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memorandum

date	September 26, 2019; revised December 6, 2019
to	Abigail Fateman, East Contra Costa County Habitat Conservancy
from	Christie Beeman, PE, Environmental Science Associates
subject	Knightsen Wetland Restoration and Flood Protection Project – Surface Water Hydrology Assessment

This memorandum describes surface water hydrologic conditions on the Knightsen Wetland Restoration and Flood Protection Project (the project) site. The site is influenced by both stormwater runoff from the surrounding drainage area and Delta tidal hydrology via No Name Sough which borders the site. The sections below describe stormwater runoff and tidal hydrology at the project site.

Tidal hydrology of the site was characterized in the 2002 Knightsen Water Quality Wetland Feasibility Study (PWA 2002). We have converted the tide signal recorded in that study into NAVD and compared it to other local tide data. We have also investigated more extreme water levels by reviewing the U.S. Army Corps Delta Flood Study (USACE 1992) to estimate the highest annual tide and 10-, 100-year tide levels in the vicinity of the site. Detailed tide gage deployment will be deferred to a subsequent project phase to inform detailed design following selection of a preferred project alternative.

Stormwater Runoff

The project site is located at the downstream-most portion of a 3.46 square-mile drainage area in the vicinity of the community of Knightsen. The topography of the entire drainage area is relatively flat with few distinct drainage features or channels. Historically, sheet flow and shallow swales directed runoff to wetlands that lined the fringe of the Delta. Currently, sheet flows are intercepted by private and public drainage ditches, roads, railroad embankments and levees. The flat topography combined with this variety of constructed features restricts drainage and results in relatively frequent flooding in some areas of the community.

Figure 1 shows the general drainage pattern for the Knightsen area. The Santa Fe Railroad tracks, which traverse the community from the southeast to northwest, split the drainage area and block surface flow from the southwestern half of the drainage area. Surface flow impounded by the railroad embankment is directed to two culverts which direct flow toward the project site. The majority of runoff generated on the west side of the tracks flows northeast towards downtown Knightsen where it is captured behind the railroad embankment and then flows southeast to a culvert under the railroad. From there, runoff flows northeast towards Byron Highway, then

north to Delta Road and east along the Delta Road drainage ditch to the project South Parcel. Within the project area (South Parcel and Veale Tract), agricultural drainage ditches and pumping operations direct this runoff to No Name Slough. A smaller, southern portion of the drainage area drains north toward No Name Slough in the vicinity of Eagle Lane.

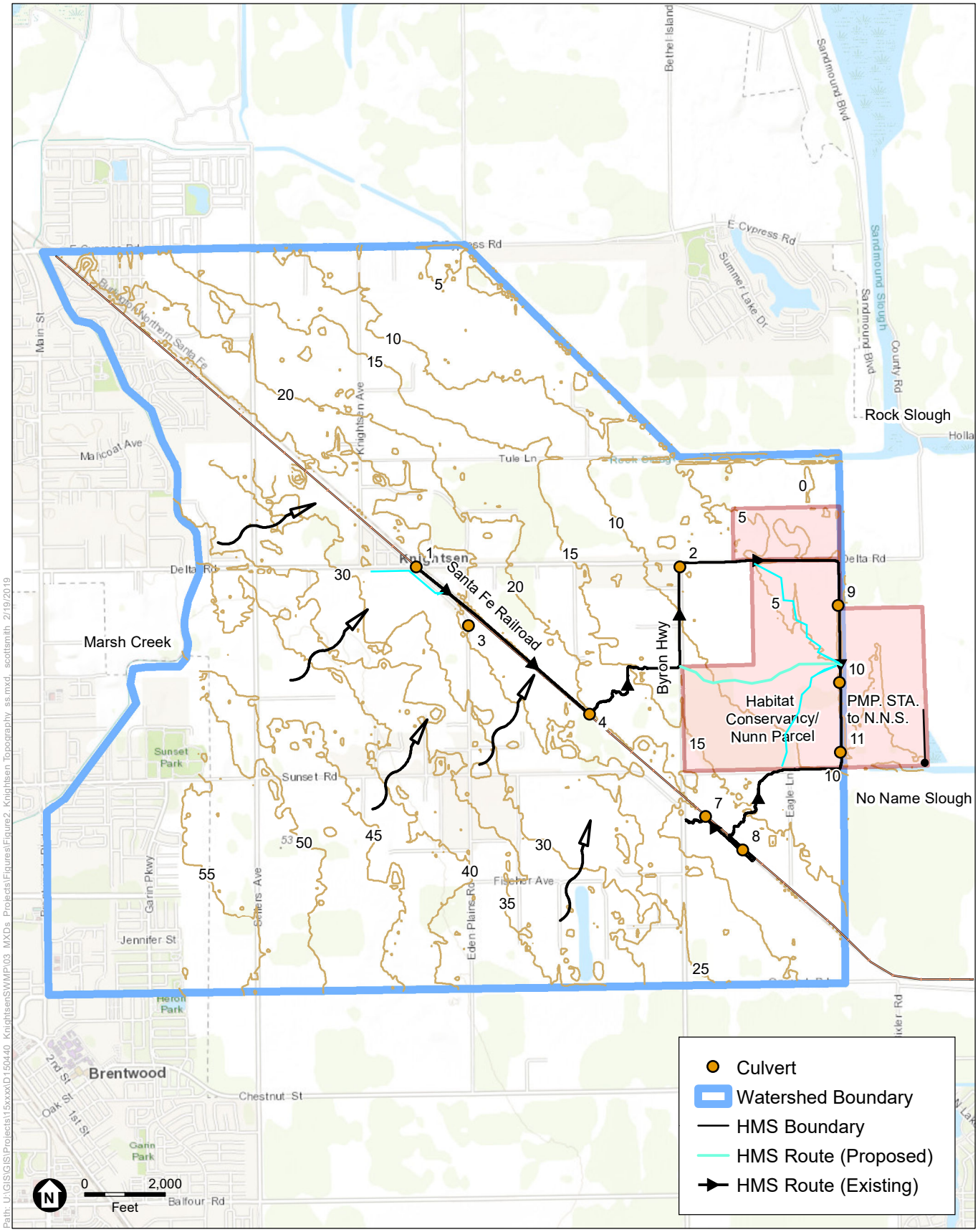
As described above, the existing Delta Road drainage ditch delivers runoff to the South Parcel and Veale tract. This supply of surface runoff, which is currently pumped into no Name Slough, could potentially be used to help support wetland and other habitats at the project site. Observations documented in Balance Hydrologics, 2019 indicate that a substantial volume of runoff may be discharged to the project site during storm events. Estimated volumes discharged to the project site range from about 47 acre-feet in a 5-year, 24-hour storm event up to about 67 acre-feet in a 25-year, 24-hour storm event. If runoff that is currently conveyed to Delta Road is diverted on to the Conservancy parcel at Byron Highway near Ironhorse Road, the volume of runoff discharged onto the project site at Delta Road would be reduced to about 9.6 to 13.8 acre-feet in a 5-year and 25-year, 24-hour event, respectively. At Byron Highway, the diversion would discharge about 36 to 51 acre-feet of runoff onto the project site in a 5-year and 25-year, 24-hour event. Additionally, the Eagle Lane triangle, south of the South Parcel, generates 15 to 25 acre-feet of runoff from 5-year and 25-year, 24-hour storm events that is currently discharged to No Name Slough via a gravity driven, flap gated culvert.

To inform alternatives development for water quality treatment functions, the following water quality volumes and flow rates were estimated:

- Delta Road – up to 7.3 acre-feet or about 30 cfs (without the Byron Highway Diversion)
- Delta Road – up to 3.4 acre-feet or about 21 cfs (with the Byron Highway Diversion)
- Byron Highway – up to 2.3 acre-feet or about 9.6 cfs
- Eagle Lane – up to 1.5 acre feet or about 6.2 cfs

Tidal Hydrology

No Name Slough, which borders the site to the south, is subject to the tidal signal of the Delta and would be the source of tidal flows for conceptual restoration alternatives that include tidal marsh restoration. The tide signal in No Name Slough is very similar to that in Rock Slough, which is located to the north of the site and has a tide gage at the Contra Costa Canal (PWA, 2002). Four months of Rock Slough tide gage data are summarized in the table below. A factor of +2.353 feet was used to convert elevations reported in NGVD to the NAVD vertical datum.



SOURCE: ESRI World Imagery

Knightsen Wetland Restoration and Flood Protection Project D170045.00

Figure 1
Knightsen Surface Water Drainage

ESA

Table 1. Rock Slough Tidal Measurements

	elevation in feet (NAVD)			
	Feb-98	Mar-98	Aug-01	Sep-01
Maximum Water Surface	9.12	7.05	5.86	5.94
Mean Daily High Water	7.62	6.34	5.48	5.36
Average Water Surface	6.16	4.83	3.73	3.74
Mean Daily Low Water	4.93	3.26	1.91	2.02
Minimum Daily Water Surface	3.54	2.70	1.65	1.64

The tidal measurements from August and September 2001 represent typical tidal elevations during the dry season. During the rainy season, water levels in Rock Slough and No Name Slough are potentially influenced by storm surge and stormwater runoff. These effects are reflected in the higher elevations recorded for February and March 1998. Additional water level data collected at No Name Slough in 2019 is reported in Balance Hydrologics 2019.

The US Army Corps of Engineers analyzed water level data from numerous gage stations within the Delta to estimate extreme water levels for the 1992 Sacramento-San Joaquin Delta, California Special Study, Hydrology (USACE 1992). The 50- and 100-year flood stages for Old River at the mouth of Rock Slough reported in this study are summarized in Table 2. (No Name Slough joins Rock Slough upstream of its confluence with Old River; **Figure 2**.)

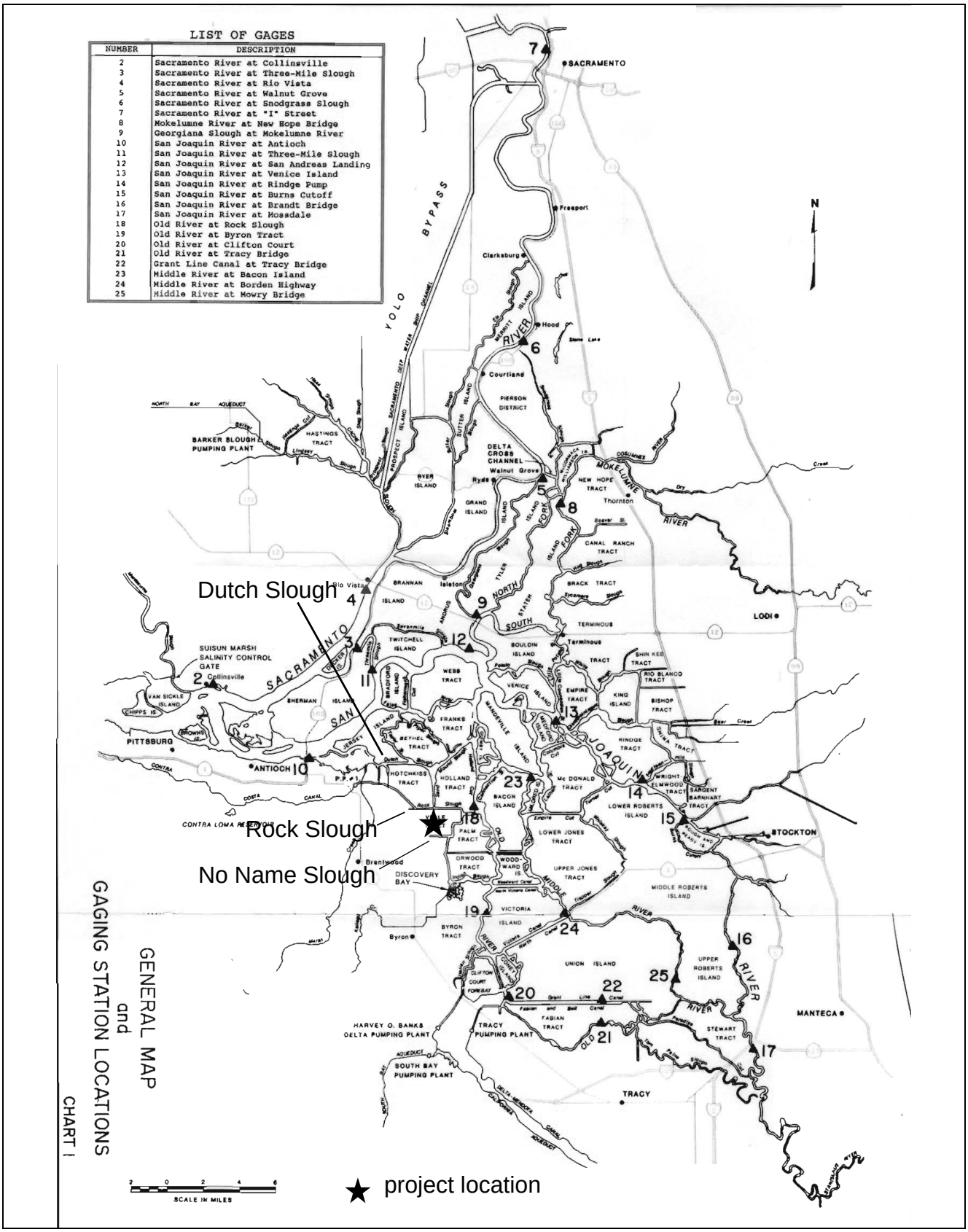
Table 2. Extreme Tides – Old River at Rock Slough

	Elevation in feet (NAVD)	
	50-year	100-year
Old River at Rock Slough	9.153	9.553

The nearest station for which NOAA reports tidal datums is Dutch Slough (Station ID 9415053), which is located about 4 miles to the north (**Figure 2**). Tidal statistics for the Dutch Slough tide gage station are shown in Table 3 below for reference (ESA 2010). Dry weather tidal measurements from Rock Slough (Table 1) suggest that the tide range in Rock Slough and No Name Slough is similar to that of Dutch Slough. Tide gages will be deployed in a subsequent project phase to collect detailed water level data for No Name Slough and inform detailed design following selection of a preferred project alternative.

Table 3. Dutch Slough Tidal Datums

	Elevation feet NAVD
100-year Tide Level	8.85
Mean Higher High Water (MHHW)	5.50
Mean High Water (MHW)	5.05
Mean Tide Level (MTL)	3.82
Mean Low Water (MLW)	2.58
Mean Lower Low Water (MLLW)	2.06



SOURCE: USACE 2002

Knightsen Wetland Restoration and Flood Protection D170045.00

Figure 2

Delta Gaging Stations

References

Balance Hydrologics 2019. Knightsen Wetland Restoration and Flood Protection Project Baseline Soils Evaluation and Hydrologic Monitoring. Prepared for the East Contra Costa County Habitat Conservancy. June 2019.

ESA 2010. Dutch Slough Tidal Marsh Restoration Revised Conceptual Plan. Prepared for the CA Department of Water Resources, Reclamation District 2137 and the CA State Coastal Conservancy. October 18, 2010

PWA, 2002. Knightsen Water Quality Wetland Feasibility Assessment. Prepared for Contra Costa County Public Works Department. November 26, 2002

U.S. Army Corps of Engineers (USACE), February 1992. Sacramento-San Joaquin Delta, California, special Study, Hydrology (unpublished report)