# Reclamation Benchmark Model Documentation

## Introduction

The United States Bureau of Reclamation (Reclamation) developed model simulations to represent facilities, regulations, and operations of the Central Valley Project (CVP) and State Water Project (SWP). Simulations were prepared to represent historical conditions (HIST) as well as 2035 climate conditions (2035CT). These products are described as Reclamation Benchmarks (Benchmarks).

If there are any questions regarding the results of these model simulations, please contact Reclamation.

Any use of model simulation results should observe limitations of the models used as well as the limitations to the modeled Benchmarks. These results should only be used for comparative purposes. More information regarding limitations of the models as well as limitations to the modeled Benchmarks is included in Attachment 4, Model Limitations.

## Models

The following CalSim II models were prepared:

* Benchmark 011721 HIST
* Benchmark 011721 2035CT

The assumptions used for each benchmark simulation and each model listed above are documented in the following attachments:

* Attachment 1 Model Assumptions
* Attachment 2 CalSim II Model Assumptions Callouts
* Attachment 3 CalSim II Model Delivery Specifications
* Attachment 4 Model Limitations and Improvements
* Attachment 5 Daily Pattern Development for the Estimation of Daily Flows and Weir Spills in CalSim II

The following is a summary of the benchmarks and the models used.

##### Benchmark 011721 HIST

The Benchmark 011721 HIST represents CVP and SWP operations to comply with the 2019 Biological Opinions and 2020 State Water Incidental Take Permit regulatory environment as of January 2021 under historical climate conditions. This includes existing facilities and ongoing programs that existed as of January 2021. Additionally, this product includes facilities and programs that received approvals and permits by January 2021.

##### Benchmark 011721 2035CT

The Benchmark 011721 2035CT represents CVP and SWP operations to comply with the 2019 Biological Opinions and 2020 State Water Incidental Take Permit regulatory environment as of January 2021 under 2035CT climate conditions and 15 cm of sea level rise. Please review the Final Environmental Impact Report for Long-Term Operation of the California SWP for details regarding development of 2035 climate hydrologic conditions (DWR, 2019). The Benchmark 011721 2035CT assumptions include existing facilities and ongoing programs that existed as of January 2021. The Benchmark 011721 2035CT assumptions also include facilities and programs that received approvals and permits by January 2021.

## CalSim II

Reclamation / California Department of Water Resources (DWR) CalSim II planning model was used to simulate the coordinated operation of the CVP and SWP over a range of hydrologic conditions. CalSim II is a generalized reservoir-river basin simulation model that allows for specification and achievement of user-specified allocation targets, or goals (Draper et al. 2004). CalSim II represents the best available planning model for CVP and SWP system operations and has been used in previous system-wide evaluations of CVP and SWP operations (U.S. Bureau of Reclamation 2015).

## References

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California Department of Water Resources (DWR). 2019. Final Environmental Impact Report for Long-Term Operation of the California State Water Project. November 2019.

Draper, A.J., Munévar, A., Arora, S.K., Reyes, E., Parker, N 1 .L., Chung, F.I., and Peterson, L.E. 2004. CalSim: Generalized Model for Reservoir System Analysis. American Society of Civil Engineers, Journal of Water Resources Planning and Management, Vol. 130, No. 6.

Martin, B. T., A. Pike, S. N. John, N. Hamda, J. Roberts, S. T. Lindley, and E. M. Danner. 2017. Phenomenological vs. biophysical models of thermal stress in aquatic eggs. Ecology Letters 20:50–59.

U. S. Bureau of Reclamation, 2015. Coordinated Long Term Operation of the CVP and SWP EIS, Appendix 5A CalSim II and DSM2 Modeling.