3.9 Hydrology and Water Quality

This section evaluates the potential impacts related to hydrology and water quality during construction, invasive plant management and maintenance of the Project. Construction activities include the earthwork involved in the estuarine restoration and infrastructure improvement portions of the Project. Invasive plant management activities include the removal of dense-flowered cordgrass (*Spartina densiflora*), European beachgrass (*Ammophila arenaria*), and dwarf eelgrass (*Zostera japonica)* using any one or a combination of the methods described in Section 2.5 (Proposed Invasive Plant Management). Maintenance activities include periodic repairs and improvements to the non-motorized boat put-in, trails, parking lots and road within the Project Area, and also include monitoring activities. For the purpose of this section, the study area includes the Project Area, McNulty Slough and associated levee systems, the first 500 feet (152 meters) of lower Hawk and Sevenmile sloughs, and the entirety of North Bay upstream of its confluence with the Eel River. See Figure 3.9-1 – Study Area, for a visual representation of the study area.

3.9.1 Setting

The study area includes a sliver of coastline that extends for nearly four miles between the Eel River mouth at the south end and the Table Bluff uplands to the north. North Bay and McNulty Slough represent the east boundary of the study area and the Pacific Ocean forms the west boundary. Immediately east and parallel to the beach are dune fields that forms a low ridgeline. Collectively, the beach and dune fields represent a barrier beach/spit that separates the Eel River valley and delta from the ocean. Between the barrier bar and McNulty Slough is a lowland salt marsh that was diked and drained to accommodate livestock grazing during the late 1800s. Associated with that grading was the construction of a network of levees that border both sides of McNulty Slough and diminish tidal exchange into and across the salt marsh. McNulty Slough proper is a tidal slough channel that extends north from North Bay, a small embayment just north of the Eel River mouth.

Watershed Context and Hydrology Overview

The Eel River drains a watershed (basin) that comprises approximately 3,683 square miles of rugged Coast Range terrain where elevations range from sea level to 7,000 feet (2,134 meters). It is about 120 miles long, averages 30 miles in width, and is underlain chiefly by sedimentary rocks (mostly graywacke sandstone) of the Franciscan complex that have been uplifted and are fractured, faulted, and penetratively sheared (Bailey et al. 1964; Brown and Ritter 1971; McLaughlin et al. 2000). Much of the watershed has been subject to heavy logging, grazing, and widespread road construction that have destabilized soils (Brown and Ritter 1971; CDFW 2010).

The region has a Mediterranean climate with cool wet winters, and warm dry summers. The study area exhibits mild weather throughout the year characterized by cool, foggy summers and cool, rainy winters. December is the coldest month, with an average maximum temperature of 55 °F and an average minimum temperature of 41 °F. August is the warmest month which has an average maximum temperature of 64 °F and an average minimum temperature of 53 °F. Rainfall occurs from October through April, and annual precipitation ranges from about 35 inches along the coast to more than 110 inches in the mountains southeast of Scotia (Rantz 1969). Large and intense cyclonic storms lasting several days occur periodically in northern California and have generated flood-producing rainfall (Wolman, 1990; Harden, et. al., 1995; Sloan et. al. 2001) Collectively, the geology, steep slopes, intense land use, and heavy precipitation generates much mass wasting and widespread erosion each year that contributes to the sediment yield out of the basin (Brown and Ritter, 1971; Sloan et. al. 2001). Brown and Ritter (1971) report that the annual suspended sediment yield out of the Eel River basin is more than 15 times that of the Mississippi River and more than four times that of the Colorado River.

The Eel River estuary is protected by a barrier beach/spit and could be classified as a bar-built estuary (Pritchard, 1967). Such a classification is based exclusively on geologic features and more recent estuary classification systems include a greater number of attributes such as wave and tidal energy, water circulation patterns, and habitat typing (USACE 2002; NOAA 2020a; FGDC 2012; Heady et. al. 2014). The Nature Conservancy (Heady et. al. 2014) classifies the Eel River estuary as a “riverine estuary”. Such estuaries are defined as being generally linear and seasonally turbid (especially in upper reaches), and possibly subjected to high current velocities. These estuaries are also sedimentary “sinks” and may be associated with a delta, bar, barrier island and other depositional features. They also tend to be highly flushed (with a wide and variable salinity range) and seasonally stratified. These estuaries are often characterized by a V-shaped channel configuration and a salt wedge (Heady et. al. 2014).

Salinity within the estuary was estimated during the 1970s by the California Department of Water Resources (CDWR) through measurements of electrical conductivity (CDWR 1977). Similar measurements were conducted periodically in McNulty Slough by the Wiyot Tribe between 2004 and 2015 (CDFW 2010; Wiyot Tribe 2020). The CDWR data indicates that salinity in the estuary is highly varied with regard to location, tide, and the seasonal fluctuations of Eel River streamflow. In general, salinity values are highest closest to the river mouth and diminish with distance away from the mouth upstream through the various sloughs and the mainstem Eel River. The maximum extent of estuarine influence in the mainstem appears to be Fernbridge located approximately 7 miles upstream from the river mouth, while tidal influence (water movement) may extend upstream as far as the confluence with the Van Duzen River (CDFW 2010)

CDWR (1977) reports greater salinity values during high tides compared to low tides, and higher salinity values during late summer when freshwater inputs to the estuary are at a minimum. CDWR also found that in early summer, specific conductance in parts of the estuary were stratified with high values at the bottom and low values at the surface during high tide. As discussed by CDFG (1977), this phenomenon was attributed to a saltwater "wedge” moving back and forth in the sloughs. High tides bring in dense saltwater from the ocean, and as the saltwater proceeds upstream, less dense freshwater flows over the denser saltwater. In late summer, however, the saltwater wedge was less prevalent because the freshwater flow is very slight. Given these patterned fluctuations of salinity, the Eel River estuary could be classified as “intermittent”. As defined in the literature however, estuarine intermittency implies wholescale shifts in salinity and ecotone for prolonged periods of time (Elliot and McLusky 2002; Tagliapietra et.al. 2009; Saintilan et.al. 2016). For example, if the freshwater input dries up completely during the dry season, the estuary loses its identity and becomes an oceanic embayment. On the other hand, if a barrier bar/beach completely blocks the mouth of the river, the estuary again loses its identity and becomes a freshwater lagoon. Review of U.S. Geological Survey (USGS) gaging station data, a compilation of newspaper articles extending back to 1854 (Klamath Resource Information System 2020) and other historic literature (Monroe and Reynolds 1974; Ames 1983; PWA 1988; USDA 1989; Roberts 1992; CDFW 2010) revealed no reports of the Eel River going dry and not discharging freshwater into the estuary. As for mouth closures, only one report was found. That closure occurred in April of 1988, is stated to have been the "first ever closure" and appears to have persisted for about three weeks (PWA 1988; USDA 1989). Collectively, the discussion above suggests that the Eel River estuary is not an intermittent estuary because freshwater input prevails year-round as does an open connection to the sea. Instead, the estuary appears better classified as a salt-wedge estuary during the winter and early summer months and perhaps a slightly stratified estuary during the late summer (NOAA 2020a).

Drainage and Flooding

Brown and Ritter (1971) report that the average annual runoff in the Eel River basin is approximately 35 inches (~6.9 million acre-feet (maf)). Runoff from nearly 91 percent of the Eel River basin is measured at two long-term USGS gauging stations: Eel River near Scotia (No. 11-477000) and the Van Duzen River near Bridgeville (No. 11-478500). The highest annual runoff volume total for the Eel River measured at the Scotia gage was 12.5 maf in 1983. During the catastrophic flood of December 23, 1964, the peak flood recorded at the USGS Scotia gage is reported to have been 752,00 cubic feet per second (cfs). Approximately two hours later and 14 miles farther downstream, the flood peak reached Fernbridge and may have exceeded 800,000 cfs (CDWR 1965). An oblique aerial photograph dated December 23, 1964 shows the lower Eel River valley/delta at Port Kenyon near the City of Ferndale inundated by about four feet of water in all directions.

Contemporary flooding of the Eel River delta and the study area is fairly common (Image 3.9-1) and associated with low-recurrence flood events of the Eel River and tides. During the dry season, Eel River baseflow conditions prevail and diurnal tidal exchange dominates the hydrology of the study area.

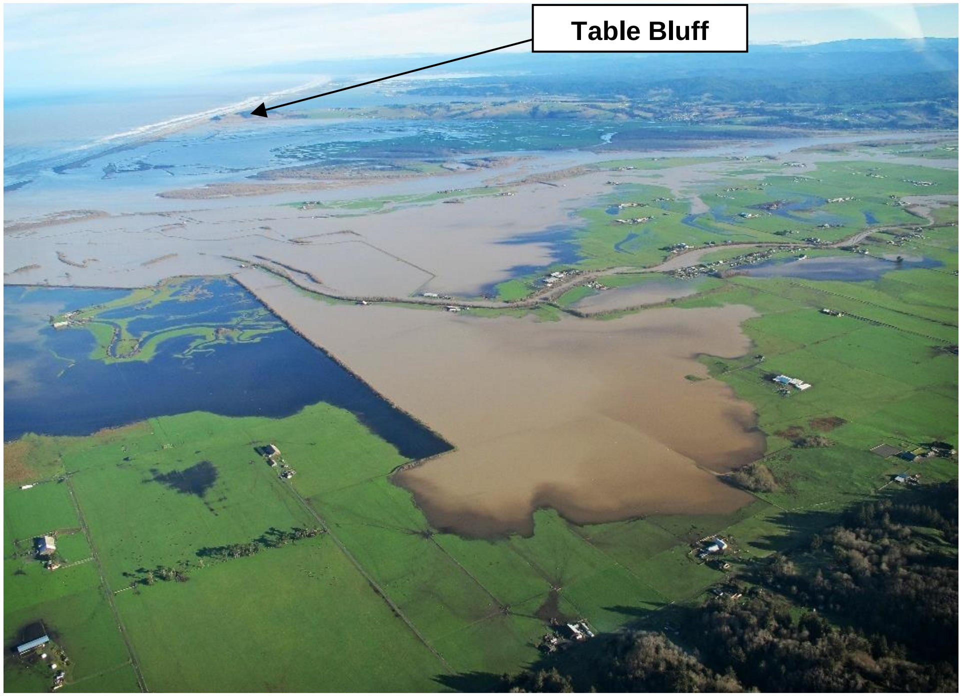

Image 3.9-1. Oblique aerial photograph taken looking north across the lower Eel River valley and delta. Foothills of the Ferndale Hills in the lower right. McNulty Slough and the Project Area are flooded in the upper left. Photograph was taken by Dr. Brad Finney (Humboldt State University) on January 18, 2016 around 10:00 AM. Flow in the Eel River measured at the USGS Gage at Scotia corresponds to a 2.7-year recurrence interval flood. Tide level is about one foot (0.3 meter) above Mean Sea Level (and about 5.5 feet [1.7 meters] below Mean Higher High Water) as recorded by the NOAA North Spit Tide Gage (#9418767).

Much of the Project Area interior is topographically low salt marsh and tidal slough channels lying less than six feet (1.8 meters) above Mean Sea Level (MSL). The Mean Higher High Water (MHHW) tide level at the Humboldt Bay North Spit tide gage (#9418767), which is located approximately 7 miles north of the Project Area, is 6.51 feet (1.98 meters) above MSL. In other words, much of the Project Area is flooded at least once-a-day during high tide cycles.

During the rainy season, low recurrence interval (~ 2.5 years) peak flow events of the Eel River flood the Study Area and much of the surrounding Eel River delta area (Image 3.9-1). Floodwater depths vary depending on the tide level. Many much larger and noteworthy floods occurred in the lower Eel River during the latter half of the 1800s and the first half of the 1900s (McGlashan and Briggs 1939). Floods in 1915 and 1937 are considered comparable and are associated with inundating homes and ranch buildings along the lower river downstream of Fortuna (McGlashan and Briggs 1939). During the latter half of the 1900s, major floods in the lower Eel River occurred in 1955, 1964, and 1974 (Hofmann and Rantz 1963; Young 1963; Wannanean et. al., 1971; CDFG 1977). Young (1963) reports that “the flood of December 1955 is known to be the greatest since 1910 and is probably the greatest since the winter floods of 1861-62.” Wannanean et. al. (1971) report that the December 1955 flood peak at the Scotia gage was comparable to that reached by the floods of 1861-62. They also state that the December 1964 flood peak stage at the Scotia gage exceeded that of the 1955 flood by 10.1 feet (3.1 meters).

In summary, the Project Area is flooded to a certain extent each day as a function of high tides and is also flooded by frequently occurring Eel River flows with recurrence intervals in the range of 2.5 years. Notable floods that exceed those which occurred in 1915 and 1937 have occurred six times since late 1955. Two of those floods were the catastrophic events occurring in 1955 and 1964. Because of the common frequency of both tidal and Eel River flooding, the Project Area is regularly exposed to potential flood-related impacts under existing conditions. Young (1963) provides a map of the 1955 flood across the lower Eel River valley which shows the flood's water surface elevation over the Project Area to be approximately 16 feet (4.9 meters) above MSL. Official flood hazard area mapping by the Federal Emergency Management Agency (FEMA) is available of the lower Eel River valley and depicts the limits of the 100-year flood on the lower Eel River very similar to the limits of the 1955 flood mapped by Young (1963). In the vicinity of the Project Area, the FEMA map indicates that the surface elevation of the 100-year flood would be approximately 10 feet (3 meters) above MSL. As per FEMA then, the 100-year flood event would inundate most of the Project Area, including the perimeter levee system that defines the Project Area. The western portion of the Project Area is not included in the 100-year flood delineation because the dune field rises to an elevation of between 20 feet to 30 feet (6.1 meters to 9.1 meters) above MSL. Importantly, the existing access road to the Project Area from Table Bluff Road does not fall within the limits of the 100-year flood as mapped by FEMA (see Figure 3.9-2 – FEMA 100-Year Flood).

In addition to natural flood hazards, flooding can occur as a result of inundation caused by failure of a dam, seiches, or tsunamis. The study area is not located near isolated bodies of water that would be subject to inundation by seiche. The topography of the study area is generally flat and no areas that are likely to produce mudflows have been mapped or are present (Humboldt County 2019). However, the study area is located within a coastal area subject to inundation from a tsunami. The tsunami hazard is discussed in Section 3.6, Geology and Soils.

Local Groundwater Basin and Beneficial Uses

The study area lies within the Eel River Valley Groundwater Basin (ERVGB) which is the largest groundwater basin in Humboldt County. This basin comprises 114 square miles and includes the lower Eel River valley from the ocean upstream to the town of Scotia as well as the lower 14 miles of the Van Duzen River valley (CDWR 2016; CDWR 2020). Groundwater from the basin represents 96 percent of the freshwater supply in the basin and serves the residential, municipal, and agriculture needs of approximately 23,400 residents and also provides baseflow to streams and surface water bodies. The principal aquifers within the basin are in good hydrologic connection with the ocean along approximately ten miles of coastline. There have been no documented instances of inelastic subsidence of the basin or persistent declines of groundwater levels, and groundwater levels have been stable for the last ten years. Excessive chloride concentrations have been detected in wells up to four miles inland of the Pacific Ocean and are attributed to the percolation of brackish water from tidally influenced reaches of the river and nearby slough channels

(CDWR 2020). The ERVGB is designated as Basin 1-010 and has been identified as a medium priority basin under the recently adopted Sustainable Groundwater Management Act (SGMA). Under SGMA, local entities are required to develop groundwater sustainability plans for high- and medium-priority basins. Humboldt County is assisting in the formation of a local groundwater sustainability agency (GSA) to oversee development of a plan to manage the groundwater resources of the basin in a sustainable manner. Primary objectives of the GSA management plan are to avoid undesirable impacts from groundwater development.

Geologic investigations of the Eel River groundwater basin were conducted by USGS in the early 1950s and then again in 1975 (Evenson 1959; Johnson 1978). Unconsolidated alluvial deposits as much as 200 feet (61 meters) thick and composed of poorly sorted sand and gravel underlie the lower Eel River valley and provide the largest volume of groundwater (Johnson 1978). Aquifers in the lower Eel River valley are recharged by rainfall, overbank flooding, and percolation as groundwater flows down the Eel and Van Duzen valleys towards the coast under a hydraulic gradient of about 5 feet (1.5 meters) per mile (Evenson 1952). Moreover, groundwater from the alluvial aquifer is discharged naturally by seepage into the tidal estuary of the Eel River. The rate of this natural seepage is probably influenced by the rise and fall of the tide; that is, at high tide natural ground-water discharge is at a minimum, and at low tide natural discharge is at a maximum. Evenson (1959) documents that groundwater levels (i.e., the groundwater table) within the lower Eel River valley generally lie within 20 feet (6.1 meters) of the ground surface. Johnson (1978) reports that groundwater levels in the lower valley fluctuate seasonally approximately four feet (1.2 meters), with lower levels occurring during the dry season. Johnson (1978) describes the alluvial aquifer north of the Eel River (i.e., between the Eel River and Table Bluffs uplands) as naturally degraded by seawater. He also maps the landward edge of the freshwater-seawater transition zone as about 3 miles east of the ocean shoreline.

In recent years, approximately 11,900 acres of private agricultural land in the lower Eel River valley has been irrigated annually by groundwater (Humboldt County 2018). Pumping and use of groundwater does not occur within the Project Area. Surface water use within the Project Area is limited to natural resources-related beneficial uses only and is not consumed or utilized for other purposes.

Beneficial Uses of Project Area Surface Waters

The Water Quality Control Plan for the North Coast Region (Basin Plan) prepared by the North Coast Regional Water Quality Control Board (NCRWQCB) identifies the beneficial uses of surface waters and groundwater within its region (NCRWQCB 2018, Table 2-1). The beneficial uses serve as a basis for determining appropriate water quality objectives for the region. The Project is located within the Lower Eel River, Ferndale Hydrologic Subarea (111.11), and the Basin Plan identifies several beneficial uses for the area, summarized in Table 3.9-1.

Table 3.9-1. Beneficial Uses of Surface Waters in the Ferndale Hydrologic Subarea

Type of Beneficial Use	E/P?	Type of Beneficial Use	E/P?
Municipal and Domestic Supply	E	Inland Saline Water Habitat	
Agricultural Supply	E	Wildlife Habitat	E
Industrial Service Supply	E	Rare, Threatened, or Endangered Species	E
Industrial Process Supply	P	Marine Habitat	P
Groundwater Recharge	E	Migration of Aquatic Organisms	E
Freshwater Replenishment	E	Spawning, Reproduction, and/or Early Development	E
Navigation	E	Shellfish Harvesting	E
Hydropower Generation	P	Estuarine Habitat	E
Water Contact Recreation	E	Aquaculture	P
Noncontact Water Recreation	E	Native American Culture	E
Commercial and Sport Fishing	E	Flood Peak Attenuation/Flood Water Storage	
Warm Freshwater Habitat		Wetland Habitat	
Cold Freshwater Habitat	E	Water Quality Enhancement	
Preservation of Areas of Special Biological Significance		Subsistence Fishing	

Source: NCRWQCB 2018 (adapted from Table 2-1)

Note: An "E" or "P" designates an "existing" or "potential" beneficial use respectively.

Surface Water Quality

Several surface waters in the study area do not meet state water quality standards. The Lower Eel River Hydrologic Area, (including the Eel River Delta), is listed as impaired for sediment and water temperature; McNulty Slough is listed as impaired for dissolved oxygen; and the mainstem Eel River with the study area is listed as impaired for aluminum (EPA 2007). Listing a waterbody as impaired for a particular constituent requires development of a Total Maximum Daily Load (TMDL), which is a pollution control plan for each water body and associated pollutant/stressor on the list. The TMDL identifies the quantity of a pollutant that can be safely assimilated by a water body without violating water quality standards. A TMDL for sediment and temperature in the Lower Eel River was adopted by the U.S. Environmental Protection Agency (EPA) on December 18, 2007. The TMDL includes numeric targets, source analysis, and sediment loading rates within the watershed (EPA 2007). TMDLs for dissolved oxygen and aluminium for the affected water bodies identified above is scheduled for completion in 2021 and 2025 respectively.

Turbidity and Salinity

Between 1973 and 1976, the CDWR measured turbidity repeatedly at eleven different sites in the lower estuary area (CDWR 1977). Those measurements found turbidity to be highly variable between stations and with time at individual stations. In general, turbidity levels were highest during the winter and spring periods of high runoff, and lowest in summer and fall. Additionally, turbidity was typically higher during low tides than during high tides. Ducks Unlimited, Inc. (DU 2015) measured turbidity and salinity in North Bay (within the study area) from January 2014 to July 2014 and again from November 2014 to January 2015. Specific to a flow event in early March 2014, they report low concentrations (5-10 milligrams per liter [mg/L]) of suspended sediment, similar to that of ocean water, when Eel River discharge was low (i.e., less than 5,000 cfs), tides dominated the estuary, and salinity values were relatively high (20-30 parts per thousand [ppt]). In contrast, suspended sediment concentrations increased to between 600 to 800 mg/L in response to higher Eel River discharge (i.e., rising limb of the hydrograph) that coincided with high tide. Turbidity concentrations decreased precipitously during the ebb tide period and remained low during the falling limb of the river hydrograph even as the flood tide returned. This example appears to indicate that high turbidity values in the estuary are primarily correlated to higher Eel River discharges. This is consistent with the findings of CDWR regarding higher turbidity during the winter and spring periods of higher river flows.

As discussed above, CDWR (1977) measured electrical conductivity at multiple sites and multiple times between 1973 and 1976 to estimate salinity values throughout the estuary (CDWR (1977). In general, CDWR reports greater salinity values during high tides compared to low tides, and higher salinity values during late summer when freshwater inputs to the estuary are at a minimum. CDFG (1977) interprets the CDWR data to indicate that in early summer, parts of the estuary are stratified with high salinity values at the bottom and low values at the surface during high tide. Ducks Unlimited’s measurements of electrical conductivity in North Bay indicate relatively high levels of salinity when the estuary is dominated by tidal action and Eel River flows are minimal. Conversely, salinity values can drop to nearly zero during Eel River freshets (Ducks Unlimited, Inc. 2015).

Site Hydrology and Management Areas

All elevations used to describe the Project Area are provided in North American Vertical Datum of 1988 (NAVD88). The Project Area is predominately flat and less than seven feet (2 meters) in elevation (see Figure 3.9-3 – Existing Topographic Elevations, for elevations of the estuarine portion of the Project Area). Extreme elevations in the Project vicinity range from a low of 10 feet (3 meters) below MSL at the invert of the existing breach to Area A to more than 150 feet (46 meters) above MSL along the crest of Table Bluff, just north of the study area. In between those extremes, dunes of the barrier beach to the west generally exceed 20 feet (6.1 meters) in elevation and locally rise to as much as 30 feet (9.1 meters) in elevation above MSL. The perimeter levee surrounding the Project Area stands at approximately 12 feet (3.6 meters) in elevation, and the borrow-ditch adjacent to the levee is typically about six feet (1.8 meters) deep with an invert elevation close to MSL. Prominent levees within the interior are also about 12 feet (3.7 meters) in elevation, and those along the east side of McNulty Slough are closer to 10 feet (3 meters) in elevation. Other constructed features within the Project Area include a roadway that extends from Table Bluff Road down through the center of Area A, and several linear drainage ditches that were excavated to create pasture for livestock grazing. Many of the remnant tidal slough channels remain within the Project Area although they have largely silted in. See Figure 3.9.4 – Existing Channel Network for an exhibit showing the existing channel network.

The Project Area is comprised of five management areas: Area A through Area E (Figure 2.2 – Project Area); the elevations of Area B are the lowest in the Project Area, averaging 1 to 2 feet (0.3 to 0.6 meters) below the elevation of the others (Ducks Unlimited, Inc. 2015). Details of each management area are provided below; a description of the dunes is provided in Section 3.6 (Geology & Soils).

Area A – 306 acres

Area A is the largest area and is connected to McNulty Slough through a levee breach along its eastern boundary. Because of the breach, Area A receives the greatest tidal prism volume of all the management areas. Three prominent interior channels drain Area A, two appear to be naturally-formed channels which are visible on the 1888 map of the Project vicinity (see Figure 3.9.5 – 1888 Map of the Eel River Estuary). The third channel is a ditch that lies inside and immediately adjacent to the perimeter levee. This channel is interpreted to be the borrow area (i.e., borrow-ditch) from which material was excavated to originally construct the levee as well as improve it as necessary over time. A freshwater seep has been impounded within Area A at its southwest corner just inside the perimeter levee (Ducks Unlimited, Inc. 2015). Most of Area A has mud substrates (silt loam and silty clay loam), but there are elevated areas within the interior with naturally occurring sand substrates, the same as found in the sand dunes on the west side of the study area. The largest of these sand dune “islands” are found in the southern interior region and several smaller ones occur in the north part of the area (Pacific Coast Fish, Wildlife and Wetlands Restoration Association (Pacific Coast Restoration) 2018). Area A is primarily tidal wetlands (saltmarsh with interspersed mudflats at low tide) with an extensive monoculture stand of dense flowered cordgrass. Brackish marsh is present in the northern reaches of Area A near Area E.

Area B – 111 acres

Area B has the lowest elevations and the most extensive intertidal mudflats of all the management areas. It contains both remnant naturally-formed tidal channels and anthropogenic linear ditches. While managed in the past as seasonal freshwater wetlands controlled by a 48-inch diameter tide-gate, the control flap has been lost and now an open connection exists between Area B and McNulty Slough. Tidal water enters the unit during high tides and Area B now functions as a muted tidal basin with daily fluctuations in water levels within a range of one foot or less. In general, water elevations are shallow throughout the unit with depths around one to two feet at high tide with deeper depths within the historic channels (Ducks Unlimited, Inc. 2015). Because of the tidal influence, over 60 percent of the area is unvegetated mudflat. However, brackish and salt marsh vegetation occupies higher-ground edge habitat surrounding the mudflats and small islands within the mudflat area are vegetated with dense-flowered cordgrass (Pacific Coast Restoration 2018).

Area C – 40 acres

Area C is bound to the north by the Table Bluff uplands out of which at least two springs/seeps contribute freshwater to the northern portion of the area. Area C elevations are on average lower than those in Area A and comparable to those in Area B. Area C also includes remnant tidal channels and is managed as freshwater wetlands with a leaky 36-inch weir box water connecting it to Area B. As of 2015, the structure was allowing a small amount of water exchange between the two areas. Like Area A, a borrow ditch parallels the inside of the perimeter levee for most of its length (Ducks Unlimited, Inc. 2015). Area C has the most extensive development of freshwater shrub wetlands and the most diverse fresh to slightly brackish marsh of all the management areas (Pacific Coast Restoration 2018).

Area D – 5 acres

Area D is the smallest management area and is separated from Area C by an internal levee. It receives muted tidal flow from McNulty Slough through two open 12-inch culverts in the perimeter levee that fills intertidal channels and interior ditches (Pacific Coast Restoration 2018), as well as from high flow and tide events at the upstream end of McNulty Slough at the road/boat ramp. The tide range within Area D is highly muted due to the constriction caused by the culverts (Ducks Unlimited, Inc. 2015). Most of the area is salt marsh and is vegetated by pickleweed mats. Along the upper margins of the salt marsh are transitional fresh to slightly brackish marsh ecotones.

Area E – 11 acres

Area E is a managed freshwater wetland and is separated from Area A by a levee with a leaky 24-inch flashboard weir that provides muted tidal flow from Area A into Area E (Ducks Unlimited, Inc. 2015). The tidal flow extends north to a shallow brackish pond bordered by salt marsh. The pond retains water at low tide but exhibits fluctuations in water level with the tidal cycle (Pacific Coast Restoration 2018). A large spring on Table Bluff delivers freshwater to this unit, and much of this wetland is densely vegetated with willows and other woody vegetation that make it difficult to access (Ducks Unlimited Inc. 2015).

Summary of Project-Specific Hydraulic Modelling

Considerable hydraulic analysis was conducted to develop an optimal restoration design for the Project Area (AECOM 2019). The hydraulic analysis involved a Project-specific two-dimension computational hydraulic model that allowed for a number of different features (e.g., different breach and channel sizes) to be compared and contrasted in terms of changes in tidal prism, flow efficiency, and water surface elevations. One aspect of the modeling effort was to detect zones of increased flow velocity. Besides the baseline model of existing conditions, 17 different model simulations were conducted. Of these simulations, Case 8a in the model represents the proposed Project, and informs the Project-specific impact analysis detailed under Impact HWQ-3.

Climate Change and Sea Level Rise

Warming atmospheric and ocean temperatures are leading to rising sea levels. Relative sea level trend for the nearby North Spit tide gage (#9418767) shows a rise in sea level of 8.3 inches (+/- 0.03 inches) over the 42 years between 1977 and 2019. This equates to an average rise of 0.2-inches per year (in/yr) which is equivalent to a change of 1.65 feet (0.5 meter) in 100 years (NOAA 2020b). The State of California Sea Level Rise Guidance document (California Ocean Protection Council 2018) projects that sea level at the North Spit (nearest modeled location to the Project Area) will most likely increase between 0.32 in/yr and 0.63 in/yr between 2060 and 2080 in response to a "high emissions" scenario. Under a "low emissions" scenario, sea level rise at the North Spit is projected to increase by a rate of between 0.2 in/yr and 0.39 in/yr (OPC 2018). Given those projected rates and a 50 year planning horizon, sea level at the North Spit is most likely to rise at least 0.84-feet and could rise as much as 2.62 feet (0.79 meter) by 2070.

AECOM (2019) conducted a sea level rise analysis in conjunction with hydraulic modeling for Project development. Their analysis assumed an increase in sea level elevation of 1.5 feet (0.46 meters), which is within the range of the OPC 50-year sea level rise estimate. The most notable difference between modeling sea level rise for existing conditions versus that of the proposed Project is local floodplain inundation (by levee overtopping) east of McNulty Slough and along Hawk Slough (AECOM 2019, Figure 53 and Figure 55).

3.9.2 Regulatory Framework

Federal

Clean Water Act

The Clean Water Act (CWA) enacted by Congress in 1972 and amended several times since, is the primary federal law regulating water quality in the United States and forms the basis for several state and local laws throughout the country. It established the basic structure for regulating discharges of pollutants into Waters of the United States. It also gave the EPA the authority to implement federal pollution control programs, such as setting water quality standards for contaminants in surface water, establishing wastewater and effluent discharge limits for various industry categories, and imposing requirements for controlling nonpoint source pollution. At the federal level, the CWA is administered by the EPA and U.S. Army Corps of Engineers (USACE). At the state and regional levels in California, the CWA is administered in part and enforced by the State Water Resources Control Board (SWRCB) and the nine RWQCBs.

Section 303(d) of CWA requires state governments to present the EPA with a list of "impaired water bodies," defined as those water bodies that do not meet water quality standards, even after point sources of pollution have been equipped with the minimum required levels of pollution control technology. In accordance with CWA Section 303(d), the State of California periodically identifies "*those waters within its boundaries for which the effluent limitations ... are not stringent enough to implement any water quality standard applicable to such waters.*" In 1992, EPA added the Lower Eel River to California's 303(d) impaired waters list due to elevated sedimentation/siltation and temperature, as part of listing the entire Eel River basin. The NCRWQCB has continued to identify the Lower Eel River as impaired in subsequent listing cycles, the latest being 2014-2016. The primary purpose of the TMDLs for the Lower Eel River is to ensure that beneficial uses of freshwater habitat (such as salmonid habitat) are protected from elevated sediment and temperature levels. The TMDLs set the maximum levels of pollutants that the water body can receive without exceeding water quality standards for the Lower Eel River basin. Sections 404 and 401 of the CWA require permitting and state certification for construction and/or other work conducted in "Waters of the United States." Such work includes levee work, dredging, filling, grading, or any other temporary or permanent modification of wetlands, streams, or other water bodies. The Project would require both a CWA Section 401 Water Quality Certification from the RWQCB and a CWA Section 404 permit from USACE.

National Pollutant Discharge Elimination System

The National Pollutant Discharge Elimination System (NPDES) permit program was established in the CWA to regulate industrial and municipal discharges to surface Waters of the United States. NPDES permit regulations have been established for broad categories of discharges including point source municipal waste discharges and nonpoint source stormwater runoff. An NPDES permit is required when proposing to or discharging waste into any surface water of the state. The SWRCB issues NPDES permits to cities and counties through RWQCBs, and implements and enforces the NPDES General Permit for Stormwater Discharges Associated with Construction and Land Disturbance Activities (Order No. 2009-0009, as amended by Order No. 2010-0014). Order No. 2009-0009 took effect on July 1, 2010 and was amended on February 14, 2011. The Order applies to construction sites that include one or more acre of soil disturbance. Construction activities include clearing, grading, grubbing, excavation, stockpiling, and reconstruction of existing facilities involving removal or replacement.

Federal Antidegradation Policy

The federal antidegradation policy is set forth in 40 Code of Federal Regulations (CFR) Section 131.12. It serves as a catch-all water quality standard to be applied where other water quality standards are not specific enough for a particular waterbody, or where other water quality standards do not address a particular pollutant. SWRCB Order No. 68-16 incorporates the federal antidegradation policy into the state policy for water quality control and ensures consistency with federal CWA requirements. This federal regulation establishes a three-part test for determining when increases in pollutant loadings or other adverse changes in surface water quality may be permitted, including consideration of existing instream uses and water quality.

State

Porter Cologne Water Quality Control Act

The Porter Cologne Water Quality Control Act (Porter-Cologne) is the primary statute covering the quality of waters in California. Under Porter-Cologne, the SWRCB allocates water rights, adjudicates water right disputes, develops state-wide water protection plans, establishes water quality standards, and guides nine

RWQCBs state-wide. The joint authority of water allocation and water quality protection enables the SWRCB to provide comprehensive protection for California's waters. RWQCB boundaries are based on watersheds and water quality requirements are based on the unique differences in climate, topography, geology, and hydrology for each watershed. The RWQCBs regulate water quality under Porter-Cologne through the standards and objectives set forth in Water Quality Control Plans (also referred to as Basin Plans) prepared for each region. The current 2018 Basin Plan prepared by the NCRWQCB provides a definitive program of actions designed to preserve and enhance water quality and to protect beneficial uses of water in the North Coast Region.

Beneficial uses of surface waters and groundwater within the study area is identified in Table 3.9-1 (Beneficial Uses of Surface Waters in the Ferndale Hydrologic Subarea). The beneficial uses serve as a basis for determining appropriate water quality objectives for the region. To protect these beneficial uses, the Basin Plan sets forth water-resource protection objectives for inland surface waters spanning many parameters. Basin Plan parameters relevant to potential water quality impacts of Project actions include: floating material, suspended material, settleable material, oil and grease, sediment, turbidity, pH, dissolved oxygen, temperature, toxicity, waste discharge and effluent limits, pesticides, and chemical constituents.

Wetland Riparian Area Protection Policy

The SWRCB adopted a State Wetland Definition and Procedures for Discharges of Dredged or Fill Material to Waters of the State (Procedures), for inclusion in the forthcoming Water Quality Control Plan for Inland Surface Waters and Enclosed Bays and Estuaries and Ocean Waters of California. The Procedures took effect May 28, 2020 and consist of four major elements: 1) a wetland definition; 2) a framework for determining if a feature that meets the wetland definition is a Water of the State; 3) wetland delineation procedures; and 4) procedures for the submittal, review and approval of applications for Water Quality Certifications and Waste Discharge Requirements for dredge or fill activities. The Procedures, formerly known as the *Wetland Riparian Area Protection Policy,* has been renamed in order to communicate that the Procedures apply to all discharges of dredged or fill material to waters of the state, not just wetlands.

California Coastal Act

The California Coastal Act (Coastal Act) of 1976 requires any person proposing to develop in the coastal zone to obtain a Coastal Development Permit or obtain coverage under a Consistency Determination. The coastal zone extends from the State's three-mile seaward limit to an average of approximately 1,000 yards inland from the mean high tide of the sea. In coastal estuaries, watersheds, wildlife habitats, and recreational areas, the coastal zone may extend as much as five miles inland. In developed urban areas, the coastal zone may extend inland less than 1,000 yards. As defined by the Coastal Act, "development" of land above, in or beneath water includes: the placement or erection of any solid material or structure; discharge or disposal of any dredge material or a gaseous, liquid, solid, or thermal waste; grading, removing, dredging, mining or extraction of any material; change in the density or intensity of use of land (including land diversions); construction, reconstruction, demolition, or alteration of the size of any structure; and the removal or harvesting of major vegetation other than for agricultural operations, kelp harvesting, and timber operations which are in accordance with a Timber Harvest Plan issued by the California Department of Forestry and Fire Protection (CAL FIRE).

Section 30233 of the Coastal Act recognizes restoration as an allowable use and reason for placing fill material in. Under this policy, the project must establish or re-establish former habitat conditions, re-establish landscape-integrated ecological processes, improve habitat value and diversity, and be self-sustaining. Section 30236 of the Coastal Act provides for review of flood control projects. Under this policy it must be demonstrated that no other measure for protecting existing structures in the floodplain is feasible, and such protection is necessary for public safety or to protect existing development. Proposed projects must also incorporate the "best mitigation measures feasible."

Fish and Game Code Section 1602

CDFW is responsible for conserving, protecting, and managing California's fish, wildlife, and native plant resources. To meet this responsibility, the Fish and Game Code (Section 1602) requires an entity to notify CDFW of any proposed activity that that would substantially alter the bed, bank, or channel of a lake or stream, would substantially divert or obstruct the flow of water, or that would use material from the streambed. A Lake or Streambed Alteration Agreement (LSAA) includes avoidance and minimization measures necessary to protect those resources, and CDFW would review an LSAA for the Project prior to implementing stream alteration work.

Regional and Local

Lands within the Project Area are owned by CDFW or are under the jurisdiction of the State Lands Commission, and therefore will not require a Conditional Use Permit from Humboldt County nor adherence to the Humboldt County General Plan or the Local Coastal Program Eel River Area Plan. Potential impacts within each resource category extending beyond the Project Area boundary, such as potential impacts to waterways or levees within the study area but outside of the Project Area, are analyzed utilizing local regulatory documents such as the Humboldt County General Plan and the Local Coastal Program Eel River Area Plan. Therefore, local and regional regulatory policies are included in this analysis.

Humboldt County General Plan

The following policies from the Humboldt County General Plan (2017) are applicable to the Project with regard to hydrology and water quality:

> **WR-P1. Sustainable Management**
>
> Ensure that land use decisions conserve, enhance, and manage water resources on a sustainable basis to assure sufficient clean water for beneficial uses and future generations.
>
> **WR-P2. Protection for Surface and Groundwater Uses**
>
> Impacts on Basin Plan beneficial water uses shall be considered and mitigated during discretionary review of land use permits that are not served by municipal water supplies.

WR-P9. Mitigate Controllable Sediment Discharge Sites

Proposed development applications involving a site identified as part of the TMDL Controllable Sediment Discharge Inventory shall be conditioned to reduce sediment discharge.

WR-P10. Erosion and Sediment Discharge

Ministerial and discretionary projects requiring a grading permit shall comply with performance standards adopted by ordinance and/or conditioned to minimize erosion and discharge of sediments into surface runoff, drainage systems, and water bodies consistent with BMPs, adopted TMDLs, and non-point source regulatory standards.

WR-P12. Project Design

Development should be designed to complement and not detract from the function of rivers, streams, ponds, wetlands, and their setback areas.

WR-P21. Enhance Groundwater Recharge Capacity

Encourage watershed management practices that enhance infiltration of rainfall into the groundwater.

WR-P35 Implementation of NPDES Permit

Implement and comply with the NPDES permit issued by the SWRCB to the designated portions of the County.

WR-P36. Natural Stormwater Drainage Courses

Natural drainage courses, including ephemeral streams, shall be retained and protected from development impacts which would alter the natural drainage courses, increase erosion or sedimentation, or have a significant adverse effect on flow rates or water quality. Natural vegetation within riparian and wetland protection zones shall be maintained to preserve natural drainage characteristics consistent with the Biological Resource policies. Stormwater discharges from outfalls, culverts, gutters, and other drainage control facilities that discharge into natural drainage courses shall be dissipated so that they make no significant contribution to additional erosion and, where feasible, are filtered and cleaned of pollutants

WR-P37. Downstream Stormwater Peak Flows

Peak downstream stormwater discharge shall not exceed the capacity limits of off-site drainage systems or cause downstream erosion, flooding, habitat destruction, or impacts to wetlands and riparian areas. New development shall demonstrate that post development peak flow discharges will mimic natural flows to watercourses and avoid impacts to Beneficial Uses of Water.

WR-P39. Restoration Projects

The County shall encourage restoration projects aimed at reducing erosion and improving habitat values in Streamside Management Areas and wetlands.

WR-P42. Erosion and Sediment Control Measures

Incorporate appropriate erosion and sediment control measures into development design and improvements.

WR-P44. Storm Drainage Impact Reduction

Develop and require the use of Low Impact Development (LID) standards consistent with RWQCB requirements to reduce the quantity and increase the quality of stormwater runoff from new development and redevelopment projects in areas within the County's MS4 boundary or as triggered under other RWQCB permits. For all other watersheds, develop storm drainage development guidelines with incentives to encourage LID standards to reduce the quantity and increase the quality of stormwater runoff from new developments

WR-P45. Reduce Toxic Runoff

Minimize chemical pollutants in stormwater runoff such as pesticides, fertilizers, household hazardous wastes, and road oil by supporting education programs, household hazardous waste and used oil collection, street and parking lot cleaning and maintenance, use of bioswales and other stormwater BMPs described in the California Stormwater Best Management Practices Handbooks or their equivalent.

WR-P46. Fish Passage Designs.

Work with federal and state agencies and local watershed restoration groups to retrofit existing drainage and flood control structures and design new structures to facilitate fish and other wildlife passage in partnership with federal and state agencies.

S-P15. Construction within Special Flood Hazard Areas

Construction within a floodplain identified as the 100-Year Flood Boundary on FEMA's Flood Insurance Rate Map shall comply with the County's Flood Damage Prevention Regulations. Fill in the floodplain shall only be allowed if it can be demonstrated that the fill will not have cumulative adverse impacts on or off site and such fill shall not be detrimental to productive farm land, and is otherwise in conformance with the County's Flood Damage Prevention Regulations.

AG-P11. Support Vegetative Management Programs

Support vegetation management programs (controlled burning, etc.) when it is found that they improve the availability and quality of rangeland for livestock and wildlife, reduce the hazard of disastrous wildfires, and increase water quality and quantity.

IS-P13. Drainage and Flood Control

Develop and maintain a countywide drainage and flood control plan to guide capital improvements and maintenance and serve as a basis for long-term sustainable funding mechanisms.

BR-P4. Development within Stream Channels

Development within stream channels shall be permitted when there is no lesser environmentally damaging feasible alternative, and where the best feasible mitigation measures have been provided to minimize adverse environmental effects. Development shall be limited to essential, non-disruptive projects as listed in Standard BR-S6 - Development within Stream Channels.

Eel River Area Local Coastal Plan

Sections of the Eel River Area Plan that pertain to protection of hydrology and water quality include:

2553 Policies. Section 5: All development should be designed to minimize erosion and sedimentation.

4235 Drainage. Section 2: Natural drainage ways shall be utilized where possible to convey drainage flows consistent with streamside management policies in the General Plan.

4235 Drainage. Section 3: Drainage facilities shall be capable of passing a 10-year intensity storm without static head at entrance and passing a 100-year intensity storm without major damage. (Res. 85-81, 8/20/85)

3.9.3 Evaluation Criteria and Significance Thresholds

The Project would cause a significant impact related to hydrology and water quality, as defined by the CEQA Guidelines, if it would:

- Violate any water quality standards or waste discharge requirements or otherwise substantially degrade surface or groundwater quality;
- Substantially decrease groundwater supplies or interfere substantially with groundwater recharge such that the project may impede sustainable groundwater management of the basin;
- Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river or through the addition of impervious surfaces, in a manner which would:
  - Result in substantial erosion or siltation on- or off-site;
  - Substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or off-site;
  - Create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff; or
  - Impede or redirect flood flows.
- In flood hazard, tsunami, or seiche zones, risk release of pollutants due to project inundation; or
- Conflict with or obstruct implementation of a water quality control plan or sustainable groundwater management plan.

3.9.4 Methodology

Potential impacts to hydrology and surface water quality are evaluated for construction, invasive plant management and maintenance activities. The Project is evaluated to determine compliance with applicable federal, state, and local permitting and design requirements related to storm water quality, flooding, and drainage. Potential impacts related to groundwater depletion are evaluated, including the potential for pumping of groundwater for excavation dewatering. The evaluation also considers potential impacts to changes in inundation area, drainage rate and water quality during average annual and more extreme storm events less than the 100-year peak flow.

3.9.5 Impacts and Mitigation Measures

Impact HWQ-1: Would the Project violate any water quality standards or waste discharge requirements or otherwise substantially degrade surface or groundwater quality?

The following provides a discussion of the impacts of the Project on surface water quality. Refer to Impact HWQ-2 for a discussion of potential construction-related impacts on groundwater.

Construction

The greatest potential Project impacts to water quality could result from sediment mobilization during tidal channel/wetland construction. Construction activities, such as levee breaching, levee lowering, construction of habitat ridges, habitat fill, levee removal, installation of ditch blocks, installation of large wood, site clearing, grading, excavation, channel widening/deepening, dredging, and material stockpiling could leave soils exposed to rain or surface water runoff that may carry soil contaminants (e.g., nutrients or other pollutants) into waterways adjacent to the site, degrade water quality, and potentially violate water quality standards for specific chemicals, dissolved oxygen, suspended sediment, or nutrients. Where possible, work areas would be dewatered and isolated; however, in some locations, including Area A, dewatering would not occur. If construction activities associated with the Project are not properly managed, applicable water quality standards and waste discharge requirements could be violated. The impact is considered potentially significant and would be reduced to a level that is less than significant with the implementation of Mitigation Measures HWQ-1, HWQ-2, and WQ-6.

Invasive Plant Management

A primary objective of the Project is to manage invasive plant species in both the estuarine restoration and tidal restoration areas. As described below, invasive plant management activities may have potential effects on water quality due to the release of sediment and/or herbicide into waterways.

Dense-flowered Cordgrass

The Project proposes management of up to 571 acres (231 hectares) of dense-flowered cordgrass using mowing, grinding, excavation, prescribed burning, and/or herbicide application methods, some of which may increase local turbidity or introduce herbicide or petroleum-based chemicals to surface waters (see analysis in Invasive Plant Removal Methods below). Potential impacts and mitigation measures for the removal of dense-flowered cordgrass using all of these methods, with the exception of prescribed burning, were evaluated in the Final Programmatic Environment Impact Report for the Humboldt Bay Regional Spartina Eradication Plan (H.T. Harvey & Associates and GHD 2013), hereafter referred to as the 2013 Spartina PEIR. Given the Project Area falls within the management area of that regional dense-flowered cordgrass eradication effort, erosion control-related impacts of invasive plant removal are incorporated by reference and summarized below.

Impact WQ-6: Erosion/Sediment Control at Staging and Access Areas.

Temporary ground disturbance associated with site ingress/egress, staging, stockpiling, and equipment storage areas could occur in areas outside and adjoining treatment areas. These temporary disturbed areas have the potential to impact water quality from erosion and sediment mobilization. Rain and wind-induced erosion from these temporarily disturbed areas could carry soil contaminants (e.g., nutrients or other pollutants) into waterways adjacent to treatment areas and degrade water quality standards for specific chemicals, dissolved oxygen, suspended sediment, or nutrients. Impacts would be less than significant with mitigation. (From 2013 Spartina PEIR, H.T. Harvey & Associates and GHD 2013, page 128.)

Impact WQ-7: Decreased Dissolved Oxygen in Receiving Waters

Treatment techniques (e.g., grinding) that increase and leave in place above ground biomass (wrack) could potentially result in decreased dissolved oxygen in receiving waters during the decay period, depending on where and how the wrack is deposited. Tidal currents and wind-induced waves could transport the wrack and debris into adjacent waters with low dissolved oxygen. In areas of poor tidal circulation, wrack and debris may accumulate, and further impede tidal exchange, further degrading dissolved oxygen. This impact would be less than significant with mitigation. (From 2013 Spartina PEIR, H.T. Harvey & Associates and GHD 2013).

Potential impacts on water quality from the removal of dense-flowered cordgrass would be potentially significant.

European Beachgrass

European beachgrass would be removed from the Primary Treatment Area (207 acres [84 hectares]) over a six-year period in two phases. Treatment methods could include manual, mechanical, prescribed burning and/or herbicide application methods. It is assumed that ongoing invasive plant management activities would occur for up to ten years or as long as needed to achieve control and/or eradication. European beachgrass removal would occur in the dune restoration area, which is predominantly sand and hydrologically disconnected from surface waters, except at the southern end where it borders North Bay and at the northern end near a small tidal channel in Area E. The hydrologic isolation of the dune restoration area would limit potential impacts to water quality resulting from various treatment strategies; however, there would still be some potential for delivery of sediment, nutrients, or chemicals to receiving waters during removal of European beachgrass which could result in a potentially significant impact on water quality.

Dwarf Eelgrass

The Project proposes to remove dwarf eelgrass from McNulty Slough, as needed, using manual removal and smothering methods. Due to its limited extent and proposed removal methods that would utilize non-intensive handwork, potential impacts to water quality resulting from the removal of dwarf eelgrass would be less than significant (see Invasive Plant Removal Methods below).

Invasive Plant Removal Methods

Manual Removal and Smothering

As noted above, dwarf eelgrass would be treated by manual removal and smothering, both of which would utilize hand tools. A small amount of local turbidity may occur for a short duration during manual removal and smothering. Any local turbidity would quickly dissipate with tidal flushing, remaining consistent with background turbidity levels commonly experienced at the site during high tide and flood events. The impact related to manual removal and smothering would be less than significant.

European beachgrass could also be treated with hand removal as a secondary method. As noted above, given the location of European beachgrass on the dunes (and its general hydrologic isolation from surface waters), water quality impacts from hand removal of European beachgrass are not anticipated.

Excavation

European beachgrass may be removed with heavy equipment (excavation) as a secondary treatment method. The use of this equipment, including ingress and egress of the equipment to treatment areas, may result in potentially significant impacts if sediment (sand) is mobilized into surface waters. These impacts would be reduced to less than significant levels with implementation of Mitigation Measures HWQ-1, HWQ-2, and WQ-6.

Herbicide Application

Application of the herbicide Imazapyr would also be used to treat dense-flowered cordgrass and European beachgrass. Use of Imazapyr in the dunes would limit potential impacts to surface waters because the dune restoration areas is generally hydrologically disconnected from surface waters. Furthermore, as described in Section 3.8.5, Imazapyr is safe for aquatic environments, where it dissipates from surface water within days, and would not adversely impact water quality during plant removal in the estuarine restoration area. Therefore, the impact related to herbicide application would be less than significant.

Flaming

Flaming would be used to control the regrowth of dense-flowered cordgrass over time. Given that flaming would utilize a handheld propane torch to deliver a small controlled flame to a targeted plant, potential impacts on water quality would be minimal and less than significant.

Prescribed Burning

The Project also anticipates using prescribed burning as a method for management of dense-flowered cordgrass and European beachgrass. Prescribed burning as a treatment method for dense-flowered cordgrass was not evaluated in the 2013 Spartina PEIR (H.T. Harvey & Associates and GHD 2013). This method would be used under the Project to address the large-scale stands of dense-flowered cordgrass within the Project Area, as well as the significant amount of large wood onsite which may make removal by mowing or excavation difficult. Prescribed burns may be used as initial treatment and later followed by manual removal to target remaining rhizomes.

European beachgrass would also be treated with prescribed burning in ten 1,312 foot (400 meter) long plots in two phases (i.e., five plots treated in Year 1; five plots treated in Year 3). Prescribed burning of European beachgrass would target aboveground removal of biomass prior to manual removal or herbicide application.

All prescribed burning would be conducted in accordance with an approved burn plan coordinated with CAL FIRE. Prescribed burning may result in localized impacts to water quality, including a potential small increase in phosphorous and other nutrient parameters. Following burning, nutrient levels of phosphates and/or nitrates are not anticipated to detectably increase. Erosion of burned surfaces after precipitation events may also result in short-term increases in turbidity into adjacent tidal waterways and saltmarshes, although these short-term small spikes in turbidity are not expected to exceed background turbidity levels due to the frequent high tides and flooding common in the Project Area.

In summary, short-term increases in turbidity, phosphates, or nitrates from prescribed burning of dense-flowered cordgrass would be less than significant level due to the tidal regime of the Project Area. Similarly, water quality impacts from prescribed burning of European beachgrass would be less than significant because treatments would occur in an area largely isolated from surface waters, and would be phased temporally over a number of years and spatially across a large area. .

Maintenance

Potential impacts to water quality are not expected to occur from maintenance or monitoring activities. All maintenance activities occurring in or near water would limit erosion and disturbance as much as possible and would employ BMPs to protect water quality where appropriate. Maintenance would occur infrequently and on an as needed basis; monitoring would occur as needed by CDFW and in accordance with Project permits. Due to the limited maintenance anticipated at the site, potential impacts to water quality from maintenance activities are considered less than significant.

Public Access

Potential water quality impacts associated with public access could include an increase in littering or disturbance to water quality (e.g., turbidity). Public access could also increase the potential off-trail use, which could result in wetland compaction and sediment delivery to surface waters. Because public access is currently supported in the Project Area and the level of public use is not expected to significantly increase, potential impacts associated with public access under the Project, including boating, are considered less than significant.

Mitigation Measures: Implement Mitigation Measures HWQ-1, HWQ-2, HWQ-3, WQ-6, HHM-2, HHM-4, and WQ-2.

The Project would implement the following mitigation measures, some of which (Mitigation Measures WQ-2, WQ-6, HHM-2, and HHM-4) are defined in the 2013 Spartina PEIR (H.T. Harvey and GHD 2013) to reduce potential impacts on water quality from management of dense-flowered cordgrass. These 2013 Spartina PEIR measures have been slightly adapted to reflect that their implementation would also apply to treatment of European beachgrass, and to other Project activities that would result in comparable potential impacts to water quality (e.g., use of equipment to implement the tidal restoration component of the project). Implementation of the mitigation measures below would reduce the potential impacts of Project construction and invasive plant management activities on water quality, including potential increases in turbidity or pollutants and/or decreases in dissolved oxygen levels, and would ensure the Project does not violate any water quality standards, waste discharge requirements, or otherwise substantially degrade surface or groundwater quality.

Mitigation Measure HWQ-1: Implement Best Management Practices to Protect Water Quality

The following representative BMPs will be implemented to protect water quality during construction:

- Contractors will be responsible for minimizing erosion and preventing the transport of sediment to sensitive habitats/wetlands. Accordingly, all contractors that would be performing demolition, construction, grading, operations or other work that could cause increased water pollution conditions at the site (e.g., dispersal of soils) shall receive training regarding the environmental sensitivity of the site and need to minimize impacts. Contractors also shall be trained in implementation of stormwater BMPs for protection of water quality.
- The following BMPs from the current California Stormwater Quality Associations' California Stormwater BMP Handbook for Construction will be implemented by the Contractor:
    - EC-1: Scheduling
    - EC-2: Preservation of Existing Vegetation
    - NS-2: Dewatering Operations
    - NS-9: Vehicle Equipment and Fuelling
    - NS-10: Vehicle and Equipment Maintenance
    - WM-2: Material Use; and
    - WM-4: Spill Prevention and Control

- Sufficient erosion control supplies will be maintained on site at all times, available for prompt use in areas susceptible to erosion during rain events;
- Disturbance of existing vegetation will be minimized to only that necessary to complete the work;
- The contractor will make adequate preparations, including training and providing equipment, to contain oil and/or other hazardous materials spills;
- Dewatering operations will be conducted where needed, with water disposed of appropriately (e.g., allowed to settle in an isolated area, or discharged to an upland location where is won't discharge back to surface waters);
- Vehicle and equipment maintenance should be performed off-site whenever practical;
- The contractor shall ensure that the site is prepared with BMPs prior to the onset of any storm predicted to receive 0.5 in (1.27 cm) or more of rain over 24 hours; and
- All erosion and sediment control measures shall be maintained until disturbed areas are stabilized.

Mitigation Measure HWQ-2: Erosion and Water Quality Control Measures During Channel Excavation and Ground Disturbance

Erosion and turbidity control measures shall be implemented in areas where excavation or ground disturbance would occur and could deliver sediment to an adjacent surface water (e.g., construction of Project tidal channels, installation of ditch blocks and large wood, levee lowering and removal, and installation of public access components). Depending on site conditions, these measures could include installation and maintenance of in-stream turbidity curtains, cofferdams and/or silt-fence along channel banks, as specified in Project designs, specifications and erosion control plans. Whenever feasible, construction will be scheduled to coincide with low tides to avoid increases in turbidity or potential impacts to aquatic habitats. Where possible, channel excavation or dredging will be isolated and hydrologically disconnected from surface waters.

Mitigation Measure WQ-6: Designate Ingress/Egress Routes

Temporary ground disturbance associated with site ingress/egress, staging, stockpiling, and equipment storage areas could occur in areas outside and adjoining work areas. Where areas adjacent to staging and stockpile areas are erosion prone, the extent of staging and stockpile shall be minimized by flagging their boundaries. An erosion/sediment control plan shall be developed for erosion prone areas outside the work area where greater than 0.25 acre (0.1 hectare) of ground disturbance may occur as a result of ingress/egress, access roads, staging and stockpile areas. The erosion/sediment control plan shall be developed by a qualified professional and identify BMPs for controlling soil erosion and discharge for treatment-related contaminants. The erosion/sediment control plan shall be prepared prior to any ground disturbing activities and implemented during construction (H.T. Harvey & Associates and GHD 2013, page 128).

Mitigation Measures HWQ-3: Removal of Wrack

Tidal flushing is anticipated to alleviate wracking throughout the Project Area. During site specific planning, tidal circulation will be visually assessed. In areas with relatively low tidal circulation, it will either be assumed that dissolved oxygen levels are depressed or monitoring will be conducted to determine if dissolved oxygen levels are depressed. In treatment areas located within or adjacent to waters known or expected to have depressed dissolved oxygen, if wrack greater than ¼ acre is generated during Project implementation, the wrack shall be removed from the treatment areas subject to tidal inundation or mulched finely and left in place.

Mitigation Measure HHM-2: Accidents Associated with Release of Chemicals and Motor Fuel.

Contractors and equipment operators on site during Project activities will be required to have emergency spill cleanup kits immediately accessible. If fuel storage containers are utilized exceeding a single tank capacity of 660 gallons or cumulative storage greater than 1,320 gallons, a Hazardous Materials Spill Prevention Control and Countermeasure Plan (HMSPCCP) would be required and approved by the NCRWQCB. The HMSPCCP regulations are not applicable for chemicals other than petroleum products; therefore, the contractor shall prepare a spill prevention and response plan for the specific chemicals utilized during Project activities. This mitigation is intended to be carried out in conjunction with Mitigation WQ-2.

Mitigation Measure HHM-4: Avoid Health Effects to the Public and Environment from Herbicide.

For areas targeted for application of herbicide that are within 500 feet (152 meters) of human sensitive receptors (i.e., houses, schools, hospitals), the contractor shall prepare and implement an herbicide drift management plan to reduce the possibility of chemical drift into populated areas. The Plan shall include the elements listed below. To minimize risks to the public, mitigation measures for herbicide application methods related to timing of herbicide use, area of treatment, and public notification, shall be implemented by entities engaging in treatment activities as identified below:

- Herbicide will be applied in accordance with the manufacturer's label.
- CDFW will coordinate with the County Agricultural Commissioner to identify and avoid impacts to any nearby sensitive areas (e.g., schools, hospitals) that require notification prior to herbicide applications.
- CDFW will identify nearby sensitive habitat and, where feasible, establish buffer zones to avoid affecting sensitive receptors.

- Herbicide will be applied using the coarsest droplet size possible that maintains sufficient plant coverage while minimizing drift into adjacent areas.
- Herbicide shall not be applied when winds exceed 10 miles per hour or when inversion conditions exist (consistent with the herbicide labels); or when wind could carry spray drift into inhabited areas. Refer to Section 3.3 (Air Quality), for discussion on inversions.
- Public access to treatment sites will be restricted during treatment windows.
- No surfactants containing nonylphenol ethoxylate will be used.

Mitigation Measure WQ-2: Minimize Herbicide Spill Risks.

Herbicides shall be applied by or under the direct supervision of trained, certified or licensed applicators. Herbicide mixtures shall be prepared by, or under the direct supervision of trained, certified or licensed applicators. Storage of herbicide and surfactants on or near the Project Area shall be allowed only in accordance with a Spill Prevention and Control Plan approved by the NCRWQCB; on-site mixing and filling operations shall be confined to areas appropriately bermed or otherwise protected to minimize spread or dispersion of spilled herbicide or surfactants into surface waters. This mitigation is intended to be carried out in conjunction with Mitigation Measure HMM-2.

Level of Significance: Less than significant with mitigation.

Implementation of Mitigation Measures HWQ-1, HWQ-2, HWQ-3, WQ-2, WQ-6, HHM-2, and HHM-4, would ensure that construction, invasive plant management, and maintenance activities under the Project do not violate any water quality standards or waste discharge requirements, and would reduce potential impacts on water quality to a less-than-significant level.

Impact HWQ-2: Would the Project substantially decrease groundwater supplies or interfere substantially with groundwater recharge such that the project may impede sustainable groundwater management of the basin?

Long-term groundwater pumping or use is not a proposed Project activity so the Project will not substantially decrease groundwater supplies. Project construction may involve local short-term dewatering but is not anticipated to be long lasting or detrimental to the surrounding environment. The Project includes the enhancement and restoration of estuarine habitat conditions (i.e., excavation of tidal slough channels that are connected to the shallow groundwater table). Groundwater in the lower Eel River valley is recharged from rainfall, overbank flooding, and percolation as groundwater flows down the Eel and Van Duzen River valleys towards the ocean under a hydraulic gradient of about 5 feet (1.5 meters) per mile. Consequently, the proposed channel enhancements and excavations would not alter or interfere with the mechanics of groundwater recharge within the study area. Given the hydraulic gradient, groundwater seeps naturally from the alluvial aquifer into the tidal slough channels and the rate of such seepage is influenced by the tide levels. Higher tides limit seepage and lower tides facilitate seepage. Hydrodynamic modelling indicates that the Project would lower the MHHW tide levels by 0.2 feet (6 cm) within main slough channels (i.e., Eel River, North Bay, McNulty, and Hawk). MLLW would be raised by about the same amount (AECOM 2019). These adjustments are in the range of 5 percent of existing conditions. Given the very short period of time in which such conditions would prevail twice daily, it is unlikely that such minimal changes in tide level would result in substantial changes to groundwater seepage rates.

The Project is located at the down-gradient end of the alluvial aquifer where groundwater discharges into tidal slough channels. There are no known groundwater wells in the study area, and groundwater in the study area, as well as approximately three miles upgradient, is considered degraded by seawater. In other words, the Project Area is located far down gradient from the freshwater portion of the aquifer that supports the agricultural communities of the Eel River valley. Consequently, the Project would not adversely impact upgradient groundwater wells nor would it affect management of those wells and the larger groundwater aquifer that makes up the Eel River valley.

Mitigation Measures: No mitigation is necessary.

Level of Significance: Less than significant.

Impact HWQ-3: Would the Project substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river or through the addition of impervious surfaces in a manner which would result in substantial erosion or siltation on- or off-site?

Channel dynamism is a desired condition in an estuary environment. Extreme tide and frequent low return period flood events occur with regularity in the Eel River estuary/delta under existing conditions. Infrequent and catastrophic flood events occur as well. These events erode and rearrange the deltaic sediments and adjust tidal channels within the study area. Thus, under current conditions, the study area regularly experiences erosion from hydraulic flood dynamics far more severe than would result from Project implementation or post-Project hydrology.

Project actions would alter the existing levee-controlled drainage pattern of the Project Area by reconnecting portions of the natural tidal channel network and increasing the tidal prism into the Project Area. The hydraulic model results indicate that this restorative work would reduce flow velocities in certain parts of the Project Area and increase flow velocities in others. Reductions in flow velocity have the potential to promote sediment deposition (e.g., siltation), while increases in velocity have the potential to generate bed scour and bank erosion. Such potentials exist both on- and off-site.

On-Site Erosion Potential

All material excavated from the Project Area would remain on-site and be incorporated into Project designs for beneficial reuse. Sediment reuse, as detailed in Section 2.4.8 – Beneficial Reuse of Excavated Sediments, includes the reuse of excavated sediments for other Project purposes, with the dual benefit of avoiding the need for off-site disposal and associated impacts. Sediment reuse includes creation of high marsh habitat, filling of internal ditches, creation of habitat ridges, and installation of ditch plugs. Excessive soil may be spread as a thin layer (less than six inches (15 cm)) deep in lower elevation saltmarsh. All sediment reuse areas would be located within the FEMA flood zone and therefore subject to potential localized remobilization during flood events. Given the low elevation profile and anticipated recolonization of saltmarsh vegetation in the sediment reuse areas within one to three years, the potential Project impacts related to sedimentation are not anticipated to be significant. Any beneficial reuse of material scoured and/or replaced during localized flooding would constitute a small, if not insignificant, volume of sediment transported and/or deposited within the Project Area. Sediment mobilization and redeposition with the Project Area and study area are natural and ongoing geomorphic process of the Eel River delta.

As per the hydraulic analysis, internal channel dimensions are designed to be in equilibrium with Project hydraulic conditions to achieve hydraulic efficiencies and simultaneously minimize lateral erosion, bed scour, and bank failure. The hydraulic model results indicate that the proposed Project design would increase flow velocities in upper McNulty Slough (see Figure 3.9-6 - Speed in McNulty Slough During Peak Flood Tide for Existing Conditions and Case 8a (Project), Figure 3.9-7 – Speed in Upper McNulty Slough During Peak Flood Tide for Existing Conditions and Case 8a (Project), Figure 3.9-8 – Speed in McNulty Slough During Peak Ebb Tide for Existing Conditions and Case 8a (Project), Figure 3.9-9 – Speed in Upper McNulty Slough During Peak Ebb Tide for Existing Conditions and Case 8a (Project), Figure 3.0-10 – Comparison of Flood Tide Current Speeds at Section 750 Feet Upstream of Existing Breach, Figure 3.9-11 – Comparison of Ebb Tide Current Speeds at Section 750 Feet Upstream of Existing Breach). Such an increase in velocity is assumed to increase the potential for bed scour and bank erosion in that channel segment. Water velocities in Lower McNulty Slough generally decrease above existing conditions, and are largely unchanged in Hawk Slough during peak flood tides Apart from the outside of channel bends discussed above, the reintroduction of tidal exchange to the excavated Project channels would not impart sufficient energy to accelerate erosion in any portion of the newly designed or improved channels. Hydraulic modeling results indicate that breaches tend to increase the tidal prism in Upper McNulty Slough and decrease the tidal prism in Lower McNulty Slough (AECOM 2019). The modelling results do not indicate that speeds through the Area A breach of McNulty Slough would increase or result in an expansion of channel capacity. The potential impact related to on-site siltation or erosion would be less than significant.

Off-Site Erosion Potential

While the hydraulic modelling did not indicate potentially substantial downstream erosion effects resulting from the Project, velocity and shear stress results suggest erosion may occur. Erosion of the eastern levee of McNulty Slough, including the toe of the eastern levee, is considered a potentially significant impact detrimental to privately owned agricultural lands and would require mitigation. Erosion of the levee would also result in a short-duration increase in turbidity. Off-site erosion downstream of the Project Area (e.g., Hawk Slough, North Bay, and the Eel River proper) is not expected to occur.

In addressing the potential of erosion along the eastern levee of McNulty Slough, several alternatives to mitigate that impact were considered: (1) armor the eastern levee of McNulty Slough; (2) construct a setback levee on the eastern bank; (3) enlarge the McNulty Slough channel; and (4) modify the Project design. The legal feasibility of the first two measures—armoring or setting back the levee—is uncertain. The levee is on private property and CDFW has no right of access to the property. Thus, the feasibility of those alternatives is questionable considering they would require CDFW to implement a Project action on property it does not own, does not have legal responsibility for, and cannot foreseeably purchase or acquire.

Hydraulic modelling was used to explore how dredging upper McNulty Slough could reduce velocities and the potential for erosion along the eastern levee. The model results (Case 11c) showed that peak flood tide velocity would still increase above existing conditions by approximately 0.2 feet/second between Station 75 and Station 100. Thus, based on hydraulic modelling results, dredging upper McNulty Slough would not effectively reduce velocities and the potential for erosion along the eastern levee. Additionally, dredging of McNulty Slough would result in potentially significant environmental impacts to sensitive species and habitats, not limited to Tidewater Goby, salmonids, eelgrass, and increases in turbidity. Significant off-hauling of dredged materials would likely be required, which would increase greenhouse gas and air quality emissions. The cost of implementing this type of mitigation—including equipment, labor, materials testing for potential contamination, and possible mitigation for environmental impacts—would significantly add to the cost of the Project. Dredging McNulty Slough may also be a temporary solution to long-term levee erosion risk because sediments may redeposit into dredged areas, causing future increases in velocity and bed shear stress. Given channel dredging in upper McNulty Slough would not mitigate the erosion potential and would be undesirable for other reasons, including construction infeasibility and/or cost infeasibility, this alternative was not further considered an effective or viable mitigation measure.

Since bank armoring and levee setback may be legally infeasible and dredging of McNulty Slough may not mitigate the erosion potential, the potential impact of erosion along the eastern levee of McNulty Slough on private property would be significant, unavoidable, and unmitigatable. The effectiveness of modifying the Project design to avoid potential hydraulic impacts (i.e., erosion potential) in McNulty Slough is described in Chapter 4, Alternatives.

Mitigation Measures: Not feasible.

Level of Significance: Significant unavoidable.

Impact HWQ-4: Would the Project substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river or through the addition of impervious surfaces, in a manner which would substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or off-site?

The Project Area, except for the dune restoration area, is predominantly low in elevation and subject to flooding, and Eel River flood flows dominate the hydrogeomorphic processes within the Project Area and study area (AECOM 2019). Both on-site and off-site post-Project flooding would remain a function of Eel River discharges into the estuary.

The Project proposes substantial changes to site drainage patterns and the way flood waters are routed through the Project Area. However, the Project does not include any elements that would change the flood magnitudes of source waters or rates of run-off entering or originating on the site. The most notable changes in inundation and drainage patterns that are anticipated to occur under the Project include an expansion of the tidal channel network, improved channel connectivity, and an increase in the tidal prism into and throughout the Project Area. Changes to surface topography within the Project Area include a slight increase in elevation of the saltmarsh plain in Area B, construction of habitat ridges, and installation of ditch blocks. The most significant changes to surface topography include levee breaching, channel excavation, and local levee lowering. These grading activities are designed to restore a properly functioning tidal prism that ebbs and flows efficiently within the Project Area.

The access road and parking areas would result in new impervious surfaces in the Project Area (see Section 2.6.1). However, these features would not be extensive in size and would drain to surrounding undeveloped, pervious surfaces without resulting in an increase in run-off or flood risk. New development of the 0.75 mile of non-motorized trails and non-motorized boat put-in would be pervious and would not alter run-off patterns. Increases in saltmarsh extent and function would also help to attenuate flood flows and potential related run-off impacts due to increased size and capacity.

As described in Impact HWQ-3, changes in hydraulics under the Project could impact the private levee on the east side of McNulty Slough. If that levee were to breach, it is possible tidal flooding could occur on private agricultural fields during tides higher than the top of the existing levee. Such flooding might occur independent of or coincident with an Eel River flood event. However, without mitigation, the potential impact would be significant.

Mitigation Measures: Not feasible.

Level of Significance: Significant unavoidable.

As described above under Impact HWQ-3, protection measures to mitigate potential erosion of the McNulty Slough east levee (i.e., bank armoring, levee setback and/or dredging) are not feasible. As a result, the potential impact of tidal flooding onto privately owned agricultural lands east of the Project Area remains both significant and unmitigatable. The effectiveness of reconfiguring the Project design to avoid hydraulic impacts in McNulty Slough is described in Chapter 4, Alternatives.

Impact HWQ-5: Would the Project substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river or through the addition of impervious surfaces, in a manner which would create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff?

Project actions would alter the drainage pattern of the Project Area by expanding the tidal channel network, increasing connectivity between tidal channels and an expanded saltmarsh plain, and increasing tidal function to enhance estuarine function. Project actions would add minimal impervious surfaces in limited areas within the overall Project Area. Enhancement actions may result in short-term construction-related impacts to stormwater drainage and/or polluted runoff, which are potentially significant. However, post-construction, water quality within the Project Area would improve, stormwater drainage would benefit, and additional sources of polluted runoff would not occur.

Construction-Related Impacts

Implementation of the Project would alter the types, quantities, and timing of stormwater contaminates relative to existing conditions. If stormwater runoff generated during Project implementation is uncontrolled and not treated, the water quality of the discharge could affect off-site drainage channels and downstream water bodies.

Construction activities could result in substantial stormwater discharges of turbidity, settleable material, and other pollutants into local drainage channels from the Project Area. Construction, invasive plant management and maintenance-related chemicals (e.g., fuels, paints, adhesives, herbicide, etc.) could be washed into surface waters by stormwater runoff. The deposition of pollutants (e.g., gas, oil, etc.) onto the ground surface by construction equipment could similarly result in the transport of pollutants to surface waters by stormwater runoff or in seepage of such pollutants into groundwater.

Stormwater within the Project Area is not controlled by constructed infrastructure (e.g., sewer lines, drainage ditches). Rather, the stormwater capacity of the Project Area relies solely upon a network of tidal channels and wetland plains in the lower Eel River estuary that are tidally connected to the Pacific Ocean. Tidal waters circulate in and out of the Project Area twice daily during high tides. Mitigation Measures HWQ-1, HWQ-2, HWQ-3, and WQ-6 would be implemented to avoid stormwater discharges, and the stormwater capacity of the Project Area would not be exceeded. The impact would be less than significant with the implementation of mitigation measures.

Post-Construction Impacts

Currently, water quality in the Project Area is impacted by poor water circulation within the existing drainage network and limited tidal exchange. This has led to stagnant ponding, likely resulting in reduced dissolved oxygen concentrations and diminished water quality. Project elements would increase interconnected channel network and tidal exchange, which would improve water circulation and quality and thereby yield more desirable aquatic habitat conditions.

The Project would not significantly increase the amount of existing developed areas or the amount of impervious area, as Project features have predominantly been designed to be pervious. Therefore, there would be no change in the type and concentration of stormwater discharge contaminants for developed areas from such factors as vehicle traffic, types of activities occurring on site, types of chemicals used on-site (e.g., petroleum by-products, herbicide), road surface pollutants, and rainfall intensity.

Mitigation Measures: Implement Mitigation Measures HWQ-1, HWQ-3, and WQ-6.

Level of Significance: Less than significant with mitigation.

Implementation of Mitigation Measures HWQ-1, HWQ-3, and WQ-6 would ensure that the Project would not violate any surface water quality standards, and that impacts associated with invasive plant management would be reduced to a less than significant level.

Impact HWQ-6: Would the Project impede or redirect flood flows?

The Project would not include any element that would impede flood flows, such as construction of a levee or other hydraulically confining structure. The Project includes removal, lowering, and breaching of levees, which in combination with channel excavation, would alter the hydraulic setting of the Project Area but not significantly redirect flood flows. As discussed below under Impact HWQ-7, high flow conditions from the mainstem Eel River and greater Eel River estuary dominate the study area during low-return interval flood events. Flood flows entering the Project Area from the Eel River would continue to inundate the vast majority of the tidal channels and adjacent saltmarsh surfaces, with the exception of the dune restoration area, similar to existing conditions. While levee removal, breaching, lowering, and channel excavations may alter the routing of flood flows within and across the Project Area, these flood flows would not be newly redirected off-site or in a manner that alters the hydrology pattern and drainage network of McNulty Slough, Hawk Slough, tidal tributaries, or the Eel River estuary. The potential impact would be less than significant.

Mitigation Measures: No mitigation is necessary.

Level of Significance: Less than significant.

Impact HWQ-7: Would the Project cause an increase in flood hazard, tsunami, or seiche zones, risk release of pollutants due to Project inundation?

The Project is not located in a seiche zone. While the Project is in flood and tsunami zones, there would be very limited pollutants in the Project Area that could be released during a natural disaster. If an extreme hazard event were to occur during construction, heavy equipment and associated diesel and fluids could be washed into the Eel River estuary and/or Pacific Ocean. Application of herbicide to remove invasive plants would not occur during a predicted flood event, when rain would limit efficacy of treatment, or during windy conditions (see Mitigation Measure HHM-4), which can be associated with high rain and flood hazard events. The period of herbicide application would be short in duration, with herbicide only present in the Project Area when in use and would not coincide with an extreme weather event.

Post-construction, it is possible that an extreme hazard event could dislodge and wash away the proposed foot bridge, non-motorized boat put-in, or interpretive signage related to public access. During such an event, the background debris load in the lower Eel River would be substantial, and the potential input of a small foot bridge or related public access infrastructure from the Project Area would be negligible in comparison. Therefore, the potential impact of a release of pollutants or debris during a significant flood or tsunami would be less than significant.

Mitigation Measures: No mitigation is necessary.

Level of Significance: Less than significant.

Impact HWQ-8: Would the Project conflict with or obstruct implementation of a water quality control plan or sustainable groundwater management plan?

Water Quality Control Plan

A primary goal of the Project is to restore natural estuarine function of the Project Area, which would improve water quality to assist in the recovery and function of habitat for native species. As discussed above, the relevant water quality control plan is the NCRWQCB Basin Plan, which establishes thresholds for key water resource protection objectives for both surface waters and groundwater.

The Project shall also obtain a NCRWCB CWA Section 401 Water Quality Certification. These regulatory requirements and associated requisite monitoring will ensure a conflict with the Basin Plan does not occur.

Project actions would also not conflict with the State's groundwater planning in the Eel River Valley Basin under the Sustainable Groundwater Management Act, which primarily monitors groundwater use via pumping for agriculture and other consumptive purposes. Project actions would not consume or diminish groundwater in the Eel River Valley or Project Area.

Mitigation Measures: No mitigation is necessary.

Level of Significance: Less than significant.

3.9.6 Cumulative Impacts

Impact HWQ-C1: Would the Project contribute to a cumulatively significant impact to hydrology and water quality?

Cumulative projects identified in Table 3.0-1 would have the potential to affect water quality and increased runoff during construction, invasive plant management, and maintenance activities. The cumulative projects would continue to contribute stormwater flows to the local and regional drainage facilities, but not at levels higher than already experienced. Construction activities associated with cumulative projects would be subject to existing federal, state, and local regulations. Existing policies for project design and approval, as well as NCRWQCB regulations, would minimize potential impacts to a less-than-significant level.

Another potential cumulative impact would be an increase in tidal prism exchanged through the lower Eel River estuary via recent enhancement actions on the south side of the mainstem Eel River, including the Salt River Ecosystem Restoration Project, pending Eel River Estuary and Centerville Slough Enhancement Project, and Smith Creek Wetland Restoration Projects. Planned restoration on Cannibal Island, which is also located in the Eel River estuary, would further restore tidal prism exchange and saltmarsh extent. These projects would, in combination with the Project, increase the volume of tidal storage and exchange through the mutually shared receiving waters of the Eel River estuary.

Designs for the Project increase channel dimensions to accommodate the increase in tidal prism exchange. As detailed in the discussion of off-site erosion potential under Impact HWQ-3, the potential erosion associated with an increased project tidal prism would not increase the rate of sediment delivery to the Eel River estuary above natural conditions. Any associated channel expansion would occur well within the footprint of historic channel migration and former saltmarsh.

However, as discussed under Impact HWQ-3, hydraulic modelling indicates there is a potential for erosion along the eastern levee of McNulty Slough as a result of increased water velocity and bed shear stress under the Project. These hydraulic changes could ultimately contribute to localized levee failure and result in a significant impact to the private agriculture lands east of the Project Area, which could flood, erode and/or experience saltwater intrusion. This potential individual impact is significant and unmitigatable, as discussed under Impact HWQ-3. However, this individual unmitigatable impact is not cumulatively significant because it is known to exist in a precise location on the eastern side of the levee along a discrete reach of McNulty Slough and would not be potentially impacted by any other project considered in Table 3.0-1. Therefore, a less than significant cumulative impact would result.

Implementation of the Project plus the cumulative projects would not otherwise result in significant cumulative impacts on hydrology and water quality. The long-term effects of the Project would be ecologically beneficial by expansively restoring hydrologic function to the Project Area, managing invasive plant species, enhancing saltmarsh and dune habitat quality, and improving water quality. Considering the Project’s landscape-scale improvement in ecological functions, cumulative impacts would be less than significant with the implementation of Mitigation Measures HWQ-1, HWQ-2, HWQ-3, WQ-2, WQ-6, HHM-2 and HHM-4, resulting in an environmental benefit.

Mitigation Measures: No additional mitigation is necessary.

Level of Significance: Less than significant.

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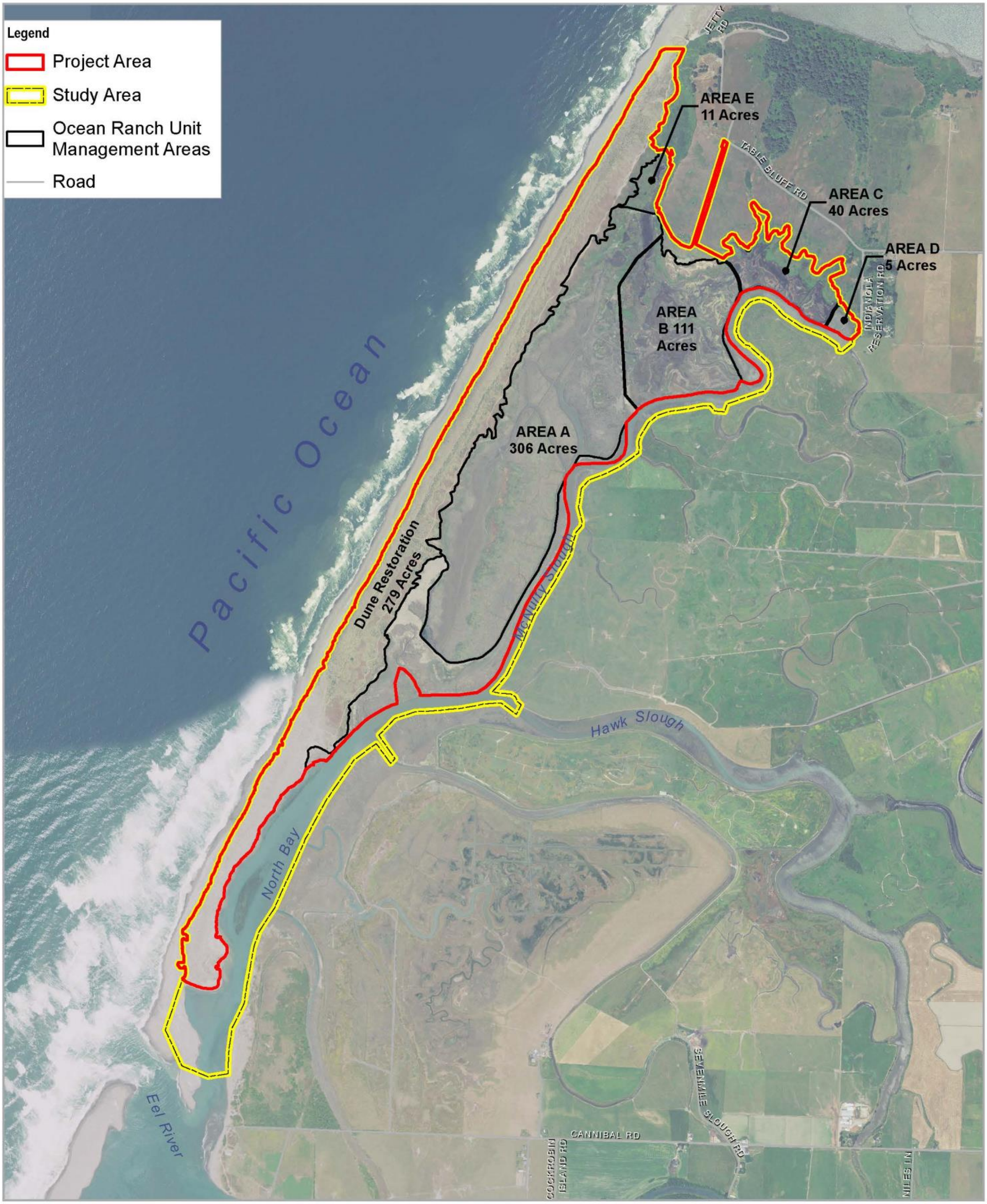

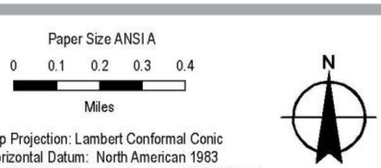

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane California I FIPS 0401 Feet

California Department of Fish and Wildlife
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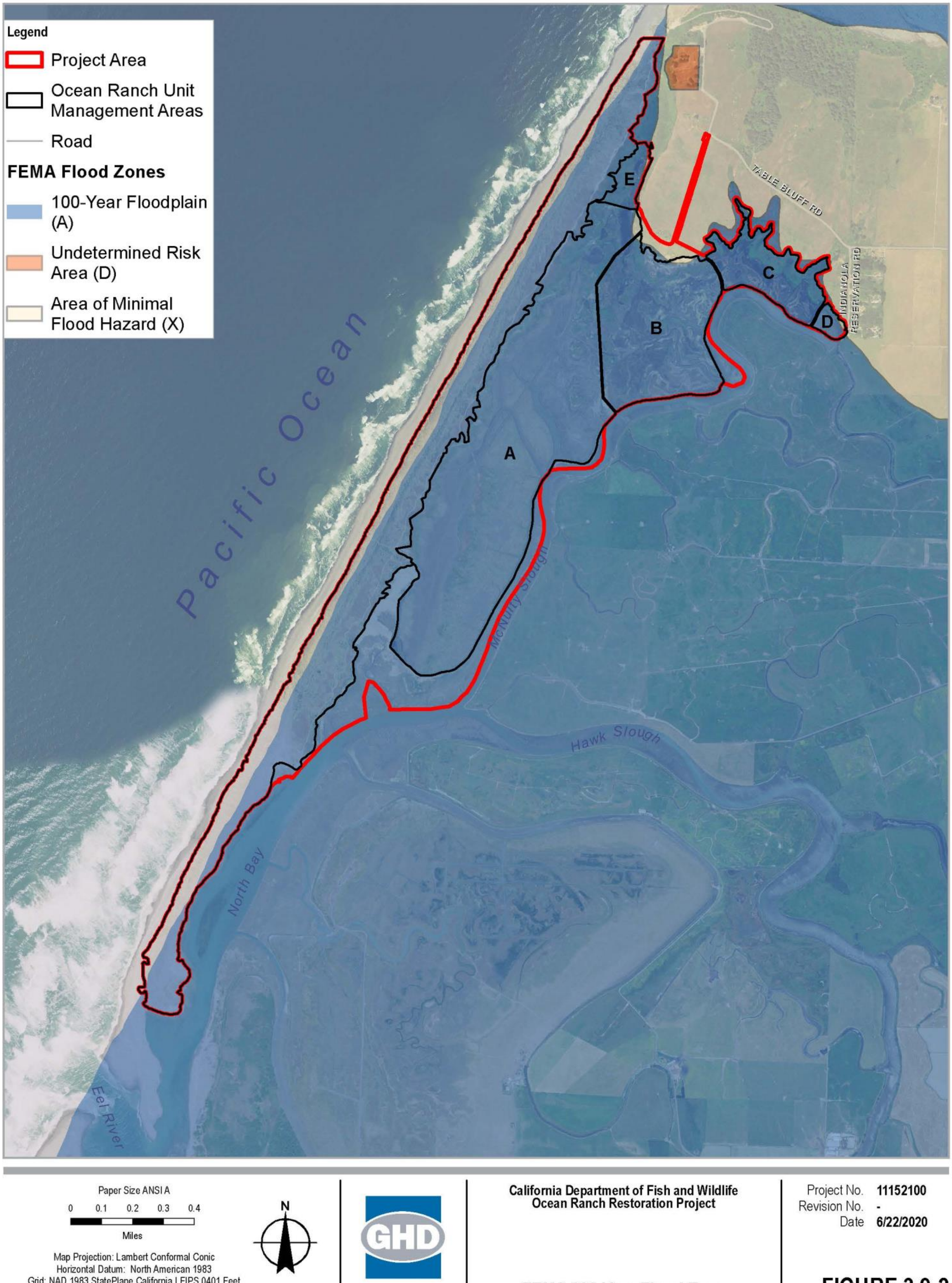
Hydrology and Water Quality Study Area

FIGURE 3.9-1

N:\US\Eureka\Projects\111\11152100 – DU Ocean Ranch Estuary CEQA\08-GIS\Maps\Deliverables\EIR\Ch3-9\11152100_03-09-01_StudyArea_RevA.mxd
Print date: 22 Jun 2020 - 14:22

Data source: DU Ocean Ranch Unit Management Areas, GHD, 10/17/2018; Project Boundary, GHD, 10/17/2018; Humboldt County roads, 2008; NAIP orthoimagery 2016; . Created by: jclark2



Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane California I FIPS 0401 Feet

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FEMA 100-Year Flood Zone

FIGURE 3.9-2

N:\US\Eureka\Projects\111\11152100 – DU Ocean Ranch Estuary CEQA\08-GIS\Maps\Deliverables\EIR\Ch3-9\11152100_03-09-02_FEMA_RevA.mxd
Print date: 22 Jun 2020 - 14:14

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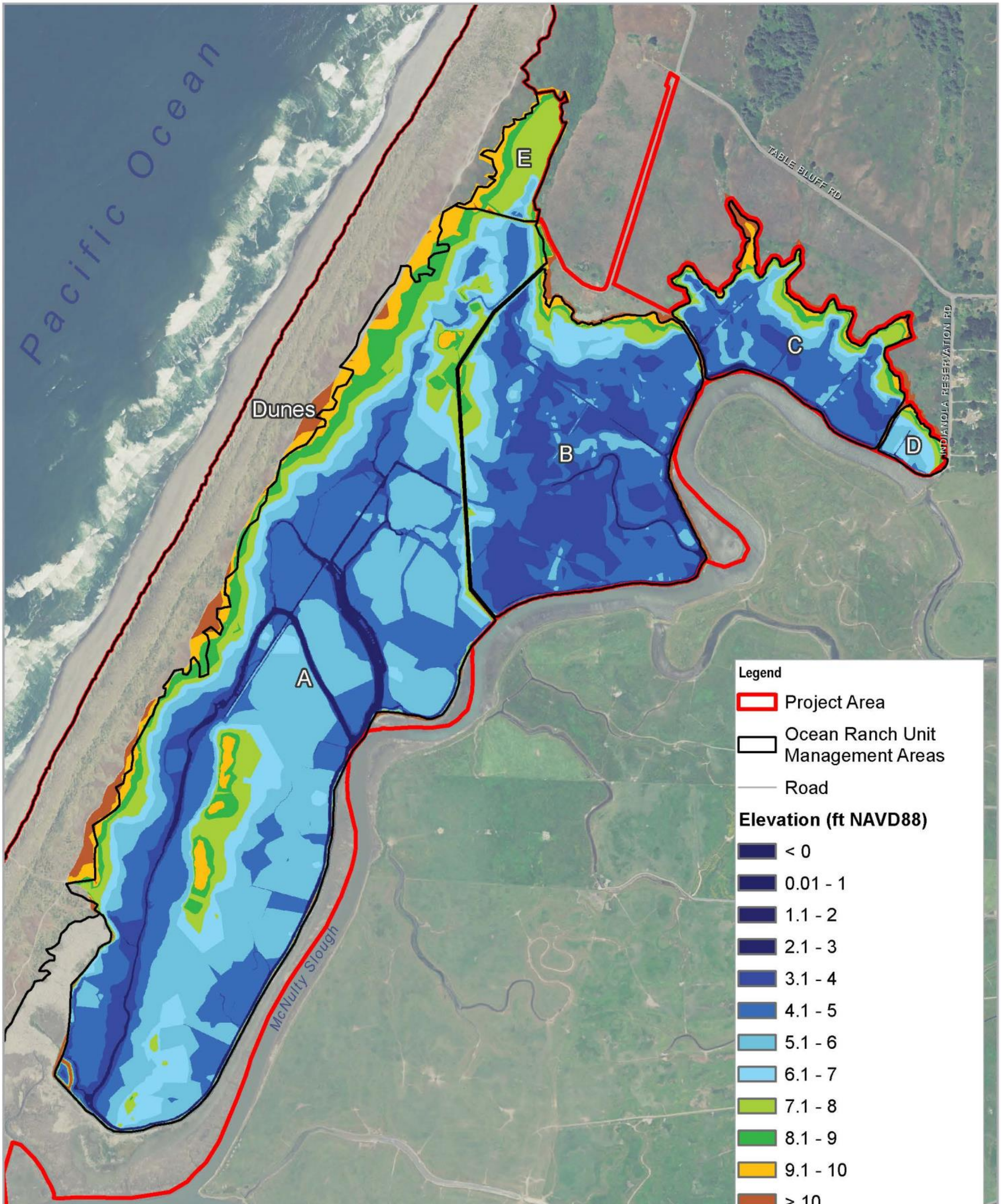

Paper Size ANSI A

0 325 650 975 1,300

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane California I FIPS 0401 Feet

GHD

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Date **6/22/2020**

Existing Topographic Elevations

FIGURE 3.9-3

N:\US\Eureka\Projects\111\11152100 – DU Ocean Ranch Estuary CEQA\08-GIS\Maps\Deliverables\EIR\Ch3-9\11152100_03-09-03_ExistingElevation_RevA.mxd
Print date: 22 Jun 2020 - 14:15

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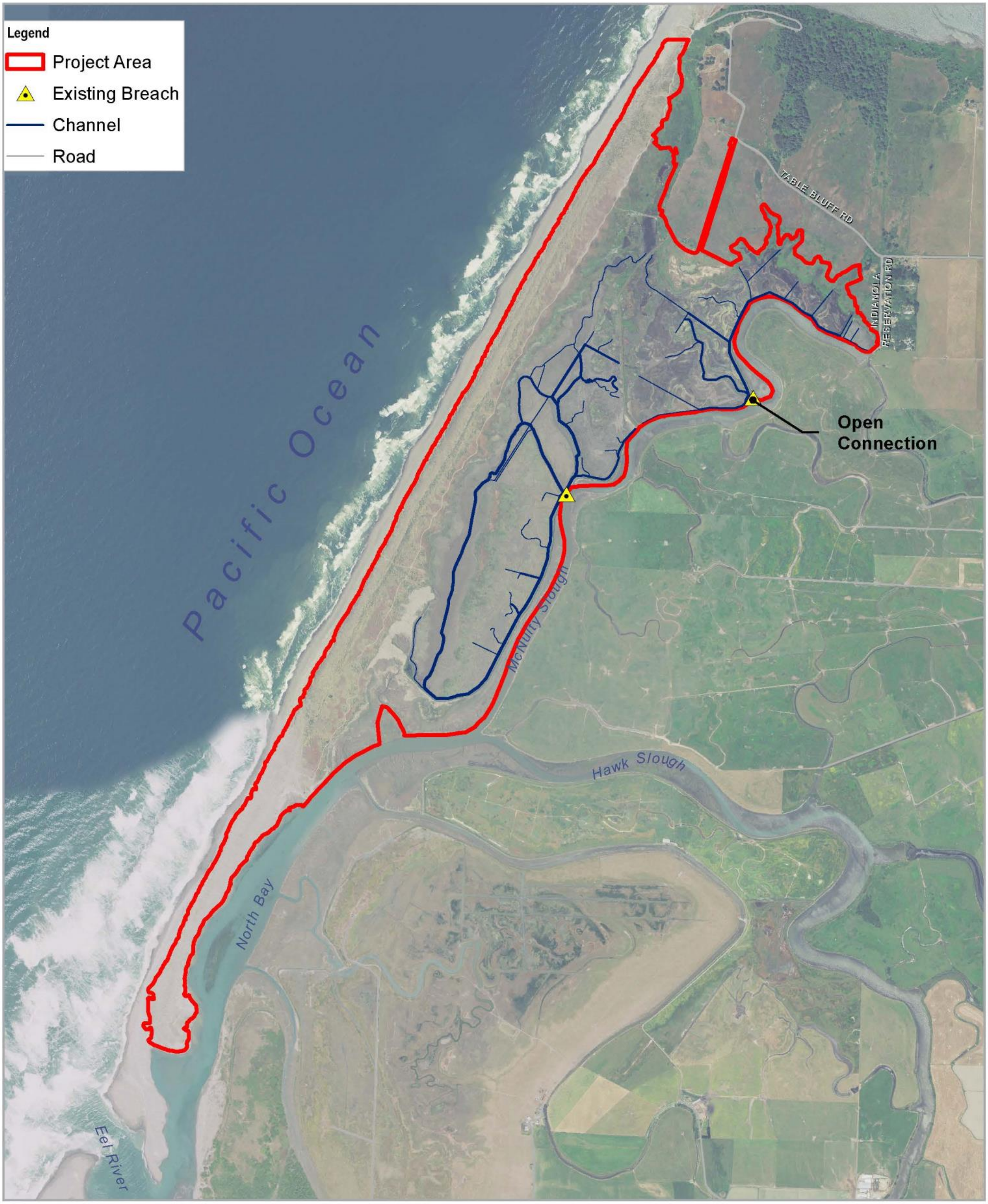

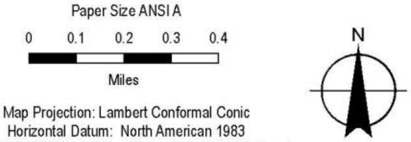

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane California I FIPS 0401 Feet

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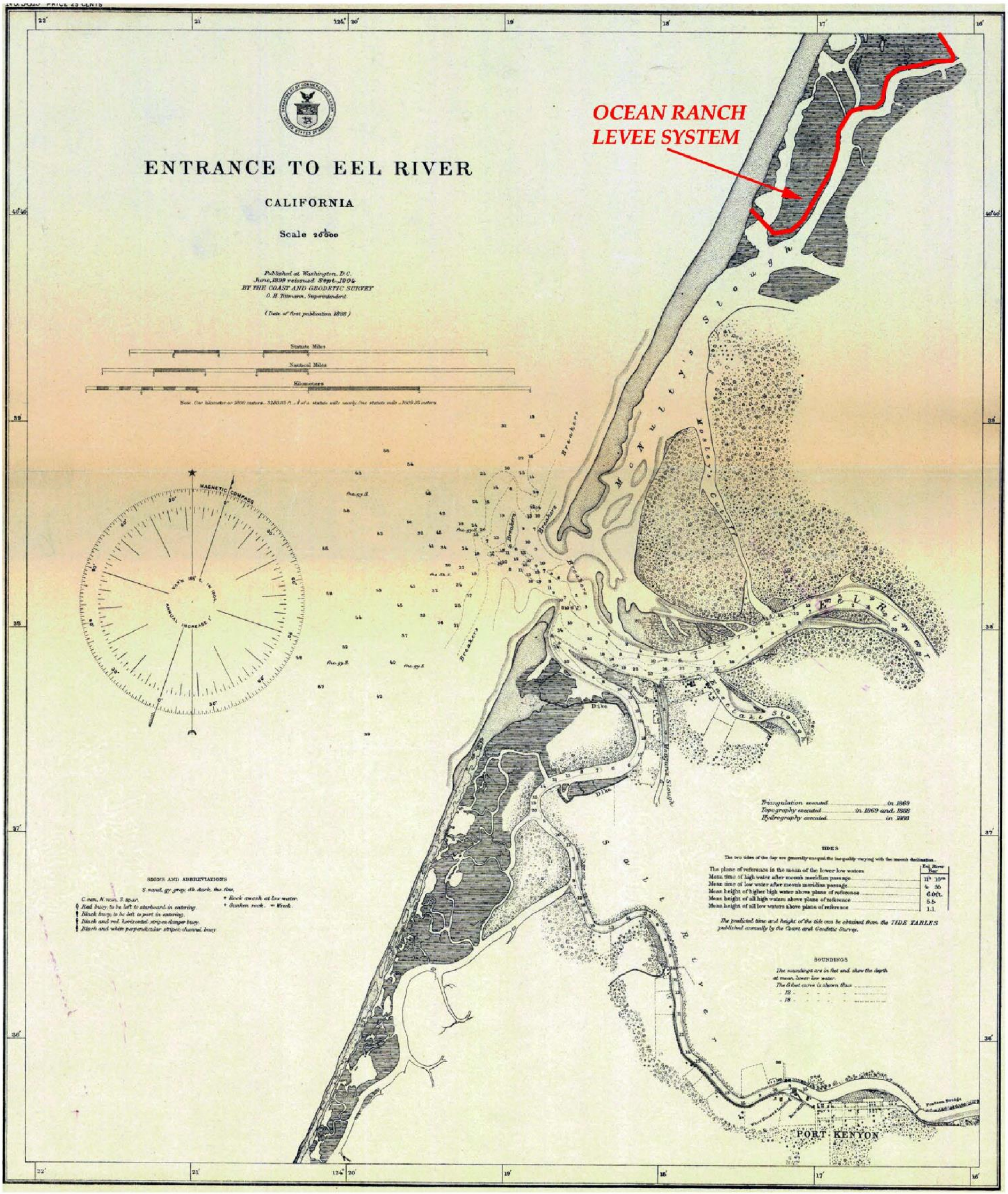
Existing Channel Network

FIGURE 3.9-4

N:\US\Eureka\Projects\111\11152100 – DU Ocean Ranch Estuary CEQA\08-GIS\Maps\Deliverables\EIR\Ch3-9\11152100_03-09-04_ExistingChannelNetwork_RevC.mxd
Print date: 03 Sep 2020 - 10:59

Data source: DU Channel Network, 2018; DU Ocean Ranch Unit Management Areas, GHD, 10/17/2018; Project Boundary, GHD, 10/17/2018; Humboldt County roads, 2008; NAIP orthoimagery 2016; . Created by: jclark2



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1888 Map of the Eel River Estuary

FIGURE 3.9-5

G:\111\11152100 – DU Ocean Ranch Estuary CEQA\08-GIS\Maps\Deliverables\EIR\Ch3-9\11152100_03-09-05_1888Map_RevB.mxd
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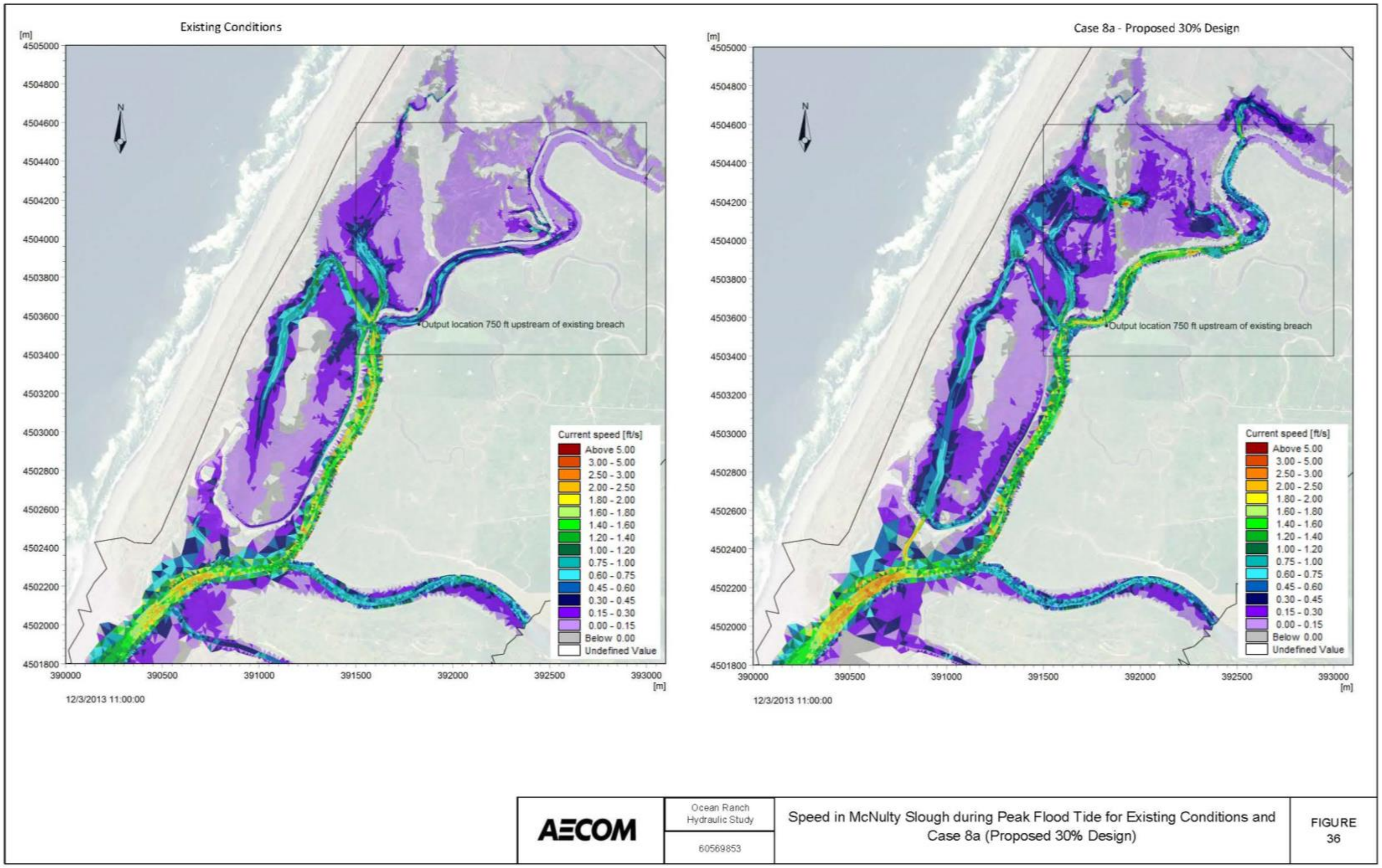
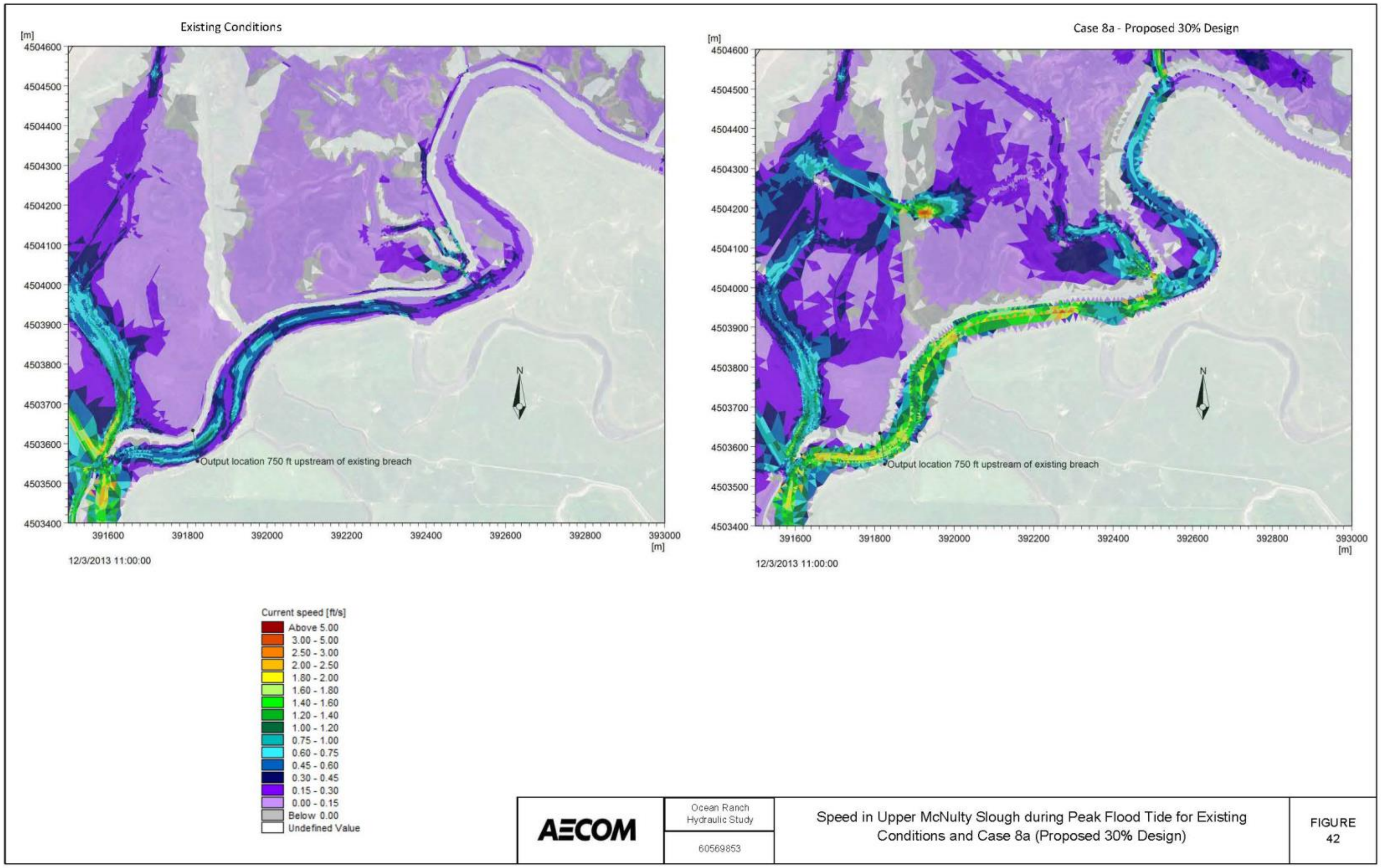
Data source: Coast and Geodetic Survey, 1888. Created by: jclark2



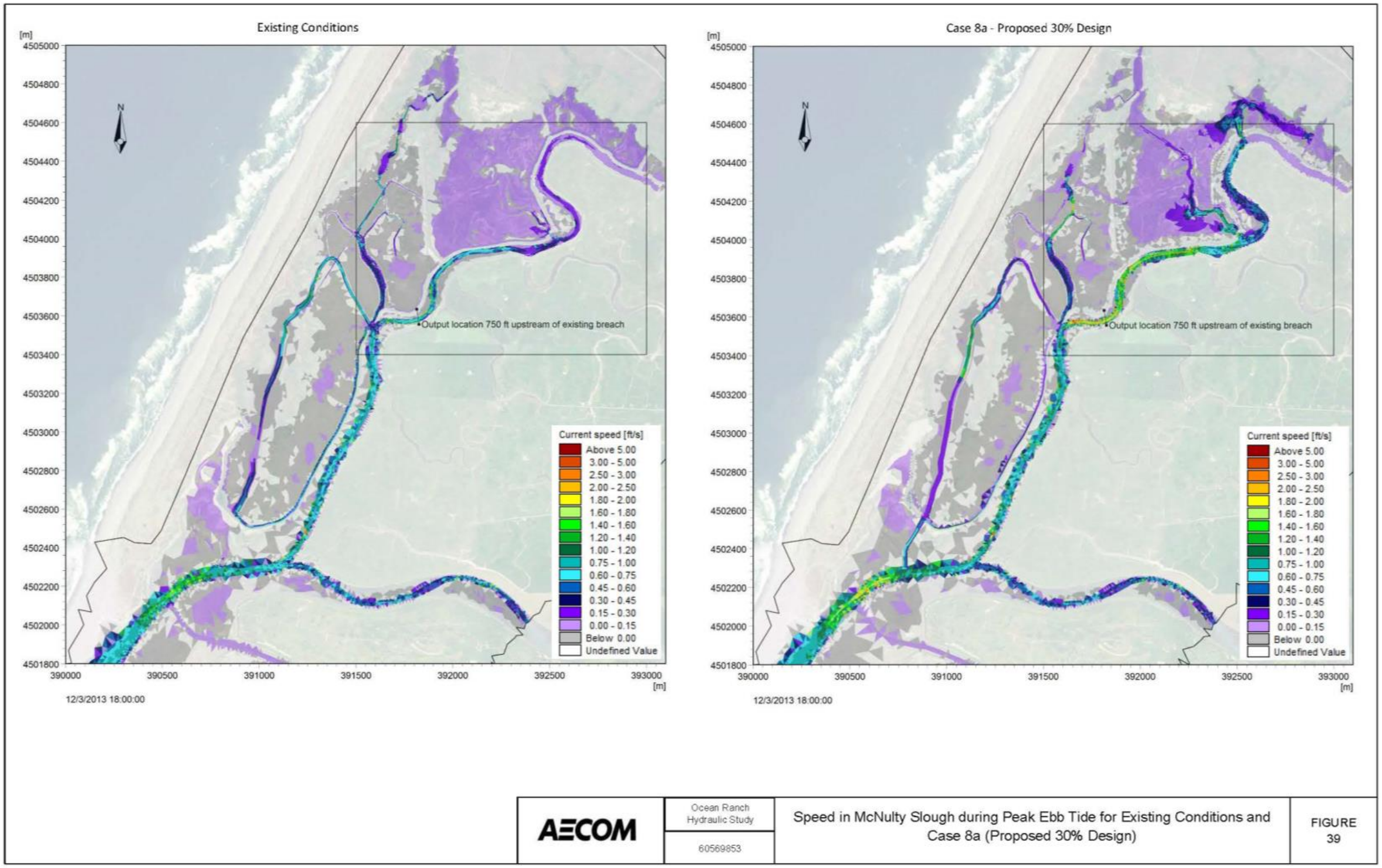
Source: AECOM 2019

Figure 3.9-6 Speed in McNulty Slough During Peak Flood Tide for Existing Conditions and Case 8a (Project)



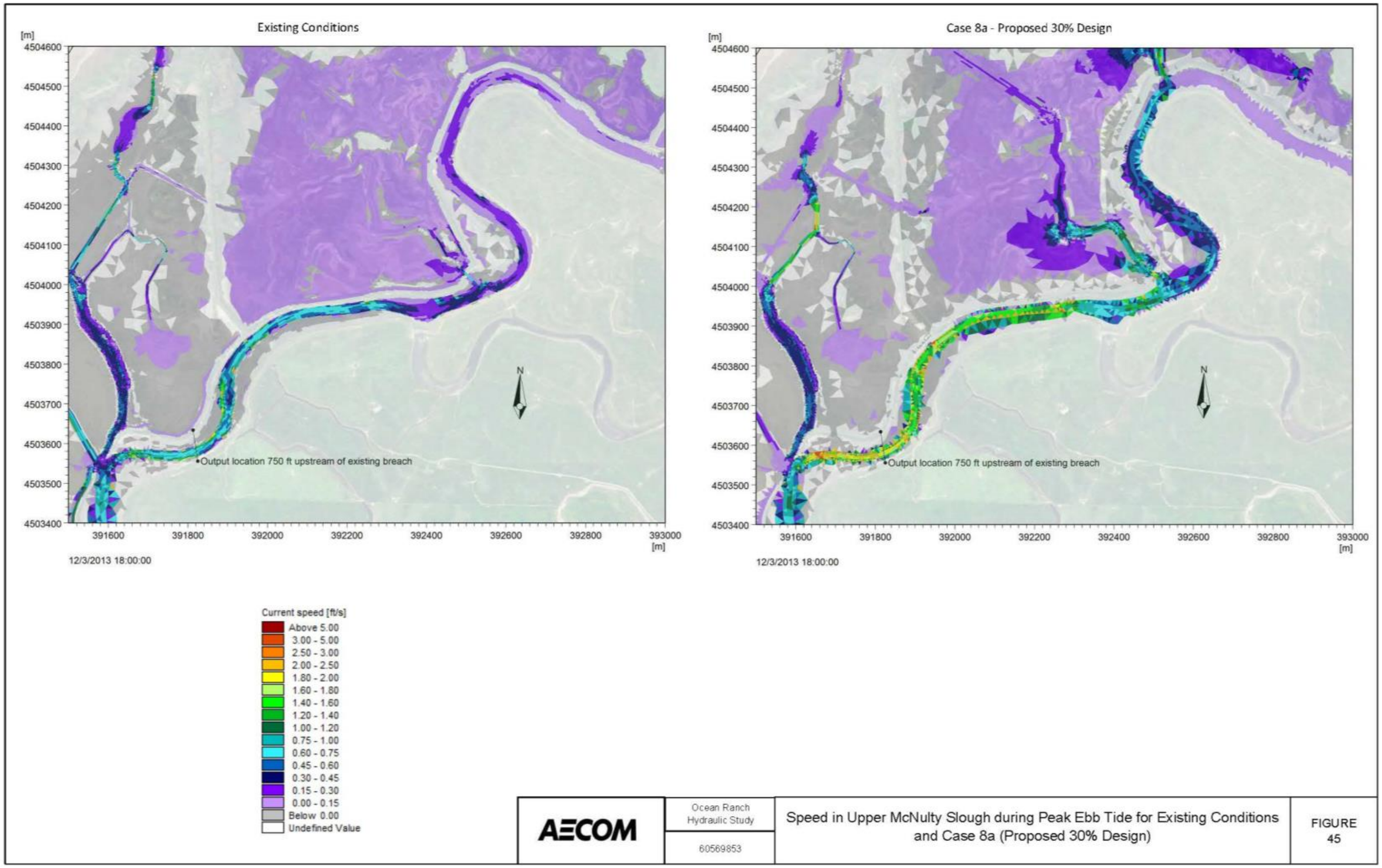
Source: AECOM 2019

Figure 3.9-7 Speed in Upper McNulty Slough During Peak Flood Tide for Existing Conditions and Case 8a (Project)



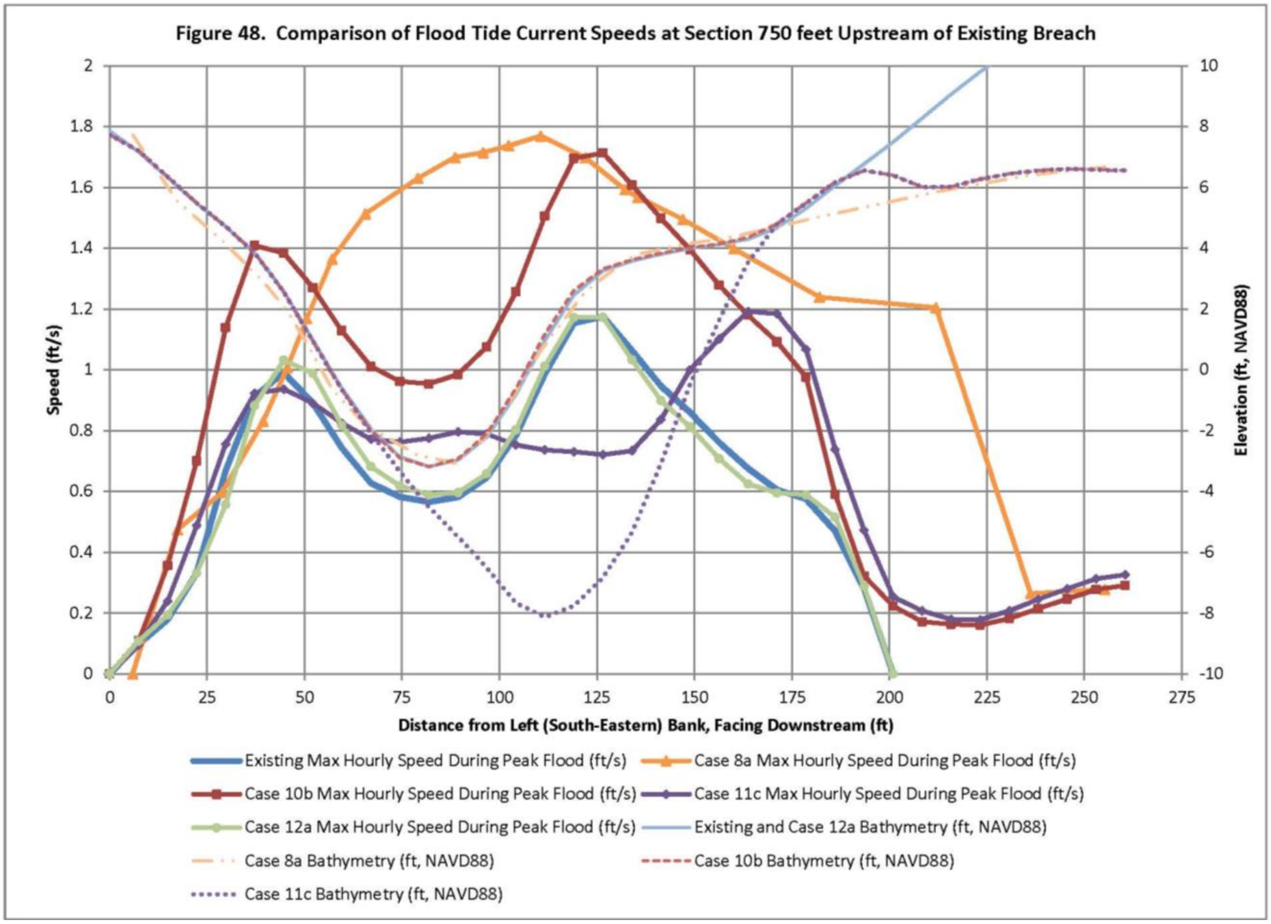
Source: AECOM 2019

Figure 3.9-8 Speed in McNulty Slough During Peak Ebb Tide for Existing Conditions and Case 8a (Project)



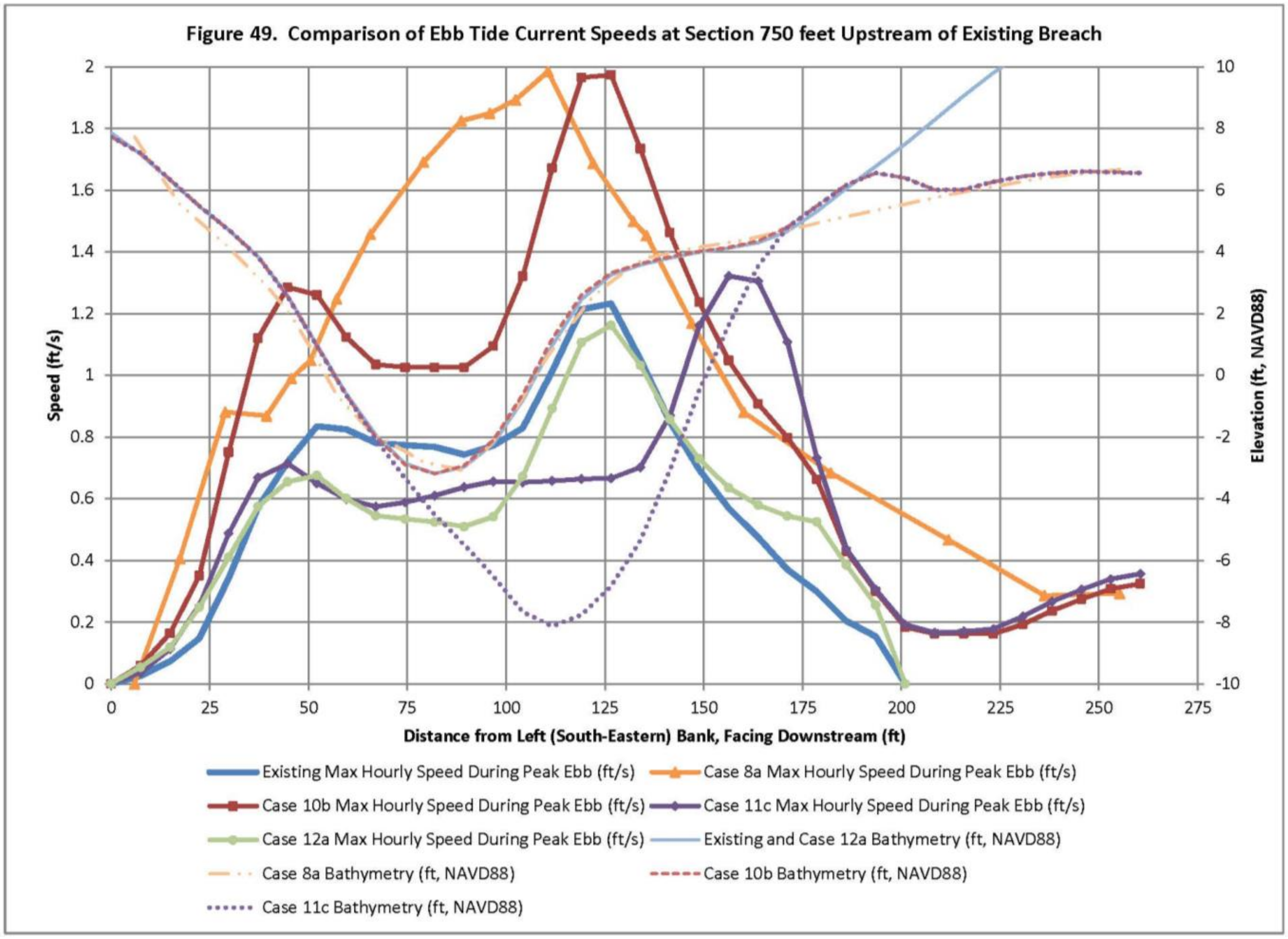
Source: AECOM 2019

Figure 3.9-9 Speed in Upper McNulty Slough During Peak Ebb Tide for Existing Conditions and Case 8a (Project)



Source: AECOM 2019

Figure 3.9-10 Comparison of Flood Tide Current Speeds at Section 750 Feet Upstream of Existing Breach



Source: AECOM 2019

Figure 3.9-11 Comparison of Ebb Tide Current Speeds at Section 750 Feet Upstream of Existing Breach