter-run Chinook Salmon juvenile out-migrant entrainment into the South Delta, the fate of individuals entrained due to OMR management, and the effects of the State Water Project (SWP) and Central Valley Project (CVP) south Delta water operations is a topic area in OMR management that has been studied in the past and merits further investigation. Loss associated with salvage events at the SWP and CVP facilities is currently used to trigger OMR management actions, but these detections in salvage occur days or even weeks after individuals were initially entrained into the South Delta and account for only a proportion of entrained individuals lost to the population. A new modeling framework is necessary for more effective real-time OMR management actions to be used to minimize winter-run Chinook Salmon entrainment into the South Delta. Specifically, the modeling framework should integrate a winter-run Chinook Salmon distribution model (e.g., Bin 2 item *i* above) with particle tracking model outcomes (potentially the individual-based ECO-PTM model developed by USGS and DWR) to estimate the proportion of the out-migrant population vulnerable to entrainment into the South Delta per day, the probability of entrainment into the South Delta given current hydrologic conditions, and the travel time to the water export facilities. Such a modeling framework should be converted into a real-time assessment tool for the SaMT to recommend OMR management actions to minimize entrainment into the South Delta well before salvage events occur.

c) *Adaptive Management Technical Team:* The existing Winter-run Chinook Machine Learning Interagency Team will lead analysis and development of all winter-run Chinook salmon OMR management sub-actions in coordination with other interested agencies and stakeholders. Specific work pertaining to this action should be conducted by the current Winter-run Chinook Machine Learning Interagency Team. The team has welcomed input from a diverse array of agency and stakeholder representatives since its inception to provide critical guidance throughout model development and interpretation. This role would continue with the addition of SDM processes as needed.

d) *Tools:* Winter-Run Chinook Salmon Machine Learning Model

State Incidental Take Permits

2020 Incidental Take Permit
California Department of Fish and Wildlife
March 31, 2020

No relevant text.

2024 Incidental Take Permit
California Department of Fish and Wildlife
November 4, 2024

Condition of Approval 7.9.2 Winter-run Chinook Salmon Machine Learning Model Development
Permittee shall, as part of the AMP (Attachment 4) and in coordination with Reclamation, support and fund the continued refinement of the Winter-run Chinook Salmon Machine Learning Model for use during real-time operations to inform the SaMT and implementation of this ITP. The continued refinement of the Winter-run Chinook Salmon Machine Learning Model will require the established Winter-run Chinook Machine Learning Interagency Team to incorporate genetic-based run-identification loss and monitoring data of CHNWR currently available. The Winter-run Chinook Machine Learning Interagency Team will also develop a CHNWR distribution model to explicitly predict daily juvenile CHNWR migration timing in the Delta using historical long-term monitoring data and environmental variables for SaMT to use by 2026 (Condition of Approval 8.1.2, Attachment 4).

The Winter-run Chinook Machine Learning Interagency Team shall develop a modeling framework that integrates the CHNWR distribution model with particle tracking model outcomes (potentially Ecological Particle Tracking Model [ECO-PTM]), and considers the efficacy of the Georgiana Slough Migratory Barrier, to estimate the proportion of the juvenile CHNWR outmigrating population vulnerable to entrainment into the south Delta per day, the probability of juvenile CHNWR entrainment into the south Delta given current hydrologic conditions, and the travel time of juvenile CHNWR to the SWP and CVP export facilities.

In addition to the real-time assessment tool, the Winter-run Chinook Machine Learning Interagency Team shall also provide modeling outputs from the Winter-run Chinook Salmon Machine Learning Model and associated OMR Conversion Tool to SaMT for the implementation of Condition of Approval 8.4.4 to this ITP.

Condition of Approval 8.4.3 Winter-run Chinook Salmon Annual Loss Thresholds
To minimize entrainment and loss of juvenile CHNWR, Permittee shall, in coordination with Reclamation, adjust south Delta exports to manage the OMR index to avoid exceeding the following annual loss thresholds:

- Natural-origin CHNWR Loss Threshold: 0.5% of JPE
- Hatchery-origin CHNWR Loss Threshold: 0.12% of JPE

JPEs and annual loss thresholds will be calculated for natural-origin CHNWR, for hatchery-origin CHNWR from Livingston Stone National Fish Hatchery (LSNFH) released into the Sacramento River near Redding, and for LSNFH hatchery-origin CHNWR released into Battle Creek.

The JPE for natural and hatchery-origin CHNWR is calculated by the JPE Subteam annually, consistent with Attachment 2, and is described in the yearly recommendation letter produced by the JPE Subteam and transmitted to NMFS and CDFW. NMFS and CDFW issues an Annual JPE Letter, with the JPE Subteam recommendation included as an enclosure to the letter, to Permittee and Reclamation. Hatchery releases of CHNWR are tracked individually, and Permittee shall sum cumulative loss, confirmed by coded wire tag (CWT), across release groups with the same JPE and annual loss threshold. Permittee shall calculate loss for the south Delta export facilities using the 2018 CDFW loss equation (Attachment 8).

Permittee shall count annual loss of natural and hatchery-origin CHNWR at the SWP and CVP salvage facilities for each brood year, starting July 1 of the calendar year through June 30 of the following calendar year. If cumulative loss of either natural or hatchery-origin CHNWR in a brood year exceeds 50% of the annual loss thresholds, then Permittee shall, in coordination with Reclamation, adjust south Delta exports to achieve a 7-day average of the OMR index no more negative than -3,500 cfs for seven consecutive days. If a CHNWR is salvaged during the 7-day action, the action will be extended for another seven days. At the conclusion of the action, Permittee, in coordination with Reclamation shall revert to the weekly distributed loss threshold until the 75% threshold is reached or throughout the end of the OMR Management season (Condition of Approval 8.6).

If:

- The cumulative loss of either natural or hatchery-origin CHNWR in a brood year exceeds 75% of the annual loss thresholds, and
- The Winter-Run Chinook Salmon Machine Learning Model and associated OMR Conversion Tool predict that a change in the OMR index to -2,500 cfs will shift the model output to a classification of CHNWR absence with a minimum probability of absence prediction of 0.559 for 1 of 30 sub-models for any of the seven most recent prediction days. These prediction values are calculated based on historical detections of length-at-date CHNWR and will be updated once genetic analysis of CHNWR is fully adopted (Condition of Approval 7.9.2).

Then, Permittee shall, in coordination with Reclamation, adjust south Delta exports to maintain a 7-day average of the OMR index no more negative than the -2,500 cfs for seven consecutive days.

Once 75% of the annual loss threshold is exceeded, each CHNWR observed in salvage shall trigger another operation to a 7-day average OMR index no more negative than - 2,500 cfs for seven consecutive days, if the Winter-Run Chinook Salmon Machine Learning Model and associated OMR Conversion Tool predict that a change in the OMR index to -2,500 cfs will shift the model output to a classification of CHNWR absence with a minimum probability of absence prediction of 0.559 for 1 of 30 sub-models for any of the seven most recent prediction days.

Condition of Approval 8.4.6 Improve Salmon Entrainment Forecasting During Real-time OMR Management

By 2028, Permittee shall, in coordination with CDFW, Reclamation, and NMFS, use best available science and information gained from the application of the Winter-run Chinook Salmon Machine Learning Model (Condition of Approval 7.9.2), new data (e.g., SR JPE monitoring, Winter-run Action Plan), population information, non-physical barrier effectiveness, and other tools to develop a CHNWR minimization measure for SWP and CVP export facilities that relies on improved forecasts of entrainment risk, while providing the same or better levels of protection as Conditions of Approval 8.2.1, 8.4.3, and 8.4.4 of this ITP. Permittee shall consult with CDFW regarding the need for an amendment to the ITP (Condition of Approval 5) to modify or replace Conditions of Approval 8.2.1, 8.4.3, and 8.4.4 with CHNWR minimization actions that do not solely rely on salvage, based on results from this effort and the AMP (Attachment 4).

Adaptive Management Action 1 – Winter-run Old and Middle River Flows Management

a) Brief Description: Onramping and offramping Old and Middle River Flows (OMR) management for winter-run Chinook Salmon is currently informed by the Salmon Monitoring Team (SaMT). The SaMT is a technical advisory team made up of technical staff from the US Bureau of Reclamation (Reclamation), the Department of Water Resources (DWR), the National Marine Fisheries Service (NMFS), the California Department of Fish and Wildlife (CDFW), and the State Water Resources Control Board (SWRCB) that synthesizes recent field monitoring data and historical long-term monitoring data, along with expert opinion to inform the Water Operation Management Team (WOMT). Specifically, the SaMT will evaluate real-time data, including the Salmonid Distribution Table, and the weekly loss threshold table, which classifies the winter-run Chinook salmon population as the percent in the Delta. This information is used to implement the winter-run weekly loss thresholds and to minimize the effects of water operations on winter-run Chinook Salmon.

ITP Conditions of Approval 8.4.3 and 8.4.4 (Proposed Action (PA) Sections 3.7.4.1 and 3.7.4.5.3) describe the use of winter-run Chinook Salmon weekly and annual loss thresholds to trigger actions aimed to minimize entrainment and loss of juvenile out-migrants. However, it is anticipated that the criteria associated with the Winter-Run Chinook Salmon Machine Learning Model will need to be reassessed using the genetics-based run-identification loss dataset currently available as described in ITP Conditions of Approval 7.9.2 (PA Section 3.7.4.1) and a larger effort to develop a real-time assessment

tool for the SaMT to recommend OMR management actions to minimize entrainment into the south Delta well before salvage events occur.

b) Assigned AM Bin: **Bin 2**
i. The development of a model explicitly predicting daily winter-run Chinook Salmon migration timing using historical long-term monitoring data and environmental variables is necessary to reduce uncertainty in the weekly Salmonid Distribution Table and the estimated percent of winter-run present in the Delta. This model needs to be made readily available as a transparent prediction tool that leverages recent biotic and abiotic data to predict current and near-future migration timing and provided to the SaMT to inform their discussions prior to WOMT. This effort should be completed and implemented no later than 2026.

ii. The explicit rate of winter-run Chinook Salmon juvenile out-migrant entrainment into the South Delta, the fate of individuals entrained due to OMR management, and the effects of the State Water Project (SWP) and Central Valley Project (CVP) south Delta water operations is a topic area in OMR management that has been studied in the past and merits further investigation. Loss associated with salvage events at the SWP and CVP facilities is currently used to trigger OMR management actions, but these detections in salvage occur days or even weeks after individuals were initially entrained into the South Delta and account for only a proportion of entrained individuals lost to the population. A new modeling framework is necessary for more effective real-time OMR management actions to be used to minimize winter-run Chinook Salmon entrainment into the South Delta. Specifically, the modeling framework should integrate a winter-run Chinook Salmon distribution model (e.g., Bin 2 item *i* above) with particle tracking model outcomes (potentially the individual-based ECO-PTM model developed by USGS and DWR) to estimate the proportion of the out-migrant population vulnerable to entrainment into the South Delta per day, the probability of entrainment into the South Delta given current hydrologic conditions, and the travel time to the water export facilities. Such a modeling framework should be converted into a real-time assessment tool for the SaMT to recommend OMR management actions to minimize entrainment into the South Delta well before salvage events occur.

c) Adaptive Management Technical Team: The existing Winter-run Chinook Machine Learning Interagency Team will lead analysis and development of all winter-run Chinook salmon OMR management sub-actions in coordination with other interested agencies and stakeholders. Specific work pertaining to this action should be conducted by the current Winter-run Chinook Machine Learning Interagency Team. The team has welcomed input from a diverse array of agency and stakeholder representatives since its inception to provide critical guidance throughout model development and interpretation. This role would continue with the addition of SDM processes as needed.

d) Tools: Winter-Run Chinook Salmon Machine Learning Model

2024 Incidental Take Permit – Amendment 1
California Department of Fish and Wildlife
September 29, 2025

Condition of Approval 7.9.2 Winter-run Chinook Salmon Machine Learning Model Development
Permittee shall, as part of the AMP (Attachment 4) and in coordination with Reclamation, support and fund the continued refinement of the Winter-run Chinook Salmon Machine Learning Model for use during real-time operations to inform the SaMT and implementation of this ITP. The continued refinement of the Winter-run Chinook Salmon Machine Learning Model will require the established Winter-run Chinook Machine Learning Interagency Team to incorporate genetic-based run-identification loss and monitoring data of CHNWR currently available. The Winter-run Chinook Machine Learning Interagency Team will also develop a CHNWR distribution model to explicitly predict daily juvenile CHNWR migration timing in the Delta using historical long-term monitoring data and environmental variables for SaMT to use by 2026 (Condition of Approval 8.1.2, Attachment 4).

The Winter-run Chinook Machine Learning Interagency Team shall develop a modeling framework that integrates a >10-year dataset of genetically classified CHNWR that has been compiled since the development of the Winter-run Chinook Salmon Machine Learning Model. A revised model incorporating these genetic data shall be developed based on the framework used during the development of the existing Winter-run Chinook Salmon Machine Learning Model. Specifically, a new model will be developed using biotic and abiotic variables upstream of the south Delta to predict salvage one or more weeks prior to salvage occurring.

In addition to the real-time assessment tool, the Winter-run Chinook Machine Learning Interagency Team shall also provide modeling outputs from the Winter-run Chinook Salmon Machine Learning Model and associated OMR Conversion Tool to SaMT for the implementation of Condition of Approval 8.4.4 to this ITP.

Adaptive Management Action 1 – Winter-run Old and Middle River Flows Management
a) Brief Description: Onramping and offramping Old and Middle River Flows (OMR) management for winter-run Chinook Salmon is currently informed by the Salmon Monitoring Team (SaMT). The SaMT is a technical advisory team made up of technical staff from the US Bureau of Reclamation (Reclamation), the Department of Water Resources (DWR), the National Marine Fisheries Service (NMFS), the California Department of Fish and Wildlife (CDFW), and the State Water Resources Control Board (SWRCB) that synthesizes recent field monitoring data and historical long-term monitoring data, along with expert opinion to inform the Water Operation Management Team (WOMT). Specifically, the SaMT will evaluate real-time data, including the Salmonid Distribution Table, and the weekly loss threshold table, which classifies the winter-run Chinook salmon population as the percent in the Delta. This information is used to implement the winter-run weekly loss thresholds and to minimize the effects of water operations on winter-run Chinook Salmon.

ITP Conditions of Approval 8.4.3 and 8.4.4 (Proposed Action (PA) Sections 3.7.4.1 and 3.7.4.5.3) describe the use of winter-run Chinook Salmon weekly and annual loss thresholds to trigger actions aimed to minimize entrainment and loss of juvenile out-migrants. However, it is anticipated that the criteria associated with the Winter-Run Chinook Salmon Machine Learning Model will need to be reassessed using the genetics-based run-identification loss dataset currently available as described in ITP Conditions of Approval 7.9.2 (PA Section 3.7.4.1) and a larger effort to develop a real-time assessment tool for the SaMT to recommend OMR management actions to minimize entrainment into the south Delta well before salvage events occur.

b) Assigned AM Bin: **Bin 2**
i. The development of a model explicitly predicting daily winter-run Chinook Salmon migration timing using historical long-term monitoring data and environmental variables is necessary to reduce uncertainty in the weekly Salmonid Distribution Table and the estimated percent of winter-run present in the Delta. This model needs to be made readily available as a transparent prediction tool that leverages recent biotic and abiotic data to predict current and near-future migration timing and provided to the SaMT to inform their discussions prior to WOMT. This effort should be completed and implemented no later than 2026.

ii. The previous winter-run Chinook salmon machine learning (WRCML) effort was developed using length-at-date classified winter-run Chinook salmon (WRC). However, a >10-year dataset of genetically classified WRC has been compiled since the onset of the original WRCML effort. A revised WRCML model incorporating these genetic data is to be developed based on the framework used during the development the existing WRCML model. Specifically, a new WRCML model will be developed using biotic and abiotic variables upstream of the south Delta to predict salvage one or more weeks prior to salvage occurring. This new model shall be used as a real-time assessment tool to recommend OMR/export management actions to minimize entrainment into the south Delta well before salvage events occur to prevent surpassing critical WRC salvage thresholds.

c) Adaptive Management Technical Team: The existing Winter-run Chinook Machine Learning Interagency Team will lead analysis and development of all winter-run Chinook salmon OMR management sub-actions in coordination with other interested agencies and stakeholders. Specific work pertaining to this action should be conducted by the current Winter-run Chinook Machine Learning Interagency Team. The team has welcomed input from a diverse array of agency and stakeholder representatives since its inception to provide critical guidance throughout model development and interpretation. This role would continue with the addition of SDM processes as needed.

d) Tools: Winter-Run Chinook Salmon Machine Learning Model