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Request for Incidental Harassment Authorization

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SECTION 1
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1.1 Background

The Elkhorn Slough Tidal Marsh Restoration Project (project), proposed to be completed in several phases, would restore 147 acres of vegetated tidal salt marsh, upland ecotone, and native grasslands in Monterey County (**Figure 1**). Phase I of the project, which was completed in late 2018, restored 61 acres of tidal marsh adjacent to Elkhorn Slough in Monterey County, California. An Incidental Harassment Authorization (IHA) for Level B harassment of Pacific harbor seals (*Phoca vitulina richardii*) during Phase I construction was issued by the National Marine Fisheries Service (NOAA Fisheries) in March 2017.[1] Phase II of the project would restore an additional 58 acres of saltmarsh habitat proximate to the Phase I restoration area, at the Minhoto-Hester and Seal Bend Restoration Areas (**Figure 2**). This request for IHA coverage addresses Phase II of the project. Future phases of the project would begin after completion of Phase II construction and would be permitted separately.

The Elkhorn Slough estuary is one of the largest estuaries in California and contains the State's largest salt marshes south of San Francisco Bay. The slough provides important habitat for an exceptionally broad range of resident and migratory birds, fish, and other wildlife, and plays a crucial role in the local estuarine and nearshore food web. The Elkhorn Slough watershed encompasses approximately 45,000 acres. The Elkhorn Slough Ecological Reserve is owned and managed by the California Department of Fish and Wildlife (CDFW). Those lands are also designated as the Elkhorn Slough National Estuarine Research Reserve (ESNERR) with administrative and research funding provided by the National Oceanic and Atmospheric Administration (NOAA) to CDFW through the Elkhorn Slough Foundation (ESF). The ESF is an accredited land trust and partner to CDFW. ESF owns nearly 3,300 acres and manages easements on an additional 300 acres of private land in the Elkhorn Slough watershed (Elkhorn Slough Foundation 2014). A large portion of Elkhorn Slough is designated by CDFW as the Elkhorn Slough Marine Protected Area. The boundary of this designation extends to the mean high tide level. Therefore, some of the project would occur within the Marine Protected Area.

[1] The U.S. Fish and Wildlife Service (USFWS) issued an IHA for Level B harassment of southern sea otter (*Enhydra lutris nereis*) during Phase I construction work in 2017 (IHA-2017-01). USFWS has determined that an IHA will not be required for Phase II of the project due to the very low level of impact to otters from Phase I, the continued lack of proposed vibratory driving, and CDFW's commitment to implement the same avoidance, minimization and monitoring requirements as in Phase I (Carswell pers. comm. 2019).

The slough system has historically faced substantial tidal wetland loss related to prior diking and marsh draining and is presently facing unprecedented rates of marsh degradation. Over the past 150 years, human activities have altered the tidal, freshwater, and sediment processes which are essential to support and sustain Elkhorn Slough's estuarine habitats. Fifty percent of the tidal salt marsh in Elkhorn Slough has been lost in the past 150 years. This habitat loss is primarily a result of two historic land use changes, 1) construction of a harbor at the mouth of the slough and the related diversion of the Salinas River, which lead to increased tidal flooding (and subsequent drowning of vegetation) and 2) past diking and draining of the marsh for use as pasture land. The act of draining wetlands led to sediment compaction and land subsidence from 1 to 6 feet. Decades later, the dikes began to fail, reintroducing tidal waters to the reclaimed wetlands. Rather than converting back to salt marsh, the areas converted to poor quality, high elevation intertidal mudflat, as the lowered landscape was inundated too frequently to support tidal marsh, and insufficient sediment supply was available in the tidal waters to rebuild elevation. The loss of riverine sediment inputs, continued subsidence of marsh areas, sea level rise, increased salinity, and increased nutrient inputs may also contribute to marsh loss (Watson et al. 2011). Bank and channel erosion in Elkhorn Slough are also leading to deepening and widening tidal creeks, causing salt marshes to collapse into the channel, and eroding sediments that provide important habitat and support estuarine food webs.

In 2004, ESNERR initiated a planning effort (Tidal Wetland Project) to evaluate marsh dieback and tidal erosion at Elkhorn Slough and to develop restoration and management strategies. Experts from multiple disciplines agreed that without intervention, excessive erosion would continue widening the tidal channels and that salt marsh would continue to convert to mudflat. If left unabated, continued erosion at present rates could result in a significant loss of habitat function and decrease estuarine biodiversity. Habitat loss is expected to become more severe with accelerating sea level rise. As described more fully in the following subsections, the project proposes restoration to address these issues across a range of impacted tidal marshlands, including subsided marsh areas that now support substantially less emergent marsh and more mudflat than was historically present.

1.2 Goals and Objectives

The project's goals and objectives were developed by ESNERR staff and are listed below:

Goal 1: Increase the extent of tidal marsh in Elkhorn Slough

***Objective 1.1*:** Restore salt marsh ecosystem of historically diked and drained areas through adding sediment.

Goal 2: Reduce tidal scour in Elkhorn Slough

***Objective 2.1*:** Add sediment to historically diked and drained areas, thereby decreasing the tidal prism.

Goal 3: Protect and improve surface water quality in Elkhorn Slough

***Objective 3.1*:** Establish a permanent vegetated buffer to absorb upland sediment and contaminants.

Goal 4: Provide resilience to climate change to estuarine ecosystems in Elkhorn Slough

***Objective 4.1*:** Increase the extent of tidal marsh from one to two feet to be resilient to moderate sea level rise.

Goal 5: Increase understanding of how best to restore salt marsh

***Objective 5.1*:** Conduct a well-designed and monitored project so that lessons learned can inform future salt marsh restoration projects in the estuary.

1.3 Location and Setting

The project is located in the Elkhorn Slough estuary, situated 90 miles south of San Francisco and 20 miles north of Monterey (**Figure 1**). The site is located on land owned and managed by CDFW as part of ESNERR. The project site is shown in **Figure 2**. One Marine Protected Area, a State Marine Reserve, encompasses a portion of the project site. Two additional Marine Protected Areas are located within approximately one mile of the project site: Elkhorn Slough State Marine Conservation Area and Moro Cojo Slough State Marine Reserve. Regional access to the site is provided by U.S. Highway 101 (U.S. 101), State Route 1 (SR 1), State Route 156 (SR 156), and State Route 183 (SR 183). Local access is provided by Dolan Road and Via Tanques Road in the unincorporated area of Monterey County known as Elkhorn, between Moss Landing and Prunedale.

1.4 Overview of Existing Land Use

The Elkhorn Slough system is a network of intertidal marshes, mudflats, and subtidal channels located at the center of the Monterey Bay shoreline. Elkhorn Slough has an average depth of 4.6 feet and is deepest at the SR 1 bridge overcrossing where it measures 25 feet deep at mean lower low water (MLLW). The main channel in Elkhorn Slough becomes narrower and shallower as it winds inland. Tidal marshes in the slough are dominated by perennial pickleweed (*Salicornia pacifica*) and occur at higher intertidal elevations than the mudflats that lie below the tidal marshes. Pickleweed provides important habitat for a variety of aquatic and terrestrial species and pickleweed-dominated marshes are generally recognized as having significant ecological value (Woolfolk and Labadie 2012).

Surrounding Elkhorn Slough are the hilly uplands and marine terraces that lie between the Pajaro and Salinas valleys. Upland areas drain into Elkhorn Slough through numerous small ephemeral creeks. The largest of these is Carneros Creek at the head of the estuary. Land use in these uplands consists of agriculture (primarily strawberries and other row crops), cattle grazing, rural residences, and the small town of Las Lomas. Wetlands, mudflats, and marsh areas on both sides of Elkhorn Slough characterize the immediate project setting. Uplands surrounding Elkhorn Slough are primarily undeveloped.

1.5 Restoration Areas

Phase II of the project would restore 58-acres of saltmarsh habitat, including 53-acres of subsided marsh within the Minhoto-Hester Restoration Area (sub-areas M4a-b, M5, and M6) and the Seal Bend Restoration Area (subareas S1-S4); 2 acres of tidal channels; and an additional 3 acres of intertidal salt marsh created at an upland borrow area (**Figure 2**). The Minhoto-Hester Restoration Area is key to restoring hydrology to the Phase I restoration area and the Seal Bend Restoration Area is important for both habitat restoration and to maintain the configuration of the main channel of Elkhorn Slough as the remnant levee in the area has almost disintegrated.

Both restoration areas consist of subsided pickleweed marsh, intertidal mudflats, tidal channels and remnant levees. They include multiple cross-levees and both natural and dredged channels. The perimeter levee at both restoration areas shows signs of erosion.

Soils to raise the marsh plain elevations to a height that would allow emergent wetland vegetation to naturally reestablish and persist would be obtained from an upland borrow area south of the Minhoto-Hester Restoration Area (**Figure 2**). The borrow area would include portions of the Phase I borrow area (i.e., the 12-acres planted in cover crop in 2018 and the 9 acres not previously utilized), as well as an additional adjacent 17 acres available to be used for fill. Historically, the borrow area was used to grow crops such as strawberries and artichokes as well as bulb/flower production but has not been in active production since 2012. It is currently planted in a cover crop (Merced rye [(*Secale cereal*)).

1.6 Project Characteristics

The Phase II project would restore 58 acres of saltmarsh habitat, including 53-acres of subsided marsh within the Minhoto-Hester and Seal Bend Restoration Areas; 2 acres of tidal channels; and an additional 3 acres of intertidal salt marsh created within the borrow area (**Figure 2**). Up to 276,000 cubic yards (CY) of soil from the borrow area would be added to the remnant marsh plain to an average height of 2.4 feet, or 1.9 feet after one year of soil consolidation, or the elevation that would allow emergent wetland vegetation to naturally reestablish and persist.

The slopes of the borrow area would be graded to create an ecotone band along the edge of the restored marsh and/or native grassland habitat (**Figure 2**). Specifically, a 5-acre buffer (proposed grassland) would be revegetated with native dominated perennial grassland adjacent to subareas M4 and M5. The native grassland areas would be revegetated by reducing the weed seed bank and planting native grasses/forbs. A weed-resistant border of rhizomatous perennial plants that readily spread (e.g., creeping wild rye [*Elymus triticoides*] or Santa Barbara sedge [*Carex barbarae*]) would be planted between the grassland and ecotone. Remaining scraped areas within the borrow area would be planted in a cover crop until local material is propagated to expand grassland restoration.

The project would improve marsh sustainability with sea level rise, as the restored marsh would be higher in the tidal frame, further from the drowning threshold, and marsh vegetation in the restored areas would accrete organic material that would help the restored marsh plain rise with

sea level. The project would also reduce tidal prism in Elkhorn Slough, reducing the potential for ongoing tidal scour and associated marsh loss.

1.7 Design Elements and Grading

Design elements to restore hydrologic function to the project area would include raising the subsided marsh plain, maintaining or re-excavating the existing tidal channels, and excavating within the upland buffer area to restore marsh plain, ecotone, and native grassland habitat.

1.7.1 Restored Marsh Plain

The subsided former marsh plain (currently mostly too low to sustain vegetation) would be raised over an area of approximately 53 acres to mid-high marsh plain elevations (**Figure 2**). Based on vegetation-elevation data collected for the project (ESA 2013), this target elevation would support a healthy growth of perennial pickleweed as well as a diverse high marsh community. Sediment would be placed to a fill elevation slightly higher than the target marsh plain elevation to allow for settlement and consolidation of the underlying soils. The average fill depth would be 2.1 feet, including 25 percent overfill. **Table 1** presents the acreages of the restoration sites and extents of proposed fill within each marsh sub-area, as well as the volume of fill required for each marsh sub-area. Onsite borrow from the upland borrow area would be used as the fill source. The project would rely primarily on natural vegetation recruitment in the restored marsh areas.

TABLE 1
VOLUME OF FILL REQUIRED IN EACH SUB-AREA

Subarea	Area (acres)	Fill Area (acres)	Estimated Fill Volume (CY)
Minhoto-Hester Restoration Area			
Sub-area M4a	2.5	1.0	6,880
Sub-area M4b	9.7	7.3	44,516
Sub-area M5	10.2	7.8	57,466
Sub-area H6	6.8	5.5	33,792
Seal Bend Restoration Area			
Sub-area S1	4.8	4.5	32,982
Sub-area S2	8.6	6.4	36,827
Sub-area S3	4.1	3.0	19,021
Sub-area S4	11.1	8.8	44,516
Total Phase II	**57.7**	**44.5**	**276,000**

Source: ESA 2014a

[1] Volumes are mid-range estimates; actual volumes may be higher or lower.

A natural marsh plain is very gently sloped, more gently than can be graded during construction. Where permeable soils are used for marsh fill, the marsh plain would be approximately flat to

simplify design and construction. Where less permeable soils are used, the design may include a slightly sloped marsh plain to improve drainage.

1.7.2 Tidal Channels

Remnant historic channels onsite would generally be left in place or filled and re-excavated in the same place. As needed for marsh access, smaller channels would be filled. Avoidance of channel fill, temporary and permanent, is preferred. As much of the existing tidal channel network would be maintained as is feasible, and the post-project channel alignments would be similar to those under existing conditions. The density of channels (length of channel per acre of marsh) after restoration would be comparable to the density in natural reference marshes.

Low levees (less than 0.5 feet above the marsh plain) composed of fill material would be constructed along the larger channels to simulate natural channel levees. Fill would be placed as close to the edge of the channel as possible to simulate the form and function of a natural channel bank.

Borrow ditches that date from the times of historical wetland reclamation in these areas would be blocked or filled completely if fill is available after raising the marsh plain. Blocking borrow ditches would route more flow through the natural channels and slightly increase hydraulic resistance, which may achieve benefits from reducing tidal prism and associated scour in Elkhorn Slough marshes.

1.7.3 Marsh, Ecotone and Grasslands in the Buffer Area

The slopes of the borrow area would be graded to increase marsh area and create a gently sloping ecotone band along the edge of the restored marsh. Specifically, a 5-acre buffer (proposed grassland) would be revegetated with native dominated perennial grassland adjacent to subareas M4 and M5. The native grassland areas would be revegetated by reducing the weed seed bank and planting native grasses/forbs. Remaining scraped areas within the borrow area would be planted in a cover crop until local material is propagated to expand grassland restoration.

1.7.4 Sediment Source

Up to 276,000 CY of soil would be required to implement the project. This soil would come from the upland borrow area south of the Minhoto-Hester Restoration Area and would include portions of the Phase I borrow area as well as an additional adjacent 17 acres available to be used for fill (**Figure 2**).

1.8 Construction Timing and Sequencing

Construction is scheduled to start as soon as permitting is complete (current start window - January 2020) and is anticipated to take up to 11 months. Construction sequencing would begin with water management and/or turbidity control measures constructed around the work areas prior to placing material on the marsh (discussed more fully in the sections below). After fill

placement on the marsh, any temporary features, such as water management berms, would be removed. The following sections describe each of these steps.

1.9 Construction

1.9.1 Access Routes

The access routes to the project area are shown on **Figure 2**. Construction crews and equipment would access the both restoration areas from Dolan Road via existing roadways located alongside the existing agricultural fields. Access within the restoration areas would be dispersed and facilitated with low-ground pressure construction equipment.

1.9.2 Construction Equipment

Construction equipment would include haul trucks, heavy earthmoving equipment, such as dozers, backhoes, loaders, and excavators to transport dry material out onto the marsh. Where appropriate, low-ground pressure equipment would be used to access the marsh.

1.9.3 Working and Staging Areas

Equipment and construction personnel would be staged along existing roads and levees, or in the upland borrow area south of the Minhoto-Hester Restoration Area.

1.9.4 Material Placement

Once water control and/or turbidity measures are in place, sediment would be transported from the stockpile to the marsh by means of earthmoving equipment. All heavy equipment used to transport dry material out onto the marsh would be low ground pressure to prevent sinking in the mud. Mats would be temporarily placed on the marsh, as needed, to spread the weight of the equipment. At the end of construction in each cell/stage, any elevated haul roads and/or berms constructed to aid in material placement would be excavated to design grades, with the resulting earth used to fill adjacent restoration areas.

1.9.5 Water Control and Turbidity Management

Work areas on the remnant marsh plain would for the most part be isolated from the tides and dewatered to allow construction in non-tidal conditions. Water control structures such as temporary berms would be utilized to isolate the fill placement area during the construction period. Existing berms would be used, where possible. Tidal channels into such areas would be blocked. The isolated work areas would be drained using a combination of gravity and pumps. Water levels within the blocked areas would be managed to keep them mostly free of water (with some ponded areas remaining) and to allow fill placement at all stages of the tides. To reduce the potential for fish to become entrained in isolated ponded areas blocking of tidal channels would occur at low tide. When sediment placement is complete, the berms would be lowered to the target marsh elevation, reintroducing tidal inundation. Additionally, any blocked tidal channels would be re-excavated.

1.9.6 Tidal Channels

Tidal channels are an important design feature of the restoration plan. For earthmoving equipment, however, tidal channels present a challenge to navigating the marsh. The most efficient method of earthmoving would be to fill the marsh plain to the target elevation, with straight paths throughout the fill footprint to push the material. Working around the channels and extending the trip paths from the stockpile to the fill locations would increase the time, and therefore cost, of restoring the marsh.

To limit trip distances onto the marsh, the project would employ one or more of the following placement approaches. Temporary channel crossings may be constructed, or tidal channels may be temporarily filled and then re-dug with an excavator or backhoe. If re-excavation of the smaller channels proves infeasible, these channels may be permanently filled, the resulting channel extent consisting of the larger channels only. The resulting channel extent would be sufficient to provide drainage and tidal exchange to support natural marsh functions.

The number and locations of channel crossings would depend on the tradeoff between haul distances and the ease of installing and removing the crossings. Where tidal channels were maintained in place, turbidity control measures (i.e., BMPs, such as hay bales or weed free straw wattles) could be staked down in or adjacent to the channels to be preserved. Bulldozers would push fill up to the hay bales and wattles, but not into the channels. Channel crossings and BMPs would be removed at project completion.

1.9.7 Construction Workforce

The construction workforce would require approximately 6 full-time workers and approximately 3 part-time workers plus occasional engineer visits and supplies delivery.

1.10 Operations and Maintenance

Following construction, it is expected that the restored marsh plain would be self-maintaining; no active management is anticipated. CDFW would maintain the upland ecotone and grasslands revegetation area in a manner consistent with its other properties in the area. Maintenance activities would generally include periodic visits to the site for removing trash, pulling weeds, and reseeding, as necessary. As a primary purpose of the restoration project is to garner scientific information about the effectiveness of various restoration techniques, all areas of the restoration project would be monitored for several years following project construction.

SECTION 2
Dates, Duration, and Specified Geographic Region

2.1 Dates and Duration

It is anticipated that construction would begin in January 2020, after all permits are secured, and would last approximately 11 months (if continuous). Construction also may be implemented over two construction seasons; if there is a break in construction activities, the construction window would be extended by the length of the break. The timing and duration of each project component is likely weather dependent. The construction period assumes that the construction contractors would work from sunrise to sunset, Monday through Friday. However, some construction activity may also be required during daylight hours on Saturdays.

2.2 Environmental Setting

The information contained in this section is from the *Final Elkhorn Slough Tidal Marsh Restoration Project Existing Conditions Report* (ESA 2014b). The biotic conditions were assessed by H.T. Harvey & Associates via a review of existing information, supplemented with a reconnaissance-level survey of the project vicinity conducted in January 2013.

2.3 Geographic Setting and Land Use History

The geographic setting and land use history within Elkhorn Slough and the larger Pajaro-Elkhorn-Salinas basin are primary drivers of both physical conditions and biological communities within and adjacent to the project site. This section describes both regional and site-scale geography and land use history.

2.3.1 Elkhorn Slough

The Elkhorn Slough system is a network of intertidal marshes, mudflats, and subtidal channels located at the center of the Monterey Bay shoreline. Like many estuarine systems along the Central Coast, tidal marshes in the slough only contain high marsh pickleweed (*Salicornia*) vegetation communities, not the low marsh cordgrass (*Spartina*) communities found in other tidal marsh systems such as those in San Francisco Bay. The Slough has a complex geologic and human history that is explained in detail by a number of documents published by ESNERR scientists and others (Van Dyke and Wasson 2005; PWA 2008; Watson et al. 2011; and many more). Prior to European colonization, the system contained broad expanses of tidal marsh, fresh-brackish marsh, and related habitats throughout Elkhorn, Parsons, Moro Cojo, Bennett, and

Tembladero Sloughs. Major anthropogenic modifications to the Slough commenced in the late 1800s with the diking and draining of marshes in Moro Cojo and Tembladero Sloughs. Around the same time, the Union Pacific Railroad was constructed along the Slough's eastern edge. In the early 1900s, large portions of tidal wetlands within Elkhorn and Parsons Slough were reclaimed for agriculture, duck hunting, and other uses, and the Salinas and Pajaro Rivers were diverted from the slough. These activities significantly decreased both fluvial flows and tidal prisms within the Elkhorn Slough system, leading to increased shoaling and periodic closure of the slough mouth near Moss Landing (Woolfolk pers. comm. *in* ESA 2014a). The diversion of the Salinas and Pajaro Rivers also eliminated a likely significant source of sediment from the Slough (Watson et al. 2011). The construction of Moss Landing Harbor in 1946-1947, and associated channel deepening, dramatically altered the hydrodynamics in Elkhorn Slough by permanently opening the system to the full range of the tides. The increased tidal range resulted in the increased inundation of the Slough's remaining salt marsh habitats, which has been compounded by shallow subsidence, a sediment deficit, and sea level rise (Callaway et al. 2012). Overall, human activities have led to the loss and/or degradation of over 2/3 of the former marsh habitats in Elkhorn Slough, severely impacting the Slough's ecosystem (Van Dyke and Wasson 2005).

Existing habitats within the estuarine portion of the Slough include areas of open water, mudflats, salt flats, diked marsh, and tidal marsh. Many of the tidal marshes in lower Elkhorn Slough and Parsons Slough are in various stages of degradation from the recent history of human activities described above.

2.3.2 Tidal Restoration Sites

Phase II work would occur within two tidal restoration areas: The Minhoto-Hester Restoration Area (subareas M4a-b, M5, and M6) and the Seal Bend Restoration Area (subareas S1-S4) (**Figure 2**).

The Minhoto-Hester Restoration Area (29.3 acres) is a low-lying area consisting of subsided pickleweed marsh, intertidal mudflats, tidal channels and remnant levees. The area has multiple cross-levees and both natural and dredged channels. A major dredged channel (over 100 feet wide in some locations) runs north-south through the remnant marsh and along the eastern boundary of the Phase II restoration area. The perimeter levee at the Minhoto-Hester area shows signs of erosion. The Phase I restoration area is located adjacent to and south/southeast of the Phase II restoration area. Both Phase I and Phase II restoration areas abut the upland borrow area, which also supports restoration of additional intertidal marsh, ecotone, and grassland habitat (**Figure 2**).

The Seal Bend Restoration Area (28.6 acres) is also a low-lying area consisting of low-quality subsided pickleweed marsh, intertidal mudflats, tidal channels, and remnant levees. Similar to the Minhoto-Hester Restoration Area, this area has been divided by multiple cross-levees and has the heavily eroded remnants of a perimeter levee along its outboard side. A large borrow channel is located adjacent to the interior of the perimeter levee. Dendritic channel networks drain the area; many of these channels exhibit evidence of historic dredging, straightening, and/or rerouting.

2.3.3 Upland Borrow Area

The borrow area upslope of the Minhoto-Hester Restoration Area is located on gently sloping uplands adjacent to the historic tidal marsh (**Figure 2**). Historically, this area was used to grow crops such as strawberries and artichokes as well as bulb/flower production (Andrea Woolfolk, pers. comm. in ESA, 2015a). Since 2012, the area has been kept fallow; it has been mowed and disked annually and at times been planted with sterile annual barley or triticale to prevent erosion of sediment into the Slough. A portion of this upland area was used to as a stockpile storage and upland borrow site for Phase I restoration work.

2.4 Habitats in the Project Area

The following provides a description of the habitat types that occur in the project area. Habitat types were developed using a combination of described habitats and vegetation alliances as per Holland (1986), Sawyer et al. (2009), and Kutcher (2008). The habitat types are based upon hydrology, land use, and vegetation, and are consistent with those previously described for Elkhorn Slough (Zimmerman and Caffrey 2002; ESTWPT 2007). The four habitat types found within the project area are subtidal, intertidal mudflat, intertidal salt marsh, and formerly cultivated field/ ruderal grassland. These are described in detail below.

2.4.1 Subtidal/Aquatic

Subtidal channels connect to the main channel of Elkhorn Slough and provide tidal exchange to intertidal mudflats and intertidal salt marsh at the site. Subtidal channel habitats occur below the elevation of the low tidemark or MLLW where the substrate is continuously submerged. Tidal creeks form networks that serve an important function of water conveyance and drainage onto and off mudflat and marsh surfaces as well as the transfer of sediment and nutrients between marshes and the main estuarine channel (ESTWPT 2007). The corresponding National Estuarine Research Reserve System (NERRS) classification for the Subtidal habitat type is Estuarine Subtidal Haline Unconsolidated Bottom Mud.

Elkhorn Slough channel habitats have substrates largely composed of material such as organic matter, mud, sand, and gravel. The fine-grained materials are often cohesive, as a result of unconsolidated material eroding away over several decades. Channel depth averages about 9.8 feet (ESTWPT 2007). Water temperatures range from 10 to 22°C, with an average temperature of approximately 13.5°C (MBARI LOBO data).

Recent water quality assessments indicate that channels in the estuary overall are moderately eutrophic, indicating excessive nutrient enrichment (Johnson 2010; Hughes et al. 2011). Elkhorn Slough is surrounded by intensely cultivated/chemically fertilized farmlands and the estuary receives substantial agricultural run-off. Nitrate concentrations in the estuary often exceed values found in the nutrient-rich waters of Monterey Bay by nearly 20-fold (Johnson 2010). Dissolved oxygen concentrations fluctuate much more widely in Elkhorn Slough than in most other estuaries, likely attributable to the high rates of primary productivity induced by external inputs of nitrogen, the physical configuration of the slough, and the general lack of non-tidal water

input. Degraded water quality is strongly affecting environmental conditions for organisms dwelling in subtidal habitats in Elkhorn Slough (Wasson et al. 2012).

Many of the slough channels in the project area have a natural, sinuous form, however there are also numerous linear human-constructed channels as well (e.g., borrow ditches). The constructed channels reduce slough channel topographic complexity relative to the natural marsh condition and thereby likely reduce plant and animal community diversity.

Subtidal macroalgal species in Elkhorn Slough include *Ulva lactuca*, *U. expansa*, and *U. lobata*. Floating macroalgal mats occur in the water column, dominated primarily by *U. intestinalis*, but also include *Rhizoclonium riparium* and *Chaetomorpha* sp.

2.4.2 Intertidal Mudflat/Aquatic

Intertidal mudflats occur between channel and marsh habitats, typically between the elevations of MLLW and Mean High Water (MHW). Mudflats are generally inundated during high tide and exposed during low tide. Mudflats serve an important function in estuarine chemical cycles (ESTWPT 2007). However, it is not clear that these mudflats, caused by historic diking and draining of salt marsh, serve those same functions. The corresponding NERRS classification for the Intertidal Mudflat habitat type is Estuarine Intertidal Haline Unconsolidated Shore Mud.

The mudflats in the project area are devoid of salt marsh vegetation but do support diatoms and macroalgae. Peak months of macroalgal productivity are in the summer, when blooms can completely cover intertidal mudflats in Elkhorn Slough. Dense macroalgal blooms are an indicator of high nutrient loading and eutrophication, which can facilitate microbial decomposition causing hypoxic and anoxic conditions and lead to an overall loss in biodiversity. Macroalgal species documented on intertidal mudflats in Elkhorn Slough include *U. lactuca, U. intestinalis, R. riparium, Chaetomorpha* sp., and *Gracilariopsis andersonii* (Hughes et al. 2010).

Because the mudflats within the project area are much higher than natural mudflats, they are devoid of large benthic invertebrates such as large clams and worms that typical characterize healthy mudflats in Elkhorn Slough.

2.4.3 Intertidal Salt Marsh

Intertidal salt marsh occurs from approximately +4 ft NAVD88 (~1 ft below MHW) to approximately +7 ft NAVD 88 (~1.3 ft above Mean Higher High Water [MHHW]). Intertidal salt marshes in Elkhorn Slough are highly saline. The corresponding NERRS classification for the Intertidal Salt Marsh habitat type is Estuarine Intertidal Haline Emergent Wetland Persistent.

The vegetation is dominated by a single native species, perennial pickleweed (*Salicornia pacifica*), as is characteristic of high elevation intertidal salt marshes in the region. Both the percent cover and the height of pickleweed are generally lower at lower elevations of the project area where the marsh transitions to mudflat. The diversity of the native plant community increases at slightly higher elevations, as on remnant interior berms, and at the upper marsh edge where a few other native

species are found occurring with pickleweed; these include saltgrass (*Distichlis spicata*), marsh jaumea (*Jaumea carnosa*), alkali heath (*Frankenia salina*), and coast gumplant (*Grindelia stricta*).

2.4.4 Formerly Cultivated Field/Ruderal Grassland

The upland borrow area is comprised of a formerly cultivated field (fallowed since 2009). Soils are described as fine sandy loam; moderately deep soils that formed in material weathered from soft sandstone (NCSS-NRCS, 2013). The corresponding NERRS classification for the Cultivated Field/Ruderal Grassland habitat type is Upland Inland Herbaceous Upland Grassland.

After it was removed from cultivation, the site was seeded annually with sterile annual barley (*Hordeum vulgare*) as an erosion protection measure, and weeds controlled as needed by disking (Woolfolk personal communication 2013 *in* ESA 2014a). In 2018, 5 acres adjacent to the borrow area were planted in native plants and grasses and an additional 12 acres were planted in a cover crop. The rest of the site was seeded in sterile Merced rye.

In a few areas, there is a narrow fringe of ruderal grassland species including poison hemlock (*Conium maculatum*), annual grasses, and mallow (*Malva* sp.), as commonly occurs adjacent to agricultural lands in the Elkhorn Slough watershed (Wasson and Woolfolk 2011; Woolfolk pers. comm. 2013 *in* ESA 2014a). Native shrub coyote brush (*Baccharis pilularis*) and a single small coast live oak tree (*Quercus agrifolia*) occur within the ruderal grassland margin.

Because the field has been tilled regularly, small mammals are likely present in low numbers; however, California ground squirrel (*Otospermophilus beecheyi*) burrows are present in the field.

2.5 Ambient Noise Conditions

Ambient noise monitoring has not been conducted for the project. However, noise levels were monitored at the adjacent Parson's Slough during construction of a restoration project in that area in 2010 and 2011. Background noise at that site was approximately 57dBC $L_{max.}$ as measured at 20 and 40 meters northeast of the pile installation site and approximately 1.5 meters above the ground (ESNERR 2011). Ambient noise levels in the project area are likely similar to those at the Parson's Slough site. Approximately 15 to 20 trains pass along the Union Pacific Railroad each day, which is located within 400 feet of the eastern-most portion of the project site (Vinnedge Environmental Consulting 2010c). Noise levels from trains were monitored during construction of the Parson's Slough Project and estimated at 108 dBC $L_{max.}$ Pick-n-Pull, a vehicle dismantling yard and recycling yard, is located approximately 300 feet from the project site. In addition, agricultural equipment is occasionally operated within the existing uplands and haul trucks regularly travel across adjacent agricultural lands and along nearby levees.

SECTION 3
Species and Numbers of Marine Mammals

Two species of marine mammals, southern sea otter and harbor seal, occupy the project area or areas adjacent to the project area. The harbor seal is described below and included for coverage in this IHA application. The U.S. Fish and Wildlife Service (USFWS) has determined an IHA will not be required for Phase II of the project due to the very low level of impact to otters from construction of Phase I, the continued lack of proposed vibratory driving, and CDFW's commitment to implement the same avoidance, minimization and monitoring requirements as in Phase I (Carswell pers. comm. 2019).

3.1 Harbor Seal

Harbor seals use Elkhorn Slough for hauling out, resting, socializing, foraging, molting and reproduction. Counts of harbor seals in the greater Elkhorn Slough began in 1975 and at that time averaged about 30 seals (Harvey et al. 1995; Oxman 1995). Counts conducted by Osborn (1985) in 1984 averaged 35, and during 1991, maximum counts reported by Oxman (1995) were five times greater. Oxman also reported a 20 percent increase between 1990 and 1991, from 150 to 180 seals. Average counts remained comparable from 1994 through 1997, with peaks coinciding with pupping and molting seasons. A count of 339 seals was reported in 1997 (Jones et al. 2002; Richman 1997). The population in the Slough is estimated at 300 to 500, but numbers can vary seasonally based on prey availability, molting and reproduction (McCarthy 2010a). Harbor seal count data as reported are collected from a variety of sources using various methodology. Data sources include former graduate student research, occasional counts by Jim Harvey et al. at Moss Landing Marine Labs, and ESNERR staff observations, including monitoring data collected by the Reserve Otter Monitoring Project.

Harbor seals have utilized Elkhorn Slough as a resting site since the 1970s, but the first births were not recorded until 1991 (Maldini et al. 2010). From 1995 through 1997, there was a significant annual increase in pups, from 14 in 1995 to 29 in 1997 (Richman 1997). Marine mammal research scientists speculate that this increase was due to removal of public restrooms from the Seal Bend area in the early 1990s (Maldini pers. comm. *in* Vinnedge Environmental Consulting 2010b). The pupping/breeding season in Elkhorn Slough peaks in April/May (Harvey pers. comm. 2019).

Females that remain in Elkhorn Slough during the pupping/breeding season seek quiet isolated locations to rest and nurse away from main haul out areas; Parsons Slough is considered a preferred resting area for mothers and pups (Harvey pers. comm. 2019). At its closest, Parsons Slough is over 2,000 feet east of the Phase II Minhoto-Hester Restoration Area. Seals that depart

Elkhorn Slough during the pupping/breeding season likely head 25 kilometers south to Cypress Point, Carmel, or 60 kilometers north to Año Nuevo to pup and breed (Osborn 1992, Oxman 1995). No births have been noted in the project area.

SECTION 4
Affected Species Status and Distribution

4.1 Harbor Seal

The harbor seal is one of 33 species of phocids found throughout the world. It is one of the most widely distributed pinnipeds, occurring along temperate, sub- Arctic and Arctic coasts of the Pacific and Atlantic in the northern hemisphere (Trumble 1995). They usually inhabit nearshore waters, and are commonly found in rivers and estuaries (Oxman 1995). Harbor seals haul out onto beaches, rocks and other substrates to rest, whelp and molt (Hanan 1996). They haul out more often and for longer periods in summer, when they are molting, than in autumn and winter (Stewart and Yochem 1994). They are central place foragers, tend to exhibit strong site fidelity within-season and across years, generally forage close to haul-out sites, and may repeatedly visit specific foraging areas (Grigg et al. 2012). In the Eastern Pacific, breeding populations range from San Quintin Bay, Baja California to Nome, Alaska (Gunvalson 2011).

Historically, management and conservation of pinnipeds was difficult due to heavy exploitation. Harbor seals in California were commercially hunted until 1938, and between 1938 and 1972 sport and commercial fisherman would harass and kill harbor seals that interfered with fishing operations (Trumble 1995). Since the passage of the Marine Mammal Protection Act in 1972 (MMPA), the U.S. coastal population has been increasing by 5 to 7 percent per year. They are now common in their range with a total population of approximately 400,000-500,000 and California coastal estimates of around 30,968 (Carretta et. al. 2015).

4.1.1 Status in Elkhorn Slough

Harbor seals inhabit Elkhorn Slough year-round and occur individually or in groups. They usually occupy areas just beyond the mouth of the Slough in the Moss Landing harbor and in the Salinas River channel south of the Moss Landing bridge, and the lower portion of the Slough extending up to Parsons Slough and Rubis Creek. As stated in Section 3, the seal population in Elkhorn Slough estimated to be between 300 and 500 individuals, but numbers can vary. **Figure 3** depicts known and potential haul-out areas used by harbor seals proximate to the project area. Excluding the haul-outs in the project area during construction would temporarily remove less than 2% of the potential haul-out areas in the slough (i.e., based on similar tidal range).

Harbor seals mainly use the Slough as a staging area for foraging in Monterey Bay, but there is a limited amount of foraging in the Slough (McCarthy 2010a). They typically use the corridor from the mouth of Slough through the Moss Landing Harbor entrance for nightly feeding in the Bay. In a harbor seal diet study conducted in Elkhorn Slough between 1995 and 1997, diets included 35

species including topsmelt, white croaker, spotted cusk-eel, night smelt, bocaccio, Pacific herring, a brachyuran crustacean, and 4 genera of mollusks (Harvey et al. 1995 *in* McCarthy 2010a).

Harbor seal abundance may change seasonally depending on prey, abundance, molt, and reproduction (McCarthy 2010a). Pupping can occur throughout the year but generally starts in late March peaking in May (McCarthy 2010a). During the pupping/breeding season, some seals may depart to other breeding areas outside of Elkhorn Slough. Harbor seals have used Elkhorn Slough for reproduction for the past two decades. Females tend to remove themselves from the group to give birth and return within a week (McCarthy 2010a). In 2010, 50 pups were observed in Elkhorn Slough (J. Harvey unpublished data *in* McCarthy 2010a).

4.1.2 Project Area Distribution

Data on harbor seal use near the project area is derived from marine mammal monitoring data collected by the Reserve Otter Monitoring Project (ESNERR 2018) and Phase I construction monitoring (Fountain et. al. 2019)

Reserve Otter Monitoring Project – Marine Mammal Monitoring

The Reserve Otter Monitoring Project has been monitoring otter movement and behavior in Elkhorn Slough since 2011. This effort has been a collaboration between ESNERR, Monterey Bay Aquarium, United State Geologic Survey and University of California Santa Cruz. In January of 2018, they added seals to their observations, and have compiled monitoring data for seals through April 2019. During this time period, biologists conducted weekly monitoring at nine locations along Elkhorn Slough and five locations in Moss Landing Harbor (**Figure 4**). Seal and otter counts were completed every Tuesday, every half hour on the hour and half hour, from 10am-12pm. Times were chosen to provide consistency for a long-term monitoring program. Eight teams were positioned concurrently throughout the estuary using high-powered binoculars and scopes to see otters and seals. Data collected included weather, observation time, tide, the number and species of marine mammal sited, and the location they were observed. All monitoring was completed by or under the supervision of a qualified biologist previously approved by USFWS and NOAA Fisheries for marine mammal monitoring.

As shown on **Figure 4** the "Seal Bend" observation area is most representative of seal use at the Seal Bend restoration area; the "Hester 2" observation area is most representative of seal use at the Minhoto-Hester restoration area. Other monitoring locations that may support seals that transit or haul out near the proposed Phase II restoration areas and that could be disturbed by construction activities include "Wildlife", "Moon Glow", "Upper Dairy (also referred to as "Main Channel"), "Yampah", and "Avila".

Figure 5 and Table 2 summarize the average (of five half-hour counts) number of seals observed at each of the seven monitored locations proximate to the Phase II restoration areas over the 16-month observation period (i.e., January 2018 to April 2019), as well as the maximum number of seals observed at any given location during the observation period. Table 2 also summarizes the highest daily count of seals observed in Elkhorn Slough on a specific day (i.e., 417 seals on June

19, 2018) These data are consistent with previous population estimates by McCarthy (2010), which estimated the population of seals in Elkhorn Slough at 300 to 500, with seasonal variability based on prey availability, molting and reproduction. The data also illustrate that seals tend to move between areas proximate to each other. For example, when large numbers of seals were observed in Parsons Slough ("Avila") in the summer of 2018, there was a comparable decline in the number of seals observed at Seal Bend (**Figure 5**).

These data are the most recent and site-specific use data available for Elkhorn Slough and were used to inform the approximate number of seals likely to be present near the restoration areas for the purposes of estimating take (see Section 6 below).

TABLE 2
HARBOR SEAL COUNTS BY RESERVE OTTER MONITORING PROJECT

Location[1]	Highest Daily Count[2]	Count[3]	
		Maximum	Average
Harbor	88	--	--
Wildlife	59	106	41
Seal Bend	56	86	24
Moonglow	0	87	16
Hester	0	33	5
Main Channel	93	100	30
Yampah	1	81	18
Avila	120	122	32
Total	**417**	**615**	**166**

[1] See Figure 4 for location of observation area. "Harbor" includes incidental counts outside of formal observation areas.
[2] Represents highest count of seals recorded on a single day during hourly counts.
[3] Represents maximum and average number or seals observed during an hourly count at any location between January 2018 and April 2019 by Reserve Otter Monitoring Project. Counts at each location may occur on different days.

Phase I Construction Monitoring

Marine mammal monitoring during Phase I project construction recorded marine mammal use near Phase I work areas. The following generally summarizes marine mammal monitoring data collected during the 9-month construction window (December 2017-August 2018). As required by the project IHAs for Phase I, marine mammal monitoring was required during all in-water work; during work within 100 feet of tidal waters; and during work north of a specific line demarcating the likely disturbance area. Monitoring of work in other areas was required for at least the first 3 days of construction, and until there were 3 successive days of no observed disturbance. Monitoring was required to resume if there was a significant change in activities or the location of activities, or if there was a gap in construction activities of more than 1 week. Phase I monitoring included hourly counts of animals hauled out and in the water (starting 30 minutes prior to the start of construction and ending 30 minutes after construction was complete),

as well as counts of any construction-related reactions by marine mammals. Refer to the Hester Marsh Annual Report (Fountain et. al 2019) for additional detail on monitoring protocols and results.

During the 9-month Phase I construction window, marine mammal monitoring was required and implemented (see above) on 89 days (976 hours monitoring). Harbor seal counts recorded by the marine mammal monitors during the daytime (6AM to 6PM) ranged from 0 to 72 in and immediately adjacent to the restoration area, and 0 to 257 individuals in the entire observation area. The average number of seals per hourly count was 8.44 seals/hour in and immediately adjacent to the restoration area and 55.94 seals/hour in the entire observation area (Fountain et al. 2019).

Table 3 summarizes the maximum number of pups observed during hourly counts by month over the duration of the Phase I construction. This metric conservatively represents the highest number of pups that were present near work areas during Phase I construction and that could have been disturbed by project-related activities (including monitoring).

TABLE 3
MAXIMUM NUMBER OF PUPS OBSERVED DURING HOURLY COUNTS BY MONTH (PHASE I CONSTRUCTION)

Month	No. Pups
2017	
December	5
2018	
January	6
February	9
March	4
April	7
May	15
June	5
July	9
August	9

SECTION 5
Type of Incidental Taking Authorization Requested

The purpose of this document is to address the requirements of the MMPA as it relates to harbor seals in the vicinity of the Phase II project area. Activities addressed in this request for an IHA include actions that may temporarily result in non-lethal take described as Level B harassment under the MMPA. As provided in the IHA for Phase I for the project, Level B harassment includes movement and/or flushing of seals as a result of implementation of the project.

SECTION 6
Take Estimates for Marine Mammals

6.1 Harbor Seal Abundance In and Around Project Area

As described in Section 4.1, data collected by the Reserve Otter Monitoring Project represent the most the most recent and site-specific use data on harbor seal use in Elkhorn Slough. As shown on Figure 4, the "Seal Bend" observation area is most representative of seal use at the Seal Bend restoration area; the "Hester 2" observation area is most representative of seal use at the Minhoto-Hester restoration area. Other monitoring locations that may support seals that transit or haul out near the proposed Phase II restoration areas and that could be disturbed by construction activities include "Wildlife", "Moon Glow", "Upper Dairy (also referred to as "Main Channel"), "Yampah", and "Avila". Figure 5 and Table 2 summarize the average number of seals observed at each of the seven monitored locations proximate to the Phase II restoration areas over the 16-month observation period (i.e., January 2018 to April 2019).

In addition, harbor seal counts recorded by the marine mammal monitors during the daytime (6AM to 6PM) of Phase I construction ranged from 0 to 72 in and immediately adjacent to the restoration area, and 0 to 257 individuals in the entire observation area. The average number of seals per hourly count was 8.44 seals/hour in and immediately adjacent to the restoration area and 55.94 seals/hour in the entire observation area (Fountain et al. 2019).

With respect to tide height and time of day, monitoring in 2013 indicated the number of seals hauled out in the Minhoto Marsh Complex increased at a 2- to 4-foot range in tide height, and progressively throughout the morning, peaking in the afternoon and declining toward sunset (Beck 2014). These results are consistent with several previous studies (Ainley et al, 1977, Fancher 1979, Allen et al. 1984), including the published results from marine mammal monitoring competed for the Parsons Slough Complex in 2009-2010 (Maldini et. al. 2010) and Phase I of the Elkhorn Slough Restoration Project in 2017-2018 (Fountain et al. 2019). The decline in numbers toward sunset is in line with findings that harbors leave the Slough in the evening to forage in Monterey Bay (Oxman 1995).

6.2 Take Estimate

Take of harbor seals would be associated with construction-related noise and/or visual disturbance proximate to seal haul out areas. Specifically, construction equipment, such as dozers, loaders, and backhoes, may generate noise above ambient levels or create a visual disturbance

during construction. Similarly, marine mammal monitors may disturb seals as they monitor the work area to reduce potential construction-related impacts on seals.

6.2.1 Phase I Harbor Seal Disturbance

As described in Section 4.1, during the 9-month construction window associated with Phase I construction, marine mammal monitoring was required and implemented on 89 days (976 hours of monitoring). During this period there were 19 incidents of Level B harassment of harbor seals (flushing or movement) that were recorded by the monitors. Of these, 16 incidents, representing harassment of 62 individual seals, were attributed to construction activity or marine mammal monitoring; the remaining 3 incidents were unrelated to the project (e.g., seals flushing as a result of a passing boat in Elkhorn Slough) (Table 4). When Level B harassment occurred, it was always when seals were within 300 meters of the disturbance source; most were when distances were 100 meters or less (Fountain et. al. 2019). In addition, not all seals located in the vicinity of the disturbance flushed or moved during each discrete incident; for example, in 9 incidents, less than one third of the seals present in the area flushed (Table 4). Relative to the average number of seals observed per day during monitoring, approximately 2% were disturbed by construction or monitoring activities.[2]

TABLE 4
PHASE I HARBOR SEAL DISTURBANCE DATA – NUMBER OF SEALS EXPERIENCING LEVEL B HARASSMENT (MOVEMENT, FLUSHING) IN RELATION TO NUMBER OF SEALS PRESENT

Incident	Number Seals Taken	Number Seals in Vicinity	Number Seals in Entire Observation Area
1	12	16	17
2	10	49	75
3	2	2	3
4	1	1	8
5	2	12	31
6	2	12	16
7	2	12	16
8	1	12	16
9	3	3	3
10	4	7	8
11	2	5	36
12	6	43	107
13	2	17	26
14	6	14	31
15	3	3	54
16	4	6	6
Total	**62**	**214**	**453**

Notes: (1) “number seals taken" = seals that moved or flushed. (2) “Number seals in vicinity" = those proximate to the disturbance site.

[2] Calculated by dividing the total number of seals recorded as “disturbed” during Phase I construction (i.e., 62 seals) by the sum of the average number of seals observed during Phase I monitoring (i.e., 4,713 seals). This percentage was then rounded up to provide a conservative percentage of seals disturbed.

Table 5 summarizes all occasions where monitors observed seal pups reacting to Phase I project-related activities. As provided in the table, there were limited number of occasions where seal pups reacted to either a monitor or construction activities (typically sound).

TABLE 5
PHASE I HARBOR SEAL PUP DISTURBANCE DATA

Date	Reaction	Trigger	Distance (meters)	Total No. Seals Present	Total No. Seals Reacted[1]	No. Pups Reacted
4/11/18	Flush	Monitor (Visual)	100	18	6	3
4/11/18	Flush	Construction (Sound)	100	12	2	1
4/11/18	Flush	Construction (Sound)	100	10	2	1
4/11/18	Flush	Construction (Sound)	100	10	2	1
4/12/18	Alert	Construction (Sound & Visual)	100	17	2	1
5/1/18	Flush	Monitor (Visual)	100	3	3	1

[1]Includes all seals (adults, pups) that reacted to project-related disturbance

6.2.2 Phase II Take Estimate

Table 6 provides a take estimate for Phase II based on the best available data on seal use near each restoration area, and in consideration of actual Level B disturbance observed during Phase 1 construction. Specifically, daily take estimates in Table 6 are based on the average percentage of seals taken during the Phase I project (i.e., total number of seals taken / sum of the average number of seals observed, or 2%), multiplied by the maximum and average number of seals anticipated at each observation location proximate to either the Seal Bend Restoration Area or the Minhoto-Hester Restoration Area. The take was assigned to the restoration area closest to the observation area; for observation areas close to both restoration sites (Moon Glow) or those associated more generally with transit in the Slough (Wildlife, Main Channel), the take estimate was applied to both work areas.

Using the maximum number of seals observed at each monitoring location, it is estimated that up to 21.4 seals per day could be taken at both restoration sites, or 3,852 seals during the 180-day construction window when take may occur.[3] Using the average number of seals observed at each monitoring location, it is estimated that up to 5.9 seals per day could be taken at both restoration sites, or 1,062 over the 180-day construction window when take may occur (Table 6). As provided in Section 7, this is significantly more take than was observed during Phase I construction and is intended solely as a conservative estimate.

[3] Phase II construction is anticipated to take up to 11 months if implemented continuously. However, it is anticipated that only activities located within 100 meters of an active seal haul out area may result in Level B harassment of seals, based on data collected during Phase I construction. As a result, the take estimate assumes that only 6 of the 11 months of construction would include activities proximate enough to seal use areas that seals could be disturbed.

Of note, if seals are in the project area before work areas are isolated, or during construction, they would be allowed to leave on their own volition..

TABLE 6
HARBOR SEAL DAILY TAKE ESTIMATE BY RESTORATION AREA – PHASE II OF THE ELKHORN SLOUGH TIDAL RESTORATION PROJECT

Seals Observed			Daily Take Estimate[3]			
Location[1]	Count[2]		Maximum		Average	
	Maximum	Average	Seal Bend Restoration Area	Minhoto-Hester Restoration Area	Seal Bend Restoration Area	Minhoto-Hester Restoration Area
Wildlife	106	41	2.5	2.5	1.0	1.0
Seal Bend	86	24	2.0	0.0	0.6	0.0
Moonglow	87	16	2.0	2.0	0.4	0.4
Hester	33	5	0.0	0.8	0.0	0.1
Main Channel	100	30	2.4	2.4	0.7	0.7
Yampah	81	18	0.0	1.9	0.0	0.4
Avila	122	32	0.0	2.9	0.0	0.8
Total	**615**	**166**	**8.9**	**12.5**	**2.6**	**3.3**

[1] See Figure 4 for location of observation area

[2] Reflects maximum and average number or seals observed between January 2018 and April 2019 by Reserve Otter Monitoring Project.

[3] Based on average % of seals disturbed during Phase 1 (i.e., 2%) multiplied by maximum **and** average counts of seals at observation locations proximate to Phase II restoration sites. The take was assigned to the restoration area closest to the observation area; for observation areas close to both restoration sites (Moon Glow) or those associated more generally with transit in the Slough (Wildlife, Main Channel), the take estimate was applied to both work areas.

SECTION 7
Anticipated Impact of the Activity

7.1 Elkhorn Slough Restoration Project – Phase I

In 2017 and 2018, harbor seals were monitored during implementation of Phase I of the project. Phase I restoration work occurred adjacent to and southeast of the proposed Phase II project site and was similar in both scope and proposed construction methods to the current project. The avoidance and minimization measures and monitoring commitments implemented under Phase I would also be implemented under Phase II.

During construction, monitors tracked abundance, distribution, and disturbances in a specified observation area. Monitors recorded any disturbance behaviors exhibited by marine mammals and concurrent construction activities and noted "no disturbance" when animals in zones closest to construction showed no disturbance associated with construction. The types of "disturbances" recorded included alerting, movement, and flushing.

7.1.1 Monitoring Conclusions

As described in the annual monitoring report for the Phase 1 project (Fountain et. al. 2019), an average of 75 seals were recorded by marine mammal monitors in the observation area at any given time, and up to 257 individual seals were observed near the Phase I restoration area in a given day. A total of 36 disturbance incidents, impacting 140 individual seals, were also recorded by monitors over the eight-month Phase I construction window. Specifically:

- Twenty-five (25) disturbance incidents were associated with use or mobilization of construction equipment, which resulted in seals alerting, moving, or flushing. A total of 92 individual seals were impacted by these incidents.

- Five (5) disturbance incidents were associated with marine mammal monitoring – e.g., monitors walking the site to ensure seals would not be harmed by construction equipment. A total of 17 individual seals were impacted by these incidents.

- The remaining six (6) incidents were not-related to the project – i.e., animals were flushed by private boats transiting the project vicinity, or large groups of birds leaving nearby mudflats. A total of 48 individual seals were impacted by non-project related disturbance.

- A total of eight (8) harbor seal pups reacted (flushed, alerted) to construction noise and/or a visual disturbance (construction equipment, monitor).

Construction was the most frequent source of disturbances for seals, and when Level B Harassment occurred (i.e., movement or flushing), it was always when seals were within 300 meters of the disturbance source. Most of the seal flushes were when the distance between the disturbance source and the flushed animals was 100 meters or less (Fountain et. al. 2019).

7.2 Construction Impacts to Harbor Seal

Construction activities have the potential to directly affect harbor seals that may be hauling out, resting, foraging, or engaging in other activities either inside or near the project area. These seals may be temporarily disturbed or harassed by construction noise or human presence.

During the construction period, various types of construction equipment would be utilized for earthmoving such as dozers, loaders, and backhoes that may generate noise above ambient levels. As described in Section 6.2.2, it is estimated that up to 5.9 seals per day could be taken at both restoration sites, or 1,062 over the 180-day construction window when take may occur. Seals that move or flush are likely to use other areas of the slough available as haul out sites.

Of note, harbor seals that use the eastern portion of the Minhoto-Hester Restoration Area (up to 50 seals) would be inhibited from hauling-out or resting within the project area during the 11-month construction period. The site would be isolated outside of the peak-pupping season to avoid impacts to mothers with pups. Non-breeding seals that would have utilized the project area for hauling-out or resting would be displaced. However, seals could use other areas of Elkhorn Slough for resting and haul-out during construction, which would minimize impacts to seals.

Short-term displacement of resting harbor seals that is likely to occur as a result of project construction is not anticipated to affect the overall fitness of any individual animal because there is an abundance of suitable resting habitat available in the greater Elkhorn Slough estuary.

During the breeding/pupping season, harbor seal pups could be impacted by construction activities if they are unduly stressed or inadvertently separated from their mother during a flushing event. As described in Section 3.1, mothers prefer quiet isolated places away from the main haul out areas to rest and nurse. If exposed to a somewhat constant presence of construction activities, females are likely to move their pups to another area. Because there are many areas within the estuary for mothers/pups to move to (including the preferred resting area at Parsons Slough 2,000 feet east of the restoration areas), a short term disturbance is not anticipated to substantially impact pup health (Harvey pers. comm. 2019). It is also unlikely that pups would be permanently separated from their mothers during a flushing event. Anecdotal accounts during harbor seal tagging (where mothers and pups may be physically separated from each other in nets) indicate that a mother and pup typically reunite within minutes of being returned to the water (Harvey pers. comm. 2019). Their ability to quickly reunite is attributed in part to "..mutual smelling and the rapidly acquired tendency for newborn pups to follow their mothers…" (Stein 1989). The only informally documented separation was a newborn pup that did not have a chance to bond before the disturbance and handling (Lambourn pers. comm 2019). Given that a flushing event would likely move a mother and pup into the water together (and would presumably be much less traumatic and disruptive than a handling event associated with tagging), it is highly

unlikely that a project-related activity would permanently or consequentially separate a mother and pup from each other.

SECTION 8
Anticipated Impacts on Subsistence Uses

Not Applicable. There are no relevant subsistence uses of marine mammals implicated by this action.

SECTION 9
Anticipated Impacts on Habitat

The purpose of the project is to return tidal wetland function to this portion of Elkhorn Slough which has been lost due to prior diking, marsh draining, and construction of the harbor. Conversion of mudflat back to tidal marsh is expected to have an overall beneficial effect on the Elkhorn Slough system. By raising the elevation of the marsh, and increasing the extent of tidal marsh, tidal prism would be reduced. This reduction would slow erosion and sediment and marsh loss within the slough system. It is expected to reduce the loss of soft sediment habitat within the slough that support prey species of marine mammals. Increasing the extent of tidal marsh would also improve water quality by establishing a buffer to absorb upland contaminants and agricultural runoff coming from the Old Salinas River mouth.

As described in Section 7, harbor seals that utilize portions of the restoration area (up to 50 seals) would be temporarily displaced during construction activities within Minhoto Marsh. Short-term displacement of resting harbor seals is not anticipated to affect the overall fitness of any individual animal because there is an abundance of suitable resting habitat available in the greater Elkhorn Slough estuary.

SECTION 10
Anticipated Effects of Habitat Impacts on Marine Mammals

As described in Section 9, the conversion of mudflat back to tidal marsh will have an overall beneficial effect on the Elkhorn Slough system. This would likely have a long-term beneficial effect on harbor seals by improving ecological function of the slough. Harbor seals use a small portion of the channel edges within the subsided marsh (now mudflat). During construction these haul-out areas will be unavailable to harbor seals; however, once construction is complete, these same haul-out areas will once again be available (**Figure 3**). Harbor seals use a very small percentage of the potential haul-out habitat that currently exists in Elkhorn Slough. They will have an abundance of area to haul out on during construction (**Figure 3**); it would probably require huge losses of mudflat habitat for this effect to become limiting to the subpopulation (McCarthy in press *in* Vinnedge Environmental Consulting 2010b).

SECTION 11
Mitigation Measures

The following conservation measure shall be implemented to avoid and/or reduce impacts to marine mammals:

1. A NOAA Fisheries and USFWS approved biologist (see Section 13.2) shall conduct mandatory biological resources awareness training for construction personnel. The awareness training shall be provided to all construction personnel to brief them on the need to avoid effects on marine mammals. If new construction personnel are added to the project, the contractor shall ensure that the personnel receive the mandatory training before starting work.
2. A NOAA Fisheries and USFWS approved biological monitor will monitor for marine mammal disturbance. Monitoring will occur at all times when work is occurring in tidal waters or within 100 meters of tidal waters. The biological monitor will have the authority to stop project activities if marine mammals approach or enter the exclusion zone. Biological monitoring will begin 0.5-hour before work begins and will continue until 0.5-hour after work is completed each day. Work will commence only with approval of the biological monitor to ensure that no marine mammals are present in the exclusion zone.
3. To reduce the risk of potentially startling marine mammals with a sudden intensive sound, the construction contractor would begin construction activities gradually each day by moving around the project area and starting tractor one at a time.
4. Biological monitors would have authority to stop construction at any time for the safety of any marine mammals.
5. In-water construction work shall occur only during daylight hours when visual monitoring of marine mammals can be implemented. No in-water work will be conducted at night.
6. If marine mammals are present within the work area, they will be allowed to leave on their own volition. If a pup less than one week old comes within 20 meters of where heavy machinery is working, construction activities in that area would be delayed until the pup has left the area. In the event that a pup less than one week old remains within those 20 meters, NOAA Fisheries would be consulted to determine the appropriate course of action.
7. Fuel storage and all fueling and equipment maintenance activities will be conducted at least 100 feet from subtidal and intertidal habitat.

SECTION 12
Arctic Plan of Cooperation

Not Applicable. The proposed activity will take place in Elkhorn Slough, and no activities will take place in or near a traditional Arctic subsistence hunting area. Therefore, there are no relevant subsistence uses of marine mammals implicated by this action.

SECTION 13
Monitoring and Reporting

13.1 Pre-construction Monitoring

As described in Section 4, ESNERR initiated biological monitoring of marine mammals in 2013 to determine population abundance and dynamics (Beck 2014). These monitoring efforts provided a foundation for evaluating effects of the overall restoration project on marine mammals. In addition, the Reserve Otter Monitoring Project has been monitoring harbor seal use in Elkhorn Slough since January 2018. Figure 5 and Table 2 summarize the average number of seals observed at each of the seven monitored locations proximate to the Phase II restoration areas over a 16-month observation period (i.e., January 2018 to April 2019) by the Reserve Otter Monitoring Project. The maximum number of seals observed on any day was 417. These data are consistent with previous population estimates by McCarthy (2010), which estimated the population of seals in Elkhorn Slough at 300 to 500, with seasonal variability based on prey availability, molting and reproduction. The data also illustrate that seals tend to move between areas proximate to each other.

13.2 Phase I Construction Monitoring

Marine mammal monitoring was completed throughout Phase I construction, which occurred over an 9-month window between December 2017 and August 2018. Monitoring was completed by qualified biologist in accordance with the monitoring protocol developed in collaboration with NOAA Fisheries and USFWS during the IHA process (see Appendix A).

As summarized in the *Elkhorn Slough Restoration Project 2018 Annual Report* (Fountain et. al. 2019), harbor seal counts during the daytime (6 AM to 6 PM) ranged from 0 to 257 individuals in the "observation zone", which encompassed the Phase I work area as well as adjacent portions of Minhoto-Hester marsh, Parsons Slough, and Elkhorn Slough. Of these, between 0 and 72 individual seals were recorded within the Minhoto complex; the rest were recorded in Elkhorn Slough or Parsons Slough. The average number of seals per hourly count during this period was 55.94; only 8.44 seals per hour were recorded using the Minhoto complex (Fountain et al. 2019).

No marine mammals entered the exclusion zone during construction, meaning it was not necessary to shut construction down for marine mammal safety. There was an average of 75 seals in the observation area at any given time. A total of 36 disturbance incidents (alerting, flushing or moving) of harbor seals, affecting 140 individual seals, were recorded by marine mammal monitors over the nine month construction window (see Section 7.1.1).

13.3 Phase II Construction Monitoring

Phase II construction monitoring will follow the same protocol as Phase I, which is provided in Appendix A. In summary, a NOAA Fisheries and USFWS approved biological monitor will monitor for marine mammal disturbance during construction within three observation areas (Figures A-1 and A-2). Monitoring will occur at all times when work is occurring in tidal waters or within 100 meters of tidal waters. The biological monitor will have the authority to stop project activities if marine mammals approach or enter the exclusion zone. Biological monitoring will begin 0.5-hour before work begins and will continue until 0.5-hour after work is completed each day. Work will commence only with approval of the biological monitor to ensure that no marine mammals are present in the exclusion zone.

Throughout construction activities that require a monitor, the biological monitor will maintain a log that documents numbers of marine mammals present before, during, and at the conclusion of daily activities (See Appendix A for a detailed description of the monitoring protocol). The monitor will record basic weather conditions and marine mammal behavior. A final report shall be submitted to NOAA Fisheries and USFWS within 90 days of the conclusion of monitoring efforts, or as required by the agencies. The report shall detail the monitoring protocol, summarize the data recorded during monitoring, and contain an estimate of the number of marine mammals that may have been harassed.

NOAA Fisheries and USFWS approved biologists will have qualifications consistent with those of NMFS Protected Species Observers as follows:

1. Independent observers (i.e., not construction personnel) are required.
2. At least one observer must have prior experience working as an observer.
3. Other observers may substitute education (undergraduate degree in biological science or related field) or training for experience.
4. Where a team of three or more observers are required, one observer should be designated as lead observer or monitoring coordinator. The lead observer must have prior experience working as an observer.

Submission and approval of observer CVs by the NOAA Fisheries and USFWS is required. Other important qualifications:

1. Ability to conduct field observations and collect data according to assigned protocols.
2. Experience or training in the field identification of marine mammals, including sea otters and harbor seals, and the identification of their behaviors.
3. Sufficient training, orientation, or experience with the construction operation to provide for personal safety during observations.
4. Writing skills sufficient to prepare a report of observations including but not limited to the number and species of marine mammals observed; dates and times when in-water construction activities were conducted; dates and times when in-water construction activities were suspended to avoid potential incidental injury from construction sound of marine mammals observed within a defined shutdown zone; and marine mammal behavior.
5. Ability to communicate orally, by radio or in person, with project personnel to provide real-time information on marine mammals observed in the area as necessary.

13.4 Post-construction Monitoring

Additional monitoring may occur (if funding allows) consisting of a monthly census of marine mammals during peak occupational times and tidal cycles for six months post-construction. Funding will depend on construction costs. Data collected after the first 30 days of post-construction monitoring will be reported as an addendum.

SECTION 14
Suggested Means of Coordination

All marine monitoring data collected before, during and after construction of the project would be made available to NOAA Fisheries, USFWS, and the general public.

SECTION 15
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FIGURES

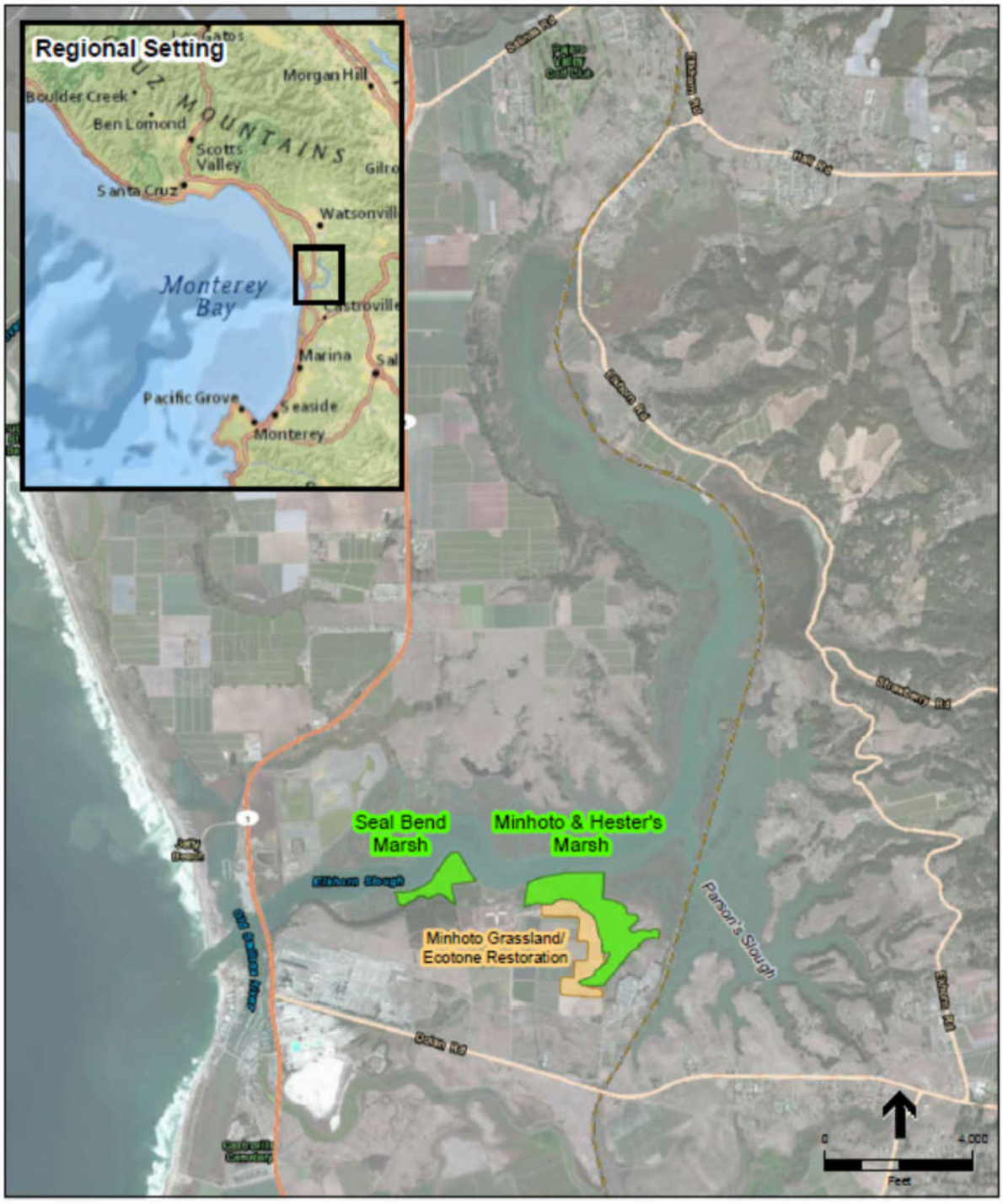

Figure 1. Regional Setting

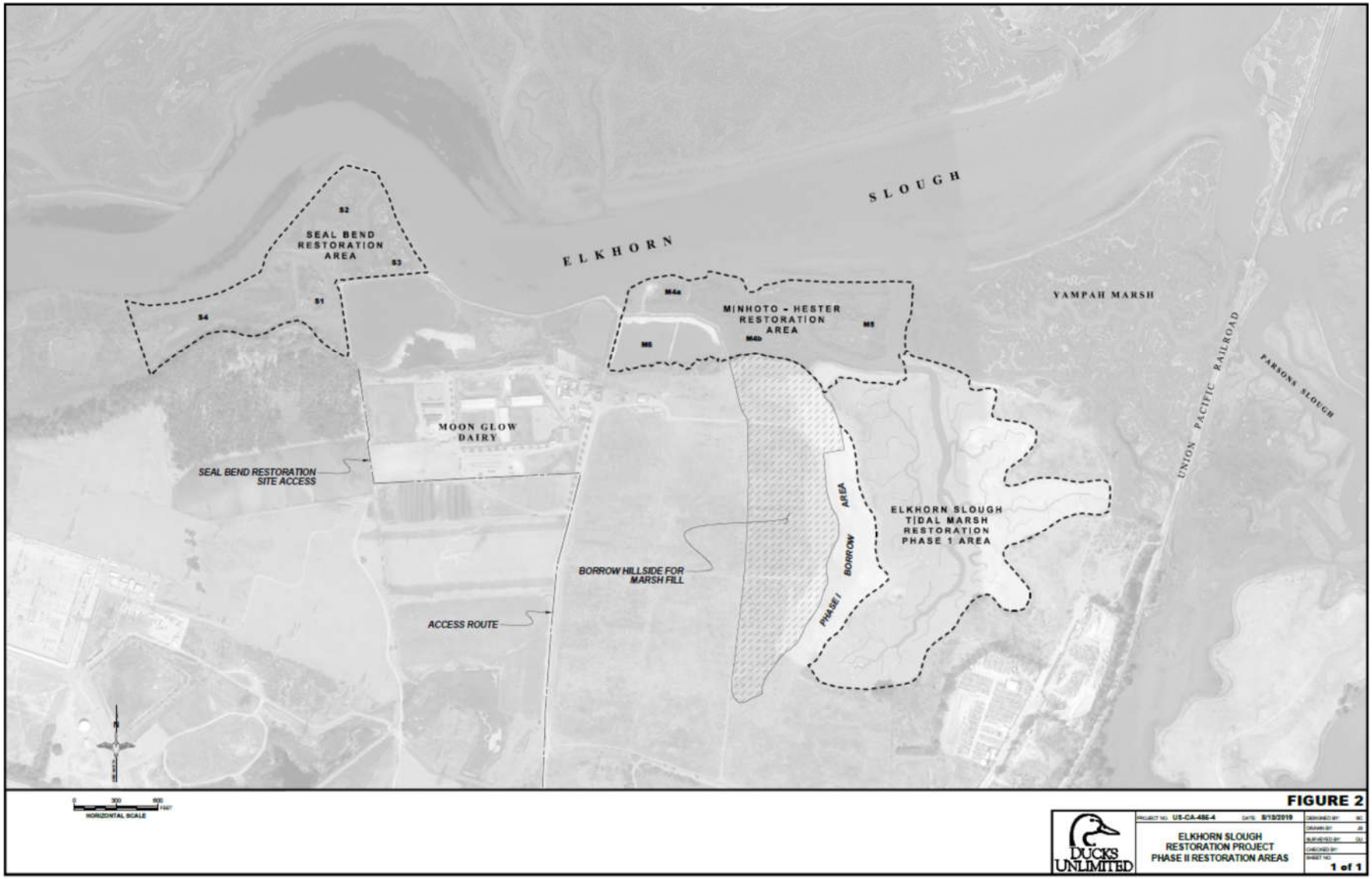

Figure 2 **Restoration Plan Overview**

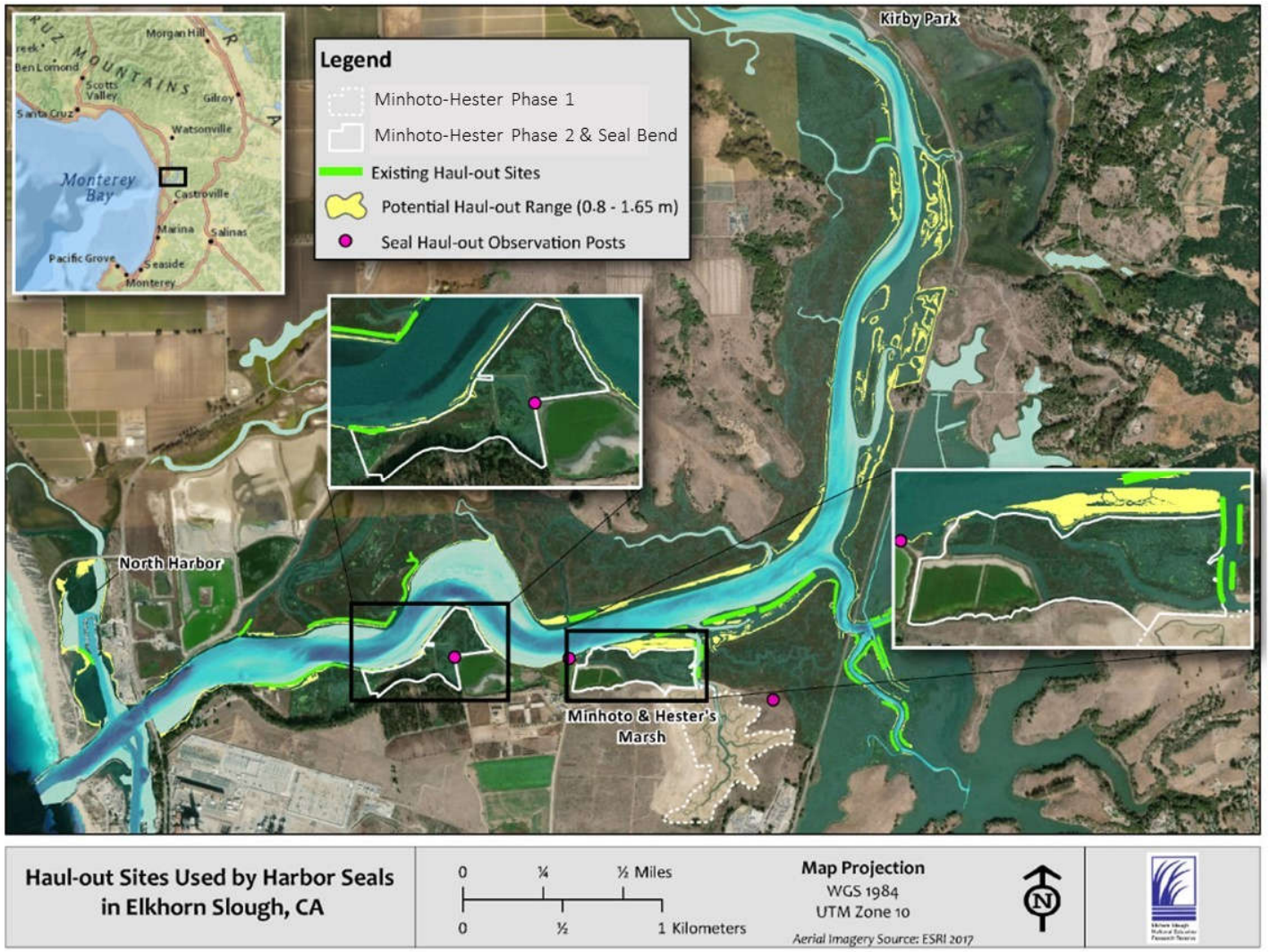

Figure 3 **Harbor Seal Haul-out Areas Potential Haul-out Areas, and Observation Areas in Relation to the Phase 2 Project Area**

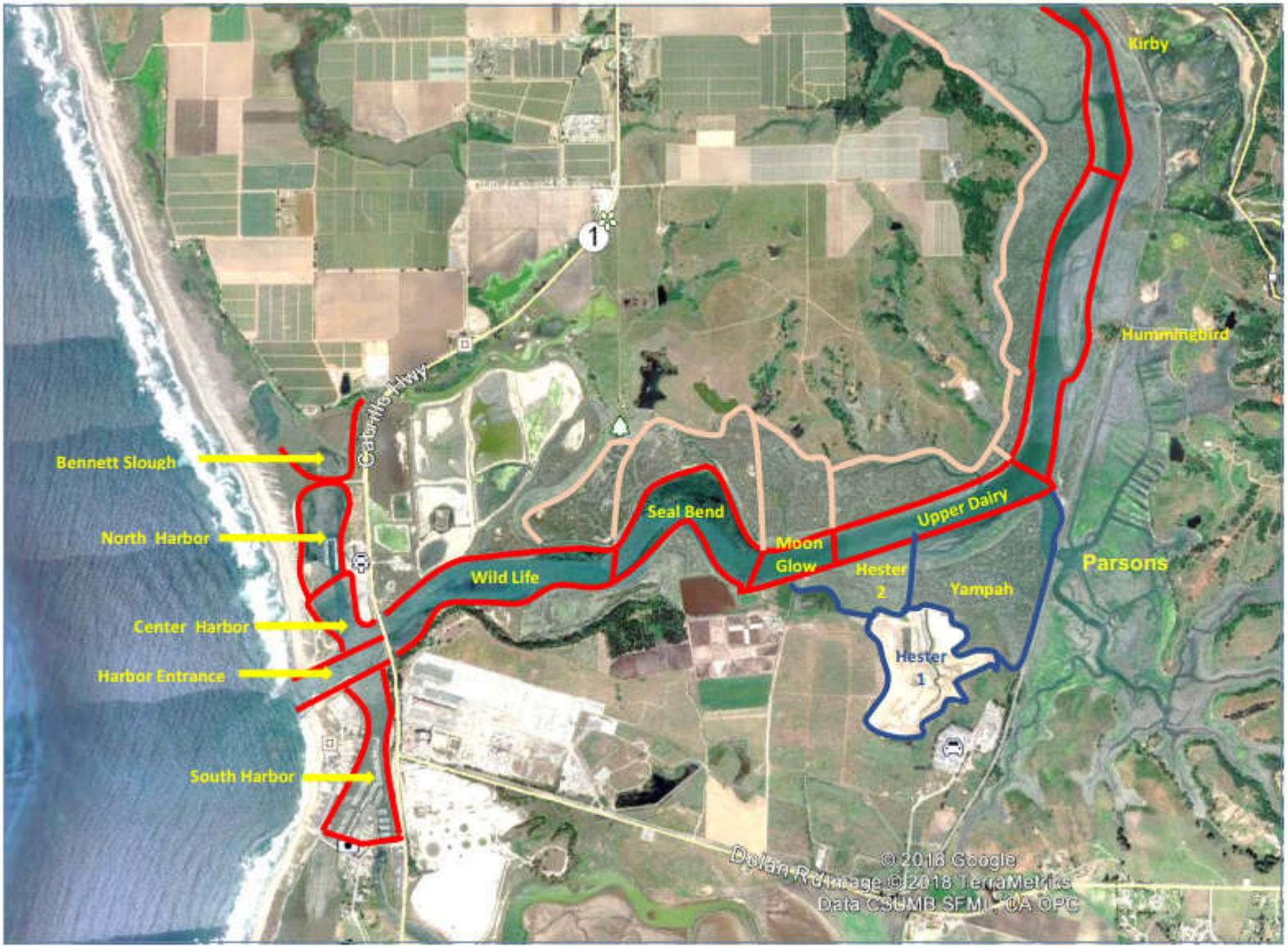

Figure 4 Reserve Otter Monitoring Project locations. Source: Reserve Otter Monitoring Project 2018. Note: "Upper Dairy" is referred to as "Main Channel" in this document.

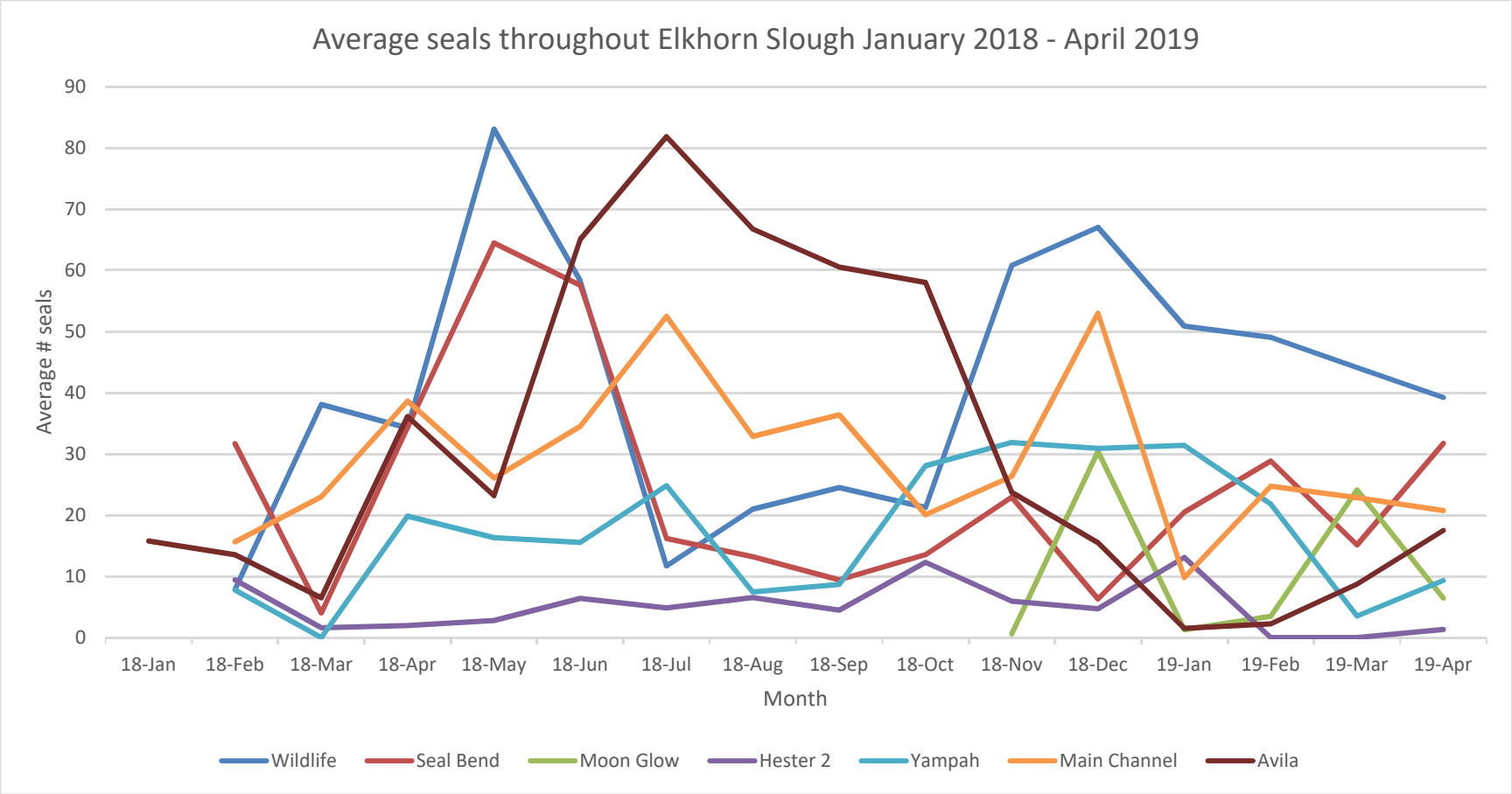

Figure 5 **Average seal counts from Reserve Otter Monitoring Program at locations relevant to Phase II restoration areas.**

APPENDIX A – MONITORING PROTOCOL

Elkhorn Slough Tidal Marsh Restoration
Marine Mammal Monitoring Protocol

Goals

1. Ensure that marine mammals are not subject to injury under the Marine Mammal Protection Act and the Federal Endangered Species Act.
2. Collect field data about the movement and activity of marine mammals during construction monitoring, which will inform NOAA Fisheries and USFWS on marine mammal sensitivity to disturbance and provide reference for future construction projects.

Objectives

1. Ensure that construction activity is halted when there is a reasonable possibility that marine mammals will enter the exclusion zone (within 15 meters of construction activity) in order to avoid any potential for physical injury.
2. Ensure that presence, distribution, movement and behavior of harbor seals and sea otters within the project area and surrounding vicinity is recorded when there is a reasonable possibility that marine mammals will experience behavioral harassment.

Observation locations

Monitoring during construction will occur from up to three observation areas – Yampah Island, Minhoto Marsh / Seal Bend East, and Seal Best West - depending on the location of active construction work (Figure A-1). Each observation area shall be accessed by foot and would provide a vantage point of the construction area, main channel of Elkhorn slough, the Minhoto Complex, and Parsons Slough. The observation areas include the entire area within which harbor seals and sea otters might reasonably be expected to experience disturbance due to construction activities.

Monitoring protocol

A NOAA Fisheries and USFWS-approved biological monitor will monitor for marine mammal disturbance. Monitoring will occur at all times when work is occurring in tidal waters, or within 100 meters of tidal waters.

The biological monitor will have the authority to stop project activities if marine mammals approach or enter the exclusion zone. Biological monitoring will begin 0.5-hour before work begins and will continue until 0.5-hour after work is completed each day. Work will commence only with approval of the biological monitor to ensure that no marine mammals are present in the exclusion zone. In addition, biological monitors will, to the extent feasible, monitor for fish, including listed species that may occur within the project site.

Pre and post construction daily censuses - A census of marine mammals in the project area and the area surrounding the project will be conducted 30 minutes prior to the beginning of construction on monitoring days, and again 30 minutes after the completion of construction activities. Data collected during censuses will include:

- Environmental conditions (weather condition, tidal conditions, visibility, cloud cover, air temperature and wind speed), recorded during pre- and post-construction daily census counts
- Numbers of each species spotted
- Location of each species spotted
- Status (in water or hauled out)
- Behavior

Hourly counts - Conduct hourly counts of animals hauled out and in the water.

- Data collected will include:
    - Numbers of each species
    - Location, including zone and whether hauled out or in the water
    - Time
    - Tidal conditions
    - Primary construction activities occurring during the past hour
    - Number of mom/pup pairs and neonates observed
    - Notable behaviors, including foraging, grooming, resting, aggression, mating activity, and others
    - Tag color and tag location (and tag number if possible)—for sea otters, note right or left flipper and location between digits (digits 1 and 2 are inside; digits 4 and 5 are outside)
- Notes may include any of the following information to the extent it is feasible to record:
    - Age-class
    - Sex
    - Unusual activity or signs of stress
    - Any other information worth noting

Construction related reactions- Record reaction observed in relation to construction activities including:

- Time of reaction
- Concurrent construction activity
- Location of animal during initial reaction and distance from the noted disturbance.
- Activity before and after disturbance
- Status (in water or hauled out) before and after disturbance

Code reactions:

Level	Type of response	Definition

1	Alert	Head orientation or brief movement in response to disturbance, which may include turning head towards the disturbance, craning head and neck or (in the case of seals) craning head and neck while holding the body rigid in a u-shaped position, changing from a lying to a sitting position, or brief movement of less than twice the animal's body length. Alerts would be recorded, but not counted as a 'take'.
2	Movement	Movements away from the source of disturbance, ranging from short withdrawals at least twice the animal's body length to longer retreats, or if already moving a change of direction of greater than 90 degrees. **These movements would be recorded and counted as a 'take'.**
3	Flush	**All retreats (flushes) to the water. Flushing into the water would be recorded and counted as a 'take'. For sea otters, any change from in-water resting to diving/swimming would also be considered a flush and counted as a 'take.'**

Steps for shutting down and resuming construction

1. Alert construction foreman of animal using the red flag and handheld radio (use 1 blow from air horn if needed)
2. Record the construction activity and the time of shutdown
3. Record the reaction and location of the animal
4. Give clearance signal (green flag) and handheld radio for construction activities when animal is seen outside of 10-meter zone and traveling away from the construction area, or when the animal is not spotted for 15 minutes
5. Record the time construction resumes

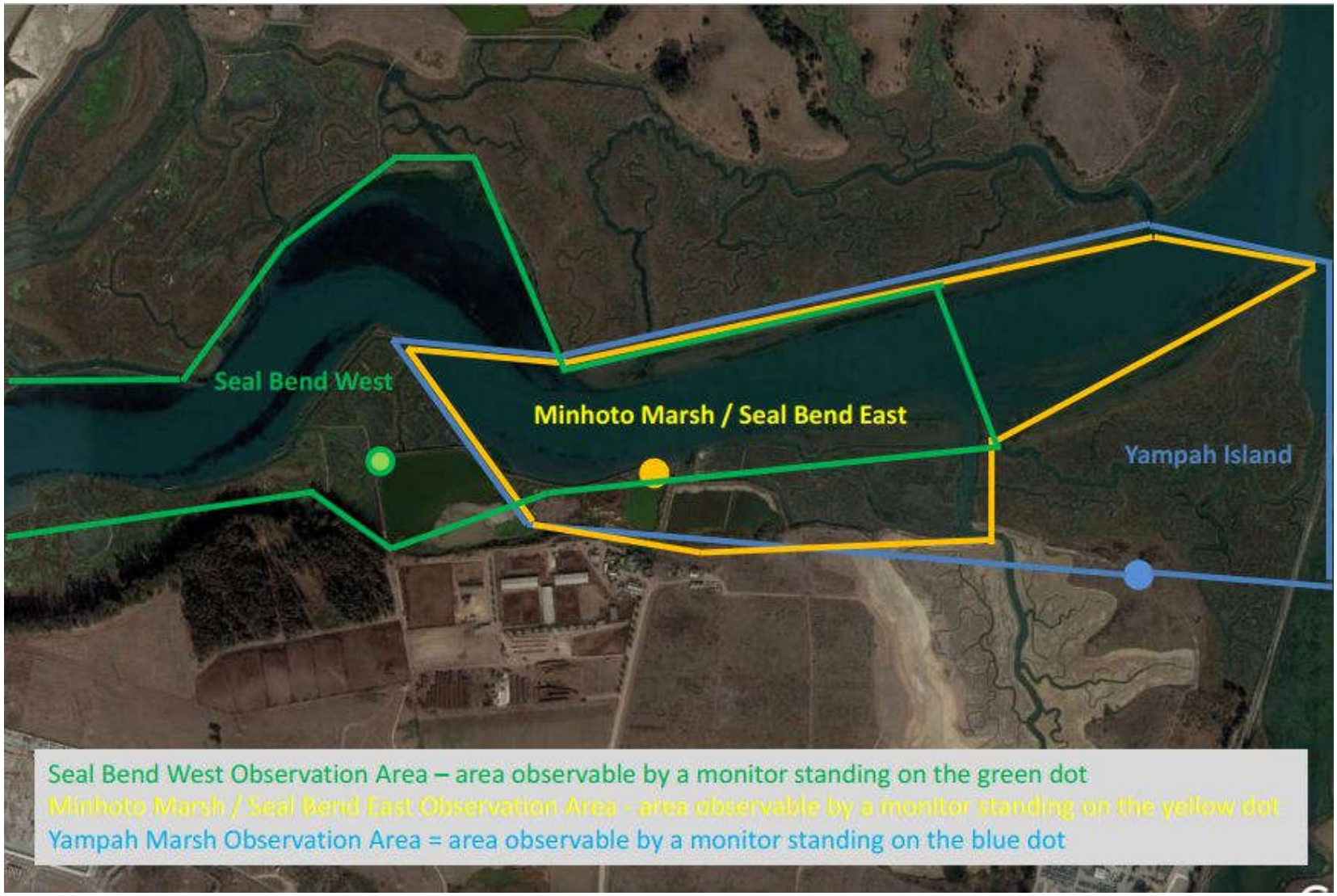

Figure A-1. Observation post and observation area. Note: Some areas within the marshes cannot be seen at low tides.