APPENDIX F-2

Chelsea Wetland Restoration Project Hydraulic Analysis Technical Memorandum (Questa, 2014)

Technical Memorandum

Date: August 11, 2014

To: Ducks Unlimited

From: Questa Engineering Corporation

Subject: Chelsea Wetland Restoration Project Hydraulic Analysis

Proposed Chelsea Wetland Restoration Project

The proposed Chelsea Wetland Restoration Project is a tidal marsh restoration project located in Pinole, Contra Costa County, California. The project is immediately adjacent to Pinole Creek approximately 1,800 feet upstream of its confluence with San Francisco Bay. Pinole Creek is part of the federally authorized Pinole Creek Local Flood Protection Project. The proposed project includes excavation and grading of approximately 12 acres of land adjacent to Pinole Creek, construction of tidal channels connecting the project site to Pinole Creek through a new concrete bottomless arch culvert. The project will also entailed the installation of a vinyl-sheet pile wall, and the construction of small upland islands.

The project is not proposing significant changes to the Pinole Creek channel geometry or hydraulic function. The new culvert will allow daily tidal influence into the site but will have little effect during large magnitude or design flows. During these events, flow overtops the existing northern (right) bank when rates exceed of the 25-year event and flood the site. These flows are generally nearly still and the project area represents flood plain storage and not conveyance.

On behalf of Ducks Unlimited, Questa conducted a hydraulic impact analysis to determine the impacts of the proposed project on the authorized Federal project. The Pinole Creek Local Flood Protection Project was authorized for a 2,600 cfs discharge.

METHODOLOGY

The methodology used to determine the hydraulic impacts associated with the proposed project were to compare the water surface elevation associated with the with-project condition to the water surface elevation of the existing condition using the design flow of 2,600 cfs. Velocities are low in the project area and the site is considered to be non-effective flow and floodplain storage.

Downstream Boundary Condition - Tidal Water Surface Elevation

The beginning tidal elevations used as the downstream boundary condition for the HEC-RAS models are summarized in **Table 1**.

Table 1. Tidal Elevations

Design Value	NAVD88
Mean Higher High Water Beginning water surface elevation : **design conditions**	**5.76 feet**

Upstream Boundary Condition and Flow Regime

The HEC-RAS models were run with the mixed flow regime and the upstream boundary conditions were set as normal depth with a slope of 0.003 ft/ft.

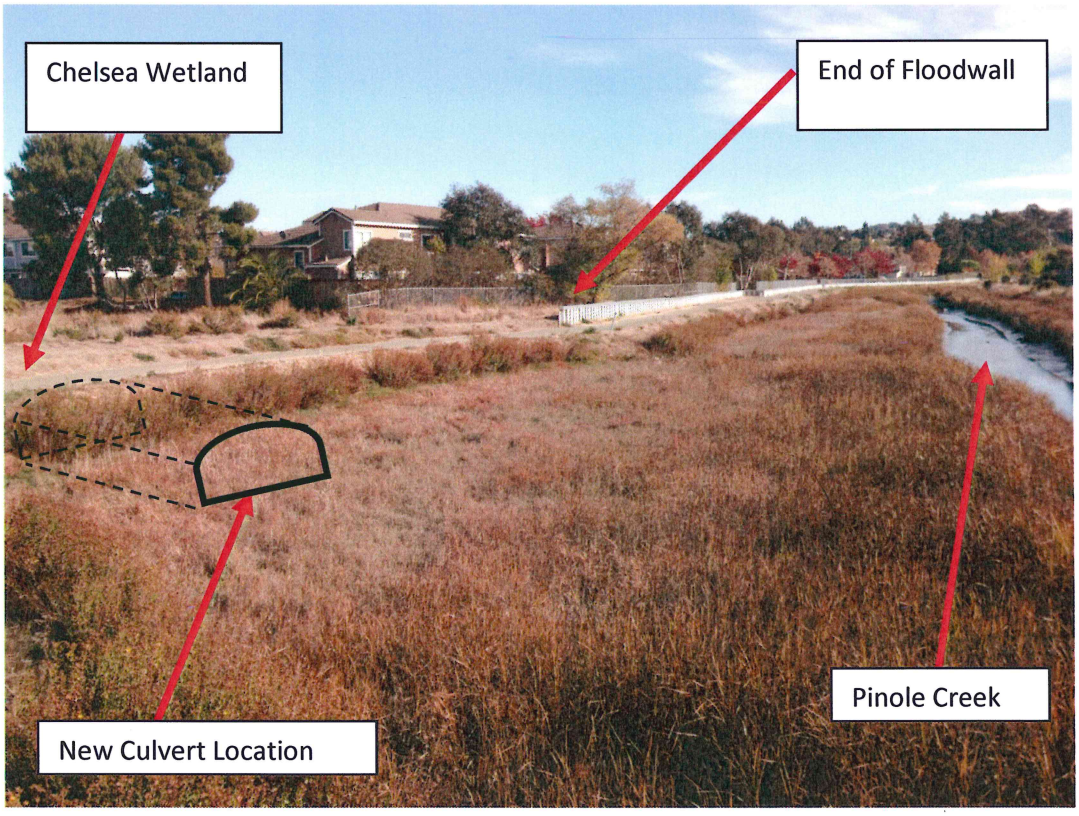

Photo 1. Floodwall along the northern bank of Pinole Creek ending at Chelsea Wetland; photo taken from new pedestrian bridge looking upstream to the east.

Existing Pinole Creek Cross Sections

Channel cross sections taken from a 2012 field survey were compared to the cross sections simulating the Chelsea Wetlands Restoration project. The existing condition and proposed project are modeled in applicable HEC-RAS models. The five cross sections located at Stations 1876.5, 1926.5, 1976.5, 2026.5, and 2076.5 as shown on **Figure 1,** were updated based on existing topography from the 2012 survey. Cross sections 1876.5, 1926.5, and 1976 were extended into the Chelsea wetland site.

Figure 1. Plan View of HEC-RAS Cross Section Location

Results

Figure 2 below shows the existing condition profile for the design flow of 2,600 cfs. As can be seem, by the profile below the bridges immediately downstream of the project site create significant back water at the site and control the water surface elevations on Chelsea site. Figure 3 show the cross section through the Chelsea site. For both the pre and post project models the levee was lowered on the right bank and flow was allowed to spill into the Chelsea site. The three cross sections in the post project model were revised to represent the general grading of the Chelsea site. The site will be lowered in elevation from 9 to 10 NAVD to 6 NAVD. The culvert installed in the right bank to allow for tidal inundation is overtopped easily and therefore is not included in these models. The Chelsea site was modeled as ineffective flow in both the pre and post project scenarios. The grading has no effect other than increasing the amount of floodplain storage on the site.

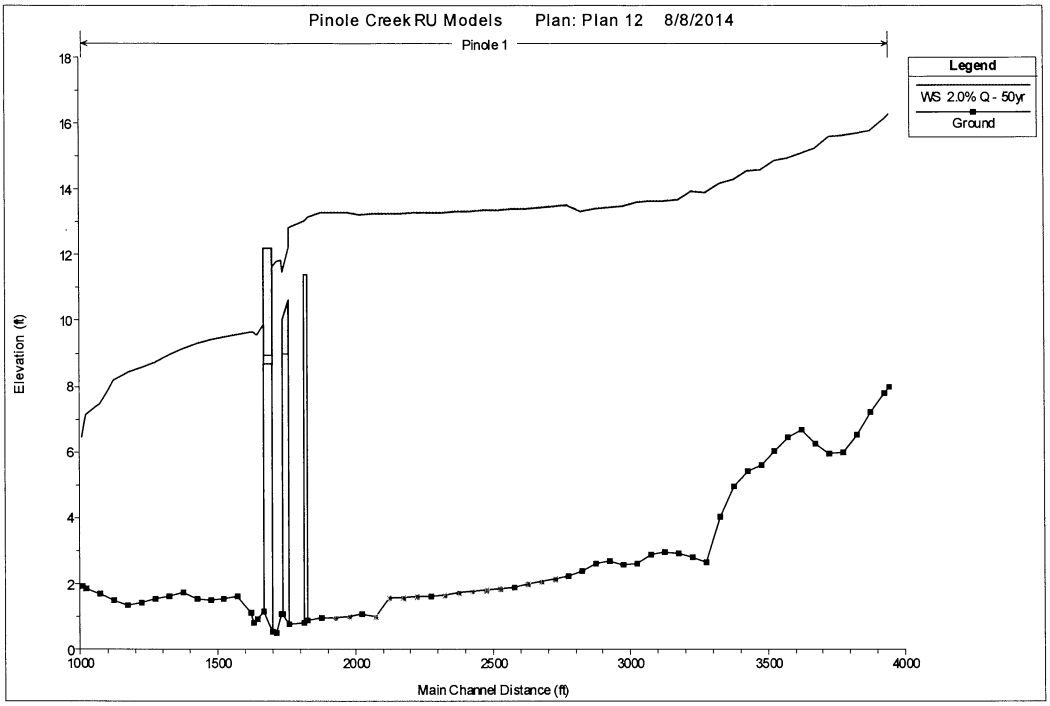

Figure 2. Existing condition Water Surface Profile, 2,600 cfs (50-year design flow)

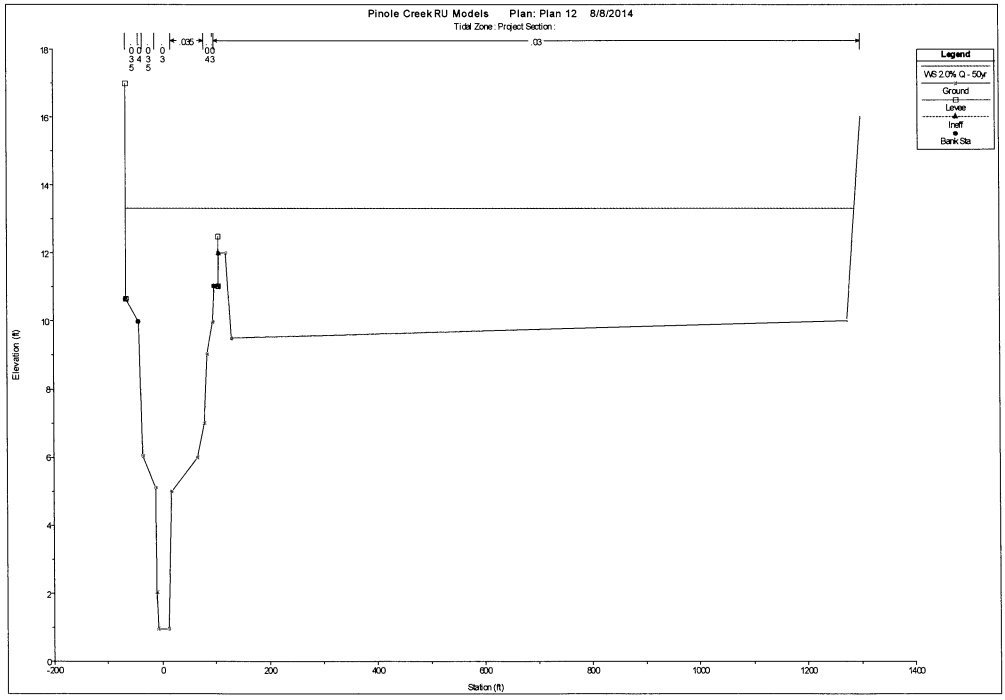

Figure 3. Existing condition, Cross section – 2013 survey

Table 2. Comparison between Existing and Proposed conditions at the Chelsea Wetlands Project

River Sta	Q Total (cfs)	Existing W.S. Elev (ft)	Proposed W.S. Elev (ft)	Existing Vel Chnl (ft/s)	Proposed Vel Chnl (ft/s)	Change in W.S. Elev (ft)	Change in Vel Chnl (ft/s)
2176.5	2600	13.3	13.28	2.89	2.9	-0.02	0.01
2126.5	2600	13.29	13.28	2.75	2.76	-0.01	0.01
2076.5	2600	13.26	13.27	2.87	2.61	0.01	-0.26
2026.5	2600	13.25	13.27	2.87	2.47	0.02	-0.4
1976.5	2600	13.33	13.33	0.68	0.25	0	-0.43
1926.5	2600	13.33	13.33	0.64	0.25	0	-0.39
1876.5	2600	13.33	13.33	0.63	0.25	0	-0.38
1826.5	2600	13.17	13.17	3.64	3.64	0	0
1820	Bridge						
1814.5	2600	13.03	13.03	3.67	3.67	0	0
1759.5	2600	12.87	12.87	4.29	4.29	0	0
1746.5	Bridge						
1733.5	2600	11.86	11.86	4.9	4.9	0	0
1712.5	2600	11.84	11.84	4.86	4.86	0	0
1700.5	2600	11.68	11.68	5.66	5.66	0	0
1684.5	Bridge						
1668.5	2600	9.91	9.91	5.99	5.99	0	0
1644.5	2600	9.61	9.61	6.97	6.97	0	0
1632.5	2600	9.66	9.66	6.45	6.45	0	0

CONCLUSION

The proposed project will not result in significant changes to the performance of the Pinole Creek Local Flood Protection Project. The maximum water surface elevation impact is 0.02 feet.

Sydney Temple P.E.
Questa Engineering Corporation