# Yolo and Sutter Bypass Flow and Weir Spill Analysis

## Introduction

This appendix includes methods and results for assessing Yolo and Sutter Bypass flow and weir spill and inundated area under the No Action Alternative (NAA) and the project alternatives.

## Methods

### Yolo Bypass Flow and Fremont Weir Spill

This analysis examined the frequency and duration of spills over the Fremont Weir as well as the total flows in the Yolo Bypass that would provide rearing habitat for salmonids and splittail. The number of years in the 82-year simulation period where there is at least one event of spill over the Fremont Weir into the Yolo Bypass of varying amounts (0, 2,000, 4,000, 6,000, 8,000, and 10,000 cfs) with a duration of 0 to 10 days, 11 to 20 days, 21 to 30 days, 31 to 45 days, and greater than 45 days are calculated from the daily results. Similarly, the number of years with at least one event where total Yolo flow exceeded these flows for frequency and duration is examined for the entire 82-year simulation period. This analysis was limited to the October–April months in which juvenile salmonids and spawning splittail would be present in the Yolo Bypass.

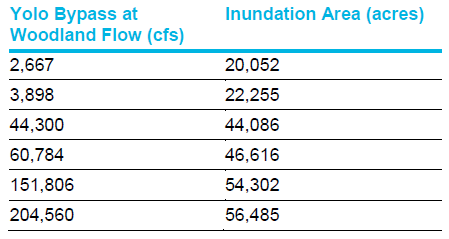
Daily Fremont Weir spill output from CalSim II was used in this analysis. Daily spill outputs from CalSim II were based on a monthly-to-daily flow mapping technique applied in the model for a better estimate of the spills at the Fremont Weir and the Sacramento Weir. The technique applies historical daily patterns, based on the hydrology of the year, to transform the monthly volumes into daily flows. Daily patterns are “borrowed” from the observed DAYFLOW period of 1956-2008. In all cases, the monthly volumes are preserved between the daily and monthly flows. It is important to note that this daily mapping approach does not in any way represent the flows resulting from operational responses on a daily time step. It is simply a technique to incorporate representative daily variability into the flows resulting from CalSim II’s monthly operational decisions.

Daily total Yolo Bypass flow results used in the current analysis were estimated using the daily CalSim II outputs of flow spills at Fremont and Sacramento Weirs, and monthly west-side stream flows disaggregated into daily flows using the historical flow patterns.

### Yolo Bypass Inundated Area

The area of Yolo Bypass habitat less than one meter deep was estimated using the Woodland gage flow-inundation area relationship developed by California Department of Water Resources (2016; Table inundation1). The habitat area was limited to area less than one meter deep based on greater habitat suitability for habitat less than one meter deep suggested by Aceituno (1990), Hampton et al. (1997), and Whipple et al. (2019).

Table inundation1. Yolo Bypass at Woodland Flow–Inundation Area Relationship



Source: Sites Project Authority (2018, Attachment A): 60.

### Sutter Bypass Flow and Weir Spill and Inundated Habitat Area

Similar to the methodology used for the Yolo Bypass, modeled daily spill into the Sutter Bypass from the Sacramento River at Ord Ferry and the Moulton, Colusa, and Tisdale weirs was used to examine the frequency and duration of total spill into the Sutter Bypass that could provide rearing habitat for salmonids and splittail. Spill (flow) at Ord Ferry, Moulton Weir, and Colusa Weir were combined to assess potential changes in the northern portion of the Sutter Bypass; total spill at Ord Ferry, Moulton, Colusa, and Tisdale weirs was combined to assess potential impacts in the central portion of the bypass; and total flow through the bypass was used as an indicator of potential changes in floodplain habitat in the southern portion of Sutter Bypass. The number of years where there is at least one event of spill over the weirs into the Sutter Bypass of varying amounts (0, 2,000, 4,000, 6,000, 8,000, and 10,000 cfs) with a duration of 0-10 days, 11-20 days, 21-30 days, 31-45 days, and greater than 45 days was calculated from the daily results. This analysis was limited to the October–April months in which juvenile salmonids and spawning splittail are anticipated to be present in the Sutter Bypass.

Similar to the Yolo Bypass analysis, the area of Sutter Bypass with depth less than one meter was also calculated.

[NEED TO ADD IN HABITAT AREA SOURCE]

## Results

Results for Yolo Bypass are provided in Attachment 11M-1, Yolo Bypass inundation. Results for Sutter Bypass are provided in Attachment 11M-2, Sutter Bypass inundation.

## References Cited

Aceituno, M. E. 1990. Habitat preference criteria for Chinook salmon of the Stanislaus River, California. US Department of the Interior Fish & Wildlife Service, Sacramento, California.

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Sites Project Authority. 2018. Appeal to Public Benefit Ratio (PBR) Review, Letter dated February 1, 2018. Attachment A, Anadromous Fish (Sacramento River).

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