

TECHNICAL MEMORANDUM

Date:	July 11, 2016
To:	Barry O'Regan (KSN)
From:	Chris Campbell
Project:	16-1002 – Wallace Weir Fish Rescue Facility
Subject:	Potential Water Surface Elevation Changes

The following is summary of potential water surface elevation (WSE) changes in the Colusa Basin Drain (CBD) near State Route 113 (SR 113) for a range of flows due to the proposed Wallace Weir Fish Rescue Facility (Project). The potential WSE changes were assessed by using a HEC-RAS hydraulic model (not described here) to compute the difference in the water surface profiles between existing and project conditions along Knights Landing Ridge Cut (KLRC) from the Tule Canal upstream to its connection with the CBD near SR 113.

FREMONT WEIR NON-OVERTOPPING CONDITIONS

For KLRC flows ranging from 50 to 4,000 cfs for Fremont Weir non-overtopping conditions, Table 1 shows the changes in upstream WSEs based on proposed gate operations required for submergence of the fish facility intake and diffusers. These results generally show that for KLRC flows below 800 cfs, the WSEs in the CBD near SR 113 are below 25.5 ft USED during which the Knights Landing Outfall Gates (KLOG) gates have historically remained open because Sacramento River WSEs are lower than CBD WSEs. As such, any increase in WSEs in CBD below a stage of 25.5 ft can be mitigated by shunting additional flows through KLOG to the Sacramento River. However, CBD WSEs above 25.5 ft result in potential flooding of agricultural lands along the west side of the CBD when flows in KLRC are above 800 cfs (which occurs 25% of the time). For CBD WSEs above 25.5 ft, the KLOG gates have historically been closed in the winter because the Sacramento River WSEs are typically higher than CBD WSEs. As such, there is no ability to convey water to the Sacramento River, and the CBD WSEs rise up to 0.36 ft at 800 cfs and 0.08 ft at 4,000 cfs (see Table 1). This may cause potential nuisance flooding to fields along the south end of the CBD during the winter season during Fremont Weir non-overtopping conditions. To minimize the potential for nuisance flooding, the head drop across the fish facility entrance gate can be reduced from its optimal range of 1.0 to 1.5 ft to the minimum NMFS criteria of 0.5 ft. For KLRC flows in the range of 800 to 3000 cfs, the minimum drop across the entrance gate reduces the CBD WSE increases from up to 0.37 ft down to below 0.13 ft (see [] values in Table 1). For the highest flows above 3000 cfs, which occur only 1% of the time between October through May for Fremont Weir non-

overtopping conditions, minimizing the drop across entrance gate has no effect on CDB WSEs because all three of the operable gates on Wallace Weir are already fully lowered.

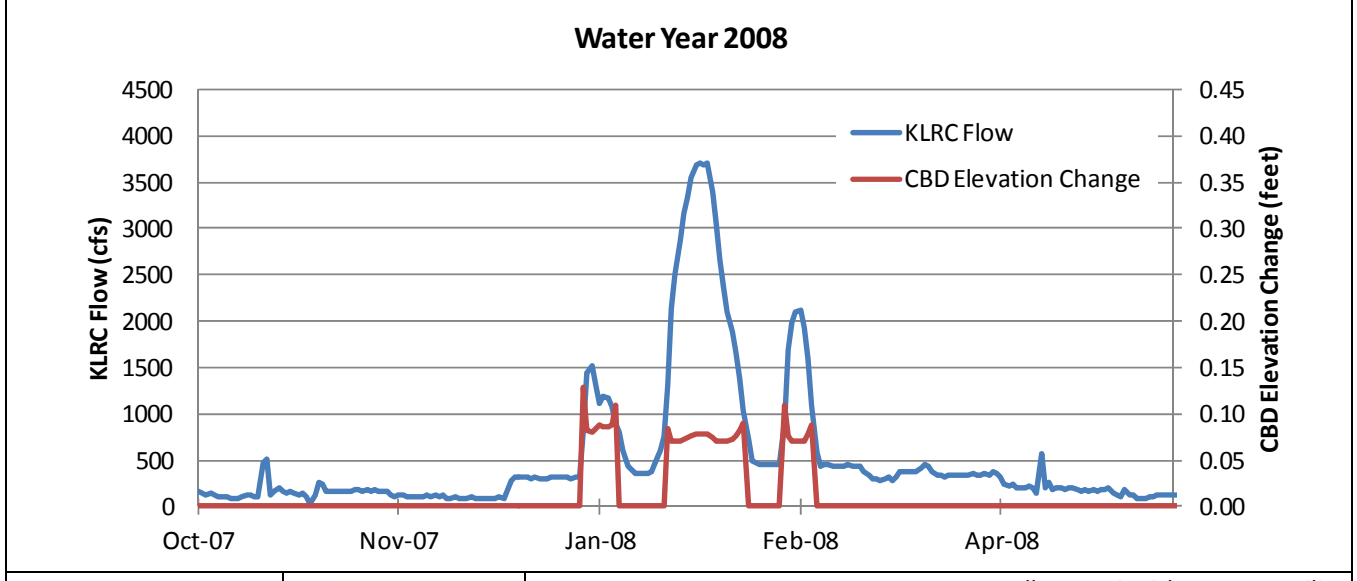
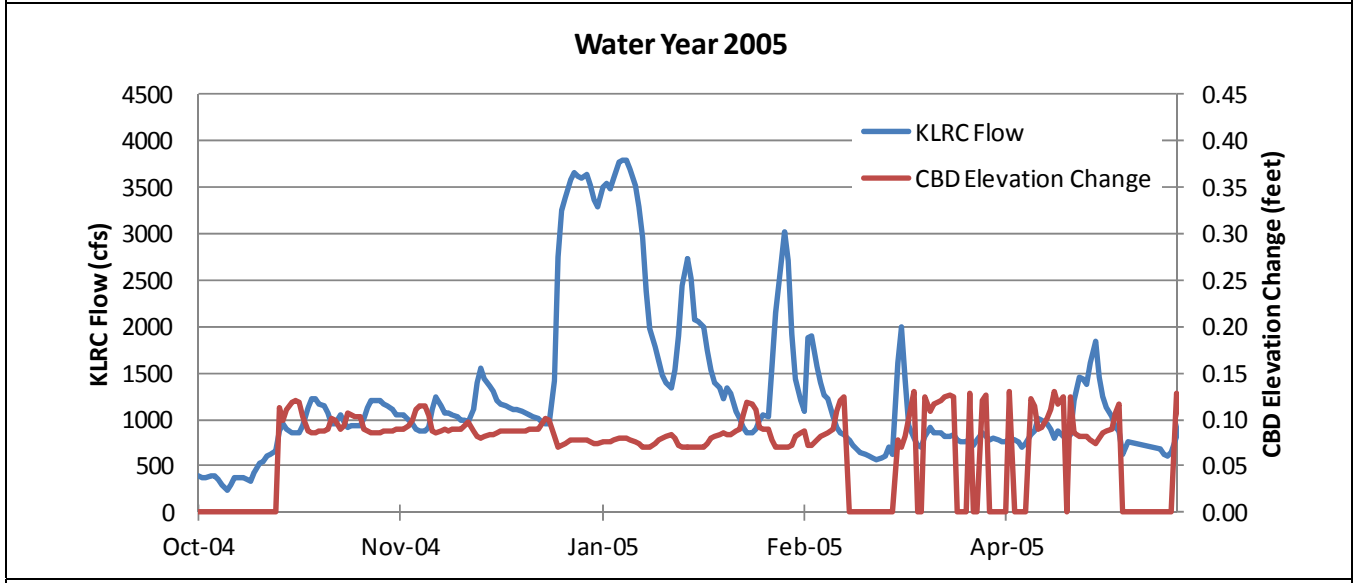
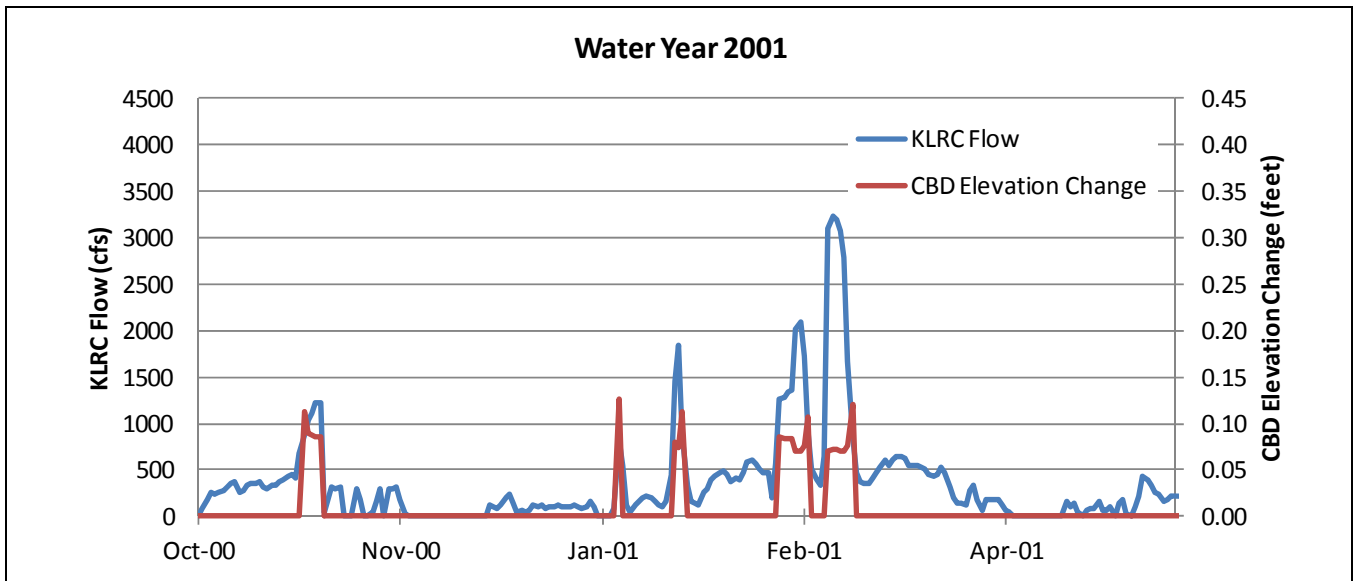
Overall, the proposed operation of Wallace Weir will result in ± 0.1 ft increase in WSEs on the CBD near SR 113 for Fremont Weir non-overtopping conditions 15% of the time from October through May. As shown by Figure 1, and depending on the water year, this can range from 1 to 7 months cumulatively within an 8 month operational period. Furthermore, the WSE changes in the CBD near 113 will quickly diminish in the upstream direction.


Table 1. Changes in upstream Colusa Basin Drain water surface elevation near SR 113.

Profile	KLRC Flow (cfs)	Existing WSE (USED, ft)	Project WSE (USED, ft) [per 0.5 ft gate drop]	Difference in WSE (ft) [per 0.5 ft gate drop]	Maximum additional capacity through KLOG (cfs)
1	50	20.81	20.95	0.14	180 ¹
2	100	21.26	21.43	0.17	190 ¹
3	200	22.04	22.24	0.20	230 ¹
4	300	22.72	22.98	0.25	280 ¹
5	400	23.3	23.67	0.36	380 ¹
6	500	23.83	24.16	0.32	350 ¹
7	600	24.33	24.62	0.29	340 ¹
8	700	24.78	25.24	0.46	490 ¹
9	800	25.24	25.61 [25.37]	0.37 [0.13]	0 ²
10	900	25.67	25.96 [25.78]	0.29 [0.11]	0 ²
11	1000	26.03	26.25 [26.12]	0.22 [0.09]	0 ²
12	2000	28.27	28.47 [28.34]	0.20 [0.07]	0 ²
13	3000	29.75	29.91 [29.82]	0.16 [0.07]	0 ²
14	3800	30.76	30.86 [30.84]	0.10 [0.08]	0 ²
15	4000	30.97	31.05 [31.05]	0.08 [0.08]	0 ²
Notes:					
[1] Based on historical correlation between KLOG flow and Sacramento River water levels					
[2] KLOG gates typically closed					

FREMONT WEIR OVERTOPPING CONDITIONS

For KLRC flood flows of 4,000, 10,000, and 20,000 cfs and concurrent with Fremont Weir overtopping, the HEC-RAS model was used to assess WSE changes in the Yolo Bypass and along KLRC. During overtopping conditions, the Yolo Bypass flood waters create a significant backwater effect that submerges Wallace Weir with up to 5, 6, and 9 feet of water at 4,000, 10,000, and 20,000 cfs, respectively. As such, there is a very localized increase in WSEs up to 0.1 ft in the immediate vicinity of Wallace Weir within the Yolo Bypass, but within KLRC up to SR 113, there are no changes to the water surface profiles when Fremont Weir is overtopping.



Notes:	 cbec eco engineering	<i>Wallace Weir Fish Rescue Facility</i> WSE changes at State Route 113 bridge
	Project No. 16-1002	Created By: CRC
		Figure 1