BOARD OF PORT COMMISSIONERS

SEPTEMBER 12, 2018

STANDARD AGENDA ITEM 4

VENTURA SHELLFISH ENTERPRISE SITE SELECTION

VENTURA PORT DISTRICT **STANDARD AGENDA ITEM 4**

BOARD COMMUNICATION Meeting Date: September 12, 2018

TO:	Board of Port Commissioners
FROM:	Everard Ashworth, Chairman
	Oscar Peña, General Manager
	Brian Pendleton, Deputy General Manager
SUBJECT:	Ventura Shellfish Enterprise Site Selection

RECOMMENDATION:

That the Board of Port Commissioners receive an informational report on the Ventura Shellfish Enterprise (VSE) site selection process with the anticipation of a final site recommendation with related permit applications, studies and reports on September 26, 2018.

SUMMARY:

As a result of the Board's actions regarding VSE project siting on November 15, 2017, the National Oceanic and Atmospheric Administration's (NOAA) National Ocean Service (NOS) prepared a Coastal Aquaculture Siting and Sustainability (CASS) Technical Report - Ventura Shellfish Enterprise: Aquaculture Siting Analysis Results (Attachment 1).

As stated in the CASS Report, spatial planning for aquaculture operations, wherein spatial data representing key environmental and use conflicts are synthesized to identify areas with the highest likelihood for compatibility with aquaculture operations, is a critical first step to ensure environmentally and economically sustainable aquaculture development. The CASS Report for the VSE project studied an area of 20,000 acres in federal waters proximate to Ventura Harbor, known as an Area of Interest (AOI).

On June 28, 2018, NOAA and the VSE team co-hosted an Inter-Agency Pre-Application Meeting in Long Beach with federal and state regulatory staff. NOAA presented the preliminary draft CASS Report and the VSE team provided information concerning the status of the project and related studies. On July 9, 2017, VSE team members met with the Commercial Fishermen of Santa Barbara (CFSB) to discuss the project and status of permit applications.

As a result of the CASS Technical Report, the VSE team has identified two new alternatives, known as CASS Report Alternative 1 and 2 (Attachment 2-3) and Dudek, the project's environmental consulting firm, has prepared a draft application to the U.S. Army Corps of Engineers (USACE) (Attachment 4) and is currently preparing a California Coastal Commission (CC) application. These two new alternatives are consistent with the Board's prior site selection both in terms of size (2,000 acres) and location in federal waters. The exact GPS coordinates of these two alternatives are included in the CASS Technical Report. The permit applications with preferred siting will be formally considered for approval by the Board on September 26, 2018.

BACKGROUND:

On November 15, 2017, the Board of Port Commissioners authorized the General Manager to prepare and submit all applications to local, state and federal agencies as required for the VSE project and prepare all necessary surveys, studies, reports and federal environmental review documents as directed by local, state and federal agencies. NOAA's CASS Technical Report has allowed the VSE team to evaluate the proposed siting and refine these permit locations and configurations in consultation with aquaculture experts prior to submission of the permit applications.

Project Goals
Increasing the supply of safe, sustainably produced domestic seafood is a priority of the State Legislature, NOAA and the U.S. Department of Commerce. The VSE project is a multi-party initiative that seeks to permit twenty 100-acre plots for growing the Mediterranean mussel (*Mytilus galloprovincialis*) via submerged long lines within the Santa Barbara Channel near Ventura Harbor. The Ventura Port District received a substantial NOAA Sea Grant sub-award of $300,000 in 2015 for the proposed project in support of these goals. As part of the 2015 grant, the VSE team developed a Strategic Permitting Plan previously provided to the Board and made available to stakeholders and the public. This Strategic Permitting Plan provides a great deal of information about project goals, objectives and regulatory requirements and can be found online at *venturashellfishenterprises.com*. The proposed project furthers several of the District's fundamental mission and objectives, as summarized below:

- Maintaining a safe and navigable harbor;
- Diversification of commercial fishing opportunities to benefit the fishing industry and local and regional economies;
- Continued priority (as a commercial fishing harbor) for federal funding appropriations for annual dredging of the federal harbor entrance.

Public Outreach
The VSE team hosted a series of public educational workshops in 2017 regarding the proposed project. In total, there were 10 educational and site selection workshops. Of these, three workshops were held to engage with stakeholders to identify the location of twenty 100 acre parcels within a broader area of interest that was identified through use of a spatial planning tool developed by the Bren School of Environmental Science and Management at UC Santa Barbara (UC Bren School). The focused site selection workshops were held at the Four Points Sheraton Hotel in our Harbor on July 11th and 13th and the final workshop was held on August 9th of 2017. While in-person participation was strongly encouraged, individuals who were not able to attend the meetings were provided the opportunity to comment on site selection through SeaSketch linked to *venturashellfishenterprise.com*. Notice of the site selection workshops was mailed out to over 500 commercial fishing vessel owners between Goleta and Port Hueneme; additionally, the VSE team coordinated with NOAA representatives and commercial fishermen to encourage their attendance. The team also contacted all of the individuals that have registered through the VSE website. This marine spatial planning opportunity was available through Wednesday, August 9th 2017, the date of the final site selection meeting. The *venturashellfishenterprise.com* website continues to be used to communicate with interested parties who registered on the website.

During and after the site selection workshops, the Board of Port Commissioners received written and oral reports on the site selection process at four public meetings held in 2017 on July 26th, September 13th and 27th, and October 11th. At a fifth public meeting on November 15, the Board authorized the General Manager to proceed with the preparation of all necessary permit applications, surveys, studies, reports for a site in federal waters known as Alternative 8.

Initial Candidate Area Considerations
The initial candidate area in state waters was selected by the VSE with the assistance of analysis prepared by the UC Bren School. The selection of the initial candidate area was detailed in the Strategic Permitting Plan; however some key considerations are summarized here. They included suitability of the candidate growing area for mussels such as water depth and ocean bottom; location in State waters near Ventura Harbor for product landing; avoidance of potential pollution sources; and avoidance of conflicts with existing subsurface leases for oil and gas pipelines, etc. Stakeholder considerations are discussed below.

Subsequent to identification of the initial candidate area, the District received information from local halibut trawlers that the proposed State waters candidate area was located in one of two areas statewide designated by CDFW as halibut trawl grounds. Further, additional information was provided by aquaculture specialist Scott Lindell, associated with Woods Hole Oceanographic Institution, that the minimum depth to support the mussel growing activities should be adjusted from 60 feet to 80 feet. This minimum depth is consistent with the only permitted mussel farms that can sell Mediterranean Mussels in Southern California, Santa Barbara Mariculture (which is located in 80 feet of water off Hope Ranch), and Catalina Sea Ranch (which is located in depths between 138 and 150 feet, approximately 6.1 miles from the shore off the coast between Long Beach and Huntington Beach). The minimum of 80' reduces exposure to various predator species (i.e. ducks) and potential storm surge, while the upper-end range of approximately 115' provides opportunities to scale operations.

2017 Siting Considerations and Expanded Candidate Area

With high levels of stakeholder engagement, ranging from existing users of the candidate area to prospective grower producers and aquaculture industry experts, the VSE team, with Board concurrence, expanded its site search to include areas in federal waters near Ventura Harbor. Specifically, the expanded candidate area comprises 200,000 acres in both state and federal waters in Blocks 651, 652, 664, 665, 666. To understand this scale, the proposed VSE project represents 2,000 acres or 1% of this 5 block area.

Additionally, the VSE team established criteria on which to evaluate and prioritize each siting alternative. As a result, the VSE team constructed a siting decision matrix to quantify the benefits of each potential siting configuration, and assist the Board in its decision-making process last November. The stakeholder engagement process supported the identification of key factors upon which to assist siting configuration decision making. Each of the criteria was assigned a weight based on perceived relative importance to achieving optimal operational capacity and minimizing potential user conflicts and environmental impacts. Siting alternatives were then scored using a rating system that corresponds to preferences identified by the VSE team. These criteria include:

- Approximate water depth
- Potential adverse water pollution sources
- Potential visual effects from shore
- Potential interaction with commercial and recreational fishing interests
- Subleasing or sub-permitting complexities
- Potential overlap with subsurface leases
- Environmental review complexity
- Contiguous siting
- Distance from Harbor

Quantification of the eight siting configuration alternatives revealed significant advantages for locating the VSE project in federal waters, and specifically for siting as was depicted and described as Alternative 8 in Block 665. Additionally, the VSE analyzed fish catch data for the 5 block area over a 5-year period. In this 200,000 acre area the data showed that the average annual wholesale value from 2012-2016 was approximately $2.96M.

A siting configuration in Federal waters is similar to any alternative in the original identified candidate area in terms of water column depth and bottom substrate. However, Alternative 8 maintained additional advantages over any alternative in CA state waters because of a reduced

level of interference with commercial fishermen; potential improved water and product quality; relative proximity to Ventura Harbor; resulting minimal visual impacts to the near shore environment; and potential to realize economies of scale. These factors led to the Board's decision on November 15th of last year.

The VSE team projects that use of 2,000 or 1% of that expanded area for the proposed project at full build out and operation could generate $45M-$55M in annual wholesale value. Many factors will ultimately determine actual revenue including project size, growing conditions, operational interruptions, time period to full build out, market conditions, project and operational costs, etc. In applying a factor of 50% to these preliminary estimates, the project could still potentially generate $22.5M -$27.5M in annual wholesale value.

In identifying the appropriate location in federal waters, the VSE project team also sought to further minimize interaction with existing commercial fisheries. Based upon the workshops and public outreach conducted in 2017, the commercial halibut trawl fishery was identified as the primary commercial fishery potentially affected by the project. To determine the potential impact, the VSE team reviewed actual CDFW trawl data from 2010 through 2016, which provided the location (i.e. latitude and longitude) of where each trawl started and stopped.

- The total trawl length within the Santa Barbara Channel during that time period was 40,480 nautical miles.
- The total trawl length within the Area of Interest was 1,508 nautical miles.
- The total trawl length within CASS Report Alternative 1 was 145 nautical miles.

Therefore, based upon CDFW trawl data, the project will require the existing commercial trawling fishery to relocate approximately 0.4% of their total trawls within the Santa Barbara Channel. It is speculative as to whether this relocation will have a negative or positive impact on the overall catch for the halibut fishery but, given the small amount of existing usage, the impact is considered to be likely negligible.

2018 NOAA CASS Technical Report

As a result of the Board's actions regarding VSE project siting on November 15, 2017, NOAA's NOS prepared a Coastal Aquaculture Siting and Sustainability (CASS) Technical Report - Ventura Shellfish Enterprise: Aquaculture Siting Analysis Results. The report is helpful to District staff in making final recommendations to the Board about project siting, but will also be helpful to inform federal and state regulatory agencies in conducting appropriate environmental review under the National Environmental Policy Act and evaluating permit applications, and other stakeholders and interested parties.

NOS obtained quantitative requirements for the project from the VSE team. These requirements included information regarding preferred project parameters: spatial boundaries of region of interest, preference for state or federal waters, preferred project location coordinates, approximate proposed project size, preferred port, the maximum distance from preferred port, species to be cultivated, acceptable depth range, acceptable seawater temperature range, acceptable current velocity range, maximum allowable wave energy, and additional comments or specifications. These quantitative requirements are contained in the CASS Technical Report and the basis from which a new 20,000 acre Area of Interest (AOI) in federal waters in Blocks 664-665 was developed.

All potential environmental and use factors that could constrain the siting of the VSE project were first plotted and mapped to compare against the identified AOI for the VSE project. These interactions included military, industry, commercial fishing, navigation, and natural resources.

NOS determined that oil and gas, commercial fisheries, navigation, and submarine cables and wrecks and obstructions were all uses that intersected with the AOI. This led to a final suitability assessment, where the northern portion of the AOI was determined to have the highest likelihood of compatibility with the proposed project and avoid/minimize interactions with the other user groups. Based on the results of the suitability analysis, NOS identified two alternative site configurations based on VSE parameters that maximize likelihood of compatibility with existing uses in the region. The primary difference between the two CASS Report Alternative sites is the configuration of the individual 100-acre cultivation areas.

Importantly, the two sites overlap with the federal waters alternative site (SeaSketch Alternative 8) identified in the UCSB Bren School spatial planning analysis and previously approved by the Board (Attachment 5), indicating the area has been shown by two independent studies to have the fewest conflicts with other uses and sensitive environmental resources. The draft permit application to USACE has identified CASS Report Alternative 1 as the preferred project site, given that it has greater operational flexibility, and Alternative 2 as a project alternative.

Seafood Inspection Program (SIP)
At the inception of the VSE project, there was not a clear pathway for compliance with the National Shellfish Sanitation Program (NSSP) guidelines for shellfish grown in federal waters. However, a pathway for NSSP compliance in federal waters has been adopted through an interim program adopted by the Interstate Shellfish Sanitation Conference and the NSSP to enable harvest and sale of safe and healthy shellfish products in interstate commerce. Through a collaborative and coordinated effort with the Food and Drug Administration (FDA) and NOAA's Seafood Inspection Program (SIP) in January 2017, they developed a pathway to implement the interim program for NSSP compliance for molluscan shellfish in federal waters. This pathway for NSSP compliance in federal waters is now being successfully implemented by another offshore mussel aquaculture project in southern California. The compliance pathway covers both pre- and post-harvest elements of the NSSP Model Ordinance and can serve as a template for further adaptation to the VSE project goals and needs. Such adaptations will take into consideration the public-private nature of the VSE enterprise, the participation of multiple grower-producers, its scale and ultimate location, and other factors. VSE team member Coastal Marine Biolabs (CMB) is committed to establishing a centralized, federally approved, Ventura Harbor-based testing facility to meet the testing requirements articulated in the NSSP. This process can be initiated independently of implementing the NSSP compliant interim program for federal waters and concurrently with the permit application process.

FISCAL IMPACT:
Staff has completed the 2015 NOAA Sea Grant and is awaiting formal announcement of two additional grant applications from the Pacific States Marine Fisheries Commission (PSMFC) and 2018 NOAA Sea Grant to help fund the next steps of the entitlement process. Additionally the Board approved $80,000 in FY18/19 for project related professional services. Staff will return to the Board with any announcements regarding grant applications, related agreements and professional services as necessary.

ATTACHMENTS:
Attachment 1 – NOAA Coastal Aquaculture Siting and Sustainability (CASS) Technical Report – Ventura Shellfish Enterprise: Aquaculture Siting Analysis Results
Attachment 2 – CASS Report Alternative 1
Attachment 3 – CASS Report Alternative 2
Attachment 4 – Draft USACE Application
Attachment 5 – SeaSketch Alternative 8

CASS Technical Report

Ventura Shellfish Enterprise: Aquaculture Siting Analysis Results

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INTRODUCTION

Spatial planning for aquaculture operations, wherein spatial data representing key environmental and space use conflicts are synthesized to identify areas with the highest likelihood for compatibility with aquaculture operations, is a critical first step to ensure environmentally and economically sustainable aquaculture industry development. Aquaculture siting analyses involve the use of geospatial analytical tools (e.g., GIS – Geographic Information Systems) to integrate pertinent spatial data and generate map-based products that can be used to inform policy and permitting decisions regarding where aquaculture operations can be located.

The Ventura Shellfish Enterprise (hereafter 'VSE') is a multi-party initiative seeking to permit twenty 100-acre plots of ocean space for aquaculture production of the Mediterranean mussel (*Mytilus galloprovincialis*) via submerged long lines in federal waters within the Santa Barbara Channel, proximate to Ventura Harbor, California, USA. The key participants in the VSE, including Coastal Marine Biolabs, The Cultured Abalone Farm, and the Ashworth Leninger Group, have worked with the Ventura Port District to develop a "Strategic Permitting Plan," with a suite of other resources and project related information and tools that can be found on the VSE website: venturashellfishenterprise.com, or by contacting the VSE Co-Project Managers, Everard Ashworth at EAshworth@algcorp.com or Brian Pendleton at BPendleton@venturaharbor.com.

NOAA's Coastal Aquaculture Siting and Sustainability (CASS) Program conducted a comprehensive and objective siting analysis for the proposed VSE project, which is the subject of this technical report. This siting analysis utilized the best available, high-resolution spatial data to represent key potential environmental and space use conflicts that constrain the siting of an aquaculture operation within the Santa Barbara Channel region of interest. This siting analysis was guided by quantitative input provided by VSE regarding specific project requirements and was iteratively developed with input provided by the United States Army Corps of Engineers (USACE) Los Angeles District, NOAA (including the National Marine Fisheries Service and the National Ocean Service), the State of California Aquaculture Coordinator, the California Coastal Commission, and the VSE team.

The **Coastal Aquaculture Siting and Sustainability (CASS)** program supports works to provide science-based decision support tools to local, state, and federal coastal managers supporting sustainable aquaculture development. The CASS program is located within the Marine Spatial Ecology Division of the National Centers for Coastal Ocean Science, National Ocean Service, NOAA.

To learn more about CASS and how we are growing sustainable marine aquaculture practices visit https://coastalscience.noaa.gov/research/marine-spatial-ecology/aquaculture/ or contact Dr. James Morris at James.Morris@noaa.gov.

METHODS

Data Inventory

A comprehensive spatial data inventory was developed for the Santa Barbara Channel region to inform the VSE siting analysis. Specifically, the data inventory included data layers from the following categories: military, industry and recreation, commercial fishing, navigation, natural resources, and oceanographic / biophysical. We conducted an exhaustive search and survey to identify web-based resources and contacts to obtain pertinent data resources. A broad suite of state and federal agencies (e.g., NOAA National Marine Fisheries Service, U.S. Department of Defense, Bureau of Ocean Energy Management, California Department of Fish and Wildlife) and academic institutions (e.g., University of California at Santa Barbara) contributed spatial data. Data was checked for completeness and quality to ensure that the most authoritative source was used. The complete data inventory generated for this siting analysis can be found in Table 1.

Project Requirements

We obtained quantitative requirements for the VSE project directly from the technical coordinator for the VSE team. These requirements included a request for the following items of information regarding preferred project parameters: 1) spatial boundaries of region of interest, 2) preference for state or federal waters, 3) preferred project location coordinates (if available), 4) approximate proposed project size, 5) preferred port, 6) maximum distance from preferred port, 7) species to be cultivated, 8) acceptable depth range, 9) acceptable seawater temperature range, 10) acceptable current velocity range, 11) maximum allowable wave energy, and 12) additional comments or specifications. This information was obtained from the VSE team via a Google Form. All fields were optional.

Spatial Analytical Approach

The spatial analysis for the VSE project was conducted within ArcMap 10.5 (Esri 2016), and is a type of spatial multi-criteria analysis known as suitability analysis. Suitability analyses allow for integration of multiple spatial data layers to identify areas of highest suitability, or areas with the highest likelihood of compatibility. When utilized within an aquaculture spatial planning context, suitability analyses integrate data representing environmental or space-use constraints to identify areas that minimize potential conflicts and have the highest likelihood for compatibility with aquaculture operations. Within a suitability analysis, each individual spatial data layer is re-scaled according to a defined suitability relationship (e.g., locations associated with the highest vessel traffic are assigned a score of ‘0’, locations of lowest vessel traffic are assigned a score of ‘1’). Each re-scaled spatial data layer can be subsequently assigned a weight (all weights must sum to 100%; higher weights = more important conflict considerations), and all data layers can be integrated within the spatial analysis to identify locations with the highest likelihood for compatibility across all factors considered within the analysis. It is important to note that while weights can be assigned to individual spatial data layers, each layer can also be assigned an equivalent weight such that no individual factor has a greater impact on the final scores and output of the spatial analysis.

Based upon the project requirements criteria defined by VSE, we established a boundary for the ‘area of interest’ (hereafter ‘AOI;’ Figure 1). We subsequently established a uniform grid within this boundary with a grid cell size of 10 acres (Figure 2). This grid cell size was selected based on the spatial resolution of the available data and the proposed size of the VSE project. Utilizing the comprehensive data inventory we had previously developed for the Santa Barbara Channel region, we projected each spatial data layer to visualize and assess which layers were contained within the AOI.

Spatial data layers not contained within the AOI were not considered further within the VSE suitability analysis, but were mapped for visualization purposes within this report. Spatial data layers contained within the AOI were subsequently converted onto the previously established grid using a custom Python script. For example, total vessel traffic density was projected onto the established grid wherein each grid cell was assigned a value corresponding to the vessel traffic density for a given cell's location. After projection of each spatial data layer onto the grid, individual grid cell values were re-scaled according to a pre-defined rule (e.g., locations associated with the highest vessel traffic are assigned a score of '0', locations of lowest vessel traffic are assigned a score of '1'). Re-scaling of each spatial data layer was essential to ensure each factor was on a common scale (0 – less compatible, to 1 – more compatible). Within GIS, the overall suitability of each cell (S_j) for siting the VSE aquaculture operation was calculated as:

$$S_j = \sum_{x=1}^{n} (L_{xj} \cdot W_x)$$

where S_j is the cumulative value of cell j calculated as the product of the suitability score L of cell j and the associated weight W for factor x summed across all factors. It is important to note that within this analysis, all factors were considered to have equivalent weighting. After calculation of overall suitability scores using the function described above, a secondary calculation was conducted to remove (i.e., assign a score of '0') grid cells that received a score of '0' for any individual factor. This second-order calculation was necessary to ensure that grid cells associated with locations of known incompatibility were removed from further consideration. On a scale of 0 to 1, grid cell suitability scores for siting the VSE operation were ranked from highest (most suitable) to lowest (least suitable).

Identification of Alternative Sites

Multiple alternative sites for siting of the proposed VSE project were identified within the overall AOI. The final suitability grid that incorporated all identified constraining factors was used to guide the identification and delineation of two specific alternative locations and configurations for the proposed VSE project. Specifically, the highest scoring grid cells (i.e., most compatible locations across all criteria considered) were used to guide delineation of two alternative locations and configurations of the twenty 100-acre parcels associated with the proposed VSE project. In addition to the proposed project's siting criteria (i.e., within federal waters of a suitable depth for mussel long-line gear, see 'Project Requirements' below) the twenty 100-acre parcels were also configured and delineated so that the long-lines (or the side of the parcel facing shore) run parallel to the shoreline to maximize longshore currents.

Additional Considerations

Certain spatial criteria (e.g., cetacean density and distribution along the California coast), while relevant to understanding the broader regional context and setting of the proposed VSE project, were inappropriate for inclusion within the siting analysis given the coarseness of the resolution of spatial data representing these criteria (e.g., kilometer-scale spatial resolution). Protected cetacean species, for example, are highly mobile and create complex set of spatial and temporal considerations. While we describe these factors and considerations to the greatest extent possible given the best available spatial data to represent them within the 'Discussion' section below, it is important to consult with regional experts regarding these considerations prior to final site selection.

RESULTS

Project Requirements

We received the following project requirements from the VSE team. Note that all fields were optional.

1. *Spatial Boundaries of Region of Interest*:	Santa Barbara Channel
2. *Preference for State or Federal Waters*:	Federal Waters
3. *Preferred Project Location Coordinates:*	*empty*
4. *Approximate Proposed Project Size*:	20 x 100-acre plots (2,000 acres total)
5. *Preferred Port*:	Ventura Harbor
6. *Maximum Distance from Preferred Port*:	9 nautical miles
7. *Species to be Cultivated*:	*Mytilus galloprovincialis*
8. *Acceptable Depth Range*:	25 – 37 m
9. *Acceptable Seawater Temperature Range*:	5 – 30 degC, optimal 20 degC
10. *Acceptable Current Velocity Range*:	0.025 – 0.1 m^{-s}
11. *Maximum Allowable Wave Energy*:	(depth range selected due to wave climate)
12. *Additional Comments or Specifications*:	(communicated through email), longlines are proposed for use for mussel cultivation

Based on the project requirements received from the VSE team, we identified an overall 'area of interest' (AOI) for the VSE project of ~20,000 acres within 9 nm of the Port of Ventura within federal waters between 25 and 37 m depth (Figure 1). A grid containing ~2,000 10-acre grid cells was established within the AOI (Figure 2).

Spatial Analysis Development

All potential environmental and space use factors that could constrain the siting of the VSE project for which an authoritative spatial data source was identified for (Table 1) were first plotted and mapped to compare against the identified AOI for the VSE project.

Military Interactions – No interactions were identified between the AOI and existing military space uses, inclusive of the Point Mugu Sea Range and existing danger zones and restricted areas (Figure 3).

Industry Interactions – An interaction was identified between the AOI and active oil and gas leases, drilling platforms, pipelines, and submarine cables (Figure 4). Active oil and gas leases intersect the central and southern portions of the AOI; oil and gas pipelines and submarine cables intersect the central and southernmost portion of the AOI; a single drilling platform is located in the southern portion of the AOI. However, no interaction was identified between the AOI and ocean disposal sites.

Commercial Fishing Interactions – Commercial fishing, including trawl and squid fisheries, interactions were identified with the AOI (Figure 5); these interactions were further examined at the regional scale for trawl fisheries (Figure 6) and the squid fishery (Figure 7). Trawl fishery interactions occur throughout the AOI (Figure 6) and were examined in more detail in the subsequent suitability analysis. Squid fishery interactions are more prevalent in the southern and central portions of the AOI, with some identified interactions in the northernmost portion of the AOI (Figure 7).

Navigation Interactions – Navigation space use interactions were identified within the AOI, including vessel traffic and wrecks and obstructions interactions (Figure 8). Aids to navigation, artificial reefs, maintained channels and designated shipping lanes do not intersect the AOI. Vessel

traffic (based on total vessel count for 2013, determined to be representative of modern vessel traffic for the region) is most significant in the central and southern portions of the AOI. Wrecks and obstructions are present in the southern portion of the AOI.

Natural Resource Interactions – Multiple levels of natural resource interactions for which authoritative spatial data was available were examined. Cetacean distribution and density data was examined, but the coarse spatial resolution of these data precluded their ability to be incorporated (Figure 9). Hardbottom habitat and deep-sea coral distribution does not interact with the AOI, but does occur within its proximity (Figure 10).

Interactions Incorporated within the Spatial Analysis – Based on examination of the broad suite of potential interactions for which authoritative spatial data were available to represent, we were able to identify which factors do not intersect the AOI and thus were not incorporated within the spatial analysis (Figure 11), and those factors that do intersect the AOI and thus were incorporated (Figure 12). Specific interactions that were subsequently incorporated within the spatial analysis included the following: 1) oil and gas, 2) commercial fisheries, 3) navigation, and 4) submarine cables and wrecks and obstructions.

Spatial Analysis Output and Identification of Alternative Sites

Oil and Gas Suitability – The following rules were applied to develop the oil and gas suitability grid: a score of '0' was assigned to grid cells intersecting oil and gas drilling platforms and pipelines (including areas within a 500-m radius of these features), a score of '0.5' was assigned to grid cells intersecting the active lease area due to the increased coordination required to site and manage the proposed project within the active lease area, and a score of '1' was assigned to grid cells outside of leases and not intersecting oil and gas platforms or pipelines. This restricted the most suitable locations based on oil and gas interactions to the northernmost and central-eastern portions of the AOI (Figure 13).

Commercial Fishing Suitability: Trawl Fishery – Compatibility with trawl fisheries was determined by assigning a relative rank from low-to-high (scores ranging from '0' to '1') to grid cells with low-to-high densities of trawl tracks. Trawl track densities for each grid cell were calculated by summing the total number of trawl track lines that passed through a given grid cell. The highest suitability was identified in western and central portions of the AOI, while lower suitability was identified in the northeastern and southern portions of the AOI where higher levels of interaction with the trawl fishery occur (Figure 14).

Commercial Fishing Suitability: Squid Fishery – Compatibility with the squid fishery was determined by assigning a relative rank from low-to-high ('0' to '1') to grid cells corresponding with low-to-high total squid landings by California Department of Fish and Wildlife reporting microblock. The highest suitability was identified in the western and central portions of the AOI, while lower suitability scores were identified in the southern and northernmost portions of the AOI (Figure 15).

Vessel Traffic Suitability – A relative rank from low-to-high ('0' to '1') was assigned to grid cells based on level (low-to-high) of interaction with vessel traffic (i.e., total vessel density for 2013 based on automatic identification system, 'AIS,' vessel density data for cargo, tanker, fishing, passenger and pleasure/sailing vessels). The highest suitability was identified in the northern portions of the AOI, while lower suitability scores were identified in the central portion of the AOI, and the lowest suitability scores were identified in the central and southernmost portions of the AOI (Figure 16).

Submerged Cables and Wrecks and Obstructions Suitability – The following rule was applied to develop the submerged cables and wrecks and obstructions suitability grid: a score of '0' was assigned to grid cells intersecting submarine cables or wrecks and obstructions and the areas within 500 m of these features, a score of '1' was assigned to all other grid cells outside of these areas. Application of this rule yielded identified areas of incompatibility in the central and southern portions of the AOI.

Final Suitability Results – The final suitability grid incorporated all major identified interactions to identify locations (grid cells) with the highest likelihood of compatibility. All identified interactions were considered with equal weighting within the analysis. Specifically, the following weights were assigned to individual suitability grids to calculate the final suitability grid: 1) oil and gas suitability – 33%, 2) commercial fishing suitability – 33% (16.5% for trawl fishery and squid fishery, each), 3) vessel traffic suitability – 33%. As the submerged cables and wrecks and obstructions grid included scores of only '0' and '1,' this grid was not weighted, but was included in the analysis as a binary factor. As described within the 'Methods' section above, if a given grid cell was assigned a score of '0' for any individual factor, it was assigned a score of '0' in the overall final suitability grid.

Based on the outcome of the final suitability calculation, the areas of highest identified suitability occur in the northern portion of the AOI (i.e., scores > 0.66; Figure 18). Areas in the southern and central portion of the AOI were generally identified as less suitable. The maximum observed suitability score for any given grid cell within the AOI was 0.90, meaning that all grid cells interacted with one or more factors within the suitability analysis.

Identified Alternative Sites – The proposed alternative site configurations for the twenty 100 acre plots (2000 acres total) were developed based on two farm configurations proposed by VSE, and were located within the areas corresponding with the highest observed suitability. Importantly, these alternative configurations do not change the amount of total area, gear, or the number of mussel long-lines included within each of the proposed farm parcels, but rather dictate how the long-lines would be arranged into rows within the parcels.

The first configuration considered (Alternative #1, Figure 19) was based on the initial configuration proposed by the VSE project team. This configuration includes 20 farm parcels of a 1,900' by 2,300' size that are configured and clustered based on optimized suitability scores from this analysis. The 20 parcels are divided across 2 blocks of 10 parcels each with a 600-ft wide navigational corridor between the blocks of parcels. This configuration allows for two long lines across each row and 12 rows (24 long lines total) per parcel, with 150' spacing between each row. The average suitability score within the 2,000 acres that this configuration covers was 0.813.

The second configuration considered (Alternative #2, Figure 20) was based on the alternative configuration proposed by the VSE project team. This configuration includes 20 farm parcels of a 1,175' by 3,707' size that are configured and clustered based on optimized suitability scores from this analysis. The 20 parcels are condensed within a single block with no navigational corridor needed. No navigational corridor is needed because this configuration allows for only two rows of parcels, where every parcel has vessel access along the perimeter of the site. This configuration allows for one longline across each row, with 24 rows per farm parcel (24 long lines total) and 150' spacing between each row. The average suitability score within the 2,000 acres that this configuration covers was 0.809.

The corner coordinates associated with each alternative are depicted in map and table form in Appendices 1-4.

Caveats – The suitability analysis described here for the proposed VSE project incorporated the best available, authoritative spatial data as of August 2018 to represent major potential interactions based on a thorough review of available resources (Table 1). While all efforts were made to incorporate the best available data, it is important to recognize that for some interactions (e.g., protected species), spatial data is unavailable or exists at an inappropriate scale for consideration within this analysis.

DISCUSSION

The siting analysis described here represents an objective, data-driven approach to identify the locations with the highest likelihood for compatibility with the proposed Ventura Shellfish Enterprise (VSE) project. Through mapping available modern, authoritative spatial data associated with major identified environmental and space use interactions, this siting analysis provides essential information needed to inform the permitting decision-making process for the proposed VSE project. The results of this siting analysis indicate that the northern portion of the area of interest (AOI) has the highest likelihood of compatibility given equal consideration of existing space use conflicts (Figures 18-20). We identify and describe two alternative configurations within the northern portion of the area of interest with the highest likelihood for compatibility given the various interactions considered within this analysis.

Across all identified space use conflicts that were incorporated within the siting analysis, the northern portion of the AOI has the highest likelihood of compatibility with the proposed project (Figures 18-20). Oil and gas, vessel traffic, and submarine cables and wrecks and obstructions interactions are minimized or non-existent within the northern portion of the AOI (Figures 13, 16, and 17). Commercial fishing interactions are present within the northern portion of the AOI, with increased trawl fishing interactions in the northwestern portion of the AOI in the areas nearest to the state-federal waters boundary (Figure 14) and some interactions with the squid fishery in the northernmost portion of the AOI (Figure 15). Importantly, as evident in the final suitability grid, the location (grid cells) with the highest likelihood for compatibility that minimize these interactions are located in the northwestern portion of the AOI (Figure 18). Despite minimization of potential interactions, the highest possible score in the final suitability grid was 0.90, indicating that even the grid cell locations with the highest likelihood for compatibility had some level of interaction with at least one factor.

Locations within the central portion of the AOI have more substantial interactions with oil and gas (Figure 13), vessel traffic (Figure 16) and submerged cables and wrecks and obstructions (Figure 17). Within the southern portion of the AOI, interactions exist with oil and gas, vessel traffic, submerged cables and wrecks and obstructions, and both the trawl and squid fisheries (Figures 14 and 15). Importantly also, the southern portion of the AOI also borders closely to the designated shipping lane and known areas of hardbottom habitat and deep-sea corals (Figure 11).

As shown in Figure 6, the northern portion of the AOI does interact with areas of known trawl fishery activity. Importantly, the known area of highest trawl fishery intensity occurs in the portion of the Santa Barbara Channel to the northwest of the AOI. For the squid fishery, the southern portion of the AOI, and areas further south of the AOI, represent the most substantial intensity and volume of landings. It is important to note that while these data represent the best available, authoritative data to represent these fisheries, there remains a need for discussion with commercial fishery stakeholders regarding spatial compatibility.

Based on the results of the suitability analysis, we identified two alternative configurations for the proposed VSE project that maximize likelihood of compatibility with existing space uses in the region. The first alternative (Figure 19) and second alternative (Figure 20) do not differ substantively in

average suitability score (0.813 and 0.809, respectively). Within the first alternative, the configuration of the farm parcels requires a navigational corridor (600 feet) to allow access to the center farm parcels. The configuration of the farm parcels within the second alternative is such that a navigational corridor is not required to access the individual parcels. In developing the alternative sites, contiguous sites and those with a more uniform shape were preferred over other dispersed alternatives. During the process of obtaining criteria from the VSE project team, it was expressed that in previous stakeholder engagements, a preference was indicated by local fishermen and other ocean users for a design that was clustered to minimize navigational challenges.

Additional Considerations

This siting analysis serves as an authoritative resource to inform the permitting decision-making process regarding where the proposed VSE project is most likely to be compatible from an environmental and space-use perspective. However, additional factors should be the subject of consideration during the permitting decision-making process that are beyond the scope of this siting analysis, including consideration of potential protected species entanglement risks, carrying capacity limitations, and farm design specifications. Below, we provide additional detail regarding engagements with state and federal government agencies to obtain the best available data for protected species for this siting analysis.

Regarding carrying capacity limitations, the environmental conditions corresponding with the proposed VSE project's AOI generally appear favorable for the species and gear combination proposed. The annual average surface current velocity in relation to the AOI is generally within the optimal range for blue mussels of 0.025 and 0.10 m/s (Appendix 1)[1]. Sufficient current velocity is essential to ensure adequate food (i.e., naturally occurring phytoplankton) delivery to the cultivated species (i.e., Mediterranean mussels), and also to ensure adequate dispersal of waste products. With regards to chlorophyll *a*, which is a proxy for the availability of naturally occurring phytoplankton, the optimal range for chlorophyll *a* for blue mussels of 0.5 – 40 µg/l corresponds with the annual average chlorophyll *a* concentration for the AOI (Appendix 2)[2]. The mean water temperature in the area immediately adjacent to the proposed project AOI is within the acceptable water temperature range of 3 – 29 degrees Celsius, and remains near the optimal water temperature of 20 degrees Celsius for nearly half of the year (Appendix 3)[3,4,5]. Carrying capacity considerations are likely to be most dependent upon the final farm design selected rather than environmental limitations. Furthermore, farm design considerations are critical to minimize entanglement risks to cetaceans and sea turtles. A recent review of documented cases of marine animal entanglements in mussel aquaculture gear identified mussel spat collection ropes as yielding the greatest risk of entanglement.[6] Careful attention must be paid to ensure the farm design, gear, and associated activities minimize the risk of protected species entanglement.

[1] Longdill, P.C., Healy, T.R., and Black, K.P. 2008. An integrated GIS approach for sustainable aquaculture management area site selection. *Ocean and Coastal Management* 51, 612-624.
[2] Sara, G., Manganaro, A., Cortese, G., Pusceddu, A., and Mazzola, A. 1998. The relationship between food availability and growth in *Mytilus galloprovincialis* in the open sea (southern Mediterranean). *Aquaculture* 167, 1-15.
[3] Widdows, J. 2009. Combined effects of body size, food concentration and season on the physiology of *Mytilus edulis*. *Journal of the Marine Biological Association of the United Kingdom* 58, 109-124.
[4] Newell, R.I.E. 1989. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (North-Mid Atlantic): Blue Mussel. *U.S. Army Corps of Engineers report TR EI-82-4.*
[5] Almada-Villela, P.C., Davenport, J., and Gruffydd, L.D. 1982. The effects of temperature on the shell growth of young *Mytilus edulis*. *Journal of Experimental Marine Biology and Ecology* 59, 275-288.
[6] Young, M.O. 2015. Marine animal entanglements in mussel aquaculture gear: Documented cases from mussel farming regions of the world including first-hand accounts from Iceland. *M.S. Thesis, University of Akureyri.*

The best available data to represent potential protected species interactions with the proposed VSE project were obtained from state and federal government agencies. Regarding pinniped species, spatial data from the NOAA Southwest Fisheries Science Center (Mark Lowry) were unavailable to represent California sea lions and Pacific harbor seals as ongoing observation efforts are land-based. Loggerhead sea turtle aerial survey and satellite telemetry data were cross-referenced with the proposed project's AOI, and no sightings or tracks as recorded by NOAA's National Marine Fisheries Service (Jeffrey Seminoff and Tomo Eguchi) intersected the area. In both cases, with regards to pinnipeds and sea turtles (including monitored loggerhead, as well as green turtles and leatherbacks that are not monitored), it was acknowledged that the lack of data representing interactions does not preclude the potential for the proposed project's AOI to interact with these protected species.

Habitat-based predicted density and distribution models for multiple cetacean species for the California coast, including: beaked whales (multiple species), blue whales, dolphins (multiple species), Dall's porpoise, fin whales, humpback whales, and sperm whales was obtained from NOAA National Marine Fisheries Service (Pers. Comm., Karin Forney and Elizabeth Becker). Cetacean species with the highest likelihood for potential interaction with the proposed VSE project based on this data include: blue whales and bottlenose dolphins (Appendix 8), long-beaked common dolphins (Appendix 9), and Rissos and short-beaked common dolphins (Appendix 10). There is a lower likelihood for potential interaction with Baird's beaked whales and beaked whales (Appendix 8), Dall's porpoises and humpback whales (Appendix 9), northern right whale dolphins and Pacific white sided dolphins (Appendix 10), and sperm whales and striped dolphins (Appendix 11). It is important to note that these data represent predicted distribution of these species and do not preclude the potential for interaction with any species.

TABLES

Table 1. Data layers integrated within the comprehensive data inventory developed for the Santa Barbara Channel region to inform the siting analysis for the proposed Ventura Shellfish Enterprise (VSE) project.

Data Layer:	**Description:**	**Source:**
Military		
Danger Zones and Restricted Areas	These data represent the location of Danger Zones and Restricted Areas within coastal and marine waters, as outlined by the Code of Federal Regulations (CFR) and the Raster Navigational Charts (RNC). The CFR defines a Danger Zone as: "A defined water area (or areas) used for target practice, bombing, rocket firing or other especially hazardous operations, normally for the armed forces. The danger zones may be closed to the public on a full-time or intermittent basis, as stated in the regulations."	Code of Federal Regulations (CFR) and the Raster Navigational Charts (RNC)
Unexploded Ordnances	Unexploded ordnances are explosive weapons (bombs, bullets, shells, grenades, mines, etc.) that did not explode when they were employed and still pose a risk of detonation, potentially many decades after they were used or discarded. Sea disposal of munitions was an accepted international practice until 1970, when the Department of Defense prohibited the practice, and Congress followed up by passing the Marine Protection, Research, and Sanctuaries Act in 1972, generally banning sea disposal.	NOAA Office of Coast Survey (OCS)
Point Mugu Sea Range	Point Mugu Sea Range is the world's largest instrumented over-water range encompassing up to 220,000 square miles of ocean space. It provides extensive test and training capabilities for the U.S. Navy and allied forces and is located adjacent to the Santa Barbara Channel.	U.S. Navy
San Pedro Channel Operating Area	Offshore military operating area within the San Pedro Channel for the U.S. Navy and allied forces.	U.S. Navy
Industry and Recreation		
Oil and Gas Drilling Platforms, Pipelines and Active Leases	Infrastructure for oil and gas offshore activities including drilling platforms for extracting minerals, particularly oil and gas, pipelines for transporting to onshore facilities, and the active leases, which include a portion of the Outer Continental Shelf (OCS) Lease Blocks that are currently leased to private entities for oil and/or gas mining rights. Importantly, active leases include those that are exploratory, non-producing, and producing.	Bureau of Ocean Energy Management (BOEM)
NOAA Charted Submarine Cables	These data depict the occurrence of submarine cables in and around U.S. navigable waters.	NOAA Office of Coast Survey (OCS)

Data Layer:	Description:	Source:
Ocean Disposal Sites	Ocean disposal sites, including both active and discontinued or historical sites. Nearly all material ocean dumped today is dredged material (sediments) removed from the bottom of waterbodies in order to maintain navigation channels and berthing areas.	NOAA Office of Coast Survey (OCS)
Wind and Marine Hydrokinetic Planning Areas	Planning areas for renewable energy, such as wind and marine hydrokinetic (MHK) development, as defined by the U.S. Bureau of Ocean Energy Management (BOEM).	Bureau of Ocean Energy Management (BOEM)
Marine Minerals and Sand Resource Blocks	This layer contains Outer Continental Shelf (OCS) block outlines and delineated polygons containing sediment resources and areas of disposal.	Bureau of Ocean Energy Management (BOEM)
Administrative Kelp Beds	Kelp beds open to state-managed commercial harvest within the state waters of California.	California Department of Fish and Wildlife
Existing Aquaculture Areas	The presence and location of aquaculture sites were derived from multiple state websites and include only those in coastal and marine saltwater areas. The following states are included in this layer: Alaska, California, Connecticut, Florida, Louisiana, Maine, New York, North Carolina, Rhode Island, and Virginia.	NOAA Office for Coastal Management (OCM) & other state and federal agencies
Commercial Fishing		
Trawl Fishery Track Lines	Logbook-derived state-managed trawl fishery track lines; inclusive of all state-managed trawl fisheries between 2010 and 2016 (connected line between start and stop location for trawls).	California Department of Fish and Wildlife
Squid Landings by Micro-Block	Total squid landings (in short tonnes) by microblock (~700 acres) for the period of 2012-2017.	California Department of Fish and Wildlife
Fishery Landings Receipt Data by Block	Total landings by fishery landings block, inclusive of multiple (20+) commercial fisheries species (e.g., halibut, spiny lobster, squid, etc.).	California Department of Fish and Wildlife
Navigation		
Principal Ports	Principal Ports are defined by port limits or US Army Corps of Engineers (USACE) projects, these exclude non-USACE projects not authorized for publication. The determination for the published Principal Ports is based upon the total tonnage for the port for the particular year; therefore the top 150 list can vary from year to year.	U.S. Army Corps of Engineers (USACE)
Shallow Draft Ports	National database of shallow draft ports, or ports accessible by small commercial and/or recreational vessels.	U.S. Army Corps of Engineers (USACE)
Aids to Navigation	Structures intended to assist a navigator to determine position or safe course, or to warn of dangers or obstructions to navigation. This dataset includes lights, signals, buoys, day beacons, and other aids to navigation.	U.S. Coast Guard
Environmental Sensors and Buoys	Buoys or structures, often near the surface of the water column, intended to collect water quality or other environmental data.	NOAA National Data Buoy Center

Data Layer:	Description:	Source:
Artificial Reefs	An artificial reef is a human-made underwater structure, typically built to promote marine life in areas with a generally featureless bottom.	NOAA Office for Coastal Management (OCM) & other state and federal agencies
Wrecks and Obstructions	In 1981, NOAA's National Ocean Service (NOS) implemented the Automated Wreck and Obstruction Information System (AWOIS) to assist in planning hydrographic survey operations and to catalog and store a substantial volume of reported wrecks and obstructions that are considered navigational hazards within U.S. coastal waters. AWOIS is not a comprehensive record of wrecks in any particular area.	NOAA Office of Coast Survey (OCS)
Maintained Channels	This layer shows coastal channels and waterways that are maintained and surveyed by the U.S. Army Corps of Engineers (USACE).	U.S. Army Corps of Engineers (USACE)
Shipping Lanes	Shipping zones delineate activities and regulations for marine vessel traffic. Traffic lanes define specific traffic flow, while traffic separation zones assist opposing streams of marine traffic.	NOAA Office of Coast Survey (OCS)
AIS Vessel Count (including total count and by vessel type)	Automatic Identification Systems (AIS) are a navigation safety device that transmits and monitors the location and characteristics of many vessels in U.S. and international waters in real-time. This dataset represents vessel counts by vessel type for 2013. Vessel count raster data layers were created by CASS Spatial team and are derived from vessel density raster data layers generated from raw AIS data.	Bureau of Ocean Energy Management (BOEM)
Anchorage Areas	An anchorage area is a place where boats and ships can safely drop anchor.	NOAA Office of Coast Survey (OCS)
Natural Resources		
Deep-Sea Corals	The National Oceanic and Atmospheric Administration (NOAA) Deep Sea Coral Research and Technology Program (DSCRTP) have developed a National Database for Deep-Sea Corals and Sponges (database).	NOAA National Centers for Coastal Ocean Science (NCCOS)
Hardbottom Habitat	Distribution of known hardbottom habitat within the Santa Barbara Channel region. Hardbottom habitat generally occurs in the ocean where rocks or other hard surfaces are exposed from bottom sand or mud; this structure can serve as habitat for fish and invertebrate species.	California Geological Survey and Moss Landing Marine Lab / UC Santa Barbara
Cetacean Predicted Density and Distribution	Habitat-based predicted density and distribution models for multiple cetacean species, including: beaked whales (multiple species), blue whales, dolphins (multiple species), Dall's porpoise, fin whales, humpback whales, and sperm whales.	NOAA National Marine Fisheries Service

Data Layer:	Description:	Source:
Seagrass	Aquatic vascular vegetation beds dominated by submerged, rooted, vascular species or submerged or rooted floating freshwater tidal vascular vegetation. This is not a complete collection of seagrasses on the seafloor, nor are the locations to be considered exact.	NOAA Office for Coastal Management (OCM) & other state and federal agencies
Essential Fish Habitat / Habitat Areas of Particular Concern	Essential Fish Habitat (EFH) represent important habitat areas for every life stage of federally managed species. Habitat Areas of Particular Concern (HAPC) are discrete subsets of Essential Fish Habitat (EFH) that provide extremely important ecological functions or are especially vulnerable to degradation.	NOAA National Marine Fisheries Service (NMFS)
Marine Protected Areas	The MPA Inventory is a comprehensive catalog that provides detailed information for existing marine protected areas in the United States.	NOAA National MPA Center
Oceanographic and Biophysical		
Bathymetry (water depth)	High-resolution bathymetry data was obtained from NOAA's National Geophysical Data Center (NGDC). This bathymetric data is a composite of various sources, including NGDC, U.S. National Ocean Service (NOS), U.S. Geological Survey (USGS), the Federal Emergency Management Agency (FEMA), and other federal, state, and local government agencies, academic institutions, and private companies. DEMs are referenced to the vertical tidal datum of Mean High Water (MHW) and horizontal datum of World Geodetic System 1984 (WGS84).	NOAA National Geophysical Data Center (NGDC)
Water Temperature	MODIS Global Level 3 Mapped SST (via MGET) mean/min/max climatologies for 20 year period 1997 – 2016.	NASA MODIS Aqua
Current Velocity and Direction	Surface current velocity and direction data from HYCOM + NCODA Global 1/12 Degree Reanalysis, experiments 19.1 (1995-2012). Directional data are represented by U and V vector data.	HYCOM
Salinity	Salinity data from HYCOM + NCODA Global 1/12 Degree Reanalysis, experiments 19.1 (1995-2012).	HYCOM
Significant Wave Height	Significant wave height (SWH or H_s) is defined traditionally as the mean wave height (trough to crest) of the highest third of waves ($H_{1/3}$).	AVISO
Chlorophyll *a*	NASA GSFC OceanColor L3 SMI (via MGET) mean/std dev climatologies for 10 yr period 2007 – 2016.	NASA OceanColor
Administrative Boundaries		
Federal / State Waters Boundary	The Submerged Lands Act (SLA) boundary line (also known as State Seaward Boundary or Fed State Boundary) defines the seaward limit of a state's submerged lands and the landward boundary of federally managed OCS lands.	Bureau of Ocean Energy Management (BOEM)

Data Layer:	Description:	Source:
Channel Islands National Marine Sanctuary Boundary	Boundary for the Channel Islands National Marine Sanctuary.	NOAA Office of National Marine Sanctuaries (NMS)

FIGURES

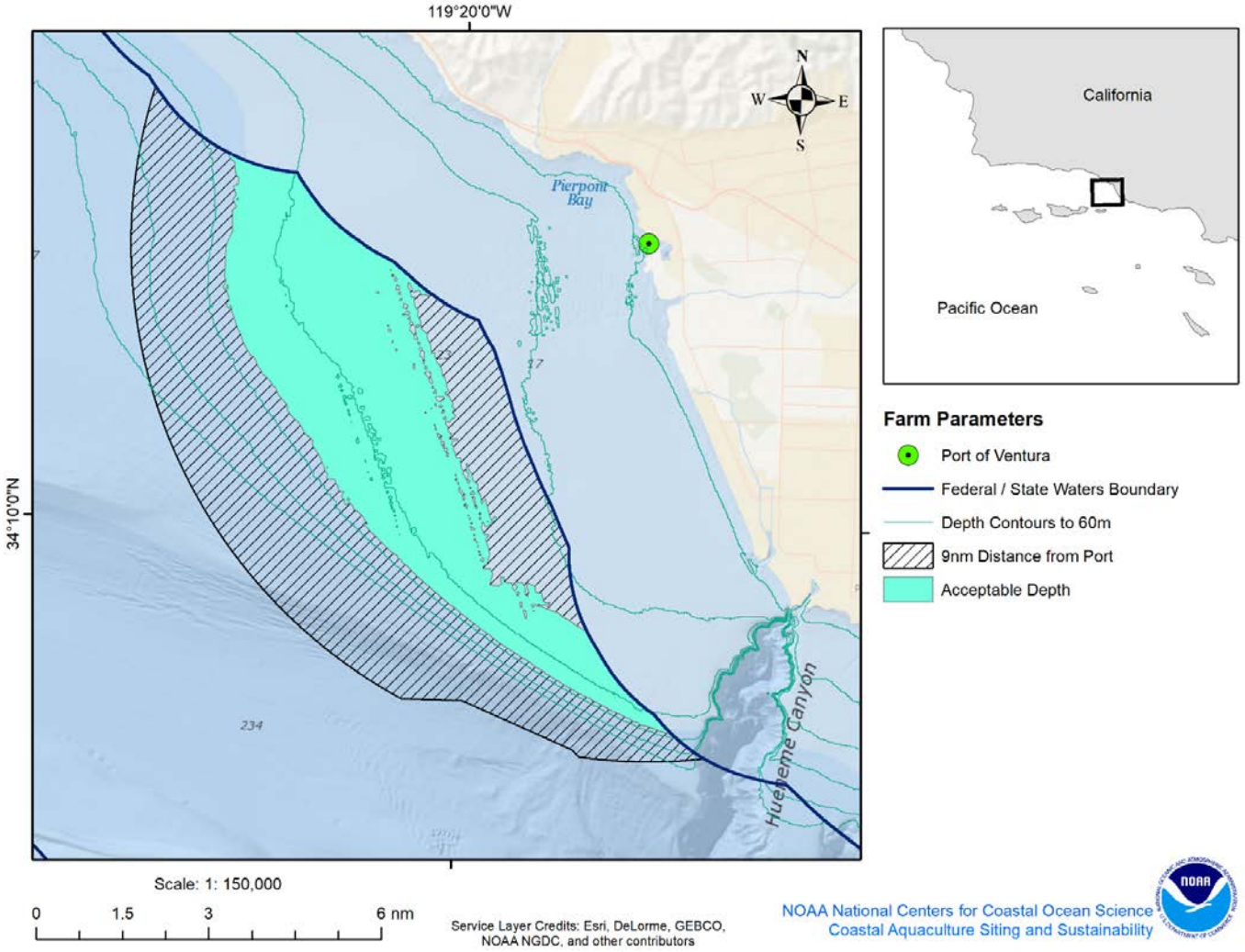


Figure 1. Map of the 'area of interest' for the proposed Ventura Shellfish Enterprise (VSE) project based on project requirements provided by VSE. The primary constraining criteria defined by VSE included: 1) federal waters only, 2) maximum 9 nautical mile distance from the Port of Ventura, and 3) a required depth range of 25 – 37 meters for the proposed Mediterranean mussel (*Mytilus galloprovincialis*) cultivation gear. The defined 'area of interest' is represented by the light green polygon denoted as 'Acceptable Depth' in the map legend. Note that the VSE project is seeking 2,000 acres within the ~20,000 acres within the overall 'area of interest'.

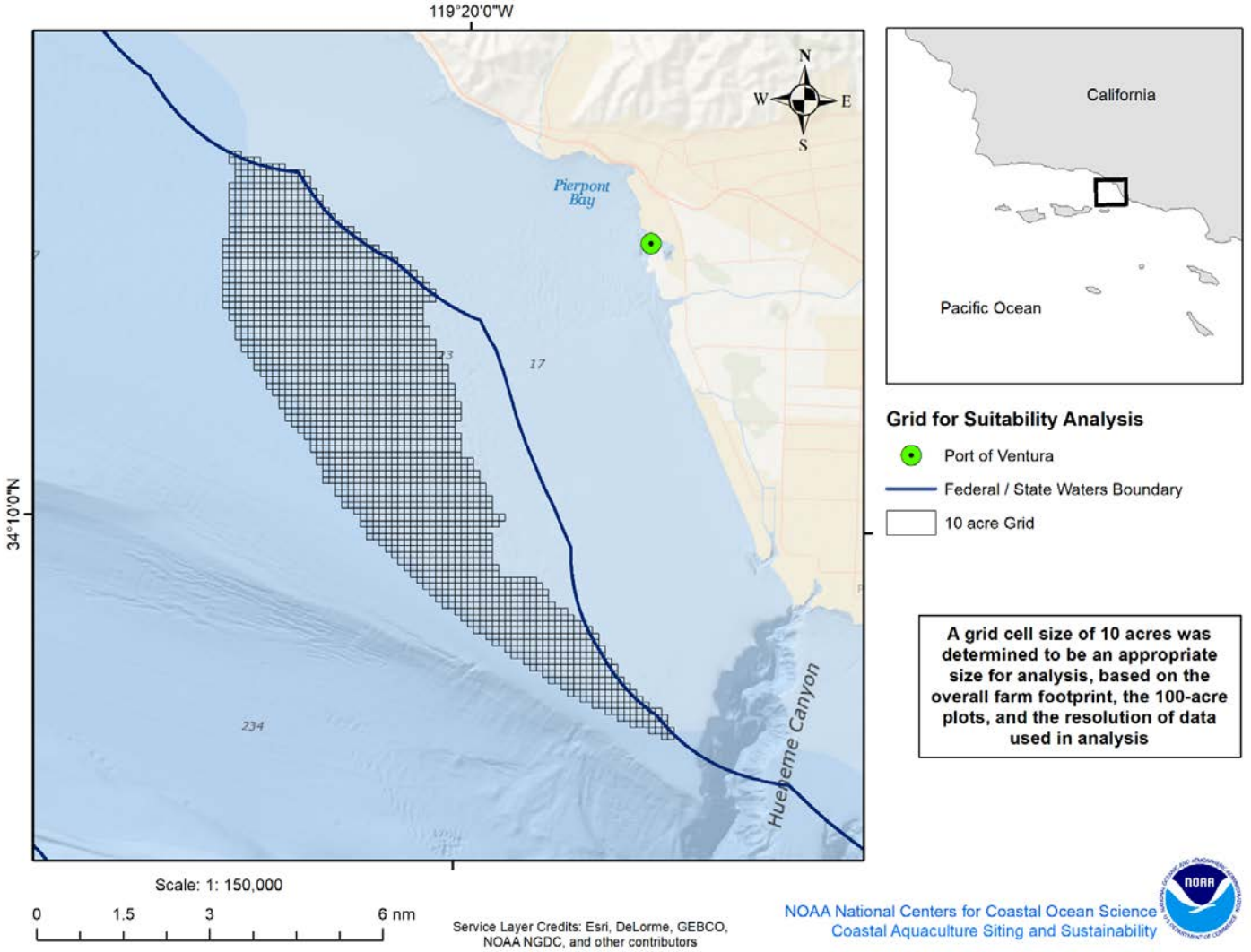


Figure 2. Grid established within the proposed Ventura Shellfish Enterprise (VSE) 'area of interest' for use in the siting analysis. A grid cell size of 10 acres was determined to be appropriate for use in the spatial analysis. The grid contains 1,953 grid cells, equivalent to 19,530 acres total. Note that the VSE project is seeking 2,000 acres within the ~20,000 acres within the overall 'area of interest' described by the grid.

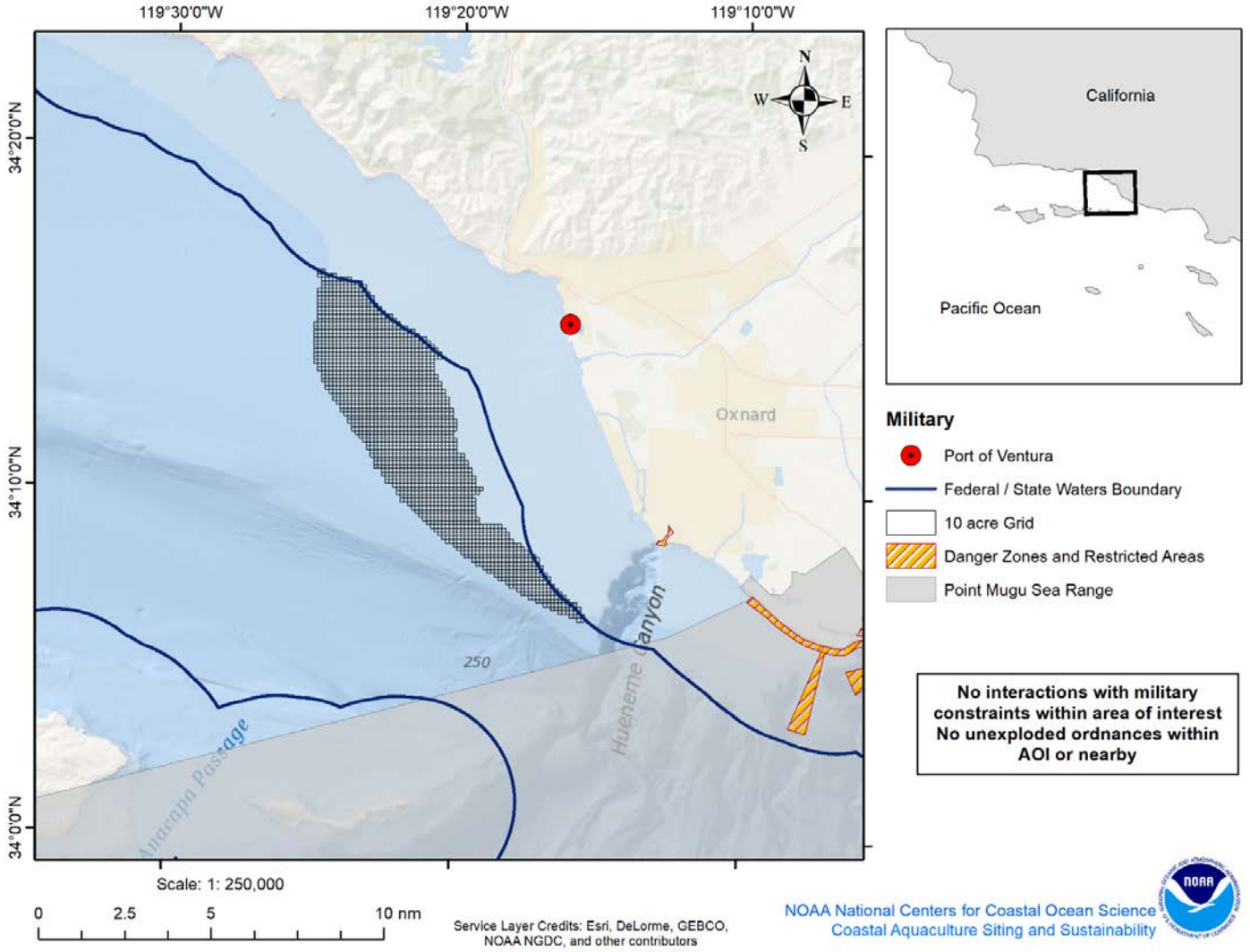


Figure 3. Military space use within the Santa Barbara Channel region in relation to the Ventura Shellfish Enterprise (VSE) 'area of interest'. No military interactions occur within the 'area of interest'.

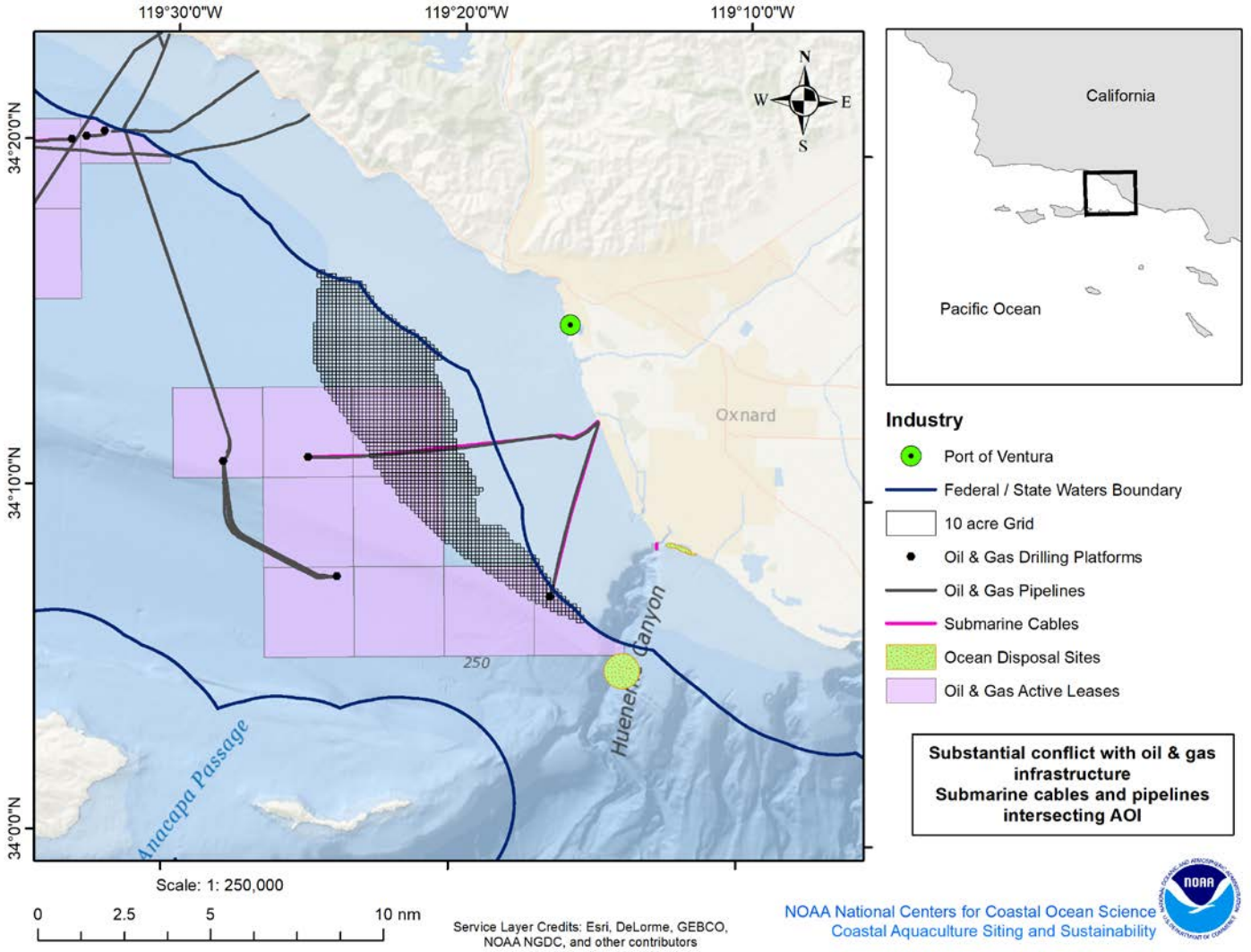


Figure 4. Industry space use within the Santa Barbara Channel region in relation to the Ventura Shellfish Enterprise (VSE) 'area of interest'. Oil and gas infrastructure (active leases, drilling platforms, and pipelines) and submarine cables interactions occur within the 'area of interest'.

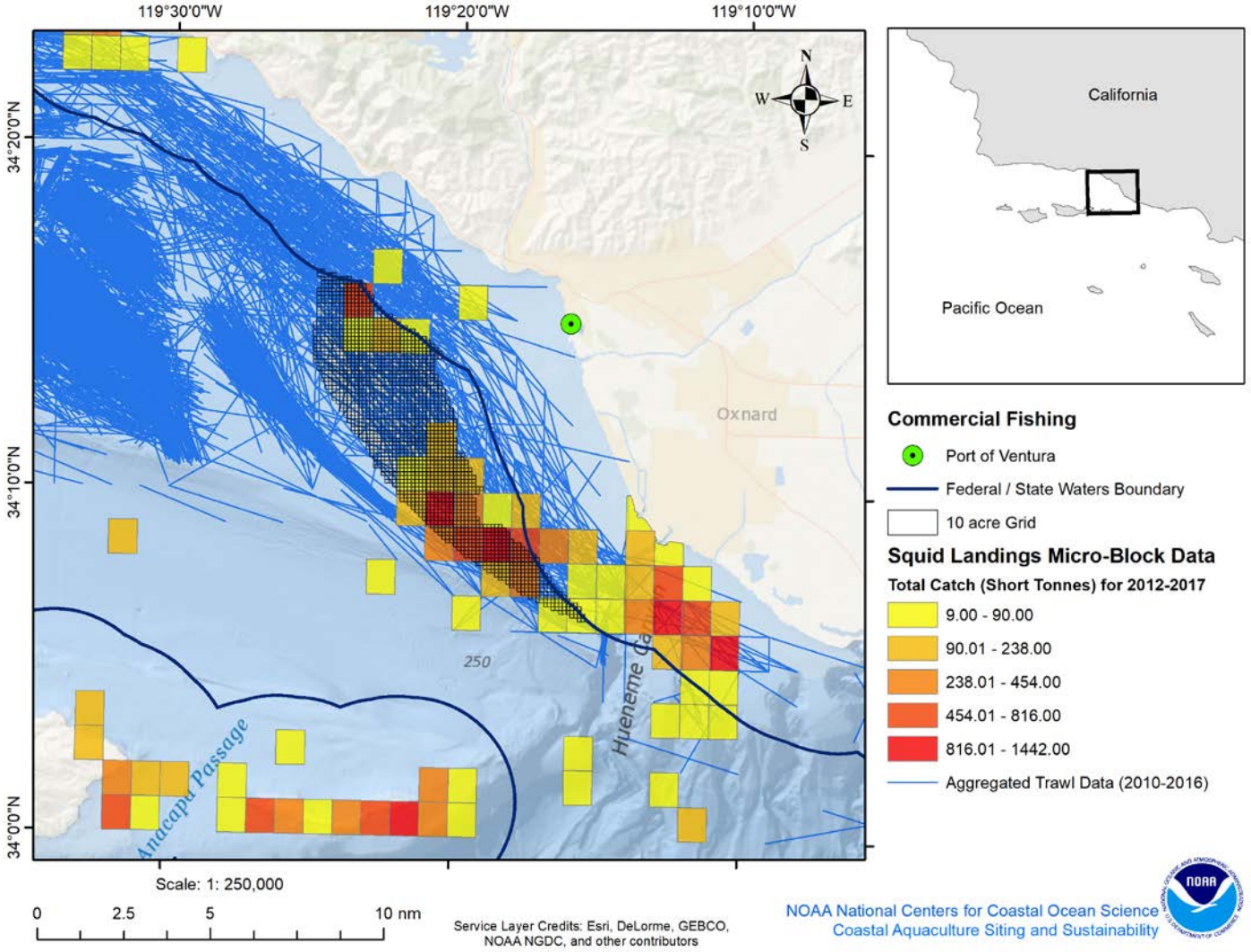


Figure 5. Commercial fishery space use within the Santa Barbara Channel region in relation to the Ventura Shellfish Enterprise (VSE) 'area of interest'. Commercial trawl and squid fishery interactions occur within the 'area of interest'.

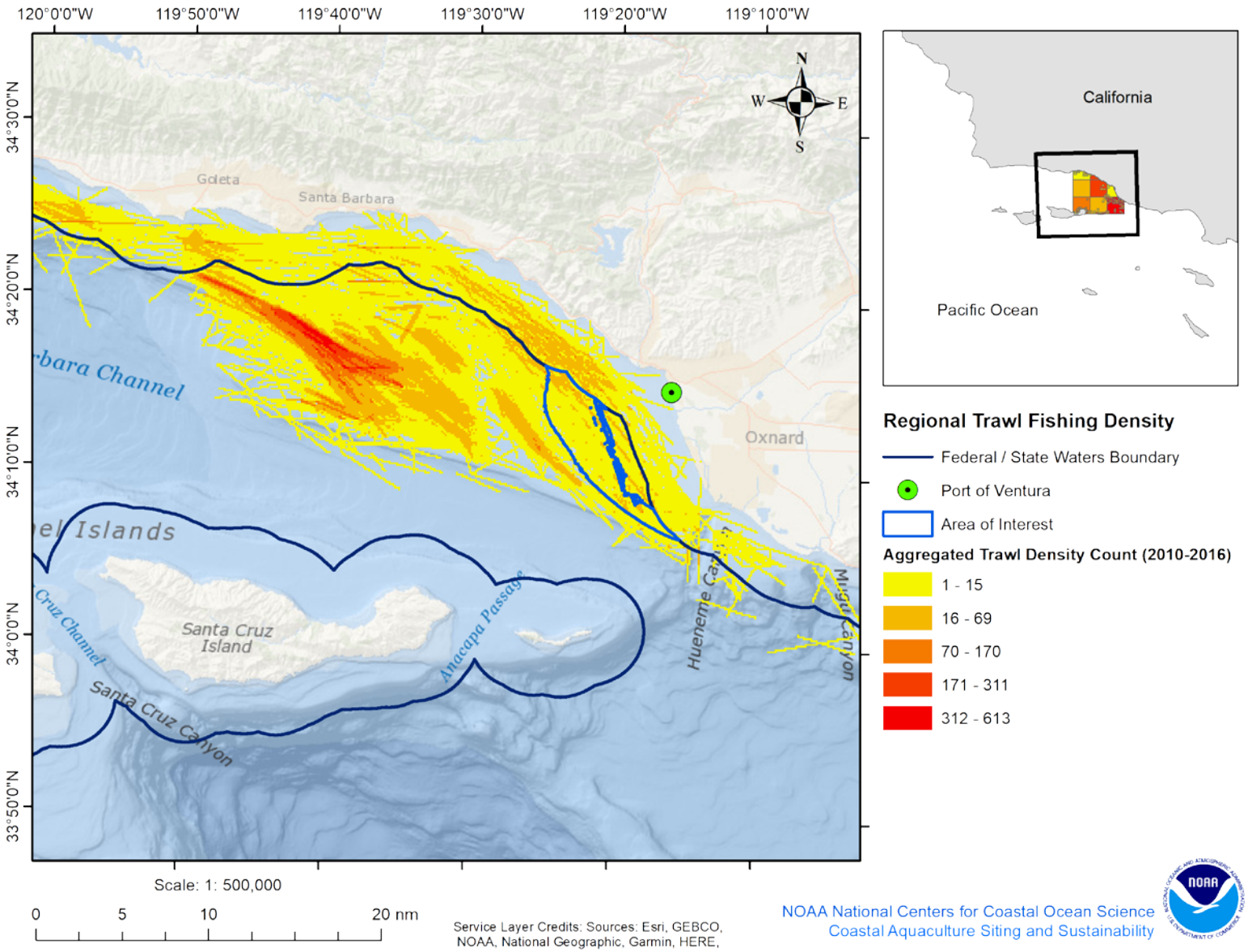


Figure 6. Regional perspective of commercial trawl fisheries within the Santa Barbara Channel region. Note that trawl fishery interactions occur within the 'area of interest,' however, the highest density of trawl fishery activity occurs northwest of the 'area of interest'.

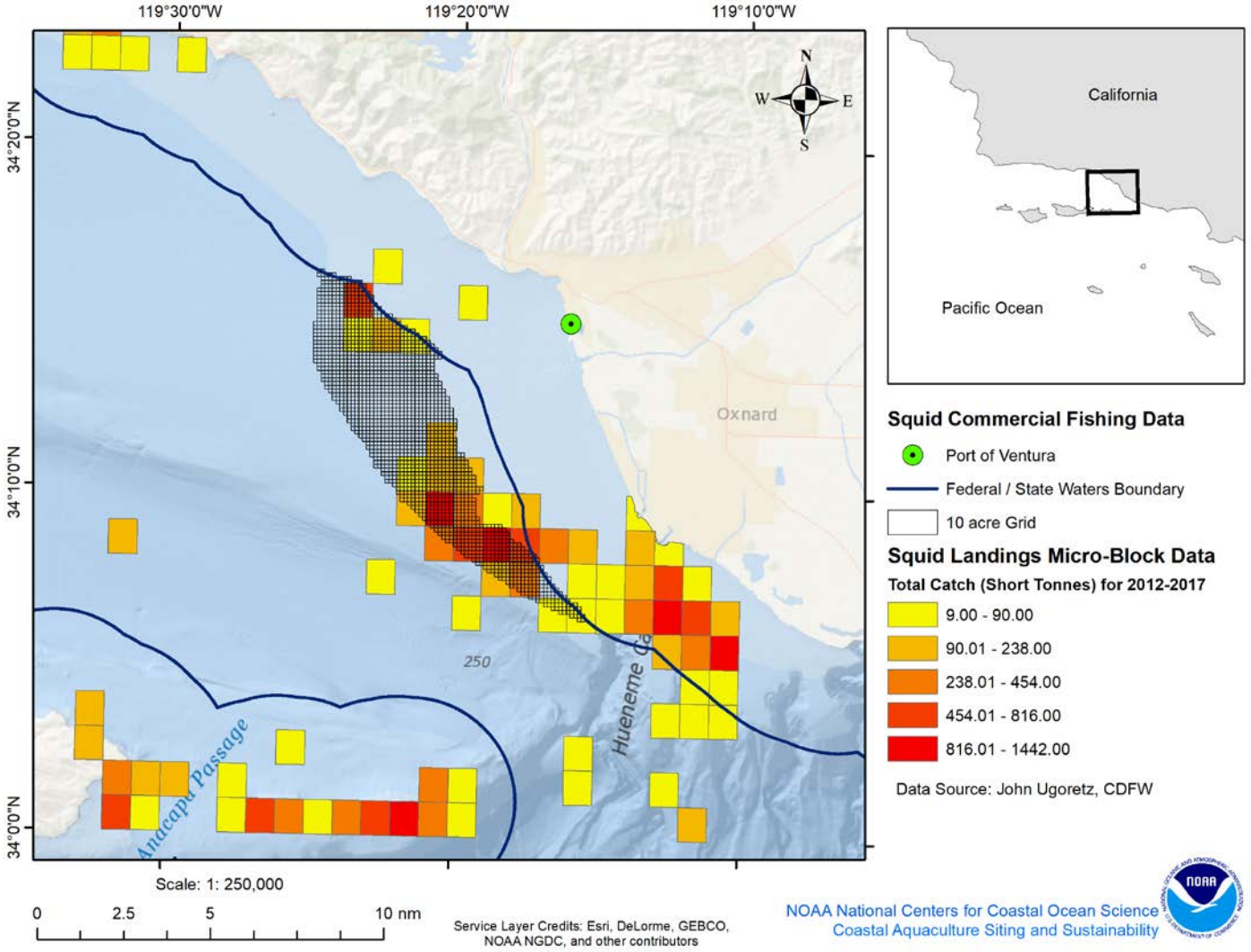


Figure 7. Regional perspective of the commercial squid fishery within the Santa Barbara Channel region. Note that trawl fishery interactions occur within the 'area of interest,' however, the highest density of trawl fishery activity occurs northwest of the 'area of interest'.

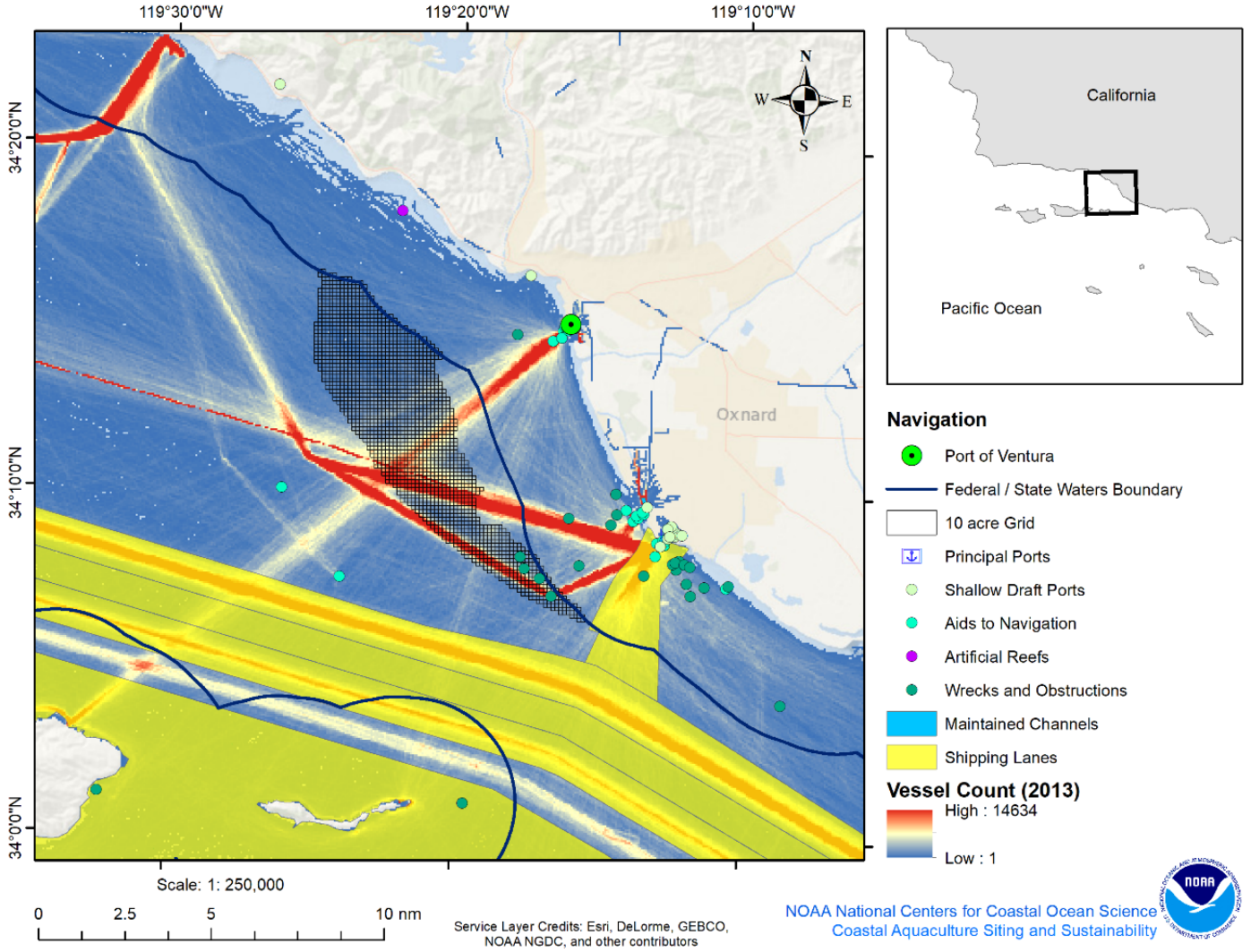


Figure 8. Navigation space use within the Santa Barbara Channel region in relation to the Ventura Shellfish Enterprise (VSE) 'area of interest'. Vessel traffic and wrecks and obstructions interactions occur within the 'area of interest'.

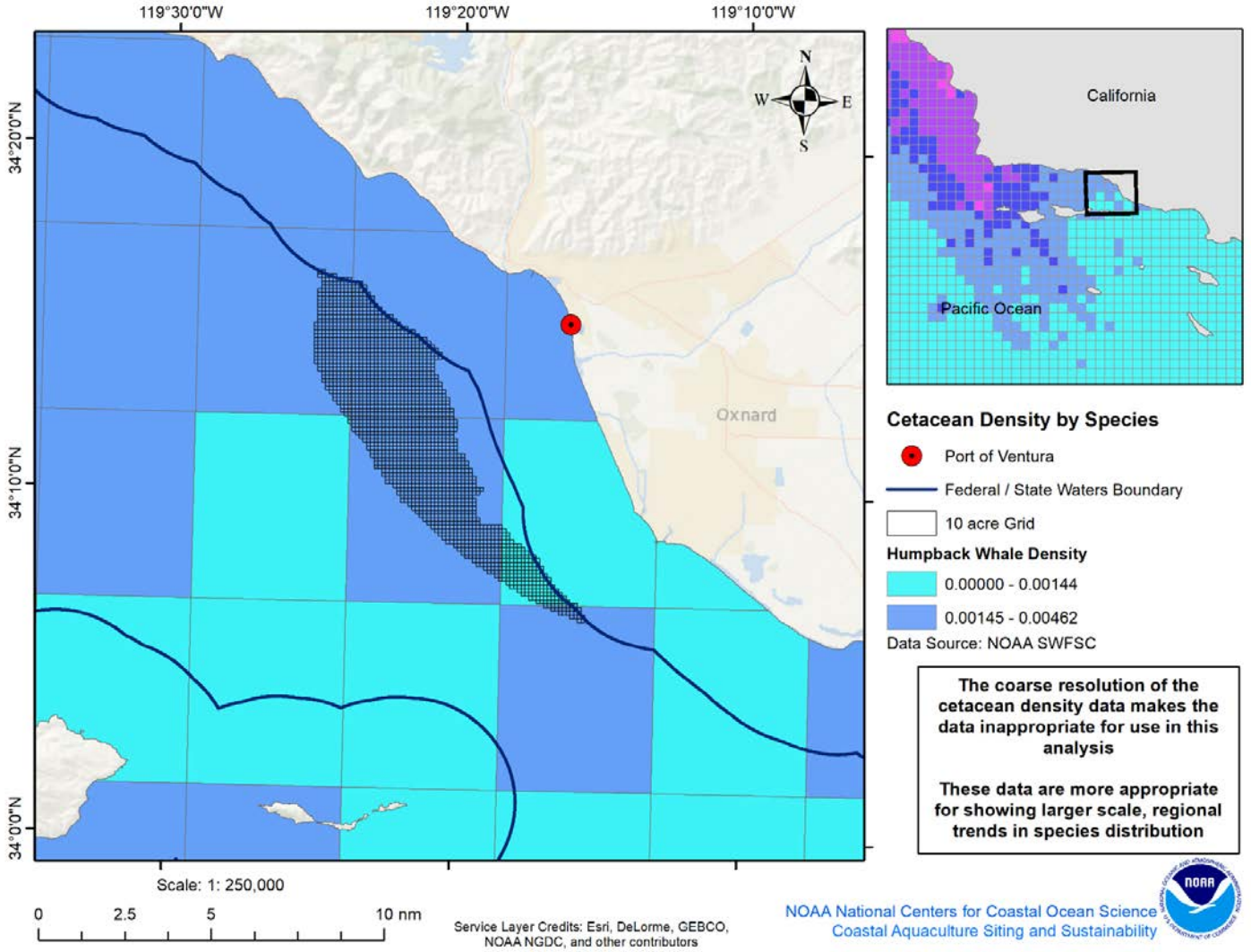


Figure 9. Cetacean (i.e., humpback whale) predicted density in relation to the VSE 'area of interest. Note that due to the coarse spatial resolution of this data, it was inappropriate for use within the VSE suitability analysis. The inset map (upper right) shows the large-scale, regional trends of cetacean (i.e., humpback whale) distribution.

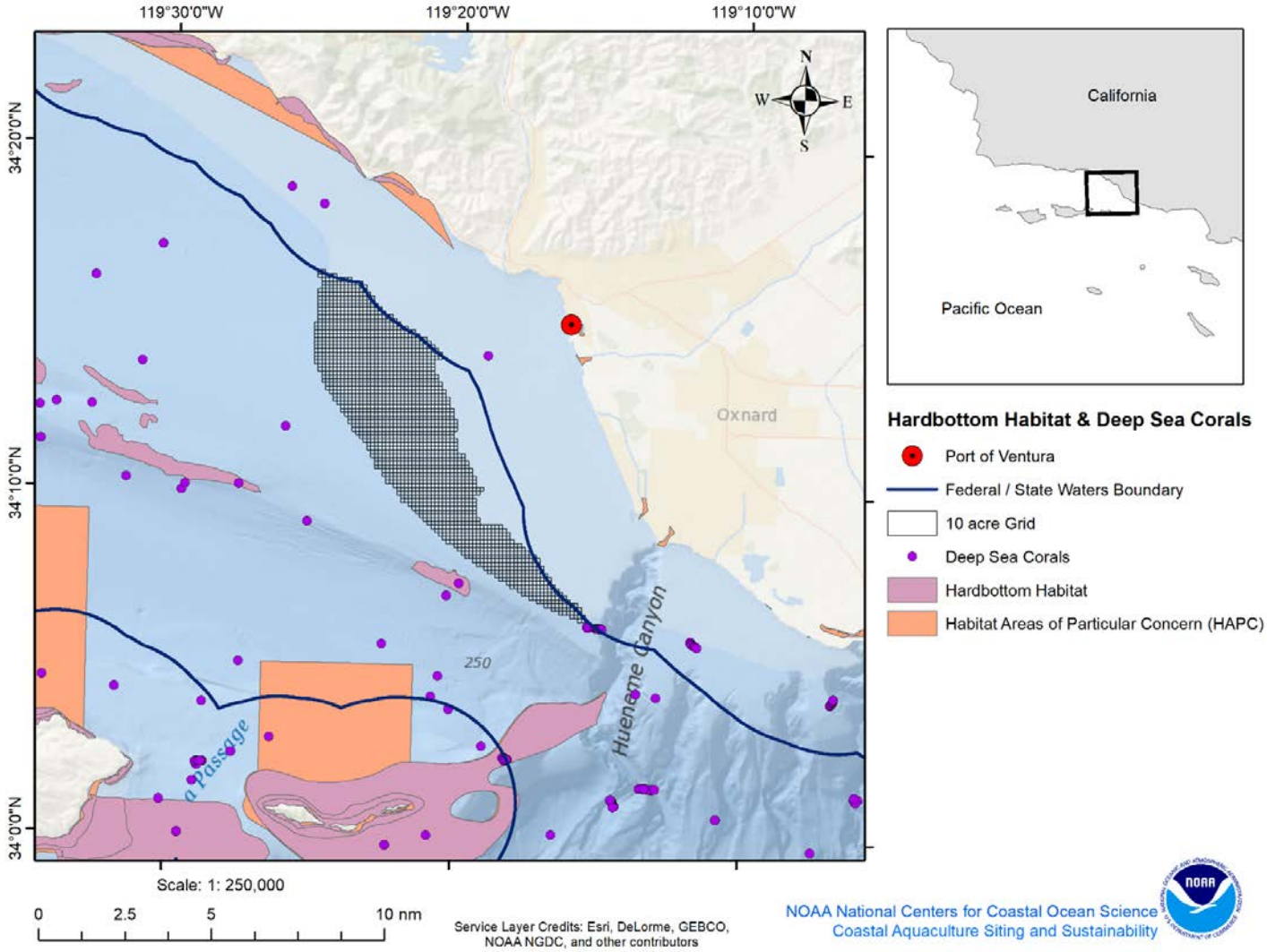


Figure 10. Distribution of hardbottom habitat and deep-sea corals in relation to the VSE 'area of interest'. Note that records of deep-sea corals and hardbottom habitat occur within proximity of the VSE 'area of interest,' but not within it.

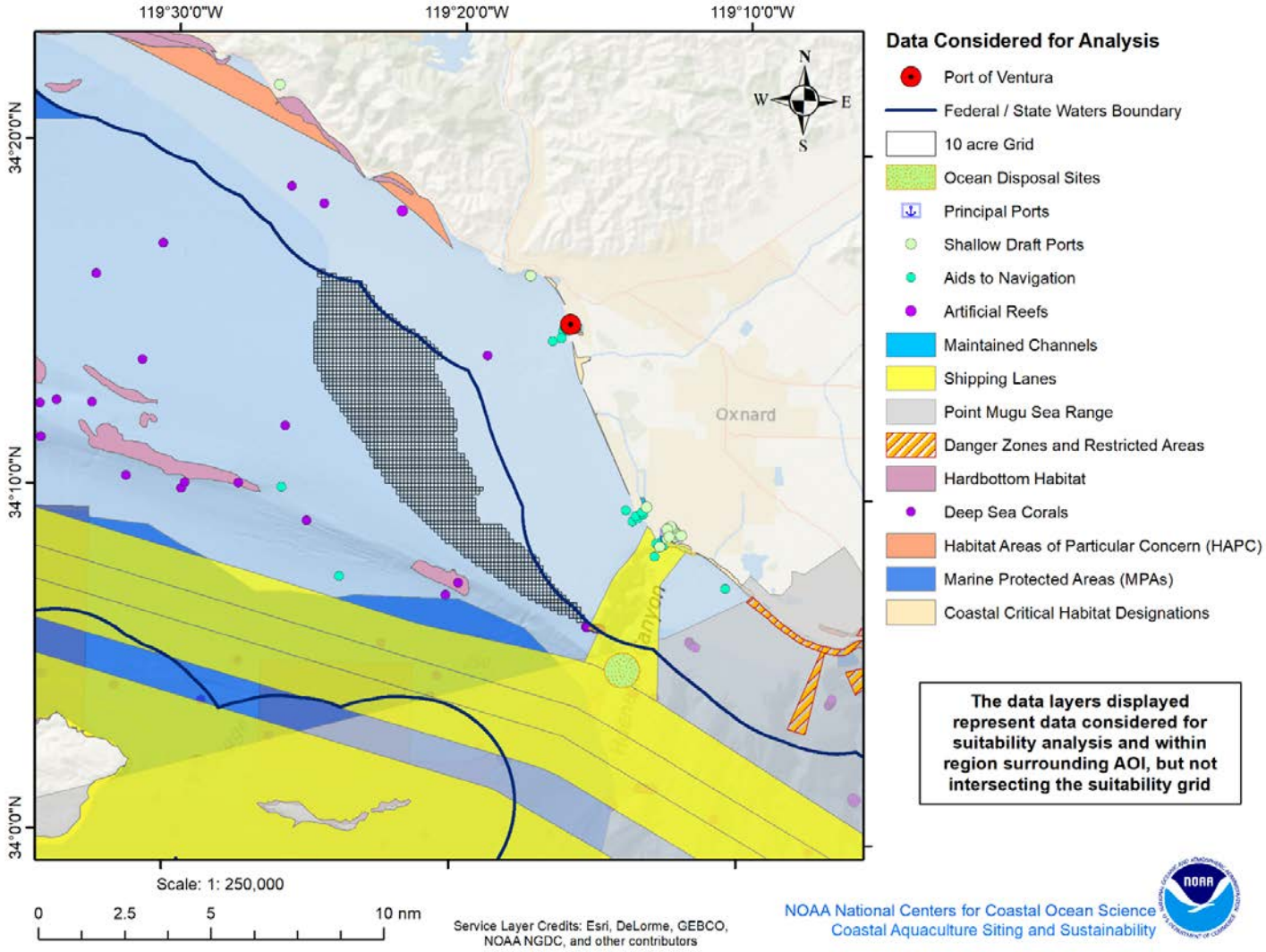


Figure 11. Distribution of all major spatial data layers representing potential space-use conflicts (e.g., military, navigation, natural resources) that were considered, but do not intersect the VSE 'area of interest' and were thus not incorporated within the suitability analysis.

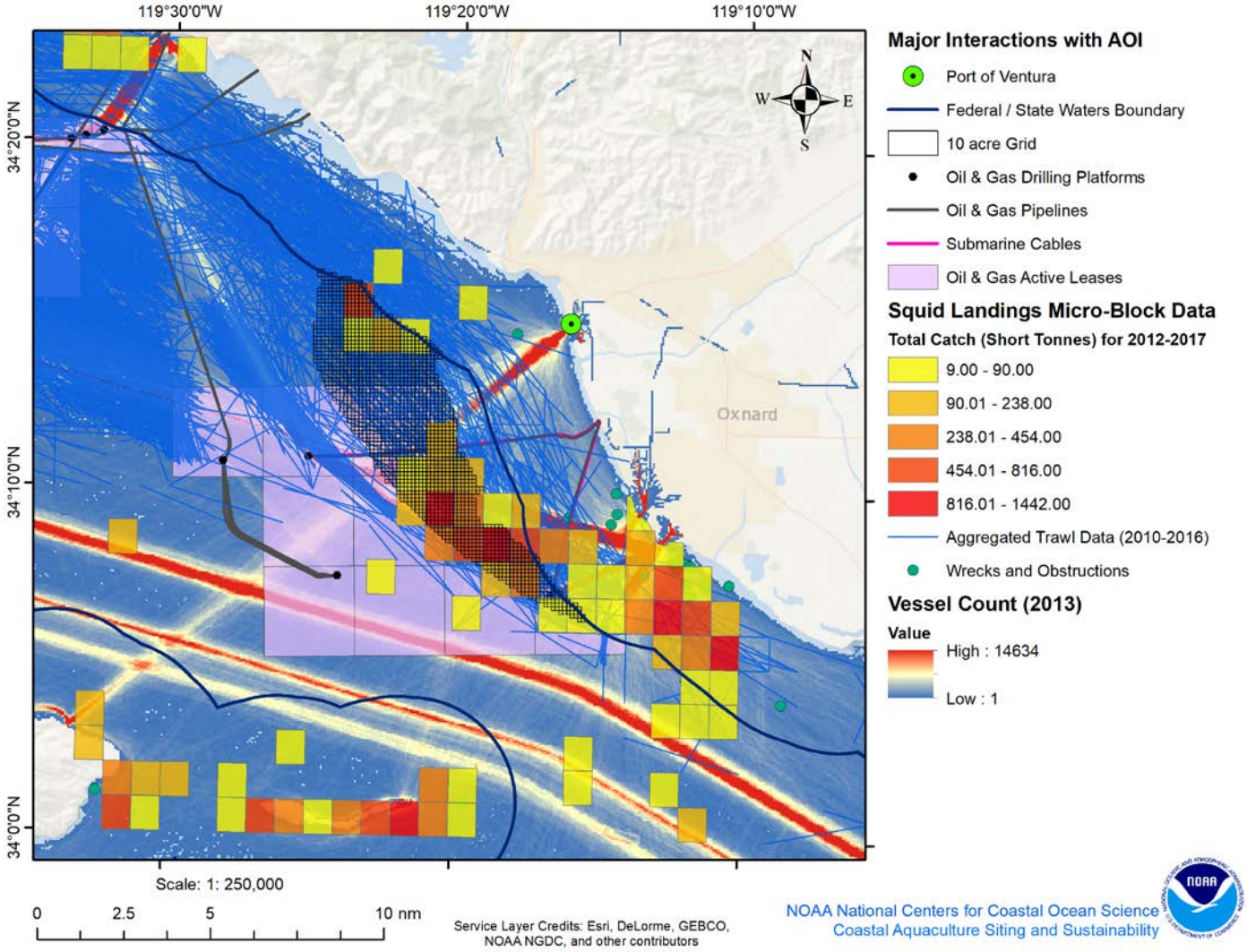


Figure 12. Distribution of all major spatial data layers representing potential space-use conflicts that intersect the VSE 'area of interest' and were incorporated within the suitability analysis. These include: (1) oil and gas leases, drilling platforms, and pipelines, (2) submarine cables, (3) commercial trawl and squid fisheries, (4) wrecks and obstructions, and (5) vessel traffic.

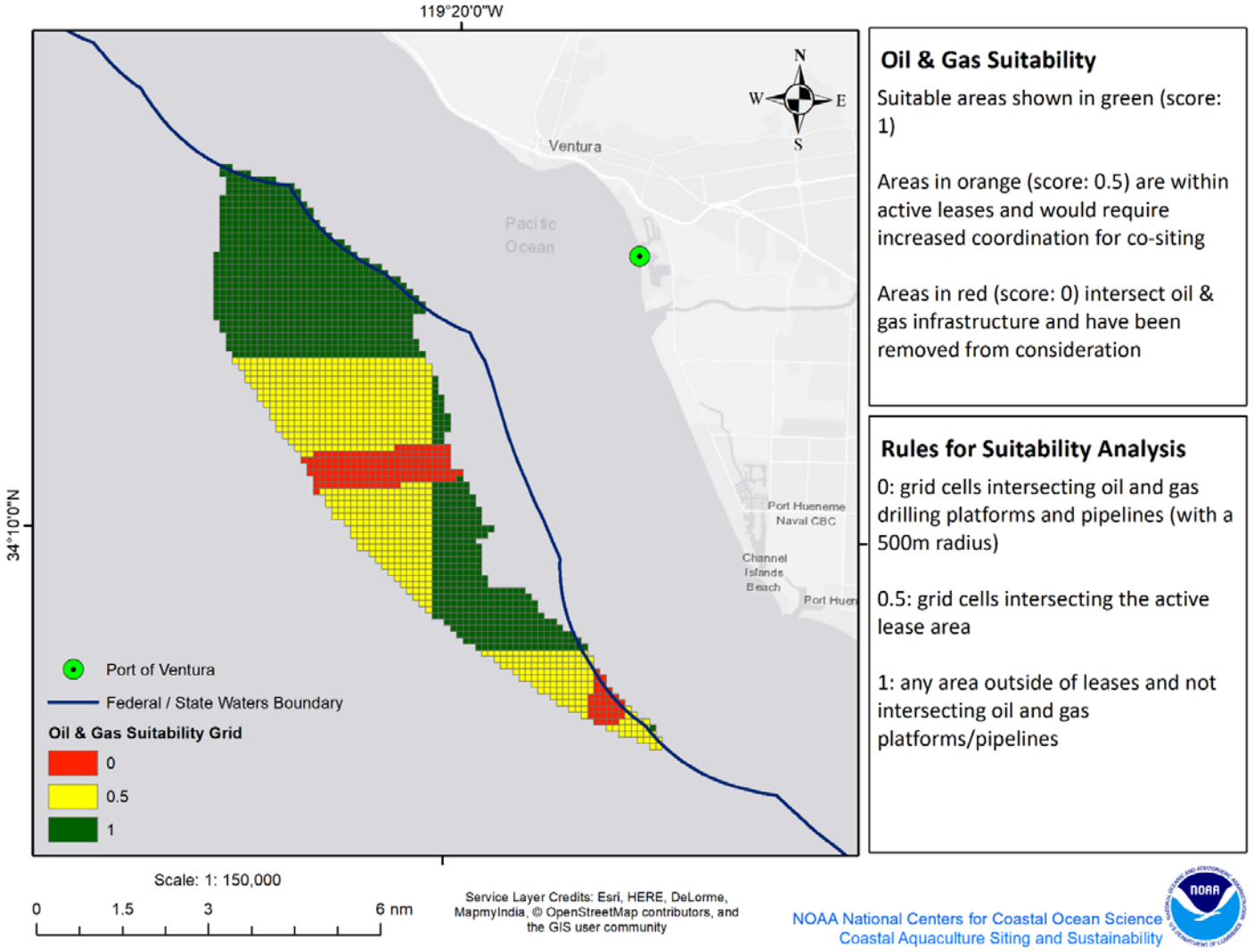


Figure 13. Oil and gas suitability layer incorporated within the overall VSE suitability analysis. Areas within a 500 meter radius of active oil and gas pipelines and drilling platforms were assigned a score of '0' (least compatible), areas within an active oil and gas lease were assigned a score of '0.5' (moderately compatible), and those outside of active oil and gas interests were assigned a score of '1' (most compatible).

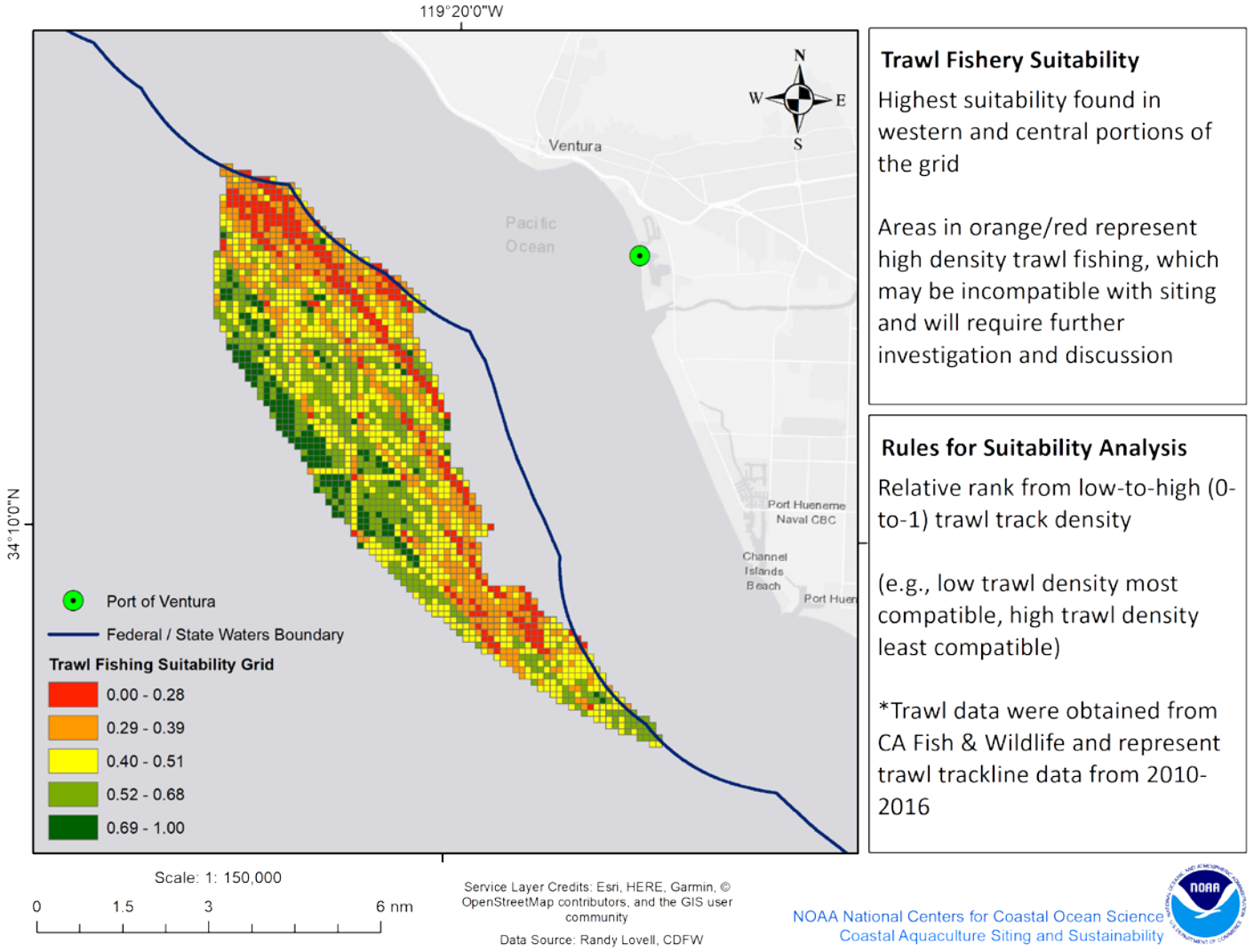


Figure 14. Commercial trawl fishery suitability layer incorporated within the overall VSE suitability analysis. Areas corresponding to the highest density of trawl track line intersections were assigned a score of '0' (least compatible) and areas of lowest density of trawl track line intersections were assigned a score of '1' (most compatible). Continuous scores between '0' and '1' were assigned for all other grid cells across the low-to-high density gradient.

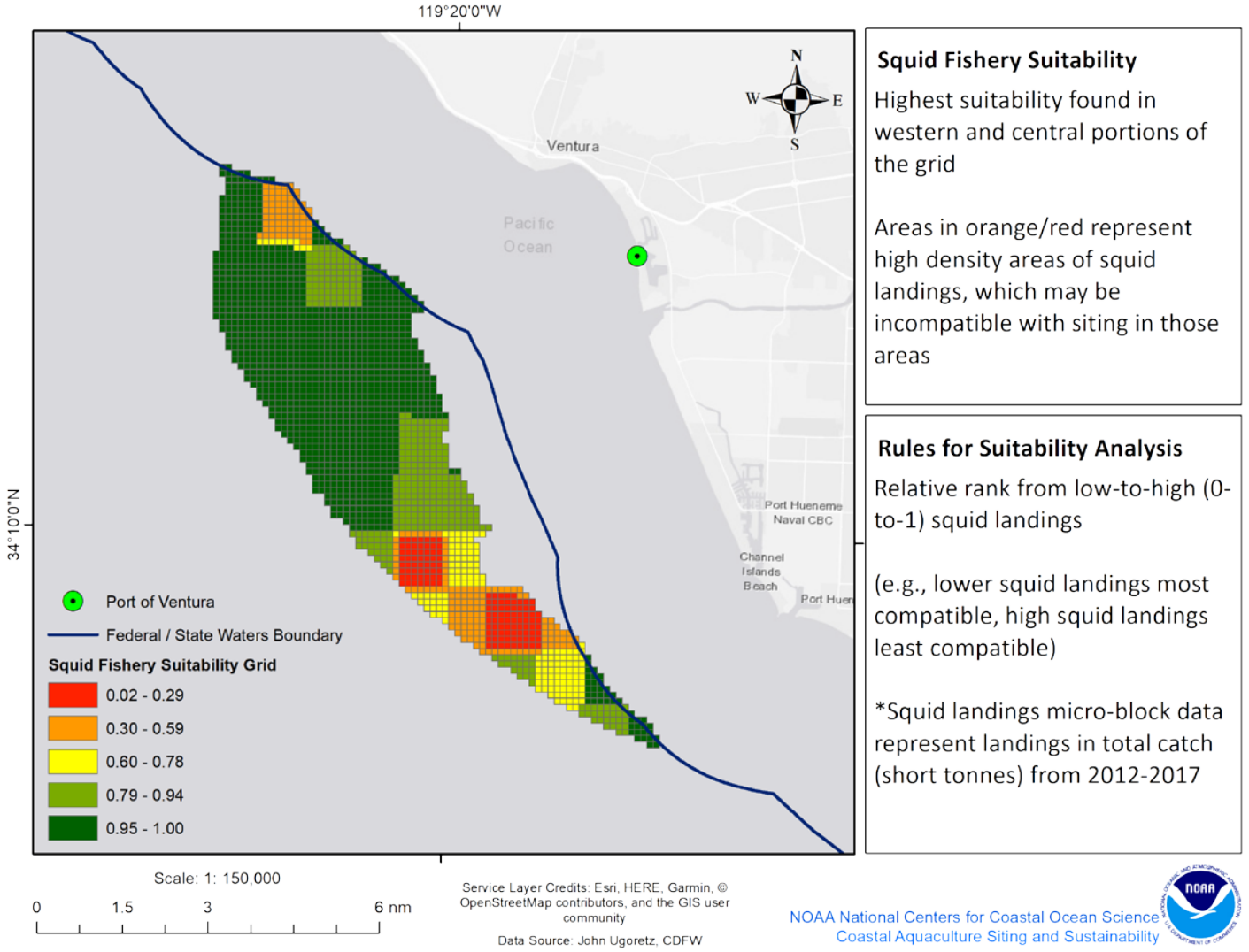


Figure 15. Commercial squid fishery suitability layer incorporated within the overall VSE suitability analysis. Areas corresponding to the highest total squid landings by microblock were assigned a score of '0' (least compatible) and areas of lowest total squid landings by microblock were assigned a score of '1' (most compatible). Continuous scores between '0' and '1' were assigned for all other grid cells across the low-to-high total squid landings by microblock gradient.

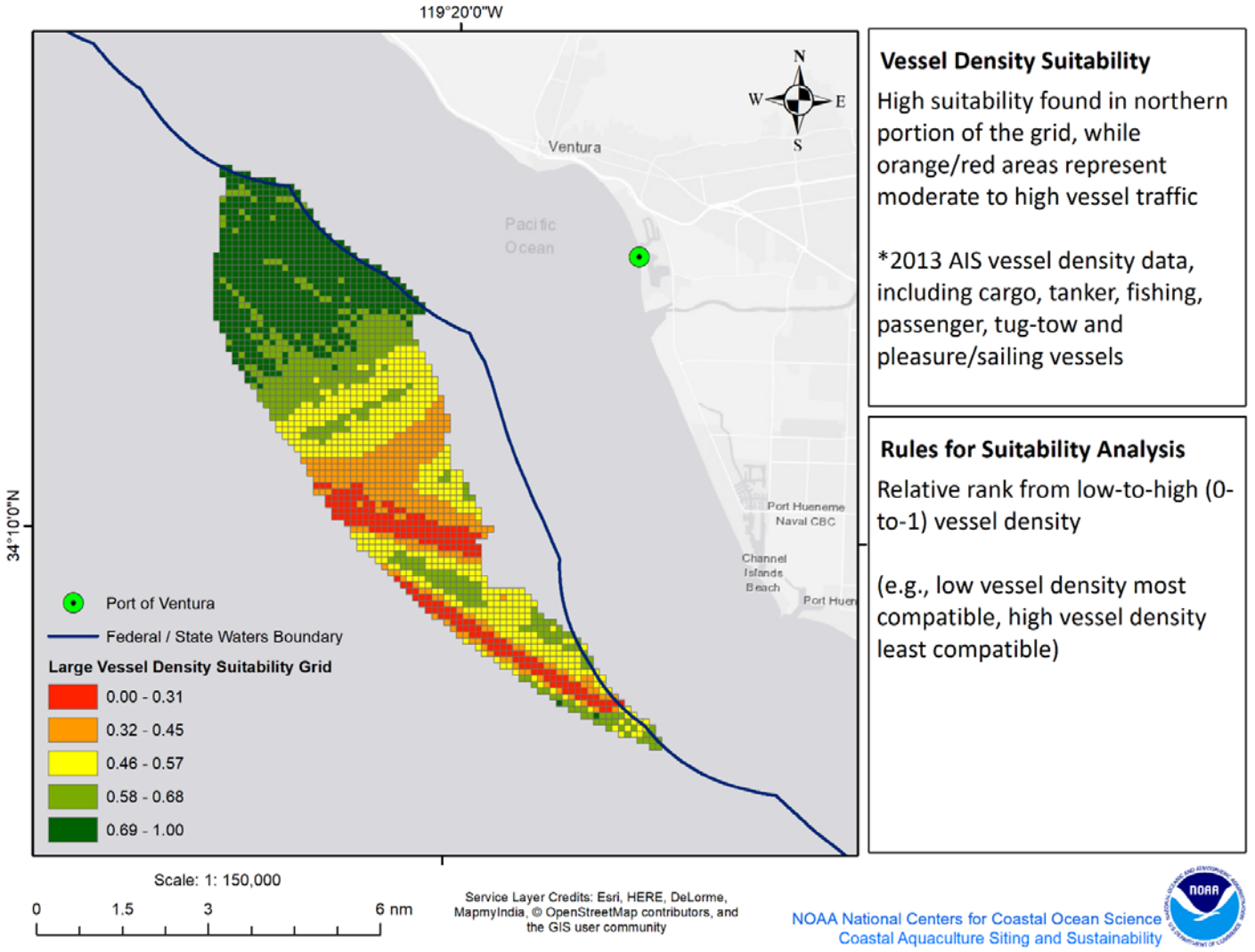


Figure 16. Vessel density suitability layer incorporated within the overall VSE suitability analysis. Areas corresponding to the highest total vessel density were assigned a score of '0' (least compatible) and areas of lowest total vessel density were assigned a score of '1' (most compatible). Continuous scores between '0' and '1' were assigned for all other grid cells across the low-to-high density gradient.

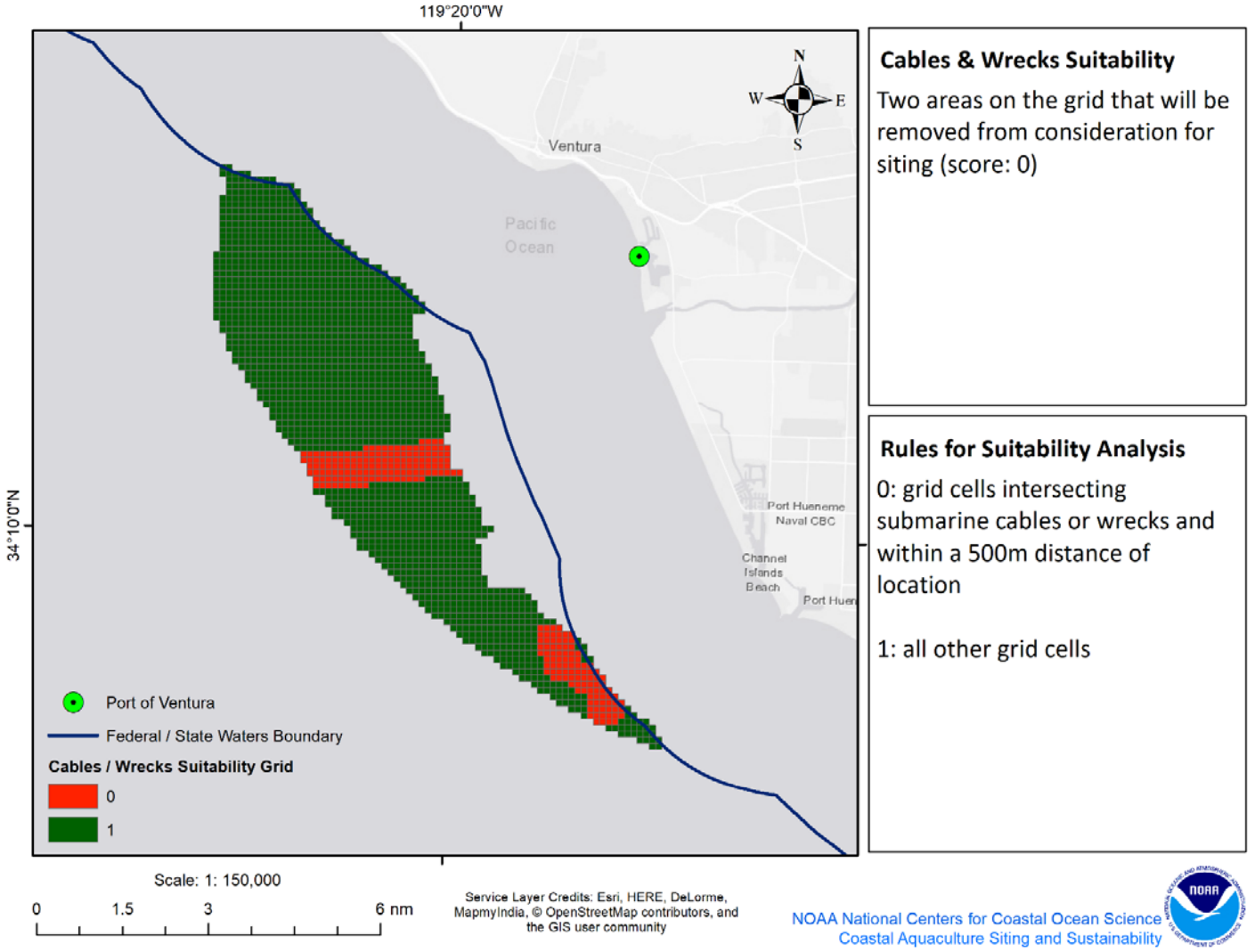


Figure 17. Submerged cables and wrecks and obstructions suitability layer incorporated within the overall VSE suitability analysis. Areas within a 500-meter radius of submerged cables and wrecks and obstructions were assigned a score of '0' (least compatible) while areas outside of a 500-meter radius of submerged cables and wrecks and obstructions were assigned a score of '1' (most compatible).

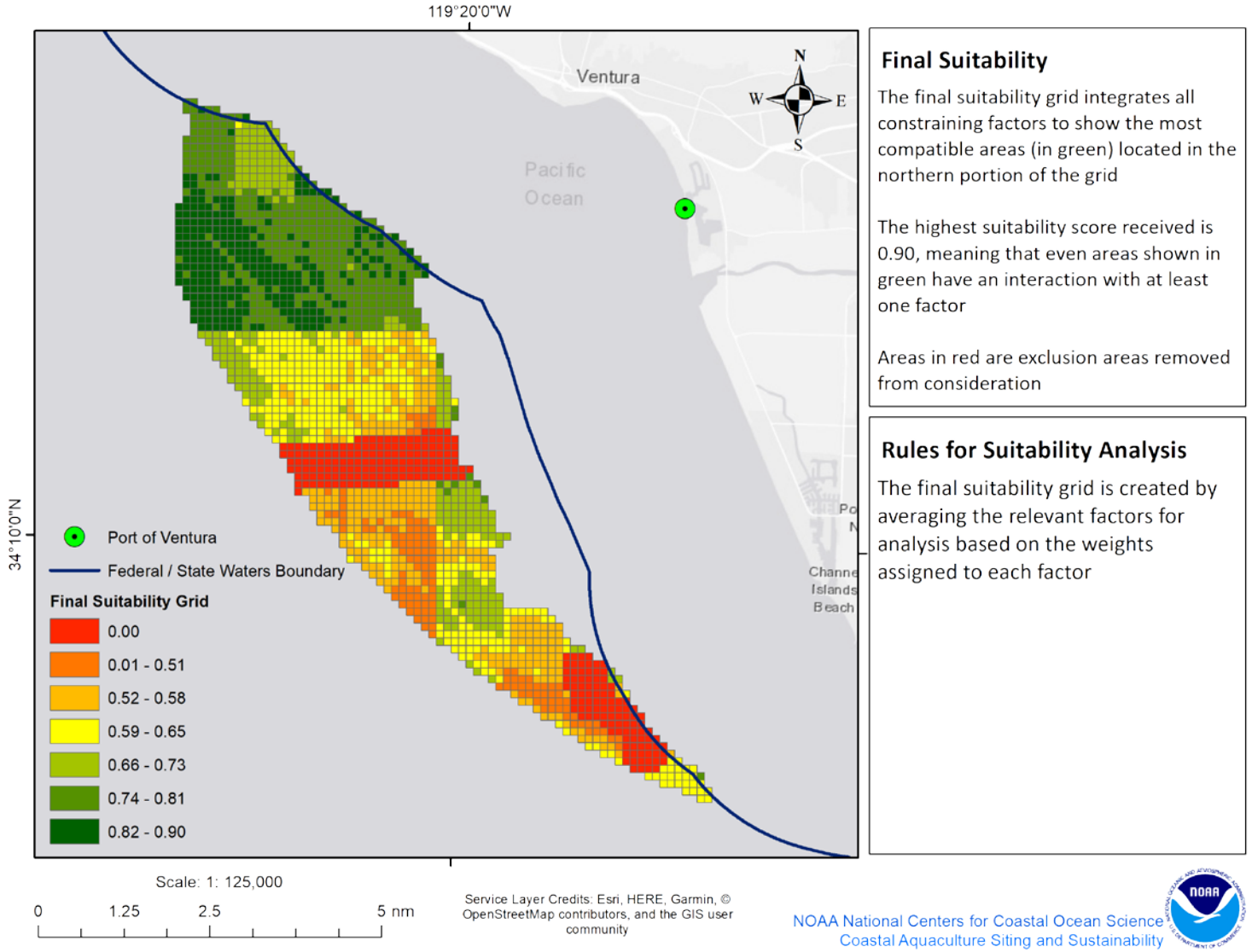


Figure 18. Final suitability grid generated through integration of all individual suitability layers (i.e., oil and gas, commercial trawl fishery, commercial squid fishery, vessel traffic, and submerged cables and wrecks and obstructions). Note that all layers were assigned equal weights within the analysis.

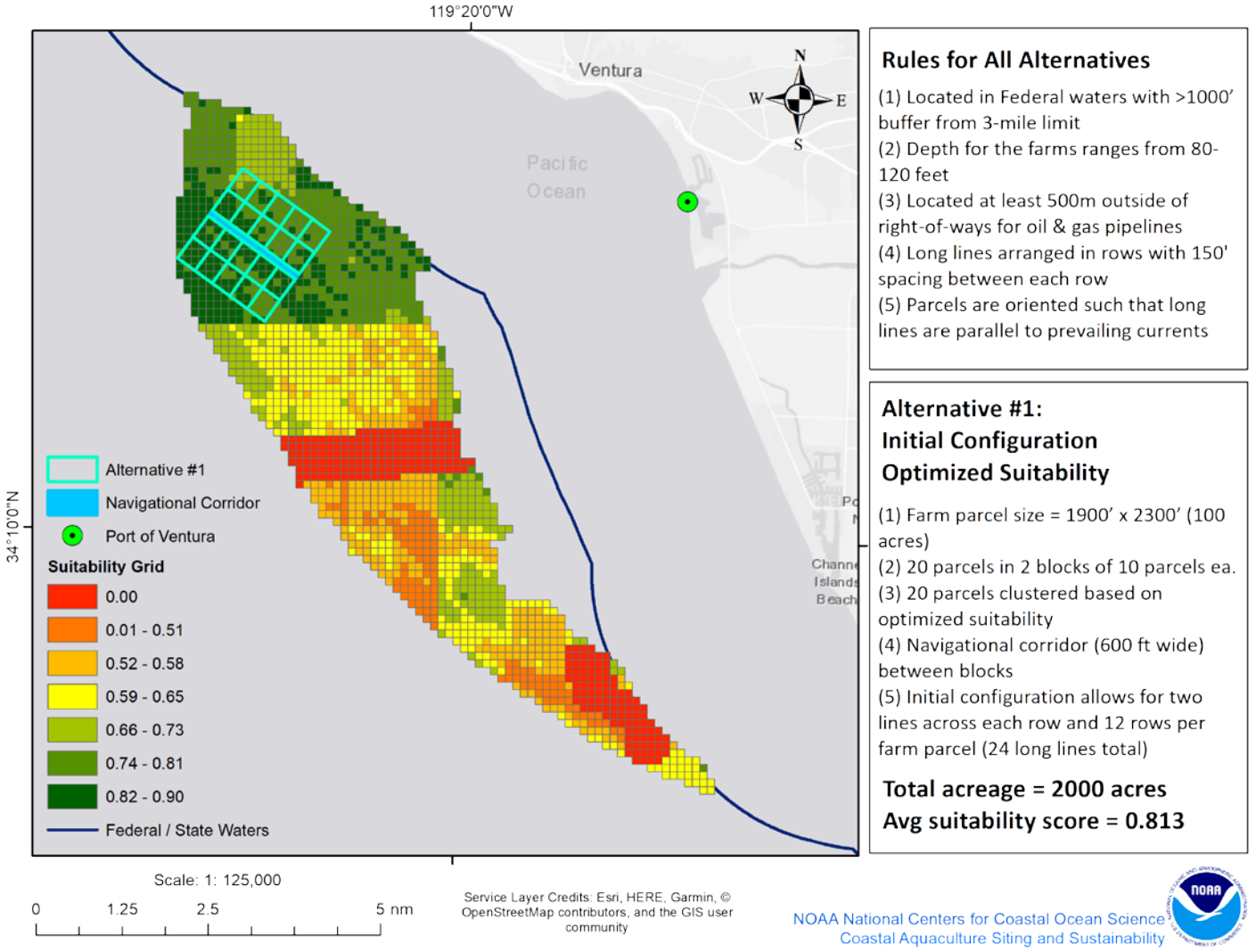


Figure 19. Alternative 1. The first alternative site for VSE was created using their initial configuration, in which the farm parcel design is a 1,900' by 2,300' plot. The alternative site contains 20 parcels, clustered into two blocks, with a 600' navigational corridor between the two blocks. The alternative site was positioned within the 'area of interest' based on optimizing suitability.

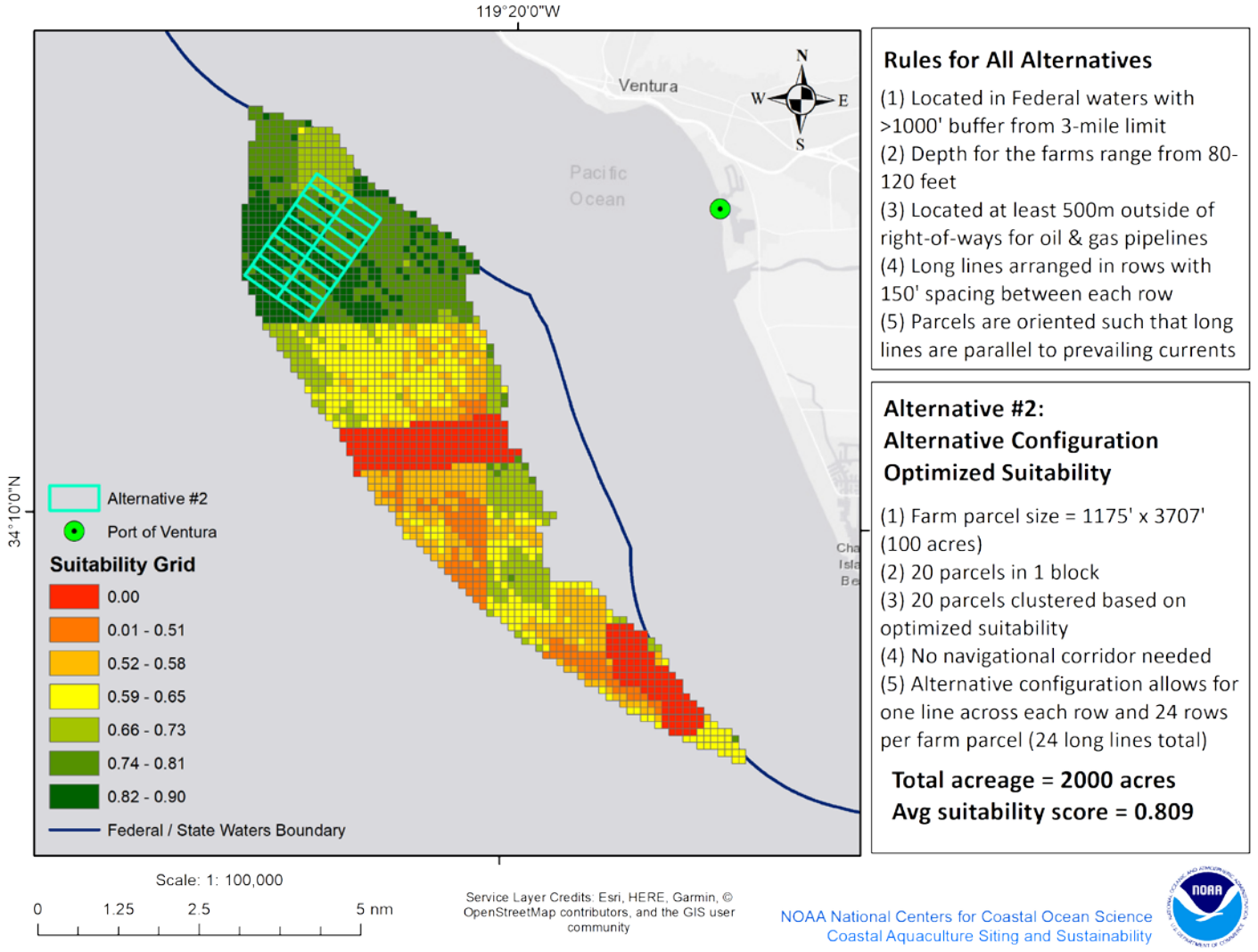
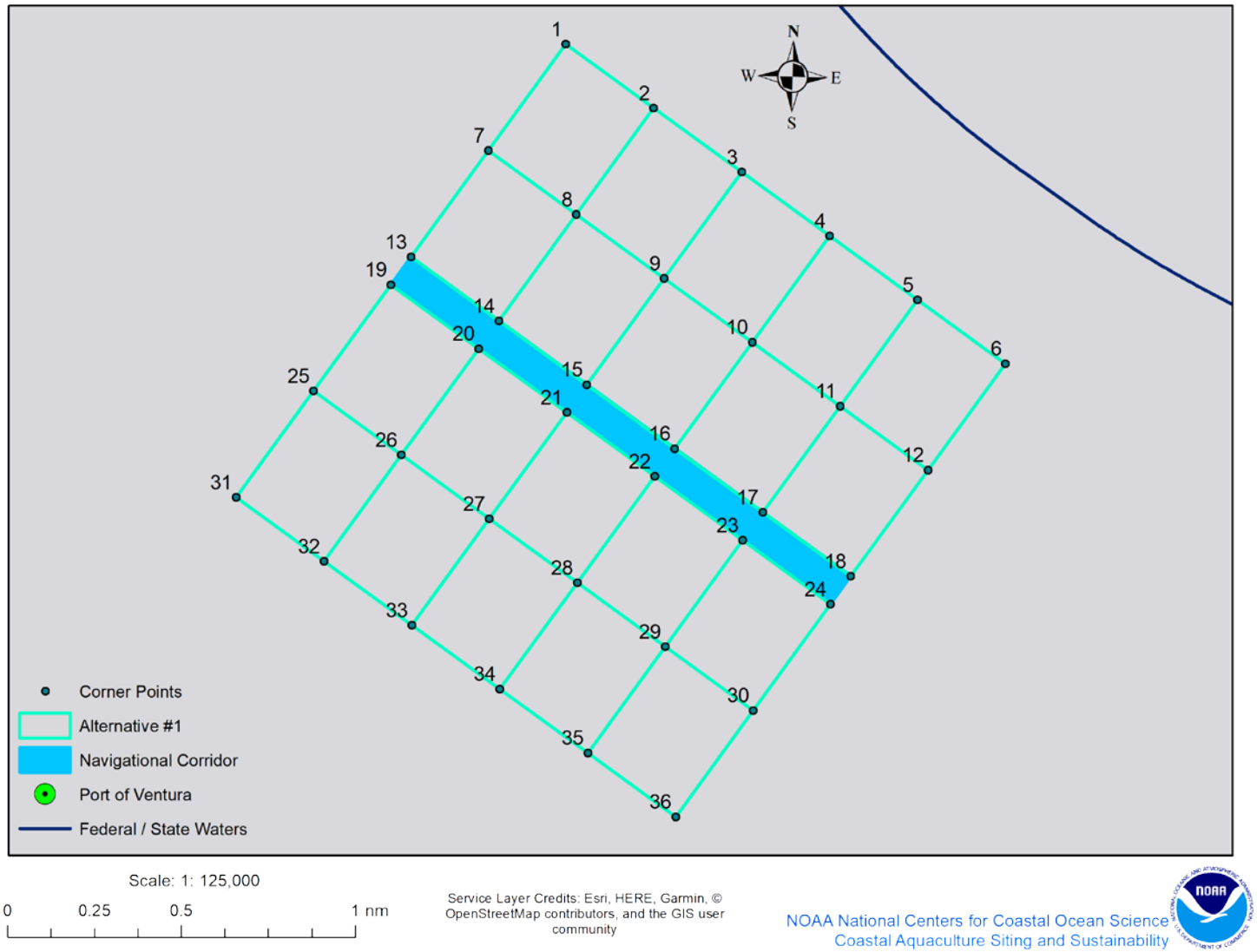


Figure 20. Alternative 2. The second alternative site for VSE was created using their alternative configuration, in which the farm parcel design is a 1,175’ by 3,707’ plot. The alternative site contains 20 parcels, clustered in one contiguous block. A navigational corridor was not needed since all parcels can be reached on the perimeter of the site. The alternative site was positioned within the ‘area of interest’ based on optimizing suitability.

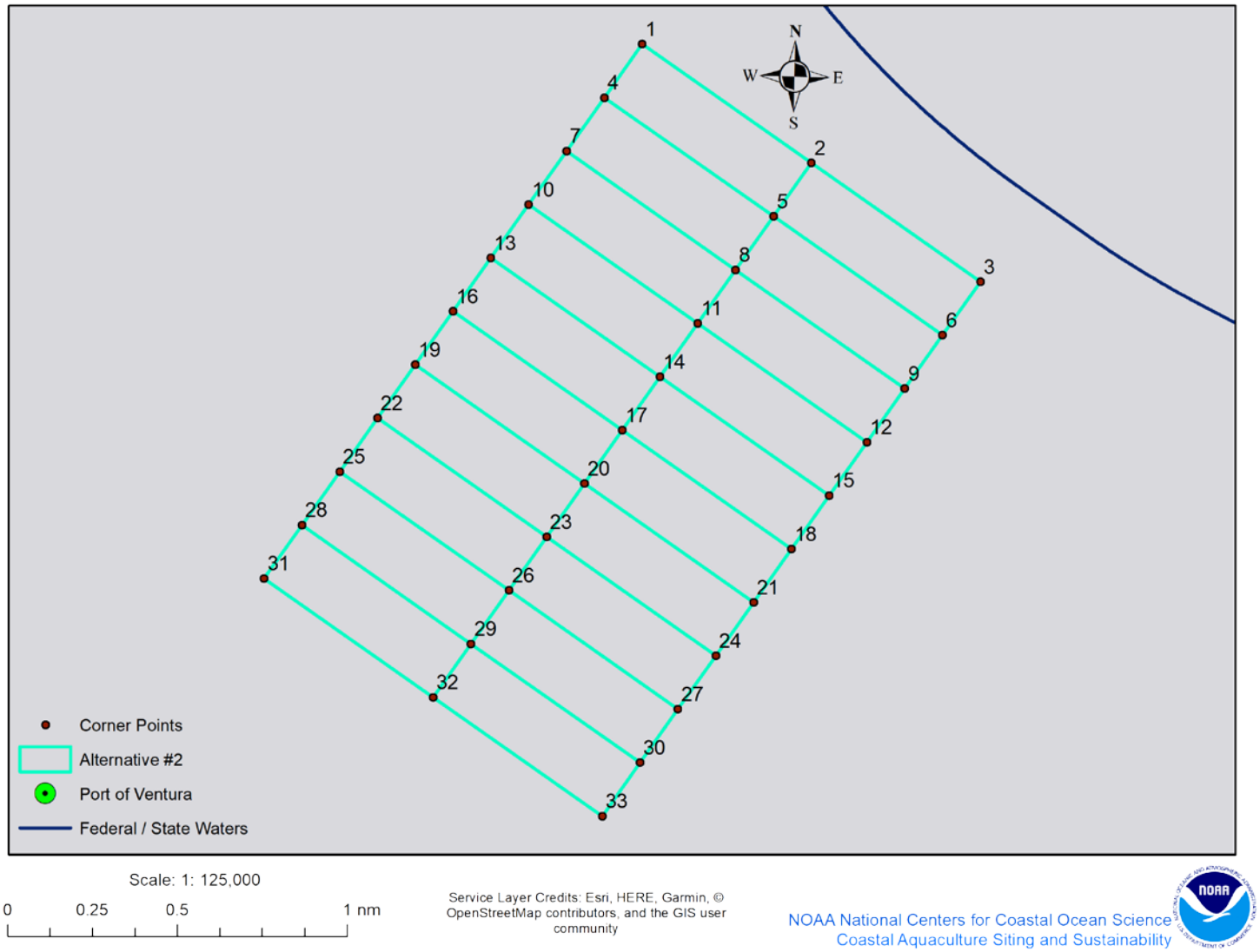
APPENDIX



Appendix 1. Corner points associated with Alternative #1 for the proposed VSE project. Note that the labelled points correspond with the latitude and longitude coordinates described in Appendix 2.

Appendix 2. Corner points and associated latitudes and longitudes for Alternative #1 for the proposed VSE project.

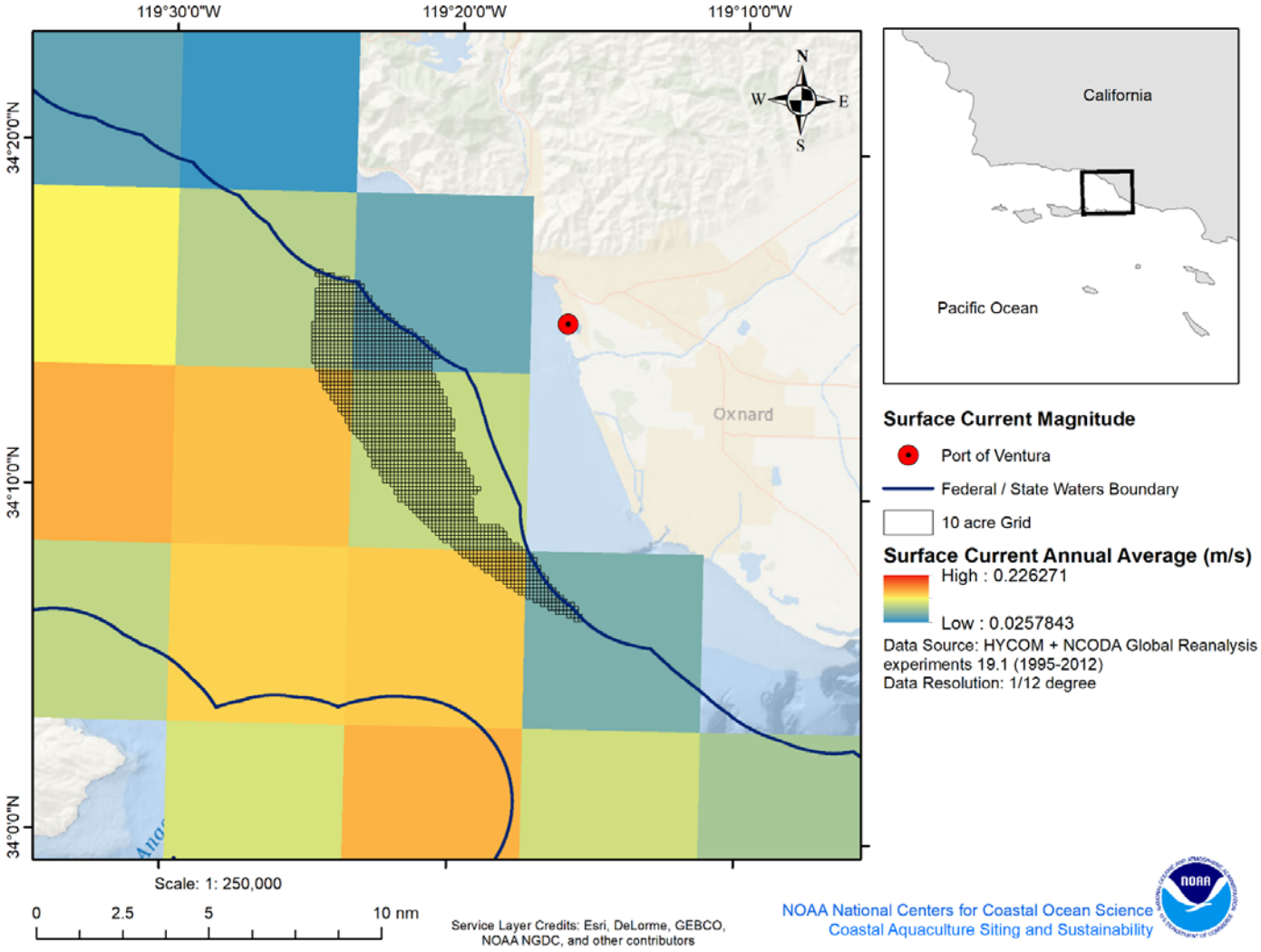
Corner ID	Latitude	Longitude
1	34° 15' 17.528" N	119° 23' 56.582" W
2	34° 15' 6.837" N	119° 23' 37.972" W
3	34° 14' 56.145" N	119° 23' 19.363" W
4	34° 14' 45.452" N	119° 23' 0.755" W
5	34° 14' 34.759" N	119° 22' 42.149" W
6	34° 14' 24.064" N	119° 22' 23.544" W
7	34° 14' 58.821" N	119° 24' 12.166" W
8	34° 14' 48.130" N	119° 23' 53.557" W
9	34° 14' 37.439" N	119° 23' 34.949" W
10	34° 14' 26.747" N	119° 23' 16.342" W
11	34° 14' 16.054" N	119° 22' 57.736" W
12	34° 14' 5.361" N	119° 22' 39.132" W
13	34° 14' 40.113" N	119° 24' 27.749" W
14	34° 14' 29.423" N	119° 24' 9.140" W
15	34° 14' 18.733" N	119° 23' 50.532" W
16	34° 14' 8.041" N	119° 23' 31.926" W
17	34° 13' 57.349" N	119° 23' 13.321" W
18	34° 13' 46.656" N	119° 22' 54.718" W
19	34° 14' 35.223" N	119° 24' 31.808" W
20	34° 14' 24.533" N	119° 24' 13.199" W
21	34° 14' 13.843" N	119° 23' 54.592" W
22	34° 14' 3.151" N	119° 23' 35.986" W
23	34° 13' 52.459" N	119° 23' 17.381" W
24	34° 13' 41.766" N	119° 22' 58.777" W
25	34° 14' 16.514" N	119° 24' 47.388" W
26	34° 14' 5.826" N	119° 24' 28.780" W
27	34° 13' 55.136" N	119° 24' 10.173" W
28	34° 13' 44.445" N	119° 23' 51.568" W
29	34° 13' 33.754" N	119° 23' 32.964" W
30	34° 13' 23.061" N	119° 23' 14.361" W
31	34° 13' 57.806" N	119° 25' 2.966" W
32	34° 13' 47.118" N	119° 24' 44.359" W
33	34° 13' 36.428" N	119° 24' 25.753" W
34	34° 13' 25.738" N	119° 24' 7.148" W
35	34° 13' 15.048" N	119° 23' 48.544" W
36	34° 13' 4.356" N	119° 23' 29.942" W



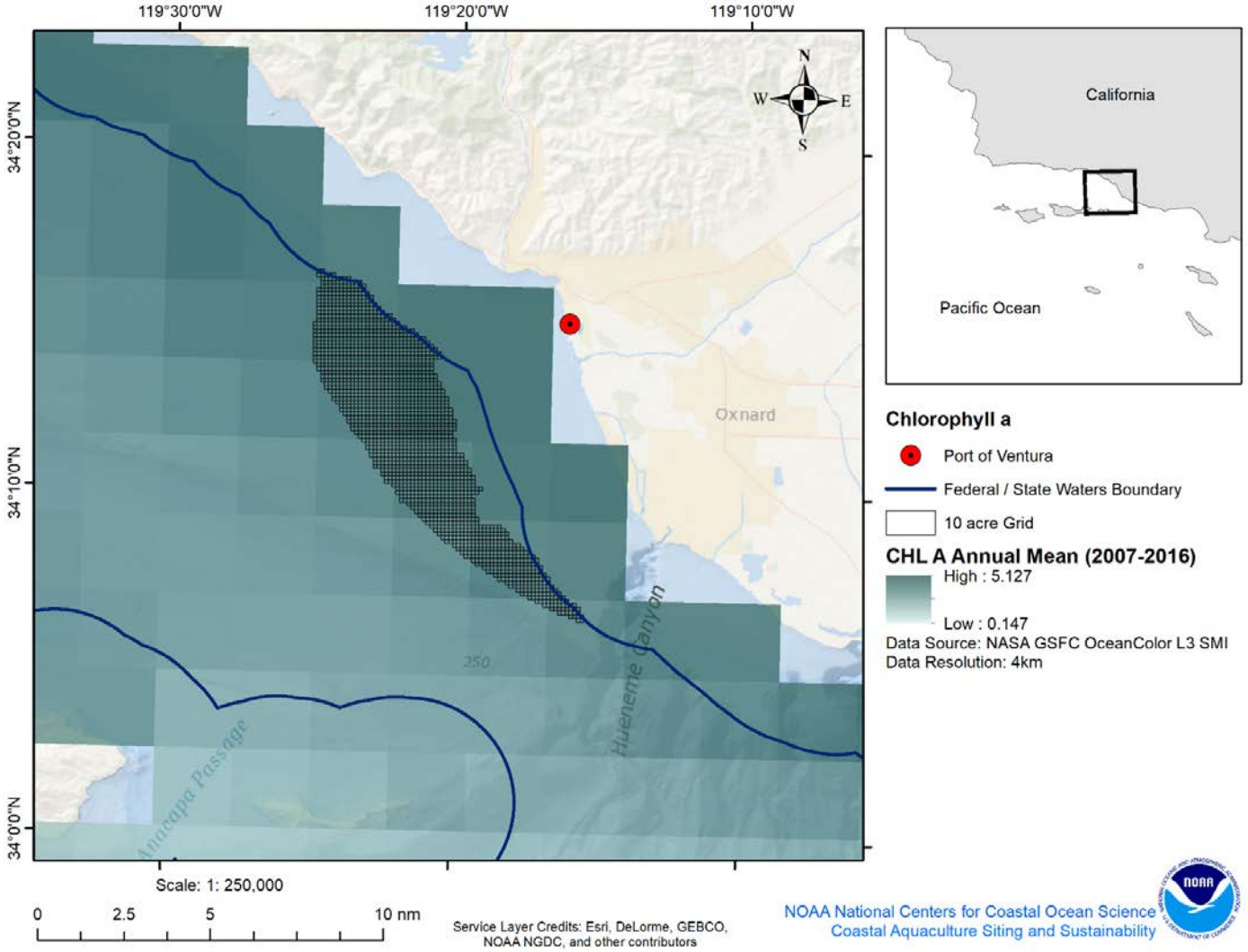
Appendix 3. Corner points associated with Alternative #2 for the proposed VSE project. Note that the labelled points correspond with the latitude and longitude coordinates described in Appendix 4.

Appendix 4. Corner points and associated latitudes and longitudes for Alternative #2 for the proposed VSE project.

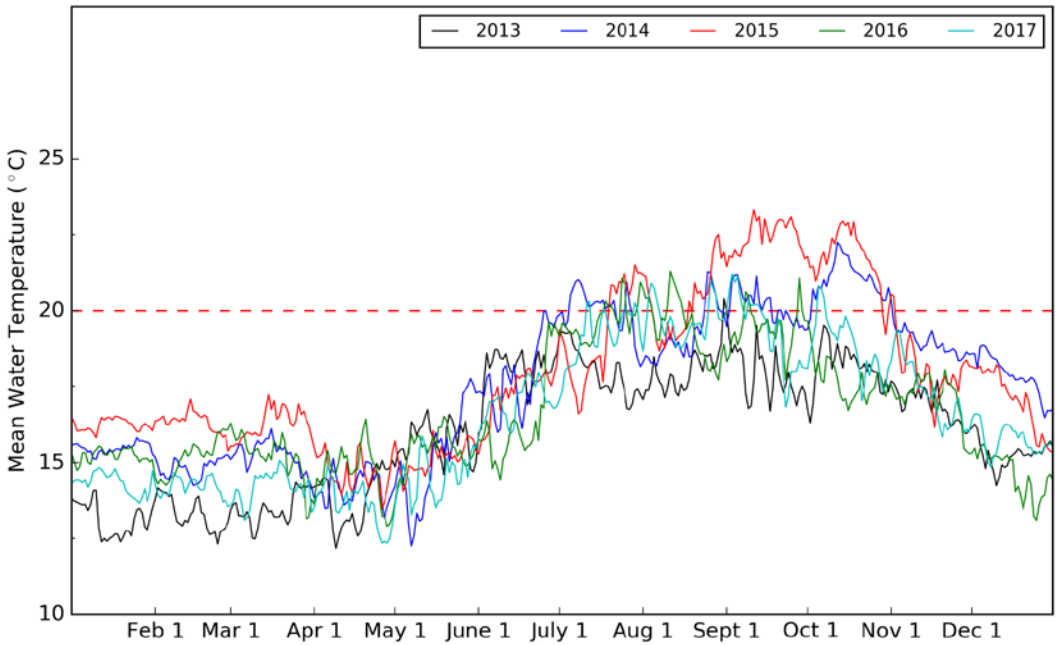
Corner ID	Latitude	Longitude
1	34° 15' 21.520" N	119° 23' 42.518" W
2	34° 15' 1.105" N	119° 23' 5.841" W
3	34° 14' 40.687" N	119° 22' 29.169" W
4	34° 15' 11.867" N	119° 23' 50.309" W
5	34° 14' 51.453" N	119° 23' 13.633" W
6	34° 14' 31.035" N	119° 22' 36.962" W
7	34° 15' 2.214" N	119° 23' 58.101" W
8	34° 14' 41.801" N	119° 23' 21.425" W
9	34° 14' 21.384" N	119° 22' 44.755" W
10	34° 14' 52.561" N	119° 24' 5.891" W
11	34° 14' 32.148" N	119° 23' 29.217" W
12	34° 14' 11.731" N	119° 22' 52.547" W
13	34° 14' 42.908" N	119° 24' 13.682" W
14	34° 14' 22.495" N	119° 23' 37.008" W
15	34° 14' 2.079" N	119° 23' 0.339" W
16	34° 14' 33.254" N	119° 24' 21.471" W
17	34° 14' 12.842" N	119° 23' 44.798" W
18	34° 13' 52.427" N	119° 23' 8.130" W
19	34° 14' 23.601" N	119° 24' 29.261" W
20	34° 14' 3.189" N	119° 23' 52.588" W
21	34° 13' 42.775" N	119° 23' 15.921" W
22	34° 14' 13.947" N	119° 24' 37.050" W
23	34° 13' 53.536" N	119° 24' 0.378" W
24	34° 13' 33.122" N	119° 23' 23.711" W
25	34° 14' 4.293" N	119° 24' 44.838" W
26	34° 13' 43.883" N	119° 24' 8.167" W
27	34° 13' 23.470" N	119° 23' 31.501" W
28	34° 13' 54.639" N	119° 24' 52.626" W
29	34° 13' 34.230" N	119° 24' 15.956" W
30	34° 13' 13.817" N	119° 23' 39.290" W
31	34° 13' 44.985" N	119° 25' 0.413" W
32	34° 13' 24.576" N	119° 24' 23.744" W
33	34° 13' 4.164" N	119° 23' 47.079" W

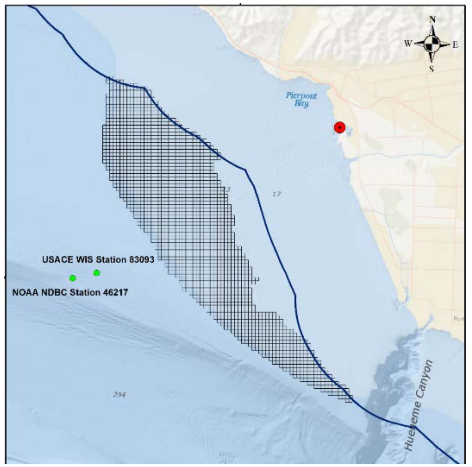


Appendix 5. Annual average surface current velocity (m/s) in relation to the area of interest for the proposed VSE project. The optimal current velocity range for blue mussel (*Mytilus galloprovincialis*) longlines is between 0.025 and 0.10 m/s (Longdill et al., 2008), which generally corresponds with annual average current velocity for the area of interest.

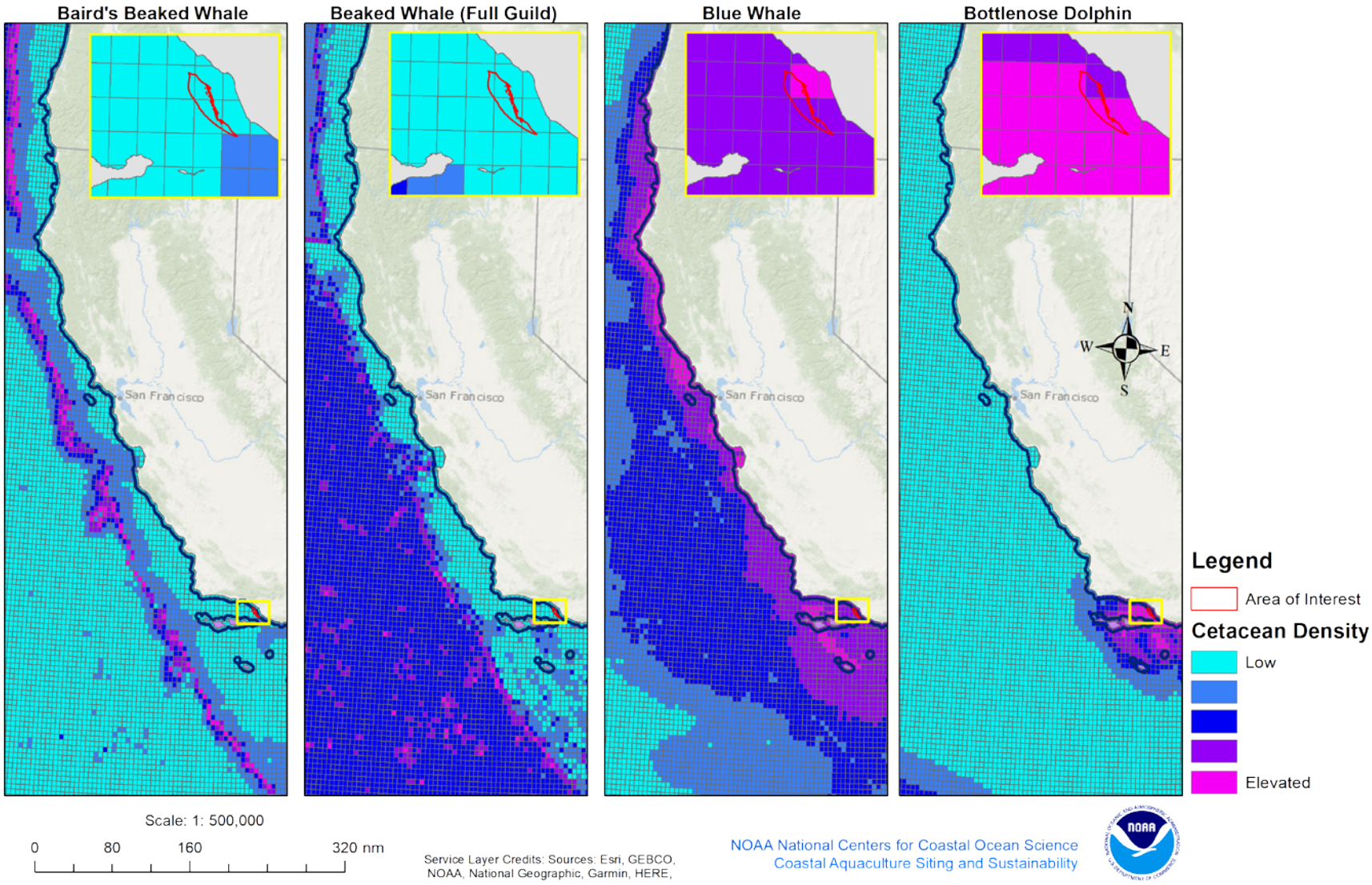


Appendix 6. Annual average chlorophyll *a* concentration (in micrograms per liter) in relation to the proposed VSE project. The optimal chlorophyll *a* range for blue mussels (*Mytlius galloprovincialis*) is between 0.5 and 55 µg/l (Sara et al., 1998), which corresponds with the annual average chlorophyll *a* concentration for the area of interest.

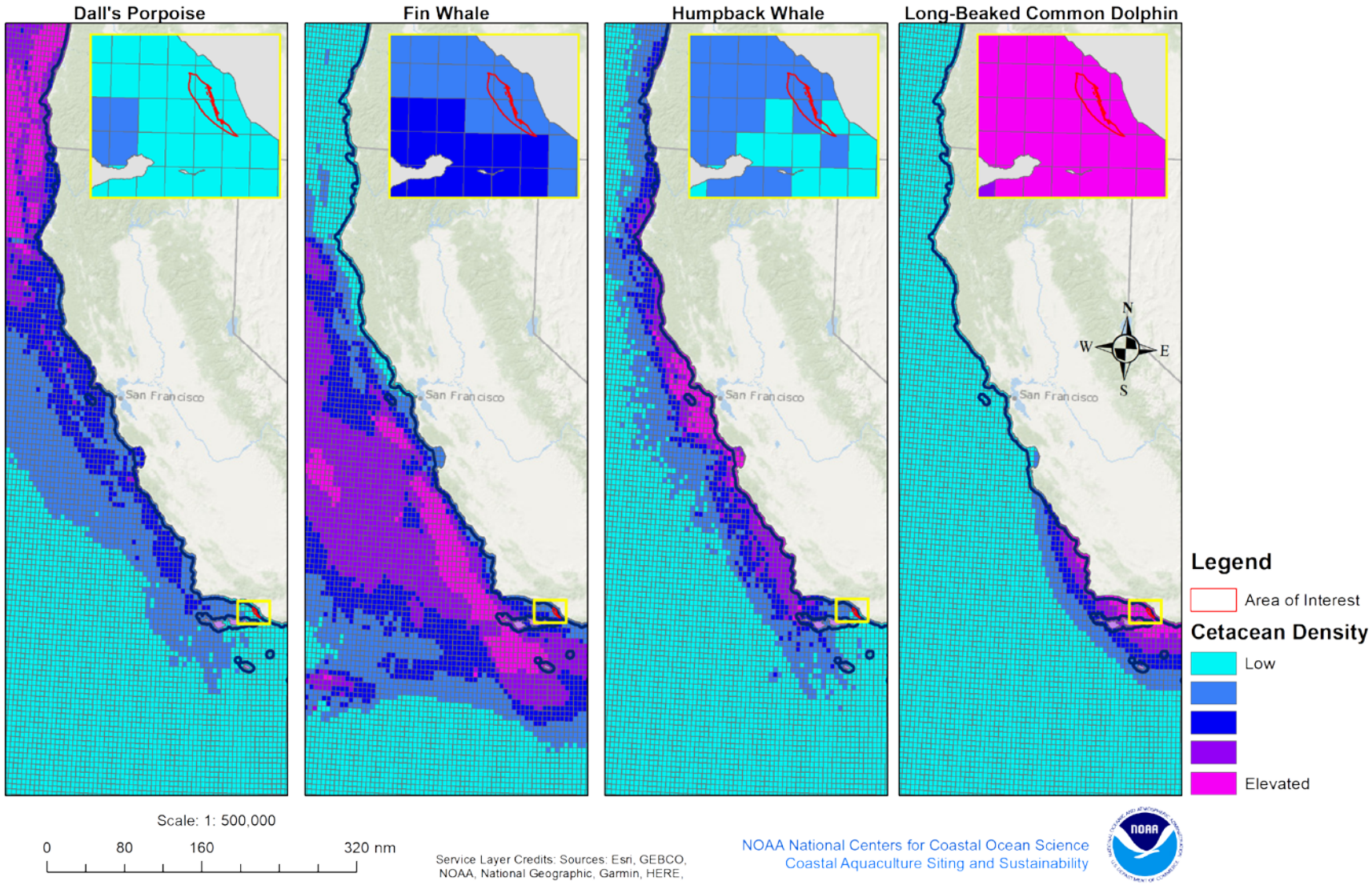




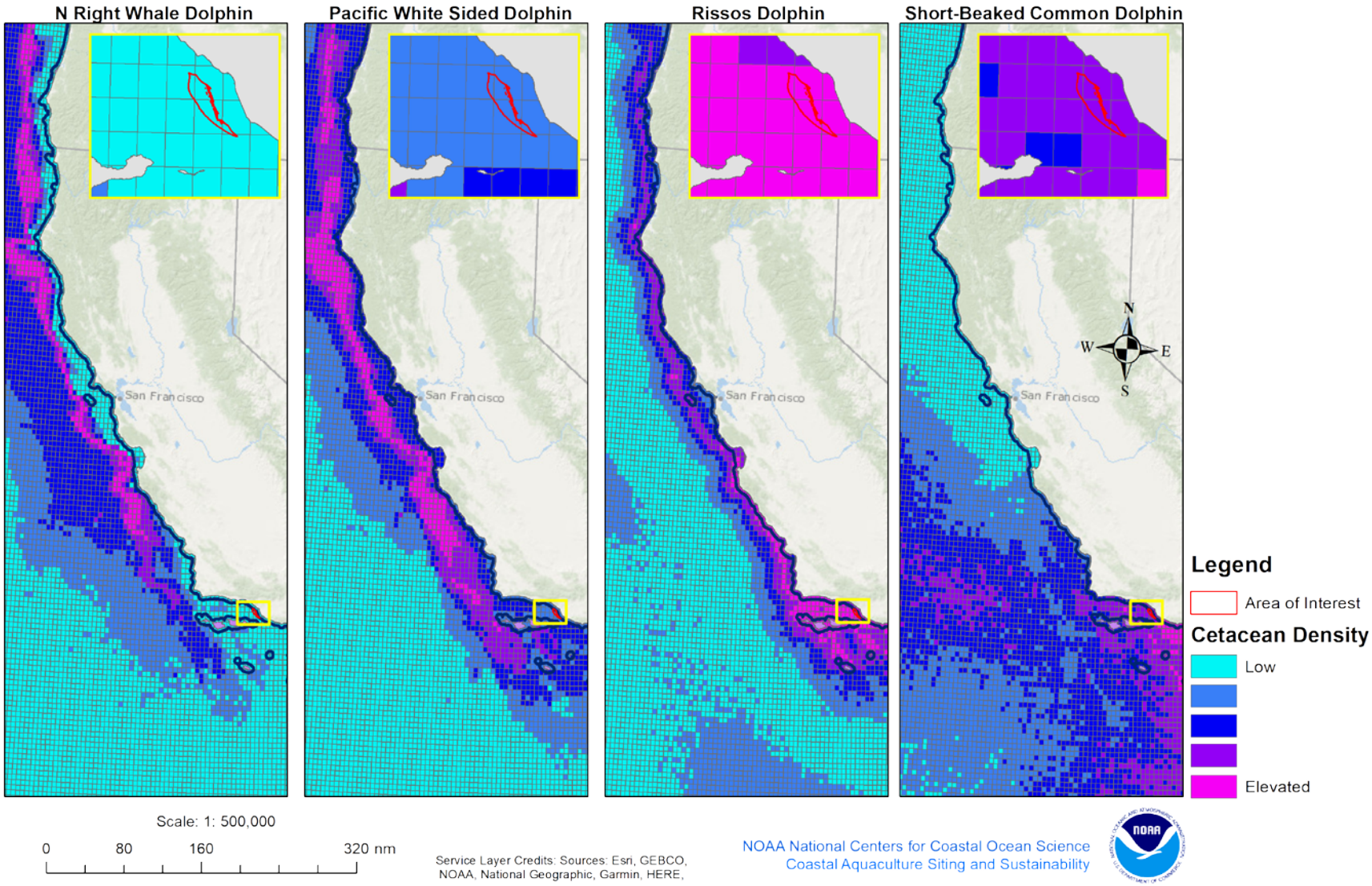
Appendix 7. Mean water temperature over a 5-year period as measured by the NOAA data buoy adjacent to the proposed VSE project area of interest. The acceptable water temperature range for blue mussels (*Mytlius galloprovincialis*) is between 3 and 29 degrees Celsius, with an optimal temperature of 20 degrees Celsius (denoted by the dashed red line in the figure above; Widdows 1978, Newell 1989, and Almada-Villela et al. 1982).



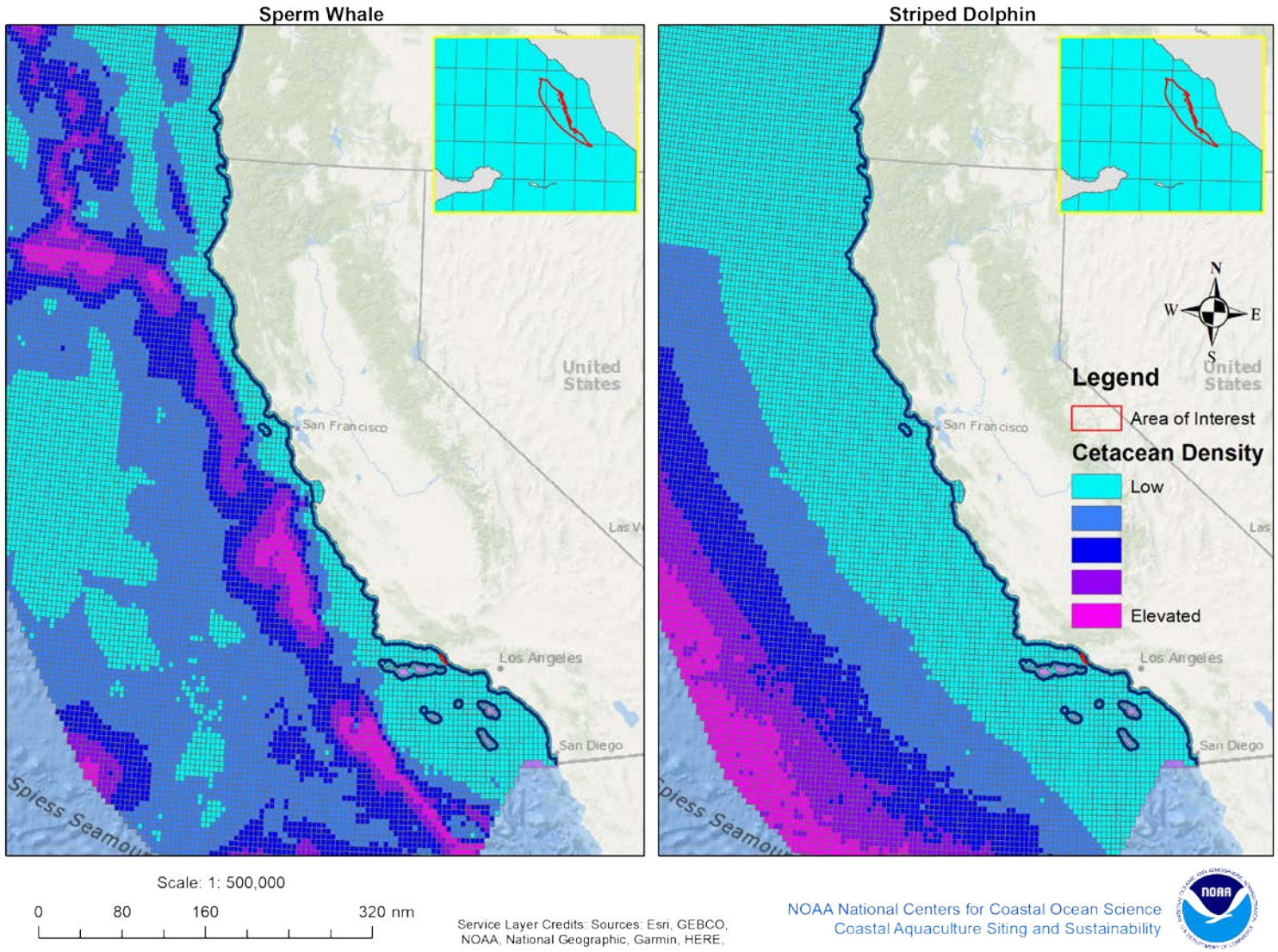
Appendix 8. Predicted habitat-based density and distribution models for multiple cetacean species, derived from NOAA National Marine Fisheries Service's CetSound database. Light blue colors indicate low predicted densities whereas purple colors indicate elevated predicted densities. Note that these maps represent predicted density, but do not necessarily correspond with actual distribution or definitive probability of encountering these species.



Appendix 9. Predicted habitat-based density and distribution models for multiple cetacean species, derived from NOAA National Marine Fisheries Service's CetSound database. Light blue colors indicate low predicted densities whereas purple colors indicate elevated predicted densities. Note that these maps represent predicted density, but do not necessarily correspond with actual distribution or definitive probability of encountering these species.



Appendix 10. Predicted habitat-based density and distribution models for multiple cetacean species, derived from NOAA National Marine Fisheries Service's CetSound database. Light blue colors indicate low predicted densities whereas purple colors indicate elevated predicted densities. Note that these maps represent predicted density, but do not necessarily correspond with actual distribution or definitive probability of encountering these species.



Appendix 11. Predicted habitat-based density and distribution models for multiple cetacean species, derived from NOAA National Marine Fisheries Service's CetSound database. Light blue colors indicate low predicted densities whereas purple colors indicate elevated predicted densities. Note that these maps represent predicted density, but do not necessarily correspond with actual distribution or definitive probability of encountering these species.

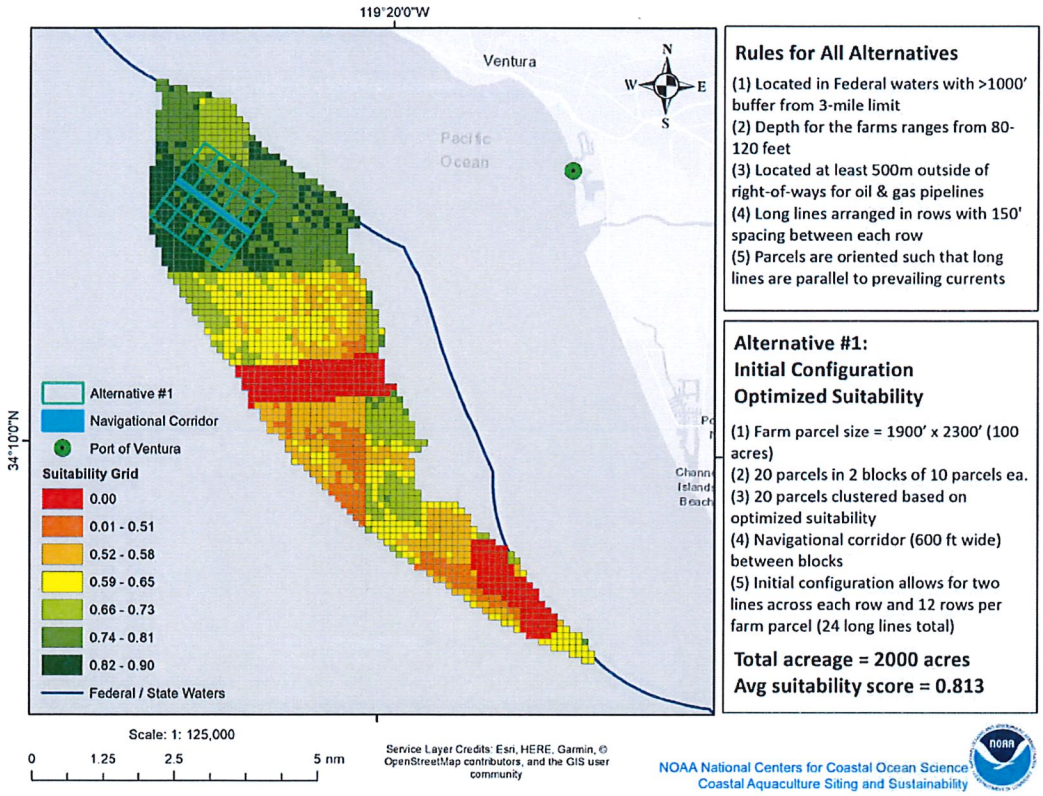


Figure 19. Alternative 1. The first alternative site for VSE was created using their initial configuration, in which the farm parcel design is a 1,900' by 2,300' plot. The alternative site contains 20 parcels, clustered into two blocks, with a 600' navigational corridor between the two blocks. The alternative site was positioned within the 'area of interest' based on optimizing suitability.

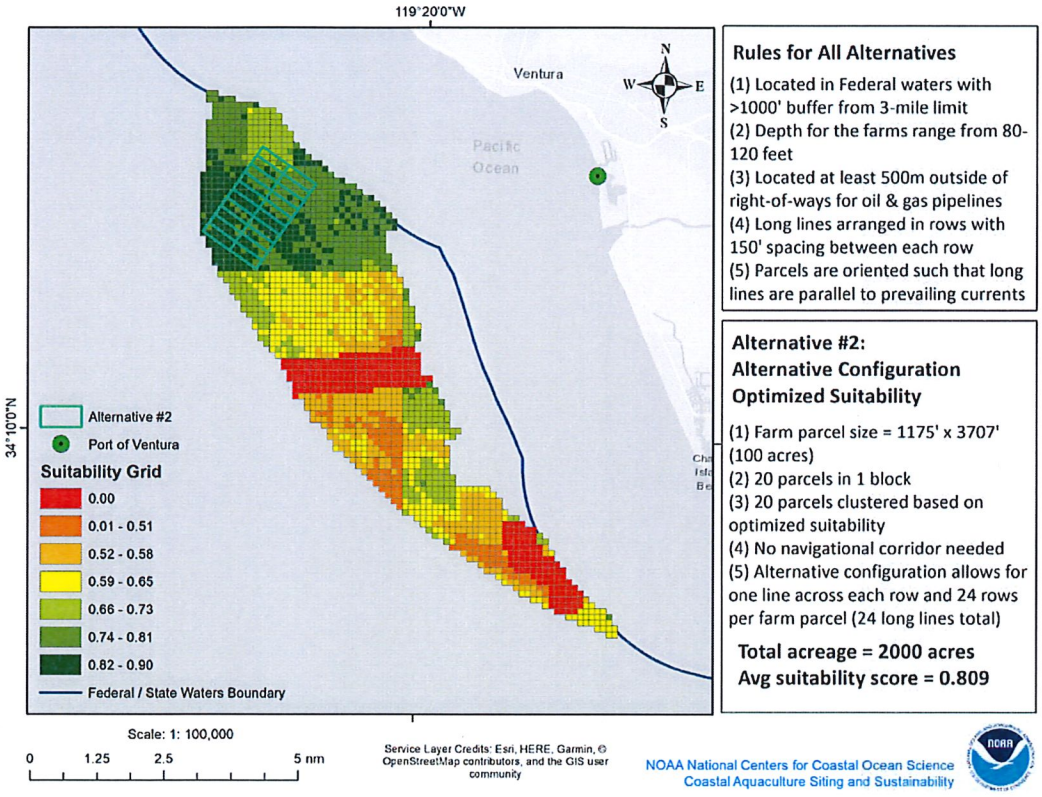


Figure 20. Alternative 2. The second alternative site for VSE was created using their alternative configuration, in which the farm parcel design is a 1,175' by 3,707' plot. The alternative site contains 20 parcels, clustered in one contiguous block. A navigational corridor was not needed since all parcels can be reached on the perimeter of the site. The alternative site was positioned within the 'area of interest' based on optimizing suitability.

U.S. Army Corps of Engineers (USACE)

APPLICATION FOR DEPARTMENT OF THE ARMY PERMIT

33 CFR 325. The proponent agency is CECW-CO-R.

Form Approved - OMB No. 0710-0003 Expires: 01-08-2018

The public reporting burden for this collection of information, OMB Control Number 0710-0003, is estimated to average 11 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding the burden estimate or burden reduction suggestions to the Department of Defense, Washington Headquarters Services, at whs.mc-alex.esd.mbx.dd-dod-information-collections@mail.mil. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.

PRIVACY ACT STATEMENT

Authorities: Rivers and Harbors Act, Section 10, 33 USC 403; Clean Water Act, Section 404, 33 USC 1344; Marine Protection, Research, and Sanctuaries Act, Section 103, 33 USC 1413; Regulatory Programs of the Corps of Engineers; Final Rule 33 CFR 320-332. Principal Purpose: Information provided on this form will be used in evaluating the application for a permit. Routine Uses: This information may be shared with the Department of Justice and other federal, state, and local government agencies, and the public and may be made available as part of a public notice as required by Federal law. Submission of requested information is voluntary, however, if information is not provided the permit application cannot be evaluated nor can a permit be issued. One set of original drawings or good reproducible copies which show the location and character of the proposed activity must be attached to this application (see sample drawings and/or instructions) and be submitted to the District Engineer having jurisdiction over the location of the proposed activity. An application that is not completed in full will be returned. System of Record Notice (SORN). The information received is entered into our permit tracking database and a SORN has been completed (SORN #A1145b) and may be accessed at the following website: http://dpcld.defense.gov/Privacy/SORNsIndex/DOD-wide-SORN-Article-View/Article/570115/a1145b-ce.aspx

(ITEMS 1 THRU 4 TO BE FILLED BY THE CORPS)

1. APPLICATION NO.	2. FIELD OFFICE CODE	3. DATE RECEIVED	4. DATE APPLICATION COMPLETE

(ITEMS BELOW TO BE FILLED BY APPLICANT)

5. APPLICANT'S NAME	8. AUTHORIZED AGENT'S NAME AND TITLE (agent is not required)
First - Oscar Middle - F. Last - Peña	First - Laurie Middle - Last - Monarres
Company - Ventura Port District	Company - Dudek
E-mail Address - opena@venturaharbor.com	E-mail Address - lmonarres@dudek.com
6. APPLICANT'S ADDRESS:	9. AGENT'S ADDRESS:
Address- 1603 Anchors Way Drive	Address- 1630 San Pablo Ave, Suite 300
City - Ventura State - CA Zip - 93001 Country - USA	City - Oakland State - CA Zip - Country - USA
7. APPLICANT'S PHONE NOs. w/AREA CODE	10. AGENTS PHONE NOs. w/AREA CODE
a. Residence b. Business 805-642-8538 c. Fax	a. Residence b. Business 510-601-2515 c. Fax

STATEMENT OF AUTHORIZATION

11. I hereby authorize, Laurie Monarres to act in my behalf as my agent in the processing of this application and to furnish, upon request, supplemental information in support of this permit application.

SIGNATURE OF APPLICANT DATE

NAME, LOCATION, AND DESCRIPTION OF PROJECT OR ACTIVITY

12. PROJECT NAME OR TITLE (see instructions)
Ventura Shellfish Enterprise

13. NAME OF WATERBODY, IF KNOWN (if applicable)	14. PROJECT STREET ADDRESS (if applicable)
Santa Barbara Channel	Address
15. LOCATION OF PROJECT	City - State- Zip-
Latitude: °N See Attach. 2, Figures Longitude: °W	

16. OTHER LOCATION DESCRIPTIONS, IF KNOWN (see instructions)

State Tax Parcel ID Municipality

Section - Township - Range -

17. DIRECTIONS TO THE SITE

The project will consist of twenty 100-acre plots (total of 2,000 acres) located in open federal waters of the Santa Barbara Channel (Channel) in the Southern California Bight (SCB), northwest of Ventura Harbor, with approximate depths ranging from between 80 to 114 feet below sea level. The plots are approximately 3.53 miles from the shore. The closest distance to the 3-mile nautical line is a minimum of 2,900 feet from the plots, with an average closest distance of over 3,000 feet. The closest distance to the City of Ventura limit is 4.5 miles. Ventura Harbor is 4.1 miles from the closest plot (8 miles in distance to the most distant plot).The lease sites are located on sandy bottom habitat outside of any rocky reef habitat, as evaluated in Gentry et al. 2017 and illustrated by NOAA United States West Coast nautical charts (NOAA 2017a).

18. Nature of Activity (Description of project, include all features)

The proposed project will establish a commercial offshore bivalve aquaculture operation based from the Ventura Harbor in Ventura, California, focused on the cultivation of Mediterranean mussels (Mytilus galloprovincialis).

See Supplemental Information Attachment Pages 1-8

19. Project Purpose (Describe the reason or purpose of the project, see instructions)

The proposed project is intended to create economic opportunities for community and marine stakeholders, produce a high value and sustainable seafood product, and provide additional economic revenue sources and commercial activity to maintain the Port of Ventura.

See supplemental Information Attachment Pages 9-17

USE BLOCKS 20-23 IF DREDGED AND/OR FILL MATERIAL IS TO BE DISCHARGED

20. Reason(s) for Discharge

Not Applicable

21. Type(s) of Material Being Discharged and the Amount of Each Type in Cubic Yards:

Type Amount in Cubic Yards	Type Amount in Cubic Yards	Type Amount in Cubic Yards

22. Surface Area in Acres of Wetlands or Other Waters Filled (see instructions)

Acres

or

Linear Feet

23. Description of Avoidance, Minimization, and Compensation (see instructions)

In addition to the design features associated with minimizing impacts, the proposed project will incorporate a number of other resource protection measures that avoid and minimize impacts on the aquatic environment. These resource protection measures will include BMPs listed below. The proposed projects actions have the potential to degrade the biological quality (i.e. water quality, invasive species), as well as potentially cause navigational concerns. Absent mitigation and best management practices, project activities may have an adverse effect on the surrounding area. However, with the incorporation of the following BMPs, the effects would be mitigated to insignificant levels.
See supplemental Information Attachment Pages 18-32

24. Is Any Portion of the Work Already Complete? ☐ Yes ☒ No IF YES, DESCRIBE THE COMPLETED WORK

25. Addresses of Adjoining Property Owners, Lessees, Etc., Whose Property Adjoins the Waterbody (if more than can be entered here, please attach a supplemental list).

a. Address- N/A

City - State - Zip -

b. Address-

City - State - Zip -

c. Address-

City - State - Zip -

d. Address-

City - State - Zip -

e. Address-

City - State - Zip -

26. List of Other Certificates or Approvals/Denials received from other Federal, State, or Local Agencies for Work Described in This Application.

AGENCY	TYPE APPROVAL*	IDENTIFICATION NUMBER	DATE APPLIED	DATE APPROVED	DATE DENIED
CCC	Consistency Certificat	In Progress			

* Would include but is not restricted to zoning, building, and flood plain permits

27. Application is hereby made for permit or permits to authorize the work described in this application. I certify that this information in this application is complete and accurate. I further certify that I possess the authority to undertake the work described herein or am acting as the duly authorized agent of the applicant.

SIGNATURE OF APPLICANT DATE SIGNATURE OF AGENT DATE

The Application must be signed by the person who desires to undertake the proposed activity (applicant) or it may be signed by a duly authorized agent if the statement in block 11 has been filled out and signed.

18 U.S.C. Section 1001 provides that: Whoever, in any manner within the jurisdiction of any department or agency of the United States knowingly and willfully falsifies, conceals, or covers up any trick, scheme, or disguises a material fact or makes any false, fictitious or fraudulent statements or representations or makes or uses any false writing or document knowing same to contain any false, fictitious or fraudulent statements or entry, shall be fined not more than $10,000 or imprisoned not more than five years or both.

18. Nature of Activity

Through this application, the Ventura Port District (VPD) seeks to permit twenty 100-acre plots of ocean space for aquaculture production of the Mediterranean mussel (*Mytilus galloprovincialis*) via submerged longlines in federal waters within the Santa Barbara Channel, proximate to Ventura Harbor.[1]

Project Description

The project consists of twenty 100-acre plots (total of 2,000 acres) located in open federal waters of the Santa Barbara Channel (Channel) in the Southern California Bight (SCB), northwest of Ventura Harbor, with approximate depths at the project site ranging from 80 to 114 feet below sea level, with an average depth of 98 feet. The plot locations are shown in Figure 1, with latitude and longitude coordinates for the outer corners indicated. Each of the 20 plots are 2,299.5 feet by 1,899.5 feet, for an average plot size of 100.27 acres. Each plot will contain up to 24 lines (12 end-to-end pairs), with each line consisting of 575 feet of backbone length and 250 feet of horizontal scope on each end. There will be a 50 foot setback on each end of the pairs (for a total of 100 feet of spacing between lines of adjacent parcels) and 50 foot spacing between the two center pins. Parallel lines will be spaced 150 feet apart, with a 125 foot setback at each of the long sides (for a total of 250 feet of spacing between lines of adjacent parcels).

The sites will be used for growing the Mediterranean mussel (*Mytilus galloprovincialis*) via submerged long lines (*see* Figure 2). The mussels will be grown and harvested by grower/producers who would sub-permit the plots from Ventura Port District, and the mussel product will be landed at Ventura Harbor.

Site Location

The project's twenty 100-acre plots are approximately 3.53 miles from the shore. The closest distance from the plots to the 3-mile nautical line is a minimum of 2,900 feet, with an average closest distance of over 3,000 feet. The closest distance from the growing area to the City of Ventura city limit is 4.5 miles. Ventura Harbor is 4.1 miles from the closest plot (8 miles from the most distant plot). The sub-permit sites are located on sandy bottom habitat outside of any

[1] The VPD also acknowledges the critical assistance of its other key participants who have contributed time, resources, and information to assist with this application, including the Cultured Abalone Farm, Coastal Marine Biolabs, and Ashworth Leininger Group, as well as other participants including Scripps Institution of Oceanography, University of California San Diego, National Oceanic and Atmospheric Administration (NOAA) Fisheries West Coast Region, Woods Hole Oceanographic Institution, the California Department of Fish and Wildlife (CDFW), and Marine Science Institute, Bren School of Environmental Science & Management, University of California Santa Barbara.

rocky reef habitat, as evaluated in Gentry et al. 2017 and illustrated by NOAA United States West Coast nautical charts (NOAA 2017a).

Site Selection

The project was initially proposed to be located in waters of the State of California, i.e., within the 3-mile limit. The VPD, in collaboration with its key participants (collectively the "VSE") undertook extensive site selection public outreach that culminated in the decision to instead locate the project in federal waters so as to minimize conflicts with commercial halibut trawlers based in Ventura and Santa Barbara Harbors.

Site Selection Process Summary

The VSE team hosted a series of seven public educational workshops regarding the proposed project. (*See* http://venturashellfishenterprise.com/index.html - About VSE, scroll down to "Get Involved" and click on "Workshop Archive.")

After these introductory workshops, VSE hosted three site selection workshops to engage with stakeholders to identify the location of the twenty 100-acre parcels within a broader area of interest identified through use of a spatial planning tool developed by researchers at University of California, Santa Barbara, Bren School of Environmental Science and Management (UCSB Bren School). While in-person workshop participation was strongly encouraged, individuals who were not able to attend the meetings were provided the opportunity to comment on site selection through a UCSB Bren School SeaSketch digital mapping and communication portal linked to the VSE website. Notice of the site selection workshops was mailed out to a list of over 500 commercial fishing vessel owners between Goleta and Port Hueneme identified by the California Department of Fish and Wildlife (CDFW); additionally, VSE coordinated with NOAA representatives and commercial fishermen to encourage their attendance. VSE also contacted all of the individuals who registered interest in the proposed project through the VSE website. During and after the site selection workshops the VPD Board of Port Commissioners received written and oral reports on the site selection process at four public meetings held in summer and fall of 2017.

The initial candidate area in state waters was selected by VSE based on marine spatial planning analysis prepared by the UCSB Bren School (Gentry et al., 2017). The site selection analysis included numerous factors related to the suitability of the candidate growing area for mussels; location in State waters near Ventura Harbor for product landing; avoidance of potential pollution sources; and avoidance of conflicts with existing subsurface leases for oil and gas pipelines, etc.

Through the stakeholder engagement process and consultation with its aquaculture specialist, Scott Lindell of Woods Hole Oceanographic Institution, it became clear that location of the project in State waters posed certain issues. Most importantly, VPD received information from local halibut trawlers that the proposed State waters candidate area was located in one of two areas statewide

designated by CDFW as halibut trawl grounds. Further, Mr. Lindell advised that a minimum 80' bottom depth (versus the initial criterion of 60' bottom depth) would reduce exposure to various mussel predator species (*e.g.*, diving ducks) and potential storm surge. Following a November 2017 public hearing, the VPD Board of Commissioners selected a federal waters alternative location, which was identified based on further refinement of the spatial planning analysis by the UCSB Bren School.

Subsequently, NOAA Fisheries Southwest District Aquaculture Coordinator, Diane Windham, connected VSE with NOAA's National Ocean Service staff, which undertook a second siting study focused on federal waters proximate to Ventura Harbor. (*See* "Coastal Aquaculture Siting and Sustainability Technical Report, Ventura Shellfish Enterprise: Aquaculture Siting Analysis Results" prepared by Coastal Aquaculture Siting and Sustainability Program, within the Marine Spatial Ecology Division of the National Centers for Coastal and Ocean Science, National Ocean Service, NOAA, dated September 6, 2018, copy attached.) The siting analysis represents an objective, data-driven approach to identify the locations within federal waters with the highest compatibility with the proposed project. The results of this siting analysis identify two alternative sites (CASS Report Alternatives 1 and 2) proximate to Ventura Harbor given equal consideration of existing use conflicts, including:

- Existing vessel traffic corridors,
- Oil and gas production,
- Commercial fishing (specifically trawl and squid fisheries), and
- Obstructions, including submerged cables and wrecks.

The two CASS Report Alternatives are both situated in the northern portion of the siting analysis study area, which was determined to have the smallest potential overlap with conflicting uses. The primary difference between the two CASS Report Alternative sites is the configuration of sub-permit areas (Figures 3 and 4). Importantly, the two sites overlap with the federal waters alternative site identified in the UCSB Bren School spatial planning analysis, indicating the area has been shown by two independent studies to have the fewest conflicts with other uses and sensitive environmental resources (Figure 5). Following a public hearing in September 2018, it is anticipated the VPD Board of Commissioners approved CASS Report Alternative 1)(also shown in Figure 1) as the preferred project site. CASS Report Alternative 2 (shown in Figure 4) is shown as an alternate site location.

Project Construction

Installation of anchors, longlines, and buoys will be performed by grower/producers in compliance with all permit requirements and VPD sub-permit conditions which will incorporate approved best management practices (BMPs). Submerged longlines consist of a horizontal structural header line, or "backbone," that is attached to the seafloor by helical screw anchors drilled into the sandy

bottom at each end and is marked and supported by a series of buoys along the central horizontal section, as shown in Figure 2. Helical screw anchors have been shown to exhibit superior holding power as compared to other anchoring systems and can be removed or cut below the surface at project decommissioning. Helical screw anchors for mussel farms in open ocean habitats have been installed all over the world, including offshore of Catalina Island, California. Helical screw anchors will be installed by a hydraulic drill with a drill head that operates from a rig lowered to the ocean floor. The helical screw anchors will be screwed approximately 10 to 20 feet deep into the sandy bottom ocean floor. Each 100-acre plot will contain up to 48 anchors for a total of 960 anchors at full project build out.

It is anticipated that the potential noise impacts from the installation of the sand screw anchors using a hydraulic drill will be minimal. The screw anchors are drilled into the seabed using a hydraulic auger controlled at the surface. The drill is submersible and is lowered with the anchor. Noise levels are very low in the water, with a relatively small (50 hp) hydraulic power pack on the installation vessel (Fielder Marine Services, New Zealand, pers.comm.). Rotation speeds are very low, which minimizes entanglement of marine species. The anchor installation disturbs less than 1 square meter of seabed on installation and once installed no rope or chain touches the sea floor, which also minimizes seabed disturbance (Fielder Marine Services, New Zealand, pers.comm.). Marine wildlife, especially cetaceans, is known to be sensitive to noise effects (e.g., NMFS 2007a). However, construction noise levels will be well within acceptable thresholds for both marine mammals and fish (ICF Jones & Stokes and Illingworth and Rodkin, Inc. 2009; NMFS 2007a). Due to the minimal noise level and area of disturbance on the sea floor, an action area of 100 feet is sufficient.

Buoys marking the corners of each parcel will identify the cultivation area for navigational safety and will comply with all regulations for height, illumination, and visibility, including radar reflection. As shown in Figure 2, permanent surface buoys for each longline will consist of two 16-inch surface corner buoys (one corner buoy supporting and marking either end of the backbone), as well as one 16-inch buoy supporting and marking the center pickup line, for a total of three surface buoys per longline. Simulated views of parcel arrays at the surface and underwater are provided in Figures 6 through 9. All surface buoys will be marked with the grower/producer name and phone number. Buoys attached to the central horizontal portion of the backbone line support the line, provide a means of lifting the backbone line to access the cultivation ropes, and determine the depth of the submerged backbone, which will vary seasonally from 15 to 45 feet below the surface. Additionally, a combination of surface and submerged buoys attached to the backbone line will be used during the mussel production cycle to maintain tension on the structural backbone line as the weight of the mussel crop increases. These will consist of 24-inch (or equivalent, with greater than 200 L buoyancy) buoys attached at required intervals along the

surface and connecting to the backbone line, in combination with smaller submerged buoys affixed directly to the backbone line. The combination of surface and submerged buoyancy is designed to create a tensioned but flexible structure that is capable of responding dynamically to surface waves and storms.

The longlines that will be utilized are thick (1-inch diameter), tensioned (to approximately 800 pounds) rope that is not conducive to wrapping around or entangling protected species. The longline configuration produces a fairly rigid tensioned structure from which the cultivation ropes, or "fuzzy ropes" are attached. Fuzzy ropes are characterized by extra filaments that provide settlement substrate for mussels to attach. Fuzzy ropes may be attached to and suspended from the backbone rope either as individual lengths or as a continuous looping single length that drapes up and down over the backbone. The length of each section or loop of fuzzy rope will be approximately 20 feet but the actual length depends on the lifting capacity of the servicing vessel. The length of the central horizontal section of backbone line will be approximately 575 feet, which will support approximately 8,000 feet of fuzzy cultivation line.

The shape of each 100-acre cultivation parcel will be a function of the geometry of the submerged backbone lines and anchoring system. Each horizontal section of the longline will be approximately 575 feet and will require an anchor scope of approximately 2.5 times depth. Therefore, in 100 feet of water depth, scope from the horizontal section of backbone to the helical screw anchor will require 250 feet on each end of the line, making a total length of 1,075 feet from anchor screw to anchor screw. A 100-acre parcel with rectangular dimensions of 1,899.5 feet by 2,299.5 feet will therefore accommodate up to 24 individual longlines (Figures 10 and 11). The submerged longline growing gear configuration will be specifically engineered for open ocean conditions with respect to size and strength of all lines, anchoring, hardware, and buoyancy.

Construction in each individual growing plot will take place only after VPD approval of a sub-permits (or other form of agreement) with the individual grower/producer. While project development is dependent on market demand, VPD estimates that full build out would occur within three to five years after project approval.

Project Operation/Cultivation Methods

The mussels will be grown and harvested by grower/producers under individual sub-permits (or other form of agreement) with VPD that incorporate all project permit conditions and BMPs. All grower/producers will be required to land their mussels at Ventura Harbor. Spat will be purchased from onshore hatcheries certified by CDFW. At the hatcheries, spat are settled on the fuzzy ropes, which is rope woven with additional loops of fiber to create additional settlement substrate and is standard industry practice. When the spat are firmly settled to the ropes, the ropes are covered with

cotton socking material to protect them from shaking off the ropes during transport to the offshore growing site and deployment. The socks hold the spat next to the rope while the mussels naturally attach with their byssal threads, by which time the cotton material naturally degrades. These ropes are then attached to the longlines and buoys, either as single sections of line or as a continuous looping strand attached in intervals.

The mussel grow-out ropes will grow to be stiff with attached mussels encasing the rope core, thus making them very unlikely sources of entanglement. As an additional precaution against entanglement, grow ropes will be attached to the head rope with a low-breaking-strength line, which will facilitate rapid detachment in the unlikely event of any interaction with the longline. To further minimize entanglement potential, a breakaway link will be installed between the surface buoys and vertical lines, similar to strategies used to mitigate potential entanglement in trap fisheries in the northeastern United States (NOAA 2008). Buoy lines between the surface and head rope are generally under tension partially equivalent to their full buoyancy and breakaway link ratings will be specific to buoy size.

Cultivated mussels grow by filtering naturally occurring phytoplankton from the ocean. Juvenile mussels will grow on lines until an intermediate size where the density of mussels on the fuzzy rope becomes limiting to further growth. At this point, a servicing vessel will lift the backbone line in order to access the fuzzy rope stocked with juvenile mussels and pull the fuzzy rope through vessel-based equipment designed to strip the mussels from the fuzzy rope, and then clean, separate, and grade the juvenile mussels by size. Juvenile mussels then will be restocked to clean fuzzy rope and covered with naturally-dissolving cotton socking at a reduced density for their second stage of grow out to market size. All these intermediate mussel-tending steps take place on the servicing vessel.

Maintenance and inspection of the longlines will be carried out at least on a monthly basis and consist of lifting the longlines out of the water and adding additional buoys as necessary to account for increased mussel weight. Inspections of the anchor ropes, anchors, and connecting ropes will be carried out monthly for the first two years following deployment, and in the event there are no marine wildlife entanglements within the first two years, may be reduced to quarterly inspections thereafter. Inspections can include a variety of techniques: recordings by depth/fish finder; remotely operated vehicle (ROV) surveys of lines; and/or monitoring performed by SCUBA divers.

Gear and planted ropes will be inspected regularly as part of a comprehensive monitoring plan, but generally the planted ropes will only be manipulated during initial stocking, intermediate harvest and restocking, and final harvest. Inspection will involve monitoring the all hardware and

rigging and surface buoys and their tension, and checking for escaped gear and potential entanglements. Examples of possible observations that would trigger concern and further investigation are (1) gaps or tangling of dropper ropes detected on depth finder or other structural anomalies, (2) fouling by objects or other marine debris detected in support buoys or buoy deployment lines, and (3) loss of function or damage to devices related to navigational safety.

Harvesting involves separating the mussels from the ropes, followed by cleaning, sorting, and bagging. When the mussels reach market size, which is expected to occur after about one year of total production time, the submerged backbone lines again will be lifted in order to access the fuzzy cultivation ropes, and mussels again will be stripped from the line, cleaned, and separated, and this time size-graded and bagged for landing at the Ventura Harbor as market-ready product. The bagged mussels will be transported to Ventura Harbor for offloading, sale, and distribution. All husbandry activities related to harvesting, grading, and restocking of mussels to cultivation lines will occur onboard the servicing vessel using specialized equipment for that purpose.

Watercraft used for planting, inspections, and harvesting will be home ported at Ventura Harbor. At full project build out 20 to 40 vessels will be traveling to the specific sub-permit sites to conduct these activities. The maximum distance traveled between the harbor and the farthest potential sub-permit area will be approximately 8 miles. Once constructed, it is projected that each sub-permit site will generate an estimated 150 trips per year to accomplish the tasks outlined above.

Landed product will comply with all testing and labeling regulations as part of the California Department of Public Health (CDPH) Shellfish Sanitation Plan and the National Shellfish Sanitation Program (NSSP) guidelines for shellfish grown in federal waters. NOAA-Seafood Inspection Program (NOAA-SIP), in collaboration with the U.S. Food and Drug Administration (FDA), recently began the process of developing NSSP-compliant sanitation protocols for bivalve shellfish cultivated in federal waters.

Organization and Governance

VPD proposes to make mussel growing area sub-permits available to a variety of grower/producers, anticipated to include existing commercial fishermen, existing commercial shellfish businesses, and startups that otherwise would be disinclined to embark on the lengthy and expensive mandatory regulatory pathway. As a requirement of their participation, grower/ producers will be obligated to operate under robust environmental monitoring guidelines and BMPs incorporated into the proposed project's entitlements. While all grower/producers will be held accountable for compliance with these requirements, VPD is ultimately responsible for compliance with all permit conditions and required BMPs. All grower/producer responsibilities would be spelled out as conditions in grower/producer sub-permits with VPD, thus establishing

VPD enforcement authority for those conditions. VPD anticipates further discussions with the U.S. Army Corps of Engineers (USACE) concerning the proposed sub-permitting process once the USACE has had an opportunity to review the application.

Project Decommissioning

The project will include a decommissioning plan, which will provide for the removal of all equipment and structures in each sub-permit area associated with project activities when activities in that sub-permit are terminated. The decommissioning plan will be a requirement of each sub-permit. Financial assurances to guarantee implementation of the decommissioning plan will be required of each grower/producer and reviewed periodically.

19. Project Purpose

Objectives of the proposed project are:

1. To increase the supply of safe, sustainably produced, and locally grown shellfish while minimizing potential negative environmental impacts;
2. To enhance and sustain Ventura Harbor as a major west coast fishing port and support the local economy;
3. To provide economies of scale, pre-approved sub-permit area, and technical support to include small local producers who would not otherwise be able to participate in shellfish aquaculture;
4. To provide an entitlement and permitting template for aquaculture projects state-wide;
5. To enhance public knowledge and understanding of sustainable shellfish farming practices and promote community collaboration in achieving VSE objectives;
6. To advance scientific knowledge and state of the art aquaculture practices through research and innovation.

1. To increase the supply of safe, sustainably-produced, and locally-grown shellfish while minimizing potential negative environmental impacts

The proposed project will serve to diversify the catch and stabilize the commercial fishing fleet home-ported at Ventura Harbor. The proposed project also will provide a locally cultivated, sustainably raised food source, and significantly advance state and national goals and objectives for increased domestic aquaculture and a secure food supply. The proposed project is supported, in part, through the NOAA Sea Grant program, the goal of which is to contribute to "a safe, secure and sustainable supply of seafood to meet public demand."

Ventura Harbor is home to one of the top fisheries off-loading harbors in the state. One of the core goals of the VSE project is to enhance the Ventura Harbor working waterfront with a sustainable and dependable seafood harvest. The project will help meet state and federal goals for the growth of domestic shellfish aquaculture to better serve the U.S. population demands for new, sustainably grown protein sources. This is consistent with the VPD's goal of upgrading infrastructure, equipment and facilities for a modernized, efficient and safe working harbor. A 2007 California Sea Grant Extension Program report titled "Commercial Fisheries of the Santa Barbara Channel and Associated Infrastructure Needs" noted that diversification of fishing operations through the development of new fisheries could provide new business opportunities.

The proposed project offers a number of other benefits related to food supply, because at present the mussel market in the United States and locally is dominated by imports from Canada, Chile, New Zealand, and Europe. California is the third-largest consumer of shellfish in the United States, and current state production lags far behind demand. Shortfalls are met by importation,

which contributes to the state and national seafood deficit and increases our carbon footprint by the need to transport shellfish into the state from around the world.

This project will supply a locally grown mussel product to an established market with the potential for expansion. Mussels provide a high-protein, low-fat source of human nutrition. Compared with other cultivated protein sources (*e.g.,* beef, pork, chicken), mussels are a more environmentally sustainable food source, require no added feed or water, have significantly lower associated greenhouse gas emissions, and use ocean areas rather than land for production (see Table 1). The proposed project at build out would produce 9,000 to 11,000 tons of mussels for market per year. Further, by serving as a template for additional offshore shellfish-growing projects, this proposed project aims to increase the efficiency of shellfish permitting and thus provide a template to promote additional shellfish growing operations offshore of California.

Table 1
Comparison of Sustainability Indicators among Animal Production Systems

Animal Type	Food Conversion (kg feed/kg edible weight)	Protein Efficiency (%)	Nitrogen Emissions (kg/ton protein produced)	Phosphorous Emissions (kg/ton protein produced)	Land (tons edible product per HA)	Consumptive Freshwater Use (m^3/ton)
Beef	31.7	5	1,200	180	0.24–0.37	15,497
Chicken	4.2	25	300	40	1.0–1.20	3,918
Pork	10.7	13	800	120	0.83–1.10	4,856
Finfish (average)	2.3	30	360	48	0.15–3.70	5,000*
Bivalve mollusks	Not fed	Not fed	-27	-29	0.28–20	0

Source: Aquaculture Workshop 2015.
Notes: kg = kilogram; HA = hectare; m3/ton = cubic meters per ton.
* Consumptive water use is difficult to compare across finfish aquaculture production systems because of variability in feed sources and depending on whether the system is freshwater or saltwater.

To minimize conflicts with other ocean uses and ensure location away from pollution sources, the proposed location was selected after multiple stakeholder workshops and consultations, noticed public meetings of the Ventura Port Commission, and utilization of two different marine spatial planning tools. (*See* "18. Nature of Activity" discussion.)

The proposed project is consistent with California's Aquaculture Development Act (California Public Resources Code, Sections 826–828), which encourages the practice of aquaculture to augment food supplies, expand employment, promote economic activity and protect and better use the land and water resources of the state, and Assembly Joint Resolution 43 (2014), wherein the State Legislature states its support "to protect existing shellfish beds and access to additional acreage for shellfish farming and restoration." The proposed project is also consistent with NOAA's National Shellfish Initiative (NOAA 2013) and National Marine Aquaculture Policy (NOAA 2011), which seek to increase populations of bivalves in coastal waters through commercial aquaculture production and acknowledge the multiple benefits of shellfish aquaculture, including providing new jobs and business opportunities, meeting the growing demand for seafood, and providing habitat for important species. Finally, the proposed project furthers the goals of the National Ocean Policy Implementation Plan (National Ocean Council 2013), one of which is to increase efficiencies in the permitting process and encourage agency coordination to facilitate additional marine aquaculture development.

2. To enhance and sustain Ventura Harbor as a major west coast fishing port and support the local economy

The proposed project is very important to the future of Ventura Harbor. The harbor's status as a robust commercial fishing port is vital to VPD qualifying for USACE harbor dredging funds since the harbor is not a deep water port and does not house a U.S. Coast Guard station. Absent USACE dredging funds the harbor will silt up and close.

Integral to the VPD's mission is to provide a safe and navigable harbor that benefits fisherman. Included amongst the VPD's goals is to maintain and enhance a safe and navigable harbor by:

- Securing federal funding to support the USACE operation and maintenance program at the harbor federal entrance;
- Dredging the Inner Harbor and preserving infrastructure;
- Providing superior Harbor Patrol, Maintenance, and related Port District services;
- Upgrading infrastructure, equipment and facilities for a modernized, efficient and safe working harbor

To meet its mission and goals the VPD allocates annual revenues to operations, maintenance and capital improvements. In FY18-19 operating revenues were approximately $10 million and operating expenses were approximately $8.7 million. However capital improvements totaled $5.2M, causing the VPD to utilize approximately $3.9 million in unrestricted reserve funds. Due to VPD reserve fund policies, this is not sustainable at this level annually. This means that some combination of increased revenues or revenue sources and alternative methods to finance some capital infrastructure projects is

necessary. Specific to the commercial fishing industry, the VSE project can play a vital role in VPD annual revenue generation that can be leveraged for the financing of commercial fishing infrastructure while creating other positive economic impacts and maintaining dredging priorities as discussed further below.

The VPD, which is an independent special district, receives approximately 88-90% of its revenues from commercial leases, boat slip fees and fish off-loading charges. The remaining funds are local property tax revenues accounting for approximately 10-12% of revenues. These property tax revenues have consistently been allocated to public safety for Harbor Patrol but do not cover these operational costs. Additionally, the VPD is expanding Harbor Patrol operations to "24-7" due to increased demand for services which further increases annual operating expenses for public safety functions.

Dredging

The VPD is completely dependent upon the USACE for the annual maintenance of the harbor's federal entrance system, and the unloading of commercially harvested seafood at the harbor is a primary justification for this federal support. Without diversified fisheries delivering consistent fish offloading necessary to justify federal funding to USACE for Ventura Harbor dredging, the Harbor risks future entrance closures.

The entrance system includes the following components:

1. A 1,750 foot entrance channel
2. A 600,000 cubic yard sand trap
3. A 1,800 foot offshore breakwater
4. A 1,550 foot north jetty
5. A 250 foot middle jetty
6. A 600 foot south beach groin

The annual maintenance dredging of the entrance channel and sand trap currently require between $5,000,000 and $7,000,000 per year. The cost of maintaining the rock structures (i.e. breakwater, jetties and groin), while not occurring on an annual basis, has nonetheless averaged about $1,280,000 per year over the last 15 years. Were it not for the federal assumption of these maintenance needs, the harbor's federal entrance channel would simply shoal to closure, and all of the maritime interests in the harbor, both commercial and recreational would lose ocean access.

In order to avoid that possibility, in March 2012, when federal funding was inadequate for the USACE to complete the necessary dredging of the harbor entrance area, the VPD was compelled to utilize $1,500,000 of its limited reserves to finish the dredging. It was only possible for the VPD to take that

action, however, because the USACE had already absorbed the contractor's $1,000,000 equipment mobilization cost. Even under such limited conditions, it is simply not sustainable for the VPD to financially support the federal dredging program.

Infrastructure

One of the core goals of the VSE project is to enhance the Ventura Harbor working waterfront with a sustainable and dependable seafood harvest. This is consistent with the VPD's goal of upgrading infrastructure, equipment and facilities for a modernized, efficient and safe working harbor. The existing commercial fishing businesses generate direct revenue to the VPD in the form of commercial boat slips and fish offloading fees. These fees generate approximately $1.2M in annual revenue that supports marina operations and some infrastructure needs. The commercial boat slip fees are highly dependent upon a stable commercial fishing fleet, which depends largely upon the ongoing success of the California Market Squid industry along with other smaller fisheries. This industry has proven resilient but unpredictable from year to year due to a variety of impacts from weather, water temperatures, and market forces, including more recently imposed tariffs on international seafood products. For example, the VPD has had years where 60 million pounds or more in squid was offloaded at the Harbor while other years the VPD has had less than 20 million pounds offloaded at the Harbor. The VPD's off-loading fees are generated largely by the squid industry; however, these fees only represent 10% of the $1.2M in total revenue identified above (approximately $120,000 annually).

The VPD, as part of its annual budget, prepares a 5-year capital improvement plan (CIP) which anticipates large scale projects that are necessary to maintain a modernized, efficient and safe working harbor. These needs are particularly pressing given the harbor's age, with many facilities 35-55 years in age. The scale of these projects necessitates capital financing, since annual revenues are largely utilized for ongoing operations and pay just a portion of capital improvements.

For example, a current project receiving capital financing is the Village Commercial dock replacement. This $4.6 million project seeks to replace the dilapidated dock system, which is used primarily by 42 purse seiners and related commercial fishing vessels such as 20 light boats for the California Market Squid fleet. The project financing requires that ongoing annual VPD revenues be used to support the debt service.

In the next five to ten years, the VPD will need to finance a substantial amount of new infrastructure construction and likely dredge the inner harbor for commercial fishing boat needs and revetment maintenance, neither of which is a USACE-funded activity because it is not part of the Harbor's federal entrance. Other projects may include future replacement of an older fisheries building, reconstruction of a fish pier, replacement or addition of fish offloading cranes, modernization of fish handling facilities, worksite improvements, fish equipment storage and fleet parking needs. It is conceivable that

the VPD could finance $20M or more in commercial fishing infrastructure costs to support ongoing operational needs. This is in addition to the $4.6 million in debt discussed above. For illustrative purposes only, if the VPD were to borrow $20 million over 30 years at current interest rates, the annual debt service costs to the VPD for this debt would be approximately $1.2 million.

The VPD is subject to significant due diligence and financial "tests" in order to borrow capital project funds. While the VPD continues to meet these borrowing requirements, and maintains a strong financial position, it is clear that the VPD must seek to diversify its fisheries to support commercial fishing operational and infrastructure costs. Annual boat slip and offloading fees are used to fund ongoing fisheries and marina operations but do not provide the necessary funding to complete large-scale capital projects. Thus, the implementation of new fisheries and resulting revenues is of major importance to the VPD.

The VSE project anticipates wholesale market values of $2.76M per 100-acre parcel or $55.2M at full build-out of 20, 100-acre parcels. Many factors will ultimately determine actual revenue, with the most critical factor being the size of the approved project, as well as growing conditions, operational interruptions, time period to full build out, market conditions, project and operational costs, etc. However, in utilizing these initial projections the VPD is evaluating potential revenue sharing models as discussed below.

The VPD is evaluating a new revenue approach with the VSE project. The VPD will be the project permittee. As such, the VPD may consider implementing a participation fee (e.g. 3-5% of gross wholesale value) for future private grower producers, rather than just rely on fish offloading and slip fees to help fund infrastructure needs. For example, an operating fee of 3% of the gross wholesale value at full build-out as described above could generate annual revenues to the VPD of approximately $1.65M. These funds generated will be used to support the VPD's project administration costs and could help support future debt issued for commercial fishing infrastructure (e.g. $1.2M annual debt service as described above). A project of a lesser scale would directly impact future VPD annual revenues that can be used in part to support the financing of ongoing commercial fishing infrastructure and harbor needs.

3. To provide economies of scale, pre-approved sub-permit area, and technical support to include small producers who would not otherwise be able to participate in shellfish aquaculture

Designed economies of scale will maximize the previously described direct and indirect secondary benefits of the proposed project. Significant expenses are associated with permitting,

environmental review, compliance with shellfish health regulations, and environmental monitoring; therefore, leasing and permitting the proposed project as one will provide economies of scale and eliminate a significant impediment to market diversification and participation by small shellfish companies or new investors. By permitting all the growing areas as a single proposed project, individual grower/producers benefit from the collective upfront permitting efforts of VPD.

As a specific example of a regulatory economy of scale, monitoring requirements such as implementation of a sediment quality monitoring plan are more efficiently handled at the VPD project scale as opposed to separate efforts by individual grower/producers. VPD, acting as the responsible party for BMP compliance, can use collective funds to monitor sediment conditions within the larger project area, offering technical sampling and reporting consistency, along with facilitating collection of a larger data set, which will offer greater opportunities to track overall project impacts. Collective sampling and reporting will also yield efficiencies in compliance review for the agencies, as VPD can act as a clearinghouse for information, handling the initial screening and vetting of information before it is transmitted to the appropriate regulatory agencies.

Project grower/producers will have access to a pooled, centralized and comprehensive monitoring and reporting program for all the growing plots. All necessary permits and entitlements will already have been obtained by VPD, making participation by the grower/producer "turn-key." The costs to the grower/producer associated with ongoing water quality sampling and monitoring will be reduced by the efficiency of a centralized pooled program, which will in turn reduce operating costs and increase the direct benefit to the grower/producer.

Further, grower/producers will also have access to technical expertise and the accepted BMPs developed through the permitting process and described below. Similarly, grower/producers will enjoy access to centralized marketing and branding of a Ventura-specific premium seafood product grown and harvested in the proposed area.

Each of these elements of the project design contributes cumulatively to a total package, which in turn contributes positively, and materially to the ongoing operational health and vitality of the Ventura Harbor community. The costs associated with the proposed project (i.e. permitting and monitoring) would be too high for a small operation. In order for the sub-permits to be affordable for individual grower/producers, the proposed project must be a large scale project.

4. To provide an entitlement and permitting template for aquaculture projects state-wide

A major goal of the proposed project is delineation of a streamlined strategic permitting pathway that will not only facilitate the establishment of a Ventura Harbor-based shellfish operation promoting sustainable economic development, but that will more generally serve as a model to

help other entities address regulatory barriers and planning challenges that currently create impediments to the expansion of the shellfish aquaculture industry in California.

The proposed project is a unique approach to developing environmentally and economically sustainable shellfish commerce with product landed at the Ventura Harbor. This initiative is novel in several ways.

- The project proposes to produce bivalve shellfish in the offshore marine environment using cultivation practices that, although well-established worldwide, are in their infancy in the United States, particularly on the West Coast.

- The proposed project is a cooperative and collaborative effort taking place in an open-source format with state and federal regulators to establish a template for additional future shellfish growing operations in California.

- The proposal to permit a group of twenty 100-acre growing plots allows for participation by potential grower/producers who might otherwise be precluded from participation in aquaculture because of the significant regulatory burden of obtaining the required government approvals.

- The scale of the proposed project allows the individual grower/producers to benefit from centralized environmental monitoring, product safety testing, and product marketing.

- This proposed project as it is scaled will bolster the working waterfront in Ventura Harbor, providing economic benefits to VPD, its tenants, and the community.

The proposed project seeks to significantly improve the interagency review and permitting process for offshore shellfish aquaculture and create a comprehensive and efficient permitting process that is cost effective for both review agencies and applicant alike. In doing so, the overarching objective is to establish a viable and replicable permitting pathway model that satisfies the requirements of the review and permitting agencies and may be used by any prospective shellfish grower/producers to facilitate project design and aid in the evaluation of future offshore aquaculture proposals.

5. To enhance public knowledge and understanding of sustainable shellfish farming practices and promote community collaboration in achieving VSE objectives

Realizing the vision of an improved permitting process requires coordinated planning among all stakeholders to attain the full environmental and economic benefits. VPD and key VSE participants are committed to transparency, open communication, and comprehensive public education and outreach efforts. To this end, VPD and key VSE participants hosted an ongoing

series of informational public meetings to discuss the social, economic, environmental, scientific, and technological variables encompassed by the proposed project. These interactive, workshop-style meetings provided a forum for open dialog among all interested members of the general public, state and federal agency representatives, shellfish industry leaders, and environmental and scientific leaders to discuss the policy, planning, and scientific issues surrounding the establishment of a Ventura Harbor-based offshore shellfish aquaculture operation. This was a critical first step toward productive collaboration and ultimately, overall project success.

6. To advance scientific knowledge and state of the art aquaculture practices through research and innovation

The project is envisioned to include both research and education components. The project includes as additional participants, researchers and educators with the following institutions:

- UCSB Bren School
- University of California, San Diego, Scripps Institution of Oceanography
- Woods Hole Oceanographic Institute
- NOAA Fisheries West Coast Region

The project will serve an in situ working laboratory for improving shellfish aquaculture techniques and will be used as an open-water classroom. Qualified researchers affiliated with universities (i.e., UCSB Bren School, or University of Southern California, etc.), or qualified marine research institutes (i.e., Woods Hole Oceanographic Institute, Scripps Institution of Oceanography, etc.) will have access to aquaculture plots to conduct research and monitoring approved by the VPD; however, access may be limited in certain circumstances to respect grower/producer proprietary data or technology or to accommodate a grower/producer's operational and logistical needs in operating the farm. VPD will review and approve research projects in consultation with USACE, NMFS, NOAA, and any affected grower/producers. Grower/producers will be fairly compensated for the use of their vessels, equipment, and fair market value of any mussels produced or generated as part of approved research projects.

23. Description of Avoidance, Minimization, and Compensation

Avoidance of User Conflicts

As described previously, the size of the proposed project was determined based on needing to meet the project objectives, primarily Objectives 2 and 3:

> 2. To enhance and sustain Ventura Harbor as a major west coast fishing port and support the local economy;
> 3. To provide economies of scale, pre-approved sub-permit area, and technical support to include small local producers who would not otherwise be able to participate in shellfish aquaculture.

To meet its mission and goals the VPD allocates annual revenues to operations, maintenance and capital improvements. As stated in Section 19, Project Purpose, the VPD had a negative cash flow of approximately $3.9 million in FY18-19, which was funded by use of unrestricted reserves, but is not sustainable at this level annually. As such, a combination of increased revenues or revenue sources and alternative methods to finance some capital infrastructure projects is necessary. Specific to the commercial fishing industry, the VSE project can play a vital role in VPD's annual revenue generation that can be leveraged for the financing of commercial fishing infrastructure while creating other positive economic impacts and maintaining dredging priorities. *See* Section 19 for further discussion of these issues.

There is a strong nexus between the continued receipt of federal support and the vitality of the harbor's commercial fishing operations and landings. In order to ensure that dredging continues, the harbor needs to increase the tonnage landed at Ventura Harbor in a sustainable manner. As other forms of commercial fishing are not currently a viable or sustainable option, the proposed project will significantly increase and diversify the catch landed at Ventura Harbor. A smaller scale fishery is unlikely to provide enough tonnage to ensure dredging continues.

Similarly, it is not feasible to provide economies of scale to small, local producers without a large scale operation. The operation costs, such as monitoring, permitting, and technical support, would be far too high with a smaller size. In order to have a sustainable fishing operation with a recognizable product, the proposed project needs to be a larger operation.

Siting Analysis

Once the size of the proposed project was determined, spatial planning guided the VPD in determining which area was most suitable for longline mussel cultivation with the lowest impact on existing marine uses. The initial candidate area in state waters was selected by VSE with the assistance of analysis prepared by the UCSB Bren School (using SeaSketch software), and focused on the Southern California Bight. The factors evaluated in the analysis included suitability of the candidate growing area for mussels considering water depth and ocean bottom; location in State waters near Ventura Harbor for product landing; avoidance of potential pollution sources; and avoidance of conflicts with existing subsurface leases for oil and gas pipelines, etc. The report identified areas where conflicts with or impacts by aquaculture development had to potential to affect stakeholders, the environmental health of the marine benthos, quality of ocean views, and the risk of disease spread among fish farms. Thousands of spatial plans were considered. The spatial plans indicated that for various locations within the Southern California Bight, mussel aquaculture can achieve considerable value while minimizing impacts to the existing sectors (0-5% impact). As a result of the UCSB Bren School spatial planning analysis, eight SeaSketch alternatives were identified, including an alternative in federal waters.

- SeaSketch Alternative 1 – 20 lease sites located along the 80' contour at 45-degree angle
- SeaSketch Alternative 2 – 20 lease sites along 80' contour with contiguous straight-line outer edge
- SeaSketch Alternative 3 – 20 lease sites along 80' contour with 2X2 configuration extending toward the middle of candidate area
- SeaSketch Alternative 4 – 20 lease sites along 3nm State waters line, six sites south of Pitas Pt. extended towards the middle of the candidate area
- SeaSketch Alternative 5 – 20 lease sites that follows 3 nm line intuitively
- SeaSketch Alternative 6 – 20 lease sites at 3nm line arranged in a 2X2 configuration
- SeaSketch Alternative 7 – 20 lease sites intuitively following the 3nm State waters line in a 2X2 configuration
- SeaSketch Alternative 8 – 20 lease sites outside of the 3nm State waters line, in Federal waters, arranged in two, ten parcel 2X2 configurations slightly offset.

The VSE team established criteria on which to evaluate and prioritize each siting alternative. As a result, the VSE team constructed a siting decision matrix to quantify the benefits of each potential siting configuration, and assist the VPD Board of Commissioners in its decision-making process. The stakeholder engagement process supported the identification of key factors upon which to assist siting configuration decision-making. Each of the criteria was assigned a weight based on perceived relative importance to achieving optimal operational capacity and minimizing potential user conflicts and environmental impacts. Siting alternatives were then scored using a rating system that corresponds to preferences identified by the VSE team. These criteria included:

- Approximate water depth
- Potential adverse water pollution sources

- Potential visual effects from shore
- Potential interaction with commercial and recreational fishing interests
- Subleasing or sub-permitting complexities
- Potential overlap with subsurface leases
- Environmental review complexity
- Contiguous siting
- Distance from Harbor

Through the stakeholder engagement process and consultation with its aquaculture specialist, Scott Lindell of Woods Hole Oceanographic Institution, it became clear that location of the project in State waters posed certain issues. Most importantly, VSE received information from local halibut trawlers that the proposed State waters candidate area was located in one of two areas statewide designated by CDFW as halibut trawl grounds. Further, Mr. Lindell advised that a minimum 80' bottom depth (versus the initial criterion of 60' bottom depth) would reduce exposure to various mussel predator species (*e.g.*, diving ducks) and potential storm surge. Following a November 2017 public hearing, the VPD Board of Commissioners selected a federal waters alternative (SeaSketch Alternative 8) location.

Subsequently, NOAA Fisheries Southwest District Aquaculture Coordinator, Diane Windham, connected VSE with NOAA's National Ocean Service staff, which undertook a second siting study focused on federal waters proximate to Ventura Harbor. (*See* "Coastal Aquaculture Siting and Sustainability Technical Report, Ventura Shellfish Enterprise: Aquaculture Siting Analysis Results" prepared by Coastal Aquaculture Siting and Sustainability Program, within the Marine Spatial Ecology Division of the National Centers for Coastal and Ocean Science, National Ocean Service, NOAA, dated September 6, 2018, copy attached.) The siting analysis represents an objective, data-driven approach to identify the locations within federal waters with the highest compatibility with the proposed project. The results of this siting analysis identify two alternative sites proximate to Ventura Harbor given equal consideration of existing use conflicts, including:

- Designated shipping fairways,
- Areas of high vessel density and wrecks and obstructions,
- Sensitive habitats,
- Military uses,
- Existing vessel traffic corridors,
- Oil and gas production,
- Commercial fishing (specifically trawl and squid fisheries), and
- Obstructions, including submerged cables and wrecks.

Other important considerations were the distance from Ventura Harbor and depth (25-37m). Slightly less influential parameters included wind speed and direction, wave height, surface current, and chlorophyll *a*.

The two CASS Report Alternatives are both situated in the northern portion of the siting analysis study area, which was determined to have the smallest potential overlap with conflicting uses. The primary difference between the two sites is the configuration of sub-permit areas (Figures 3 and 4). In CASS Report Alternative 1, each sub-permit area has two shorter lines in parallel, and is represented in Figure 3. CASS Report Alternative 2, shown in Figure 4, was designed as a longer "stack" of single lines within each sub-permit area, which was found to be less flexible. Since varying oceanic patterns may necessitate more design flexibility, CASS Report Alternative 1 was determined to be the most compatible configuration. CASS Report Alternative 1 will have 20 plots, each with a dimension of 2,299.5 feet by 1,899.5 feet, and an average water depth of 98 feet.

Importantly, the two CASS Report Alternative sites overlap with the federal waters alternative site (SeaSketch Alternative 8) identified in the UCSB Bren School spatial planning analysis, indicating the area has been shown by two independent studies to have the fewest conflicts with other uses and sensitive environmental resources (Figure 5). Following a public hearing in September 2018, it is anticipated the VPD Board of Commissioners approved CASS Report Alternative 1)(also shown in Figure 1) as the preferred project site. CASS Report Alternative 2 (shown in Figure 4) is shown as an alternate site location.

Measures to minimize impacts to the waters of the U.S.

The proposed project has been designed to minimize direct and indirect impacts to waters of the U.S. to the maximum extent practicable through implementation of the following measures. Please see Table 2 for details of the BMPs, the responsible party, and the enforcing agency of each measure.

Measures to minimize debris and impacts to water quality

1. Sediment Quality Monitoring Plan. A Sediment Quality Monitoring Plan shall be developed requiring monitoring of sediment conditions within the project area, including monitoring the quantity, type, and distribution of biological materials (such as shellfish, shell material, and fouling organisms) that accumulate on the seafloor. Monitoring will also include an evaluation of any changes to oxygen demand of benthic infaunal and epifaunal communities, and changes to the chemical and biochemical conditions of seafloor sediments along with a description of performance standards to meet.

   If performance standards are not met, corrective actions will be outlined. The Plan will include reporting requirements, including annual report submittals to NOAA and NMFS for review. If performance standards are met for a period of time, the plan will provide for appropriately scaling down monitoring and intervals over time.

2. Spill Prevention and Response. Discharges of feed, pesticides, or chemicals (including antibiotics and hormones) in ocean waters are prohibited. Fuel, lubricants and chemicals must be labeled, stored and disposed of in a safe and responsible manner, and marked with warning signs. Precautions shall be taken to prevent spills, fires and explosions, and procedures and supplies shall be readily available to manage chemical and fuel spills or

leaks. Each grower/producer shall comply with the Spill Prevention and Response Plan (SPRP) for vessels and work barges that will be used during project construction and operations. Each grower/producer operating in the project area shall be trained in, and adhere to, the emergency procedures and spill prevention and response measures specified in the SPRP during all project operations. The SPRP shall provide for emergency response and spill control procedures to be taken to stop or control the source of the spill and to contain and clean up the spill. The SPRP shall include, at a minimum: (a) identification of potential spill sources and quantity estimates of a project specific reasonable worst case spill; (b) identification of prevention and response equipment and measures/procedures that will be taken to prevent potential spills and to protect marine and shoreline resources in the event of a spill. Spill prevention and response equipment shall be kept onboard project vessels at all times; (c) a prohibition on at-sea vessel or equipment fueling/refueling activities; and (d) emergency response and notification procedures, including a list of contacts to call in the event of a spill; (e) assurance that all hydraulic fluid to be used for installation, maintenance, planting, and harvesting activities shall be vegetable based.

3. Aquaculture Gear Monitoring and Escapement Plan. Include in overall management plan an aquaculture gear monitoring and escapement plan. Any farm gear that has broken loose from the farm location shall be retrieved. The farm site shall be visited at minimum twice per month to examine the aquaculture gear for potential loss or non-compliant deployment, including inspections for fouling organisms. Any organisms that have a potential to cover the sea floor will be removed and disposed of at an identified upland facility. A Marine Debris Management Plan shall also be prepared that includes (a) a plan for permanently marking all lines, ropes, buoys, and other facility infrastructure and floating equipment with the name and contact information of the grower/producer; (b) a description of the extent and frequency of maintenance operations necessary to minimize the loss of materials and equipment to the marine environment resulting from breakages and structural failures; and (c) a description of the search and cleanup measures that would be implemented if loss of shellfish cultivation facility materials, equipment, and/or infrastructure occurs.

4. Decommissioning Plan. A decommissioning plan for the timely removal of all shellfish, structures, anchoring devices, equipment, and materials associated with the shellfish cultivation facility and documentation of completion of removal activities will be a requirement of each permit or sub-permit. Financial assurances to guarantee implementation of the plan will be in place and reviewed periodically.

Measures to prevent spread of invasive species

1. Cultivation of Spat Offsite. Only hatchery-reared mussel spat grown at a facility certified by CDFW will be used in order to ensure that spat are free of introduced invasive species, parasites, and pathogens; however, natural mussel spat collected on farm grown-out lines and buoys may also be harvested and cultivated.

2. Invasive Species. Grower/producers operating in the project area shall be required to receive training from NMFS to identify potential invasive species and how to properly dispose of such invasive species if discovered.

Measures to prevent navigational impacts

1. Update NOAA Charts. VPD to submit to the NOAA Office of Coast Survey: (a) the geographical coordinates of the facility boundaries obtained using a different geographic position unit or comparable navigational equipment; (b) as-built plans of the facility and associated buoys and anchors; (c) each grower/producer's point of contact and telephone number; and (d) any other information required by the NOAA Office of Coast Survey to accurately portray the location of the shellfish cultivation facility on navigational charts.

2. Notice to Mariners. No less than 15-days prior to the start of in-water activities associated with the installation phase of the project, VPD shall submit to (a) the U.S. Coast Guard (for publication in a Notice to Mariners); and (b) the harbormasters (for posting in their offices of public noticeboards), notices containing the anticipated start date of installation, the anticipated installation schedule, and the coordinates of the installation sites. During installation, VPD shall also make radio broadcast announcements to the local fishers' emergency radio frequency that provide the current installation location and a phone number that can be called for additional information.

Measures to prevent impacts to threatened or endangered species

The enclosed Biological Assessment evaluates the potential effects of the VSE project on federally protected species. In addition to the BMPs identified below, the Biological Assessment identifies certain design features that minimize potential impacts, including marine mammal entanglement. With the incorporation of appropriate avoidance and minimization measures, a preliminary determination has been made that the project may affect, but is not likely to adversely affect any federally-listed threatened or endangered species, or cause adverse modification to federally designated critical habitat.

1. Marine Wildlife Entanglement Plan. No less than once per month, each grower/producer operating on a VPD lease shall visually inspect all ropes, and equipment via depth/fish finders to determine if any entanglement of a marine mammal has occurred and to ensure that (a) no lines have been broken, lost or removed; (b) all longlines, anchor lines, and buoy lines remain taught and in good working condition; and (c) any derelict fishing gear or marine debris that collects in the growing gear is removed and disposed of at an identified onshore facility. All equipment and materials accidentally released or found to be missing from the facility during monthly inspections, including buoys, floats, lines, ropes, chains, cultivation trays, wires, fasteners, and clasps, shall be searched for, collected, properly disposed of onshore, and documented in the annual inspection report. Monitoring shall occur monthly for the first two years following deployment and, in the event that there are

no marine wildlife entanglements within the first two years, may be reduced to quarterly inspections thereafter.

Inspections shall include recordings by depth/fish finder or ROV surveys of lines and/or monitoring performed by SCUBA divers. Recorded video shall be provided along with the annual report described above. Any maintenance issues including wear, loosening, or fatigue of materials shall be remedied as soon as possible. All incidents of observed whale entanglement shall be immediately reported to SOS WHALe. Any other marine wildlife (i.e., other marine mammals, turtles) observed to be entangled will be immediately reported to NOAA Fisheries Marine Mammal Stranding Network Coordinator, West Coast Region, Long Beach Office. Only personnel who have been authorized by NOAA Fisheries and who have training, experience, equipment, and support will attempt to disentangle marine wildlife. If possible, the grower/producer shall document and photograph entangled wildlife and the entangling gear material.

2. Predator Control. Potential predator species will be identified. Specified humane methods of predator deterrence will be utilized, favoring non-lethal methods. No controls, other than non-lethal exclusion, shall be applied to species that are listed as threatened or endangered.

3. Marine Wildlife Observer. A Marine Wildlife Observer shall be present on each project construction vessel during all construction activities, including the installation of long lines and anchoring systems. The observer shall monitor and record the presence of all marine wildlife (marine mammals and sea turtles) within 100 yards of the work area. The observer shall have the authority to halt operations if marine wildlife are observed or anticipated to be near a work area and construction activities have the potential to result in injury or entanglement of marine wildlife. In addition, all work (including vessel motors) will be halted if a cetacean is observed within the monitoring area or if a pinniped or sea turtle is observed within 50 yards of the work area. Work may commence after the observed individuals have moved out of the monitoring area.

   Observers' reports on marine mammal monitoring during construction activities shall be prepared and submitted to NOAA Fisheries on a monthly basis. Reports shall include such information as the (1) number, type, and location of marine mammals observed; (2) the behavior of marine mammals in the area of potential sound effects during construction; (3) dates and times when observations and in-water project construction activities were conducted; and (4) dates and times when in-water construction activities were suspended because of marine mammals.

   VPD shall prepare a list of qualified marine wildlife observers who meet the following minimum qualifications: visual acuity in both eyes (correction is permissible) sufficient to discern moving targets at the water's surface with ability to estimate target size and distance; (2) use of binoculars or spotting scope may be necessary to correctly identify the target; (3) advanced education in biological science, wildlife management, mammalogy, or related fields (bachelor's degree or higher is preferred); (4) experience and ability to conduct field observations and collect data according to assigned protocols (this may

include academic experience); (5) experience or training in the field identification of marine mammals (cetaceans and pinnipeds) and sea turtles; and (6) ability to communicate orally, by radio or in person, with project personnel to provide real time information on marine wildlife observed in the area, as needed.

4. Entanglement Prevention. Grow-ropes will be attached to the head rope with a low-breaking-strength twine (4-millimeter (0.16-inch) diameter; <1,000 pounds), which will facilitate rapid detachment in the unlikely event of any interaction with the longline. A 1,100-pound breakaway link will be installed between the surface marking buoys and the vertical lines.

5. Marine Wildlife Education. Each grower/producer will be required to provide bi-annual (twice per year) marine wildlife education to its employees regarding proper procedures relating to marine wildlife. The training curriculum will include identifying the presence of specified marine wildlife and procedures for avoiding impacts to marine wildlife during operations. These procedures will include (1) reducing speed and observing the distances from marine life specified in Wildlife-7; (2) providing a safe path of travel for marine mammals that avoids encirclement or entrapment of the animal(s) between the vessel and growing apparatus; (3) if approached by a marine mammal, reducing speed, placing the vessel in neutral and waiting until the animal is observed clear of the vessel before making way; (4) avoiding sudden direction or speed changes when near marine mammals; (5) refraining from approaching, touching or feeding a marine mammal; and (6) immediately contacting their supervisor and other identified parties/agencies identified in Wildlife-1 should an employee observe an injured marine mammal.

6. Lighting. All growing area operations shall be completed during daylight hours. No growing area operations will be conducted at night and no permanent artificial lighting of the shellfish cultivation facility shall occur, except for that associated with the use of navigational safety buoys required by the U.S. Coast Guard.

7. Vessel Management. Vessels in transit to and from the growing area shall maintain a distance of 100 yards from any observed cetacean and 50 yards between any observed pinniped or sea turtle. If cetaceans are observed within 100 yards or pinnipeds or sea turtles observed within 50 yards, the vessel shall reduce speeds to 12 knots or less until it is the appropriate distance (as required by this condition) from the particular marine life. If a cetacean is heading into the direct path of the vessel (i.e., approaching a moving vessel directly into the bow), the vessel shall shut off the engine until the cetacean is no longer approaching the bow and until a greater separation distance is observed. If small cetaceans are observed bow-riding, and the vessel is operating at speeds of 12 knots or less, the vessel shall remain parallel to the animal's course and avoid abrupt changes in direction until the cetaceans have left the area.

   Each sighting of a federally listed threatened or endangered whale or turtle shall be recorded and the following information shall be provided:

   a. Date, time, coordinates of vessel

b. Visibility, weather, sea state
c. Vector of sighting (distance, bearing)
d. Duration of sighting
e. Species and number of animals
f. Observed behaviors (feeding, diving, breaching, etc.)
g. Description of interaction with aquaculture facility

Table 2: Ventura Shellfish Enterprise
Proposed Best Management Practices to Mitigate Potential Adverse Project Impacts

Measure	Description of Measure	Responsible Party	Enforcing Agency
Seed supply – 1	**Cultivation of Spat Offsite.** Only hatchery-reared mussel spat grown at a facility certified by CDFW will be used in order to ensure that spat are free of introduced invasive species, parasites, and pathogens; however, natural mussel spat collected on farm grow-out lines and buoys may also be harvested and cultivated.	Grower/Producer[2]	Ventura Port District (VPD) and CDFW
Sediment quality – 1	**Sediment Quality Monitoring Plan.** A Sediment Quality Monitoring Plan shall be developed requiring monitoring of sediment conditions within the project area, including monitoring the quantity, type, and distribution of biological materials (such as shellfish, shell material, and fouling organisms) that accumulate on the seafloor. Monitoring will also include an evaluation of any changes oxygen demand of benthic infaunal and epifaunal communities, and changes to the chemical and biochemical conditions of seafloor sediments along with a description of performance standards to meet. If performance standards are not met, corrective actions will be outlined. The Plan will include reporting requirements, including annual report submittals to NOAA and NMFS for review. If performance standards are met for a period of time, the plan will provide for appropriately scaling down monitoring and intervals over time.	VPD to prepare plan Third-party consultant hired by VPD to conduct monitoring	NOAA and NMFS
Wildlife – 1	**Marine Wildlife Entanglement Plan.** No less than once per month, each grower/producer operating on a VPD lease shall visually inspect all ropes, cables, and equipment via depth/fish finders to determine if any entanglement of a marine mammal has occurred and to ensure that (a) no lines have been broken, lost or removed; (b) all longlines, anchor lines, and buoy lines remain taught and in good working condition; and (c) any	Grower/Producer to inspect and respond VPD to identify disposal facility	VPD and NOAA Fisheries

[2] Note that all Grower/Producer responsibilities will be spelled out as conditions in grower/producer sub-permits with VPD, thus establishing VPD enforcement authority for those conditions.

	derelict fishing gear or marine debris that collects in the growing gear is removed and disposed of at an identified onshore facility. All equipment and materials accidentally released or found to be missing from the facility during monthly inspections, including buoys, floats, lines, ropes, chains, cultivation trays, wires, fasteners, and clasps, shall be searched for, collected, properly disposed of onshore, and documented in the annual inspection report. Monitoring shall occur monthly for the first two years following deployment and, in the event that there are no marine wildlife entanglements within the first two years, may be reduced to quarterly inspections thereafter. Inspections shall include recordings by depth/fish finder or ROV surveys of lines and/or monitoring performed by SCUBA divers. Recorded video shall be provided along with the annual report described above. Any maintenance issues including wear, loosening, or fatigue of materials shall be remedied as soon as possible. All incidents of observed whale entanglement shall be immediately reported to SOS WHALe. Any other marine wildlife (i.e., other marine mammals, turtles) observed to be entangled will be immediately reported to NOAA Fisheries Marine Mammal Stranding Network Coordinator, West Coast Region, Long Beach Office. Only personnel who have been authorized by NOAA Fisheries and who have training, experience, equipment, and support will attempt to disentangle marine wildlife. If possible, the grower/producer shall document and photograph entangled wildlife and the entangling gear material.		
Wildlife – 2	**Predator Control.** Potential predator species will be identified. Specified humane methods of predator deterrence will be utilized, favoring non-lethal methods. No controls, other than non-lethal exclusion, shall be applied to species that are listed as threatened or endangered.	VPD to identify potential predator species and deterrence methods Grower/Producer to implement identified methods as necessary	Any methods of predator control are subject to prior approval of VPD, U.S. Fish and Wildlife Service, and NOAA Fisheries
Wildlife – 3	**Marine Wildlife Observer**. A Marine Wildlife Observer shall be present on each project construction vessel during all construction activities, including the installation of long lines and anchoring systems. The observer shall monitor and record the presence of all marine wildlife (marine mammals and sea turtles) within 100 yards of the work area. The observer shall have the authority to halt operations if marine wildlife are observed or anticipated to be near a work area and construction activities have the potential to result in injury or entanglement of marine wildlife. In addition, all work (including vessel motors) will be halted if a cetacean is observed within the monitoring area or if a pinniped or sea turtle is observed within 50 yards of the work area. Work may commence after the observed individuals have moved out of the monitoring area.	VPD to identify qualified Marine Wildlife Observers and submit monthly observers' reports Growers/Producers to assure a qualified observer is present during construction activities and that observers' directives are heeded	VPD and NOAA Fisheries

	Observers' reports on marine mammal monitoring during construction activities shall be prepared and submitted to NOAA Fisheries on a monthly basis. Reports shall include such information as the (1) number, type, and location of marine mammals observed; (2) the behavior of marine mammals in the area of potential sound effects during construction; (3) dates and times when observations and in-water project construction activities were conducted; and (4) dates and times when in-water construction activities were suspended because of marine mammals. VPD shall prepare a list of qualified marine wildlife observers who meet the following minimum qualifications: visual acuity in both eyes (correction is permissible) sufficient to discern moving targets at the water's surface with ability to estimate target size and distance; (2) use of binoculars or spotting scope may be necessary to correctly identify the target; (3) advanced education in biological science, wildlife management, mammalogy, or related fields (bachelor's degree or higher is preferred); (4) experience and ability to conduct field observations and collect data according to assigned protocols (this may include academic experience); (5) experience or training in the field identification of marine mammals (cetaceans and pinnipeds) and sea turtles; and (6) ability to communicate orally, by radio or in person, with project personnel to provide real time information on marine wildlife observed in the area, as needed.		
Wildlife – 4	**Entanglement Prevention**. Grow-ropes will be attached to the head rope with a low-breaking-strength twine (4-millimeter (0.16-inch) diameter; <1,000 pounds), which will facilitate rapid detachment in the unlikely event of any interaction with the longline. A 1,100-pound breakaway link will be installed between surface marking buoys and the vertical lines.	Grower/Producer	VPD
Wildlife – 5	**Marine Wildlife Education.** Each grower/producer will be required to provide bi-annual (twice per year) marine wildlife education to its employees regarding proper procedures relating to marine wildlife. The training curriculum will include identifying the presence of specified marine wildlife and procedures for avoiding impacts to marine wildlife during operations. These procedures will include (1) reducing speed and observing the distances from marine life specified in Wildlife-7; (2) providing a safe path of travel for marine mammals that avoids encirclement or entrapment of the animal(s) between the vessel and growing apparatus; (3) if approached by a marine mammal, reducing speed, placing the vessel in neutral and waiting until the animal is observed clear of the vessel before making way; (4) avoiding sudden direction or speed changes when near marine mammals; (5) refraining from approaching, touching or feeding a marine	VPD to prepare training curriculum Grower/Producer to provide training	VPD and NOAA Fisheries

	mammal; and (6) immediately contacting their supervisor and other identified parties/agencies identified in Wildlife-1 should an employee observe an injured marine mammal.		
Wildlife – 6	**Lighting.** All growing area operations shall be completed during daylight hours. No growing area operations will be conducted at night and no permanent artificial lighting of the shellfish cultivation facility shall occur, except for that associated with the use of navigational safety buoys required by the U.S. Coast Guard.	Grower/Producer	VPD and U.S. Coast Guard
Wildlife – 7	**Vessel Management.** Vessels in transit to and from the growing area shall maintain a distance of 100 yards from any observed cetacean and 50 yards between any observed pinniped or sea turtle. If cetaceans are observed within 100 yards or pinnipeds or sea turtles observed within 50 yards, the vessel shall reduce speeds to 12 knots or less until it is the appropriate distance (as required by this condition) from the particular marine life. If a cetacean is heading into the direct path of the vessel (i.e., approaching a moving vessel directly into the bow), the vessel shall shut off the engine until the cetacean is no longer approaching the bow and until a greater separation distance is observed. If small cetaceans are observed bow-riding, and the vessel is operating at speeds of 12 knots or less, the vessel shall remain parallel to the animal's course and avoid abrupt changes in direction until the cetaceans have left the area. Each sighting of a federally listed threatened or endangered whale or turtle shall be recorded and the following information shall be provided: a. Date, time, coordinates of vessel b. Visibility, weather, sea state c. Vector of sighting (distance, bearing) d. Duration of sighting e. Species and number of animals f. Observed behaviors (feeding, diving, breaching, etc.) g. Description of interaction with aquaculture facility	Grower/Producer	U.S. Coast Guard
Wildlife – 8	**Invasive Species.** Grower/producers operating in the project area shall be required to receive training from NMFS to identify potential invasive species and how to properly dispose of such invasive species if discovered.	Grower/Producer	NMFS or entity delegated by NMFS to conduct training

Storage and disposal of supplies – 1	**Spill Prevention and Response**. Discharges of feed, pesticides, or chemicals (including antibiotics and hormones) in ocean waters are prohibited. Fuel, lubricants and chemicals must be labeled, stored and disposed of in a safe and responsible manner, and marked with warning signs. Precautions shall be taken to prevent spills, fires and explosions, and procedures and supplies shall be readily available to manage chemical and fuel spills or leaks. Each grower/producer shall comply with the Spill Prevention and Response Plan (SPRP) for vessels and work barges that will be used during project construction and operations. Each grower/producer operating in the project area shall be trained in, and adhere to, the emergency procedures and spill prevention and response measures specified in the SPRP during all project operations. The SPRP shall provide for emergency response and spill control procedures to be taken to stop or control the source of the spill and to contain and clean up the spill. The SPRP shall include, at a minimum: (a) identification of potential spill sources and quantity estimates of a project specific reasonable worst case spill; (b) identification of prevention and response equipment and measures/procedures that will be taken to prevent potential spills and to protect marine and shoreline resources in the event of a spill. Spill prevention and response equipment shall be kept onboard project vessels at all times; (c) a prohibition on at-sea vessel or equipment fueling/refueling activities; and (d) emergency response and notification procedures, including a list of contacts to call in the event of a spill; (e) assurance that all hydraulic fluid to be used for installation, maintenance, planting, and harvesting activities shall be vegetable based.	VPD to prepare SPRP and provide training to growers/producers Growers/Producers to implement VPD-prepared SPRP	U.S. Army Corps of Engineers, U.S. Coast Guard, California Office of Emergency Services
Storage and disposal of supplies – 2	**Aquaculture Gear Monitoring and Escapement Plan.** Include in overall management plan an aquaculture gear monitoring and escapement plan. Any farm gear that has broken loose from the farm location shall be retrieved. The farm site shall be visited at minimum twice per month to examine the aquaculture gear for potential loss or non-compliant deployment, including inspections for fouling organisms. Any organisms that have a potential to cover the sea floor will be removed and disposed of at an identified upland facility. A Marine Debris Management Plan shall also be prepared that includes (a) a plan for permanently marking all lines, ropes, buoys, and other facility infrastructure and floating equipment with the name and contact information of the grower/producer; (b) a description of the extent and frequency of maintenance operations necessary to minimize the loss of materials and equipment to the marine environment resulting from breakages and structural failures; and (c) a description of the search and cleanup measures that would be implemented if loss of shellfish cultivation facility materials, equipment, and/or infrastructure occurs.	VPD to prepare plan Growers/Producers to implement plan	VPD and U.S. Army Corps of Engineers

Storage and disposal of supplies -3	**Decommissioning Plan**. A decommissioning plan for the timely removal of all shellfish, structures, anchoring devices, equipment, and materials associated with the shellfish cultivation facility and documentation completion of removal activities will be a requirement of each permit or sub-permit. Financial assurances to guarantee implementation of the plan will be in place and reviewed periodically.	Grower/Producer to prepare and implement approved plan VPD to approve plan	U.S. Army Corps of Engineers
Navigation - 1	**Update NOAA Charts.** VPD to submit to the NOAA Office of Coast Survey: (a) the geographical coordinates of the facility boundaries obtained using a different geographic position unit or comparable navigational equipment; (b) as-built plans of the facility and associated buoys and anchors; (c) each grower/producer's point of contact and telephone number; and (d) any other information required by the NOAA Office of Coast Survey to accurately portray the location of the shellfish cultivation facility on navigational charts.	VPD	NOAA
Navigation - 2	**Notice to Mariners.** No less than 15-days prior to the start of in-water activities associated with the installation phase of the project, VPD shall submit to (a) the U.S. Coast Guard (for publication in a Notice to Mariners); and (b) the harbormasters (for posting in their offices of public noticeboards), notices containing the anticipated start date of installation, the anticipated installation schedule, and the coordinates of the installation sites. During installation, VPD shall also make radio broadcast announcements to the local fishers' emergency radio frequency that provide the current installation location and a phone number that can be called for additional information.	VPD	U.S. Coast Guard

Monitoring Plans

Conditions within the project area will be monitored throughout the proposed project's implementation to ensure compliance with all permit requirements and to evaluate all effects, including beneficial effects, of the growing areas. Monitoring will be conducted according to a robust monitoring programs designed to evaluate the proposed project's potential effects on the following factors:

- The seafloor and benthic environment beneath and in the vicinity of the facilities, including biological, physical, and chemical conditions
- Wildlife interactions including marine mammals, sea turtles, fish, and seabirds
- Marine debris, including lost and broken gear

As noted in Table 2, a sediment quality monitoring plan, aquaculture gear monitoring and escapement plan, and a decommissioning plan will be developed in conjunction with the permit

review process. These plans will be developed through iterative review with the appropriate regulatory agencies.

Figures

Figure 1- Project Location

Figure 2- Detailed Plan for Shellfish Longlines

Figure 3- CASS Report Alternative 1

Figure 4- CASS Report Alternative 2

Figure 5- CASS Report Alternative 1 Overlaid with SeaSketch Alternative 8

Figure 6- Simulated View of Parcel Array at the Surface: 100-Acre Plot

Figure 7- Simulated View of Parcel Array at the Surface

Figure 8- Simulated View of the Parcel Array Underwater

Figure 9- Simulated View of Parcel Array Underwater with Anchor Line

Figure 10- Parcel Array Overview

Figure 11- Parcel Array Overview Backbone Details

Attachments

Biological Assessment

Essential Fish Habitat Assessment

NOAA CASS Study

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Dudek. 2017b. Draft Ventura Shellfish Enterprise Environmental Impact Report. Prepared by Dudek. Prepared for Ventura Port District. May.

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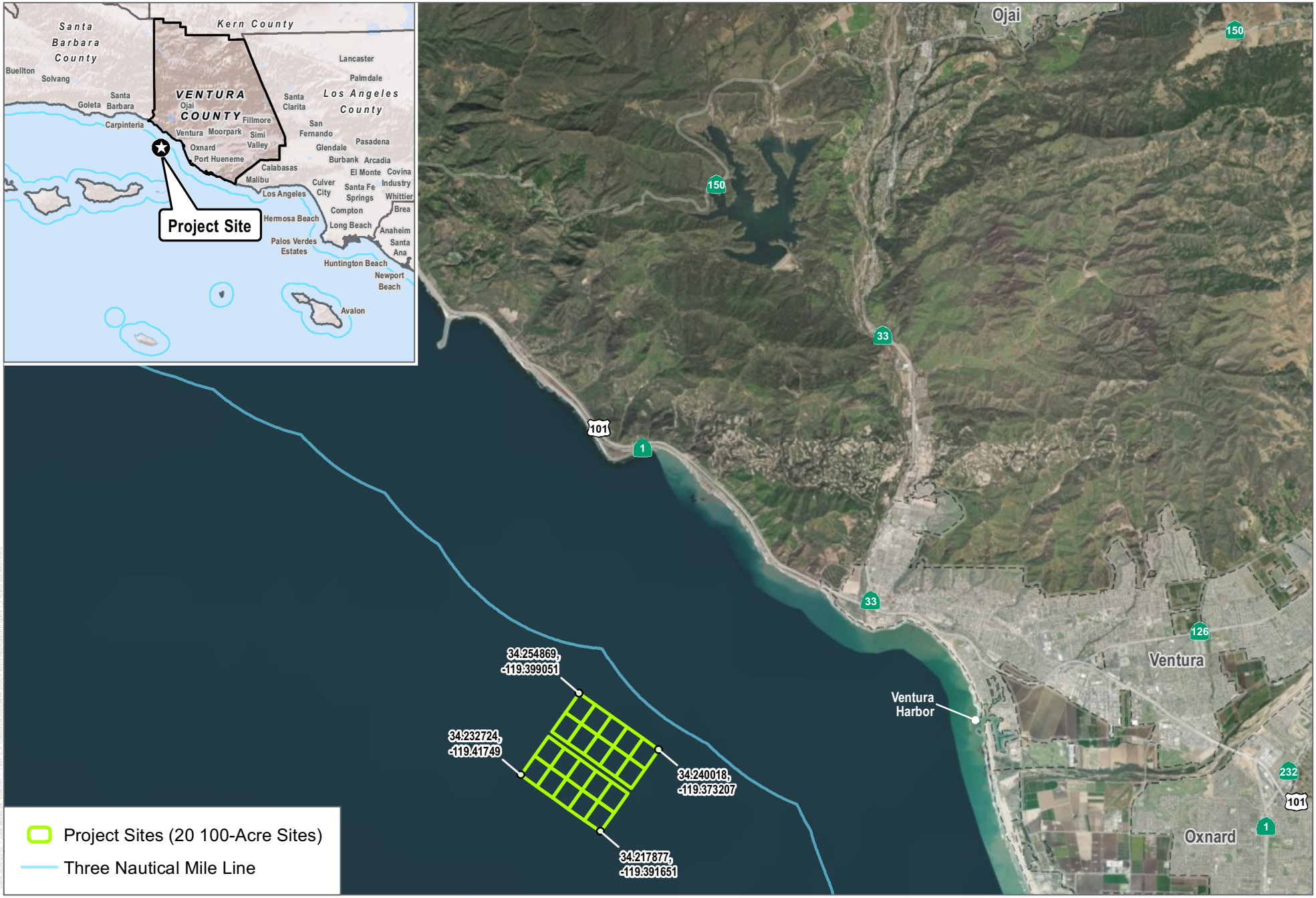


SOURCE: NAIP 2016

DUDEK

0 6,250 12,500 Feet

FIGURE 1

Project Location

Ventura Shellfish Enterprise Project

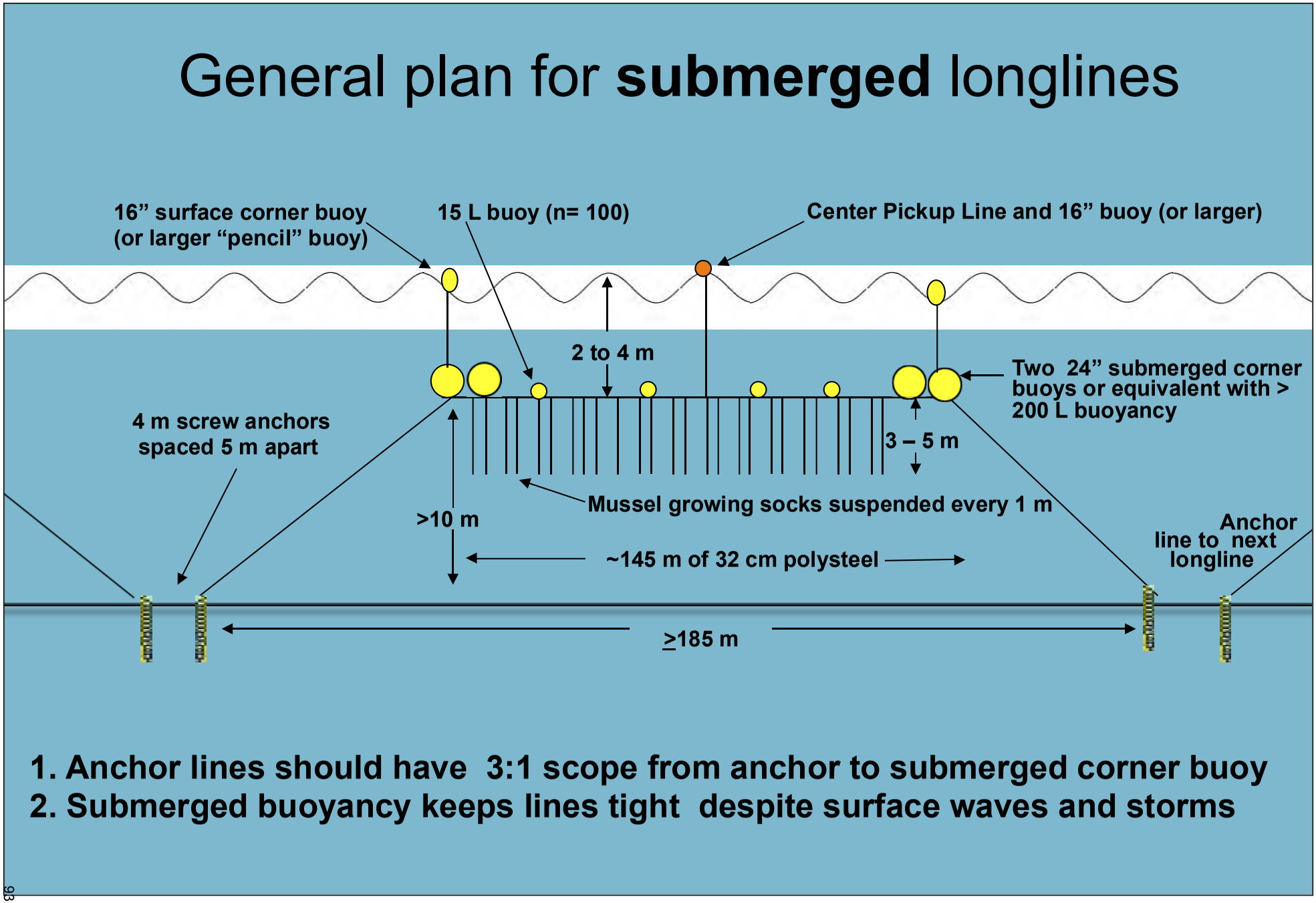
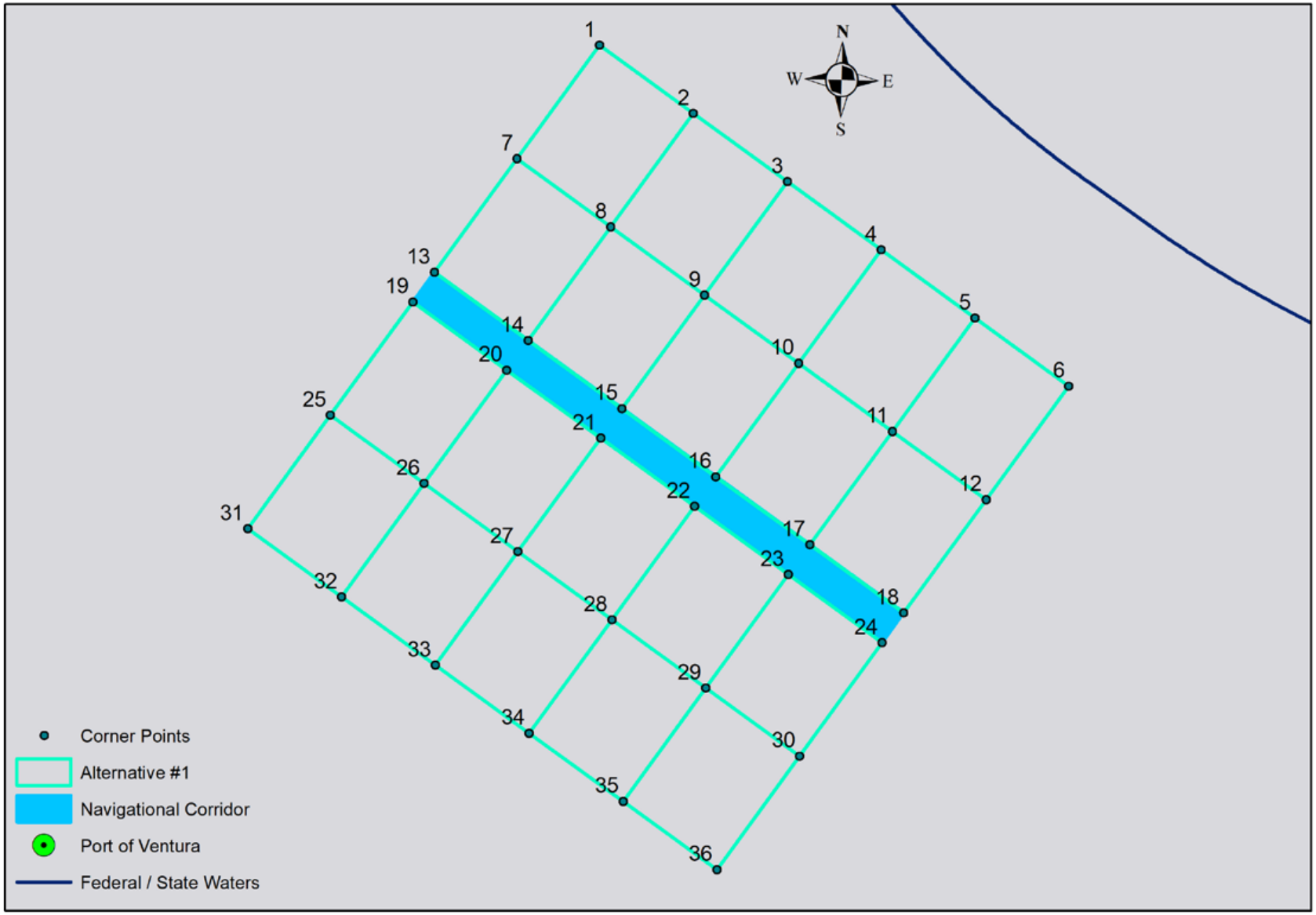


FIGURE 2

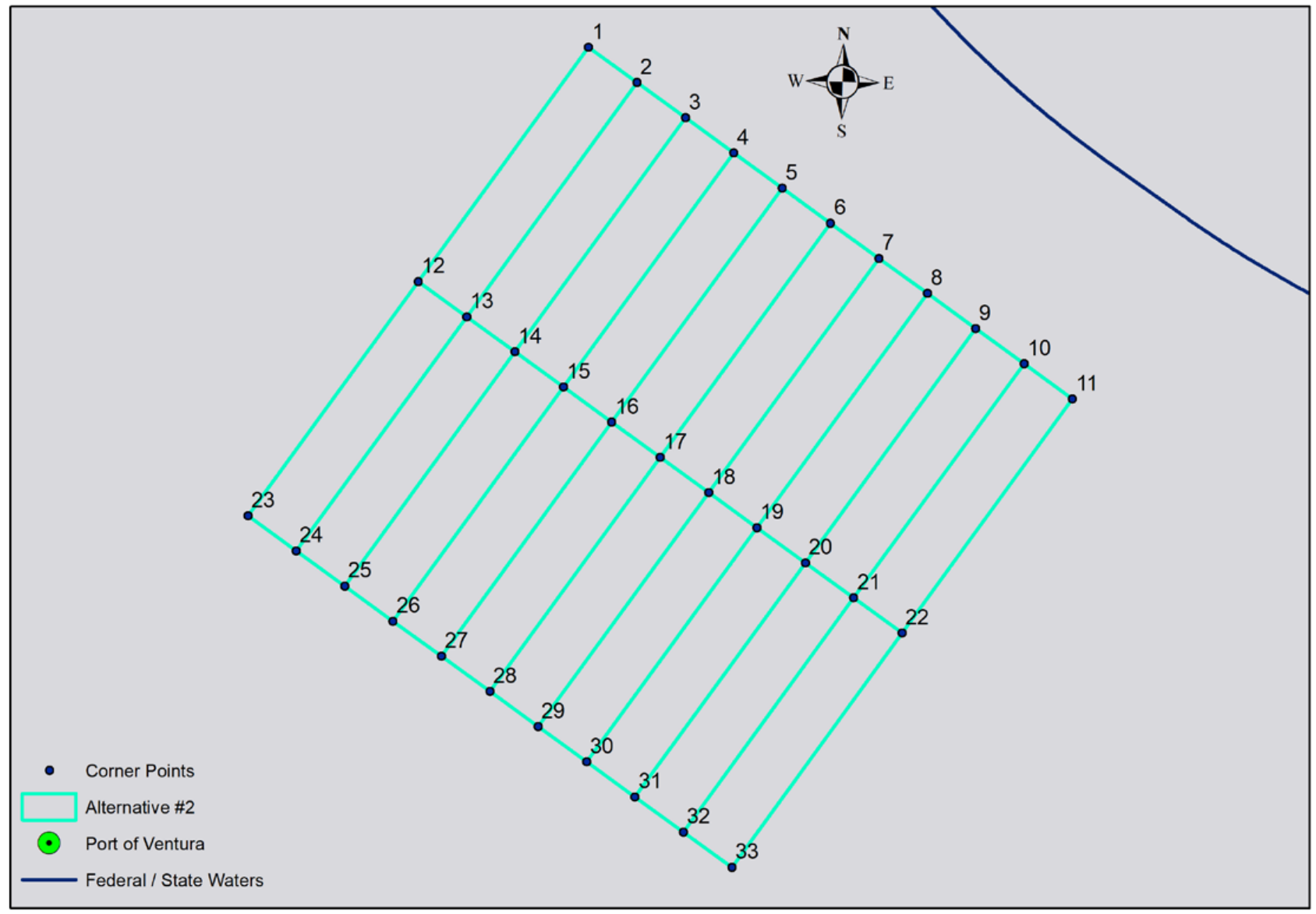
Detailed Plan for Shellfish Longlines



SOURCE: NOAA 2018

FIGURE 3

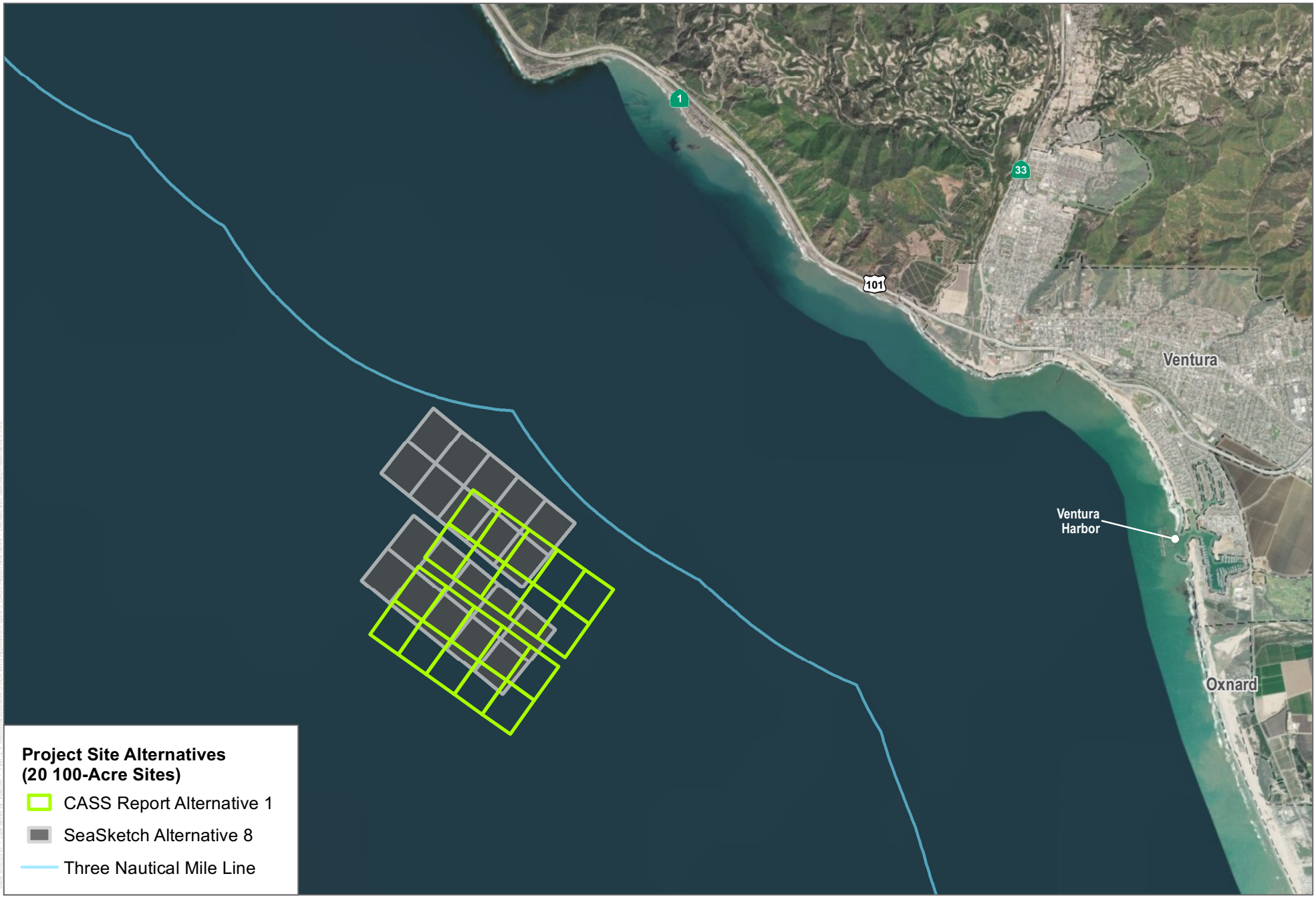
CASS Report Alternative 1



SOURCE: NOAA 2018

FIGURE 4

CASS Report Alternative 2



SOURCE: NAIP 2016

DUDEK

0 3,600 7,200 Feet

FIGURE 5

CASS Report Alternative 1 Overlaid with SeaSketch Alternative 8

FIGURE 6

Simulated View of Parcel Array at the Surface: 100 Acre Plot

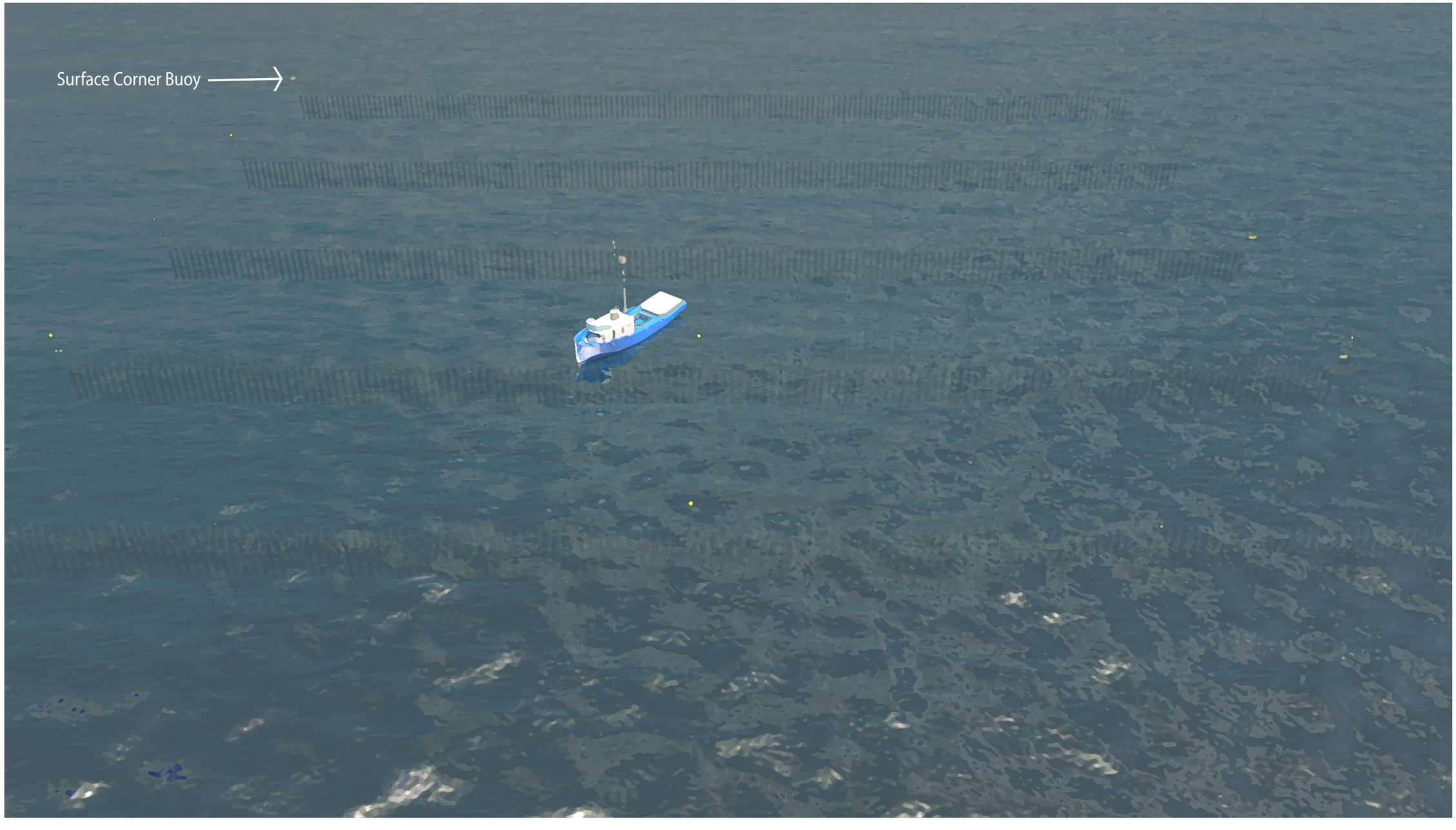


FIGURE 7

Simulated View of Parcel Array at the Surface

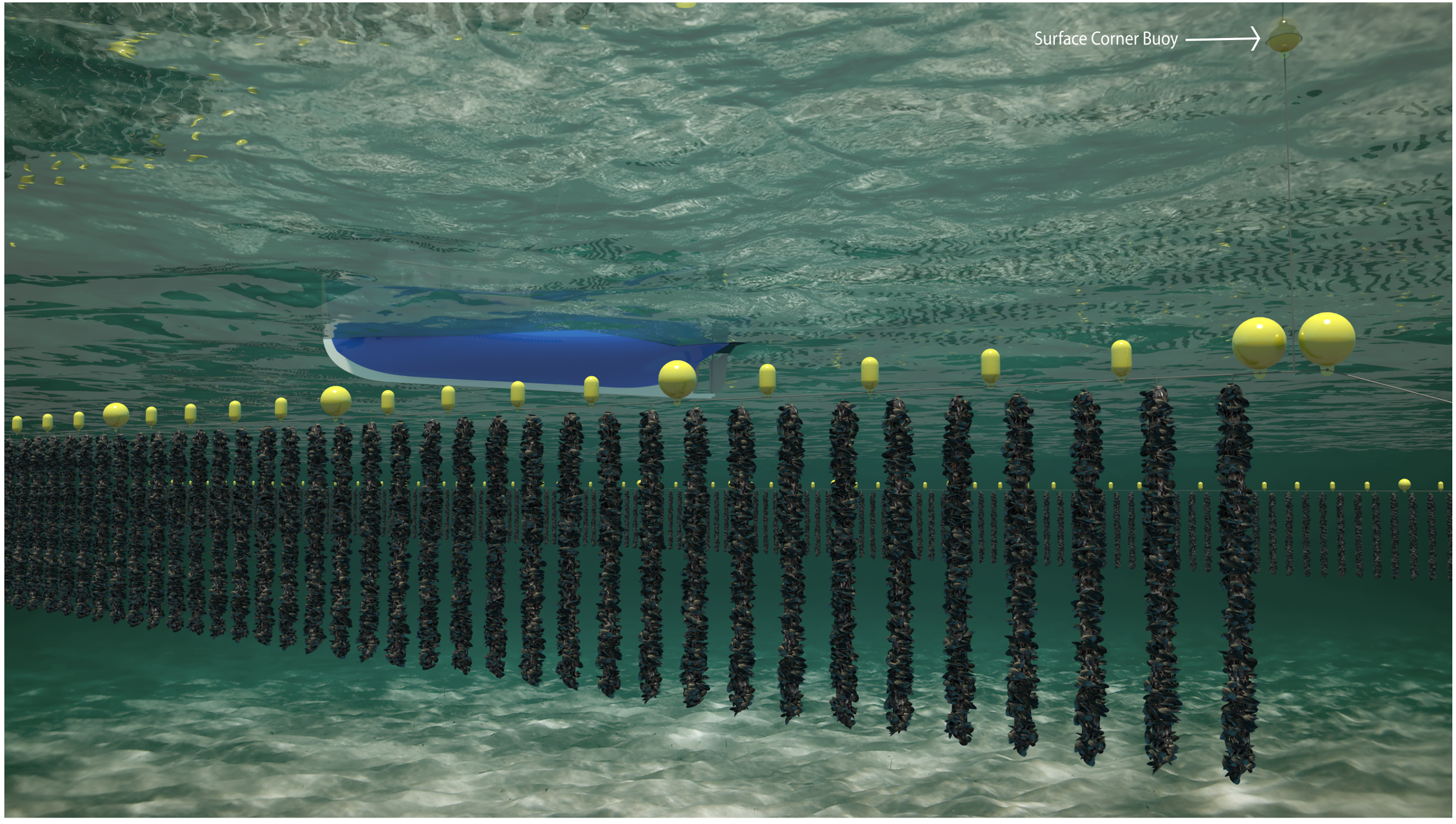


FIGURE 8
Simulated View of Parcel Array Underwater

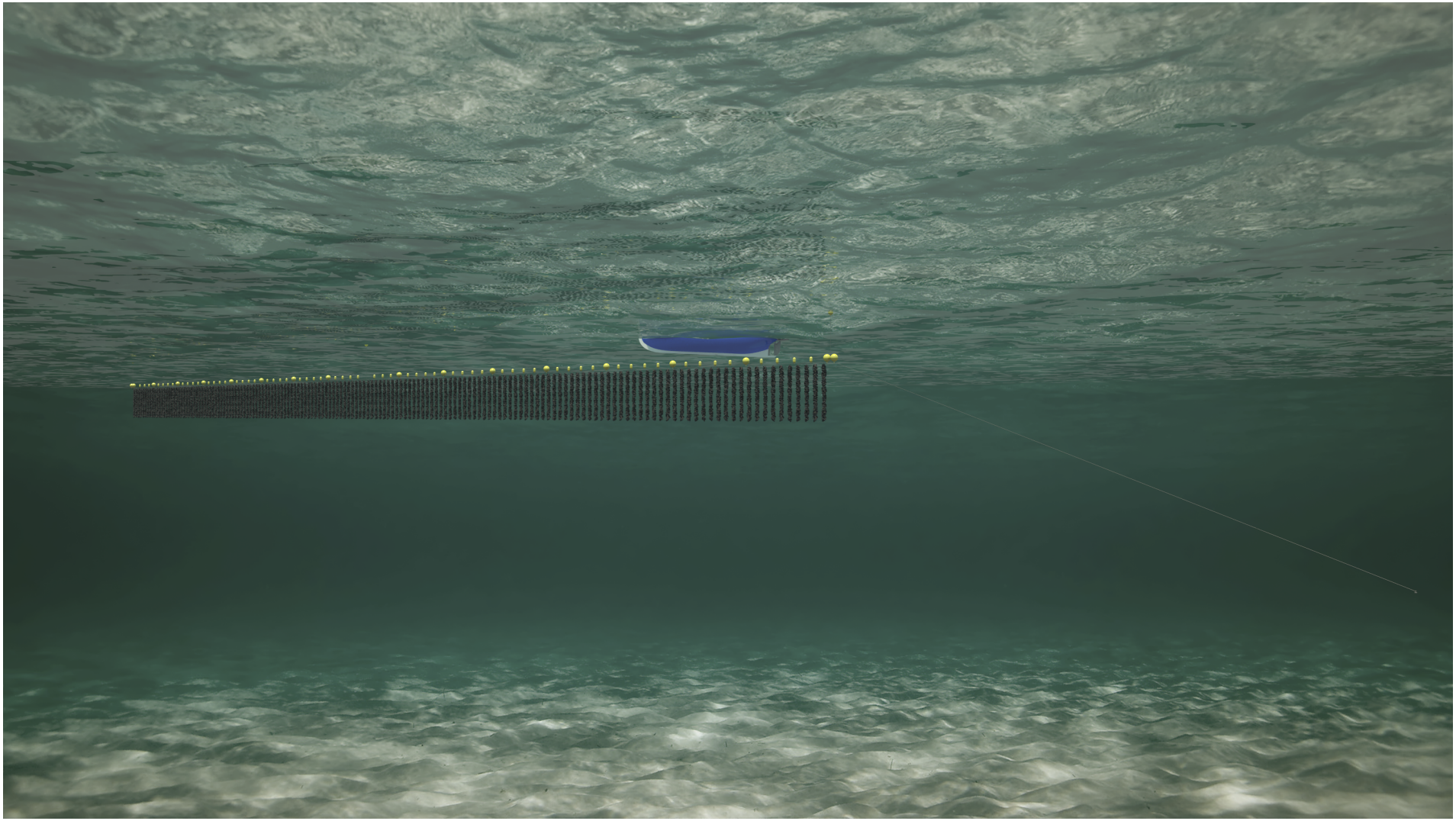


FIGURE 9

Simulated View of Parcel Array Underwater with Anchor Line

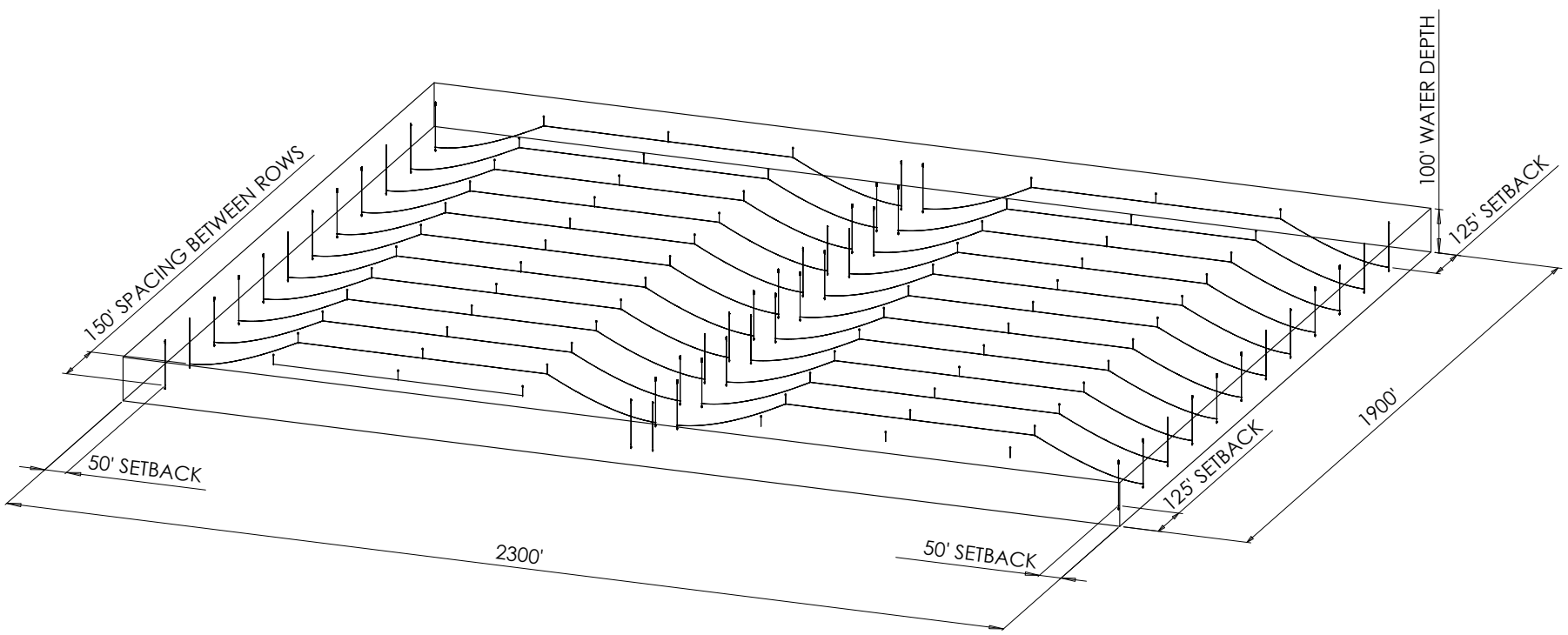
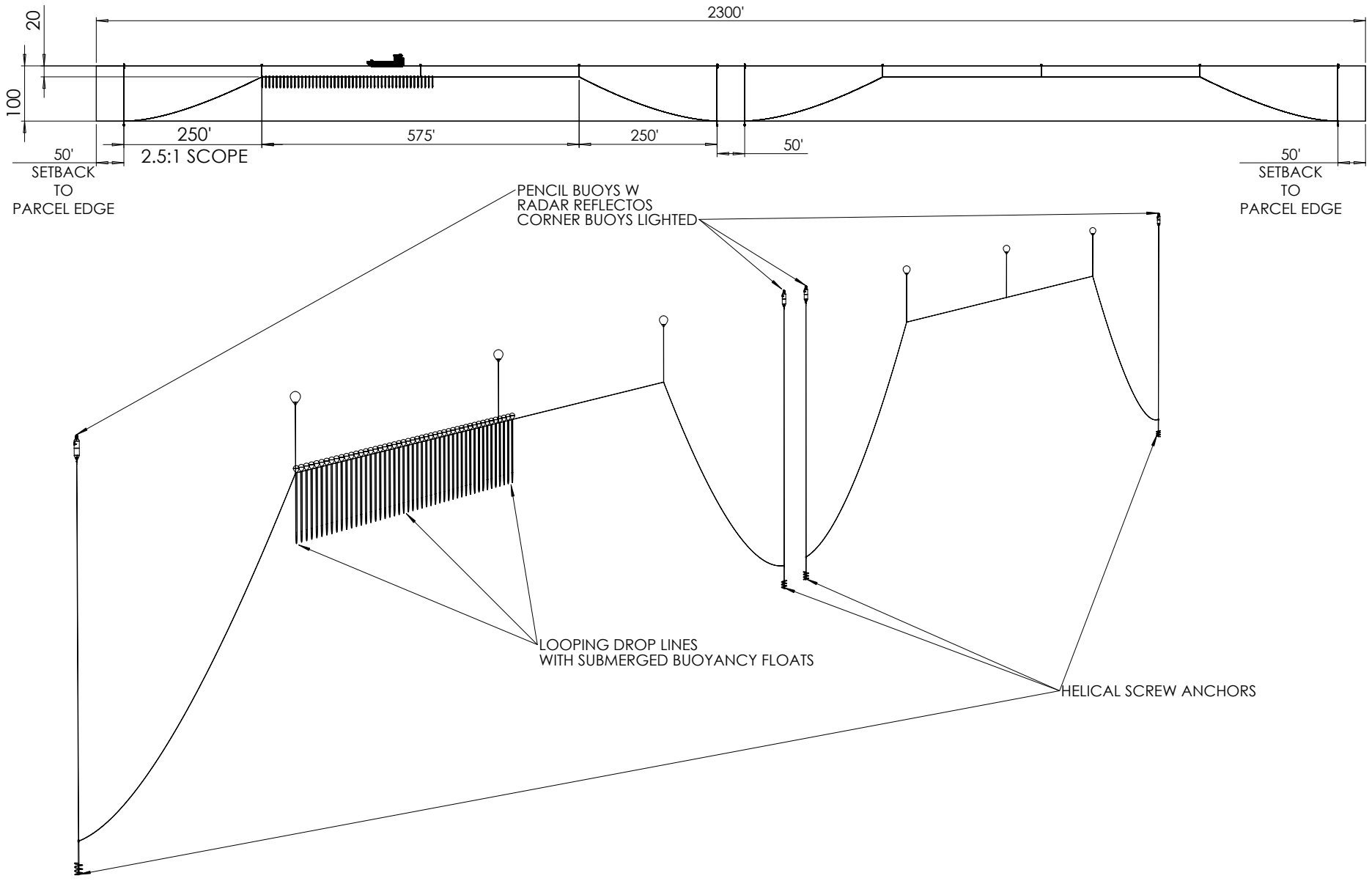


FIGURE 10

Parcel Array Overview

Ventura Shellfish Enterprise Project



SOURCE: VSE 2018

FIGURE 11

Backbone Details

CONFIDENTIAL

BIOLOGICAL ASSESSMENT

FOR THE VENTURA SHELLFISH ENTERPRISE PROJECT

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SEPTEMBER 2018

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1.0 INTRODUCTION

This Biological Assessment (BA) has been prepared for the Ventura Port District (VPD, project applicant) to evaluate the effects of the Ventura Shellfish Enterprise (VSE) Project (project) on federally protected species along with federally designated critical habitat. The project, supported in part through the NOAA 2015 Sea Grant Aquaculture Extension and Technology Transfer to California Sea Grant (NOAA Sea Grant Program), will establish a commercial offshore bivalve aquaculture operation. VPD is applying for a U.S. Army Corps of Engineers (Corps) authorization under Section 10 of the Rivers and Harbors Act. The Corps will act as the federal lead agency on the project. The BA will determine whether any federally protected species or habitats are likely to be adversely affected by the project. Pursuant to Section 7 of the Endangered Species Act (ESA) and its implementing regulations (50 CFR § 402.01 et seq.), this BA has been prepared to support consultation between the Corps, the U.S. Fish and Wildlife Service (USFWS), and National Oceanic and Atmospheric Administration's (NOAA's) National Marine Fisheries Service (NMFS). Section 7 of the ESA insures that through consultation federal actions are not likely to jeopardize the continued existence of any federally protected species or result in the destruction or adverse modification of critical habitat. This BA is also intended to support of the National Environmental Quality Act (NEPA) planning process as well as the resource agency permitting of the project. An Essential Fish Habitat (EFH) assessment has also been prepared, which analyzes how the project would affect EFH for species regulated under a Fisheries Management Plan, pursuant to the requirements of the Magnuson-Stevens Fishery Conservation and Management Act, which requires consultation with NMFS on all actions or proposed actions that may adversely affect EFH (Appendix A).

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2.0 DESCRIPTION OF PROJECT ACTION

The project will establish a commercial offshore bivalve aquaculture operation based from the Ventura Harbor in Ventura, California, focused on the cultivation of Mediterranean mussels (*Mytilus galloprovincialis*).

2.1 Project Location

The project will consist of twenty 100-acre plots (total of 2,000 acres) located in open federal waters of the Santa Barbara Channel (Channel) in the Southern California Bight (SCB), northwest of Ventura Harbor (Figure 1), with approximate depths ranging from 78 to 114 feet below sea level (13 – 19 fathoms) and an average depth of 98 feet. The plots are 3.53 miles from the shore. Each of the 20 plots are 2,299.5 feet by 1,899.5 feet, for an average plot size of 100.27 acres. Each plot will contain up to 24 lines (12 end-to-end pairs), with each line consisting of 575 feet of backbone length and 250 feet of horizontal scope on each end. There will be a 50 foot setback on each end of the pairs (for a total of 100 feet of spacing between lines of adjacent parcels) and 50 foot spacing between the two center pins. Parallel lines will be spaced 150 feet apart, with a 125 foot setback at each of the long sides (for a total of 250 feet of spacing between lines of adjacent parcels). The closest distance to the 3-mile nautical line is 2,900 feet from the plots, with an average closest distance of over 3,000 feet. The closest distance to the City of Ventura limit is 4.5 miles. Ventura harbor is 4.1 miles from the closest plot (8 miles in distance to the most distant plot). The lease sites are located on sandy bottom habitat outside of any rocky reef habitat, as evaluated in Gentry et al. 2017 and illustrated by NOAA United States West Coast nautical charts (NOAA 2017a).

The project site is characterized by a gradually sloping sandy/soft bottom. The SCB is located along the curved coastline of Southern California from Point Conception south to Cape Colnett in Baja California and includes the Channel Islands and the Pacific Ocean. The habitats and biological communities of the SCB are influenced by dynamic relationships among climate, ecology, and oceanography (e.g., currents) (Leet et al. 2001). The SCB provides essential nutrients and marine habitats for a range of species and organisms. Submarine canyons, ridges, basins, and seamounts provide unique deep water habitats within the region. The basins provide habitats for a significant number of mid-water and benthic deep-sea fish near the Channel Islands, whereas nearshore areas provide habitats for kelp and seagrass communities. Nearshore geology includes a variety of bottom types, including soft sediments and rocky bottoms. Hard-substrates environments, such as the rocky intertidal, shallow subtidal reefs, and deep rock reefs, are a key component of the high productivity found near the project area. Due to linkages among ecosystems, the impacts of ecosystem dynamics contained within the project area extend to interactions with species in the greater Eastern Pacific Ocean. The Santa Barbara Channel is located within the SCB and extends from Point Conception to Point Mugu.

The waters of the Santa Barbara Channel form one of the most biologically productive ecosystems found on Earth. Unlike most of coastal California, which faces due west and the open ocean, the coastal waters of the Santa Barbara Channel are on a south-facing coast and caught between two land masses, the South Coast and the Northern Channel Islands. The project site is 9.1 miles from the Channel Islands National Marine Sanctuary, a Federal Marine Protected Area, and 13.5 miles from the Channel Islands National Park boundary. The western section of the Santa Barbara Channel is a meeting place of the cool Northern California Current and warm Southern California Countercurrent. This type of ecosystem is called a

"transition zone." Transition zones are known to promote large concentrations of both biomass and species diversity, as they are the confluence between two or more ecologically distinct systems. In addition, upwelling provides unusually high concentrations of nutrients, especially macrozooplankton, which are one of the primary driving forces behind the Santa Barbara Channel's biological productivity and diversity. Wind patterns around Point Conception and in the Santa Barbara Channel create frequent seasonal upwelling, which force deep nutrient-laden ocean waters to rise up the water column into the biologically rich euphotic zone (Santa Barbara Channelkeeper 2017). Data from last year, for the closest oceanographic buoy to the project site (Station 46217 Anacapa Passage), shows the following average wave action conditions for the project area: an average wave height of 1.04 feet, with a dominant wave period of 10.1 seconds, and an average wave period of 6.49 seconds, with surface currents generally moving in a SW (249 degrees) direction and an average temperature of 16 °C (National Data Buoy Center 2017). The Ventura area is known to be an area of high swell height, particularly in the winter (Guza and O'Reilly 2001). Wave action is focused by the large fan of sediment deposited on the shelf from the Ventura and Santa Clara rivers. When deep water swell comes in from a WSW direction, these bathymetric features can focus the wave energy northward into the Ventura area. Wave action is slightly less in the summer months when the Channel Islands block southward swells (Guza and O'Reilly 2001).

2.2 Project Actions

2.2.1 PROJECT CONSTRUCTION

The proposed plots will be used for growing Mediterranean mussels via submerged longlines (Figures 2 and 3).

Installation of anchors, longlines, and other facilities will be performed by permitted shellfish companies, in compliance with all permit requirements. Submerged longlines consist of a horizontal structural header line, or "backbone," that is attached to the seafloor by sand screw anchors at each end and is marked and supported by a series of buoys along the central horizontal section. Sand screw anchors have been shown to exhibit superior holding power as compared to other anchoring systems and are removable. Sand screw anchors will be installed by a hydraulic drill with a drill head that operates from a rig lowered to the ocean floor. The sand screw anchors would be screwed into the sandy bottom ocean floor approximately 10 to 20 feet (3 to 6 meters) deep. Each 100-acre plot will contain up to 48 anchors for a total of 960 anchors at full project build out.

Buoys marking the corners of each parcel will identify the cultivation area for navigational safety and will comply with all regulations for height, illumination, and visibility, including radar reflection. As shown in Figure 2 and Figure 3, surface buoys for each longline would consist of two 16 inch surface corner buoys (one corner buoy supporting and marking either end of the backbone), as well as one 16 inch buoy supporting and marking the center pickup line, for a total of three surface buoys per longline. Simulated views of parcel arrays at the surface and underwater are provided in Figures 4 through 7. All surface buoys would be uniquely colored for each operator and marked with the grower/producer name and phone number. Buoys attached to the central horizontal portion of the backbone line support the line, provide a means of lifting the backbone line to access the cultivation ropes, and determine the depth of the submerged backbone, which will vary seasonally from 15 to 45 feet below the surface. Additionally, a combination of surface and submerged buoys attached to the backbone line will be used during the mussel production

cycle to maintain tension on the structural backbone line as the weight of the mussel crop increases. These will consist of 24-inch (or equivalent, with greater than 200 L buoyancy) buoys attached at required intervals along the surface and connecting to the backbone line, in combination with smaller submerged buoys affixed directly to the backbone line. The combination of surface and submerged buoyancy is designed to create a tensioned but flexible structure that is capable of responding dynamically to surface waves and storms.

The longlines that will be utilized are thick (1-inch diameter), tensioned (to approximately 800 pounds) rope that is not conducive to wrapping around or entangling protected species. The longline configuration produces a fairly rigid tensioned structure from which the cultivation ropes, or "fuzzy ropes" are attached. Fuzzy ropes are characterized by extra filaments that provide settlement substrate for mussels to attach. Fuzzy ropes may be attached to and suspended from the backbone rope either as individual lengths or as a continuous looping single length that drapes up and down over the backbone. The length of each section or loop of fuzzy rope would be approximately 20 feet but would depend on the lifting capacity of the servicing vessel. The length of the central horizontal section of backbone line would be 575 feet, which would support approximately 8,000 feet of fuzzy cultivation line.

The shape of each of the 100-acre cultivation parcels would be a function of the geometry of the submerged backbone line and anchoring. Each horizontal section of the longline will be approximately 575 feet and will require an anchor scope of approximately 2.5 times depth. Therefore, in 100 feet of water depth, scope from the horizontal section of backbone to the helical screw anchor will require 250 feet on each end of the line, making a total length of 1,075 feet from anchor screw to anchor screw. A 100-acre parcel with rectangular dimensions of 1,899.5 feet by 2,299.5 feet will therefore accommodate up to 24 individual longlines. The submerged longline growing gear configuration would be specifically engineered for open ocean conditions with respect to size and strength of all lines, anchoring, hardware, and buoyancy.

Construction in each individual growing plot will take place only after VPD approval of a sub-permits with the individual grower/producer. While project development is dependent on market demand, VPD estimates that full build out would occur within three to five years after project approval.

2.2.2 PROJECT OPERATION

The mussels will be grown and harvested by permitted growers/producers and landed at Ventura Harbor. Initial plantings of juvenile seed mussels, commonly referred to as spat, will be purchased from onshore hatcheries certified by the CDFW. At the hatcheries, mussels adhere directly to special textured ropes that promote mussel attachment and growth. When the seed are firmly settled to ropes, the ropes are covered with cotton socking material to protect them from shaking off the ropes during transport to the offshore growing site and deployment. The socks hold the spat next to the rope until the mussels naturally attach with their byssal threads, after which the cotton material naturally degrades. These ropes are then attached to the longlines and buoys, as described above.

The mussel grow-out ropes themselves are typically planted with seed 3-inches thick and may grow to be stiff with byssus at diameters of 10-inches or more at harvest, thus making them very unlikely sources of entanglement. As an additional precaution, grow ropes will be attached to the headrope with a low-breaking-strength twine (4-millimeter

(0.16-inch diameter), which will facilitate rapid detachment in the unlikely event of any interaction with the longline. To further minimize entanglement potential, a 1,100 pound breakaway link will be installed between the surface buoys and vertical lines, similar to strategies used to mitigate potential entanglement in trap fisheries in the northeastern United States (NOAA 2008). Buoy lines between the surface and headrope are generally under tension partially equivalent (0 to 10 kilograms (0 to 22 pounds)) to their full buoyancy (42 kilograms (93 pounds)).

Cultivated mussels grow by filtering naturally occurring phytoplankton from the ocean. Harvesting involves separating the mussels from the ropes, followed by cleaning, sorting, and bagging. All of these activities will take place aboard the harvesting vessel. Juvenile mussels will grow on lines until an intermediate size where the density of mussels on the fuzzy rope becomes limiting. At this point, a servicing vessel will lift the backbone line in order to access the fuzzy rope stocked with juvenile mussels and pull the fuzzy rope through vessel-based equipment designed to strip the mussels from the fuzzy rope and then clean, separate, and grade the juvenile mussels by size. Juvenile mussels then will be restocked to clean fuzzy rope at a reduced density for their second stage of grow out to market size. Maintenance and inspection of the longlines is proposed to be carried out on a monthly basis, which consists of lifting the longlines out of the water and adding additional buoys as necessary to account for increased mussel weight. Inspections of the anchor ropes, anchors, and connecting ropes shall take place at a minimum of twice per month. Inspections shall include recordings by depth/fish finder or ROV surveys of lines and/or monitoring performed by SCUBA divers.

When the mussels reach market size, which is expected to occur after about one year of total production time, the submerged backbone lines again will be lifted in order to access the fuzzy cultivation ropes, and mussels again will be stripped from the line, cleaned, and separated, and this time size-graded and bagged for landing at the Ventura Harbor as market-ready product. The bagged mussels will be transported to Ventura Harbor for offloading, sale, and distribution. All husbandry activities related to harvesting, grading, and restocking of mussels to cultivation lines will occur onboard the servicing vessel using specialized equipment for that purpose.

Watercraft used for planting, inspections, and harvesting would be home ported at Ventura Harbor. On average, between 20 to 40 boats would be traveling to the specific lease sites to conduct these activities on a three times per week to daily basis. The maximum distance traveled would be between the harbor and the farthest potential lease area, which could be up to approximately 8.7 miles. Once constructed, it is projected that each sub-permit site will generate an estimated 150 trips per year to accomplish the tasks outlined above.

Landed product will comply with all testing and labeling regulations as part of the California Department of Public Health (CDPH) Shellfish Sanitation plan and the National Shellfish Sanitation Program (NSSP) guidelines for shellfish grown in federal waters. NOAA-Seafood Inspection Program (NOAA-SIP), in collaboration with the Food and Drug Administration (FDA), recently began the process of developing NSSP-compliant sanitation protocols for bivalve shellfish cultivated in Federal waters.

Qualified researchers affiliated with universities (i.e., U.C. Santa Barbara - Bren School, or University of Southern California, etc.), or qualified marine research institutes (i.e., Woods Hole Oceanographic Institute, Scripps Institution of Oceanography, etc.) will have access to aquaculture plots to conduct research and monitoring approved by the

Ventura Port District; however, access may be limited in certain circumstances to respect grower/producer proprietary data or technology or to accommodate a grower/producer's operational and logistical needs in operating the farm. The Ventura Port District will review and approve research projects in consultation with USACE, NMFS, NOAA, and any affected grower/producers. Grower/producers will be fairly compensated for the use of their vessels, equipment, and fair market value of any mussels produced or generated as part of approved research projects.

2.2.3 PROJECT DECOMISSIONING

The project will include a decommissioning plan when activities in that lease are terminated. The decommissioning plan for the timely removal of all shellfish, structures, anchoring devices, equipment, and materials associated with the shellfish cultivation facility and documentation of completion of removal activities will be a requirement of each permit or sub-permit. Financial assurances to guarantee implementation of the plan will be in place and reviewed periodically.

2.2.4 PROJECT OBJECTIVES

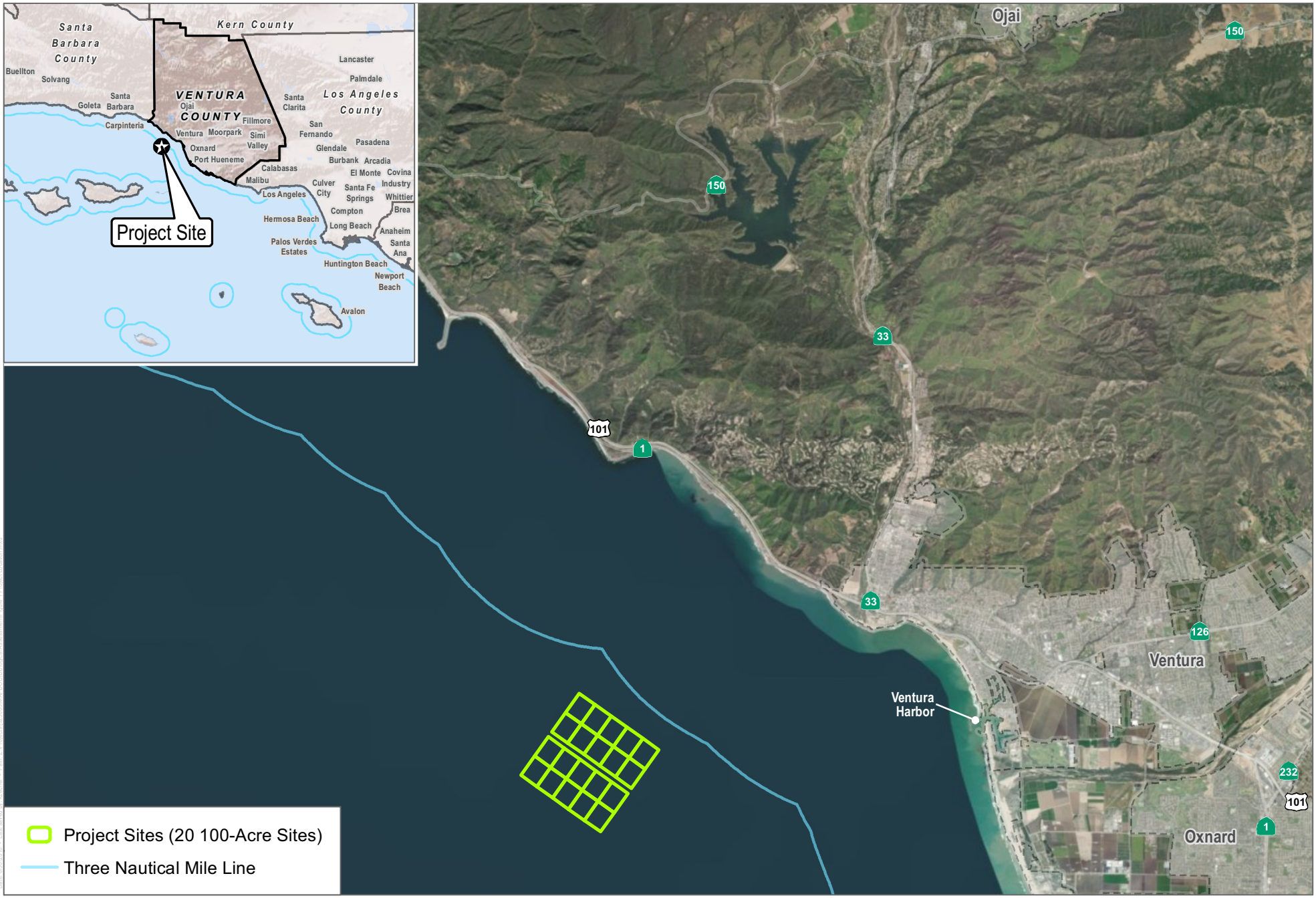
Objectives of the proposed project are as follows:

1. To increase the supply of safe, sustainably produced, and locally grown shellfish while minimizing potential negative environmental impacts;
2. To enhance and sustain Ventura Harbor as a major west coast fishing port and support the local economy;
3. To provide economies of scale, pre-approved sub-permit area, and technical support to include small local producers who would not otherwise be able to participate in shellfish aquaculture;
4. To provide an entitlement and permitting template for aquaculture projects state-wide;
5. To enhance public knowledge and understanding of sustainable shellfish farming practices and promote community collaboration in achieving VSE objectives;
6. To advance scientific knowledge and state of the art aquaculture practices through research and innovation.

2.3 Project Action Area

The Action Area for this project includes the project site (twenty 100-acre growing sites occupying a total project area of 2,000 acres) and all areas within 100 feet of the Project Actions (Figure 8). This Action Area was defined based upon several factors, including the project location and components, the potential noise impacts and disturbance areas for project components, and the properties of underwater acoustics. It is anticipated that the potential noise impacts from the initial installation of the sand screw anchors using a hydraulic drill will be minimal. Helical anchors for mussel farms in open ocean habitats have been installed all over the world, including at Catalina Island. They are drilled into the seabed using a hydraulic auger controlled at the surface. The drill is submersible and is lowered with the anchor. Noise levels are very low in the water, with a 50 horsepower hydraulic power pack on the boat (Fielder Marine Services, New Zealand, pers.comm.). Rotation speeds are very low, which minimizes entanglement of marine species. The anchor installation disturbs less than 1 square meter of sea bed on installation and once installed no rope

or chain touches the sea floor which also minimizes seabed disturbance (Fielder Marine Services, New Zealand, Pers.comm). Marine wildlife, especially cetaceans, are known to be sensitive to noise effects (NMFS 2007a). However, construction noise levels will be well within acceptable thresholds for both marine mammals and fish (ICF Jones & Stokes and Illingworth and Rodkin, Inc. 2009; NMFS 2007a). Due to the minimal noise level and area of disturbance on the sea floor, we believe an action area of 100 feet is sufficient.



SOURCE: NAIP 2016

DUDEK

0 6,250 12,500 Feet

FIGURE 1

Project Location

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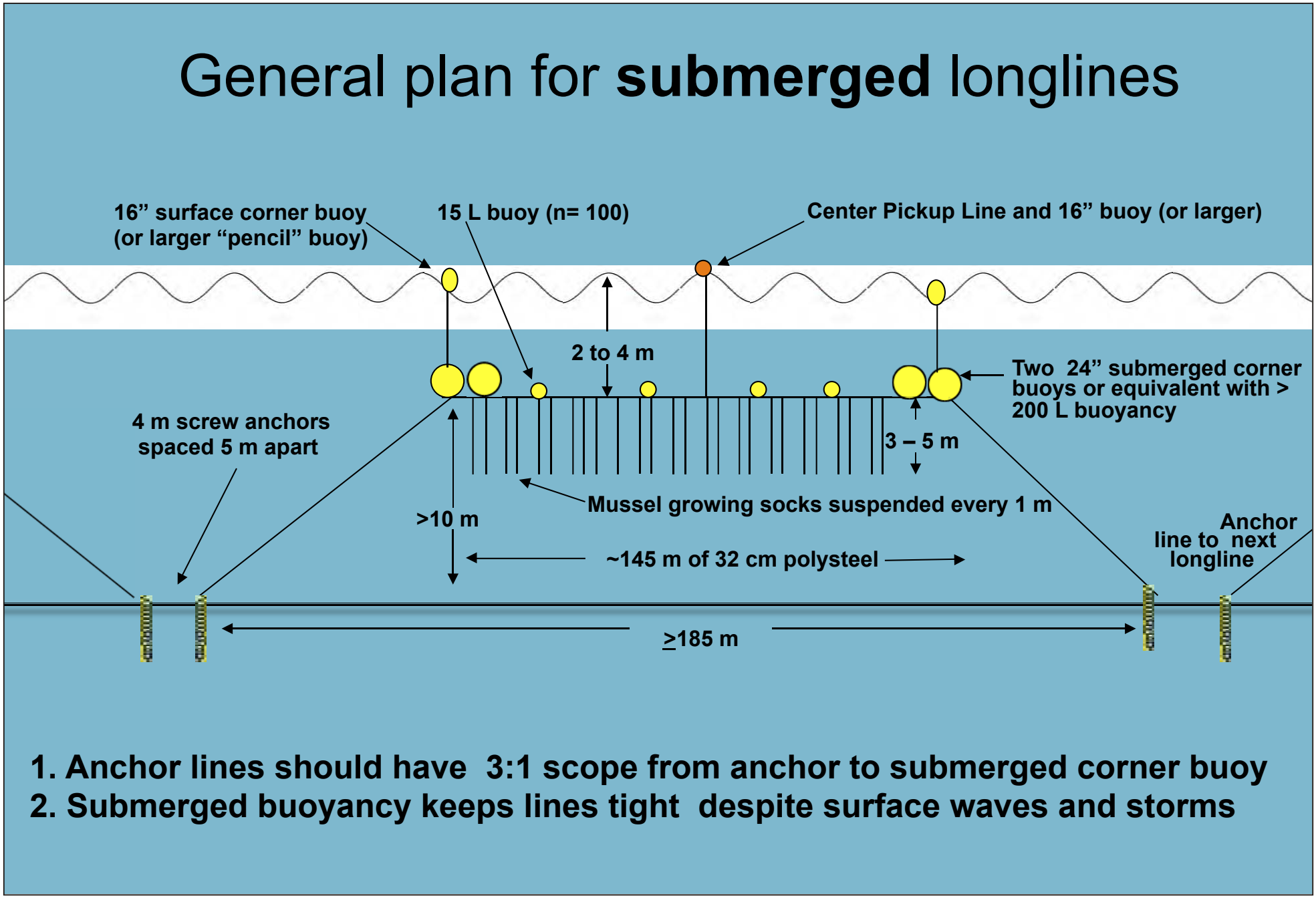

FIGURE 2

Detailed Plan for Shellfish Longlines

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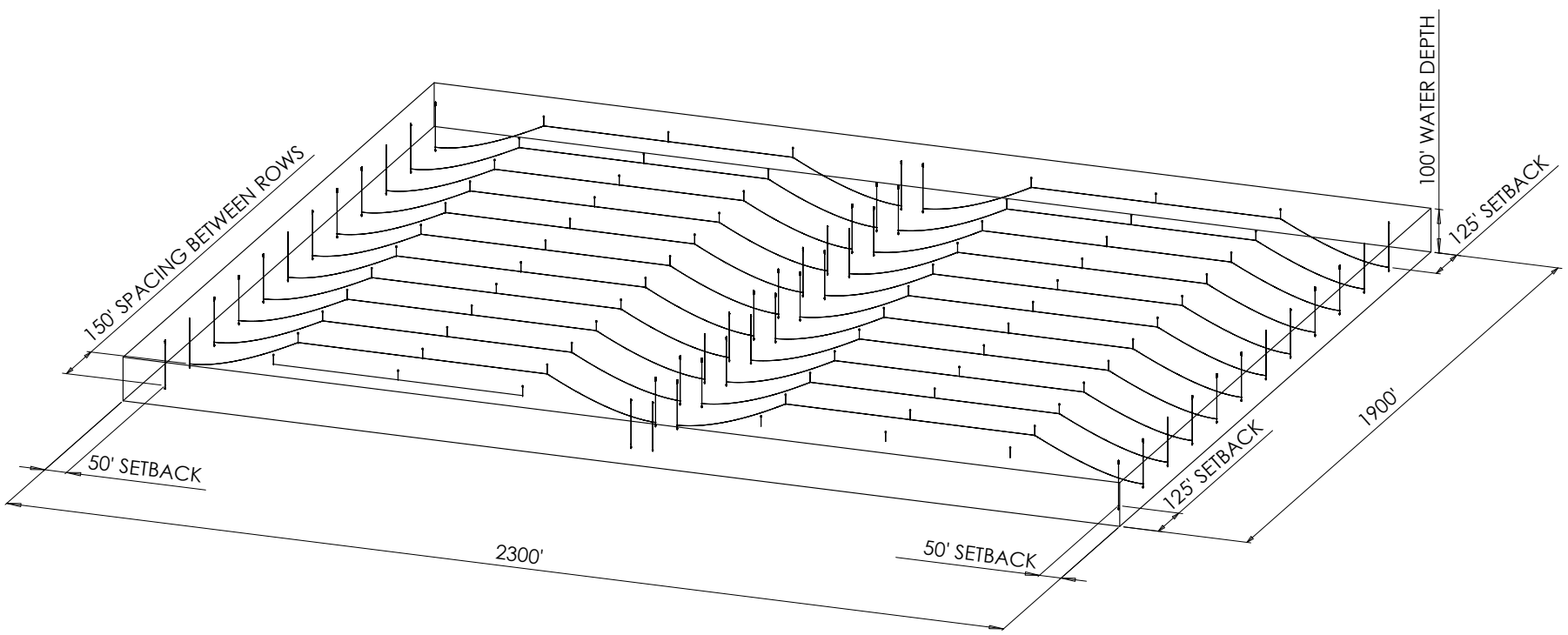

FIGURE 3A

Parcel Array Overview

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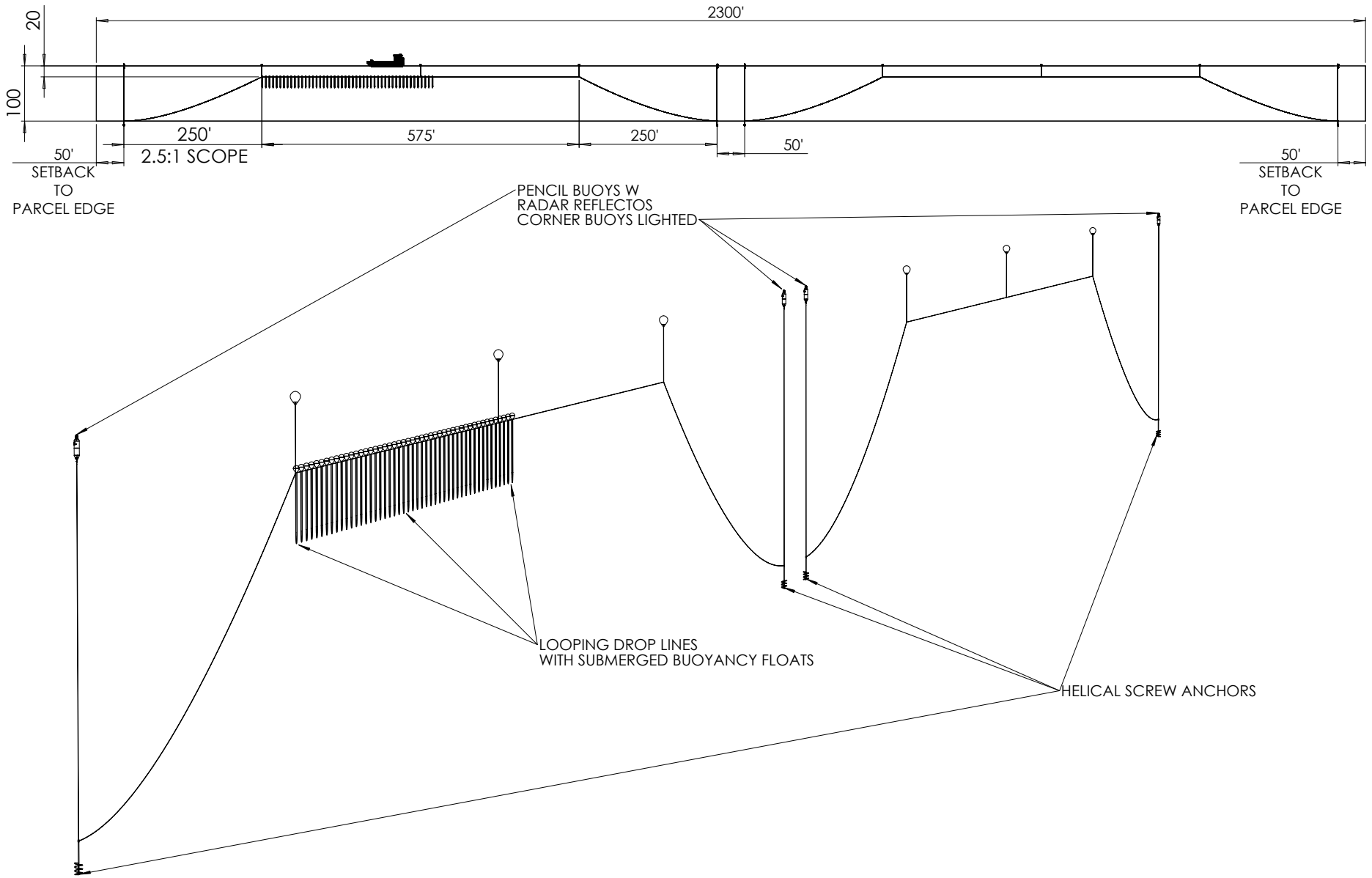

SOURCE: VSE 2018

FIGURE 3B

Backbone Details

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FIGURE 4

Simulated View of Parcel Array at the Surface: 100 Acre Plot

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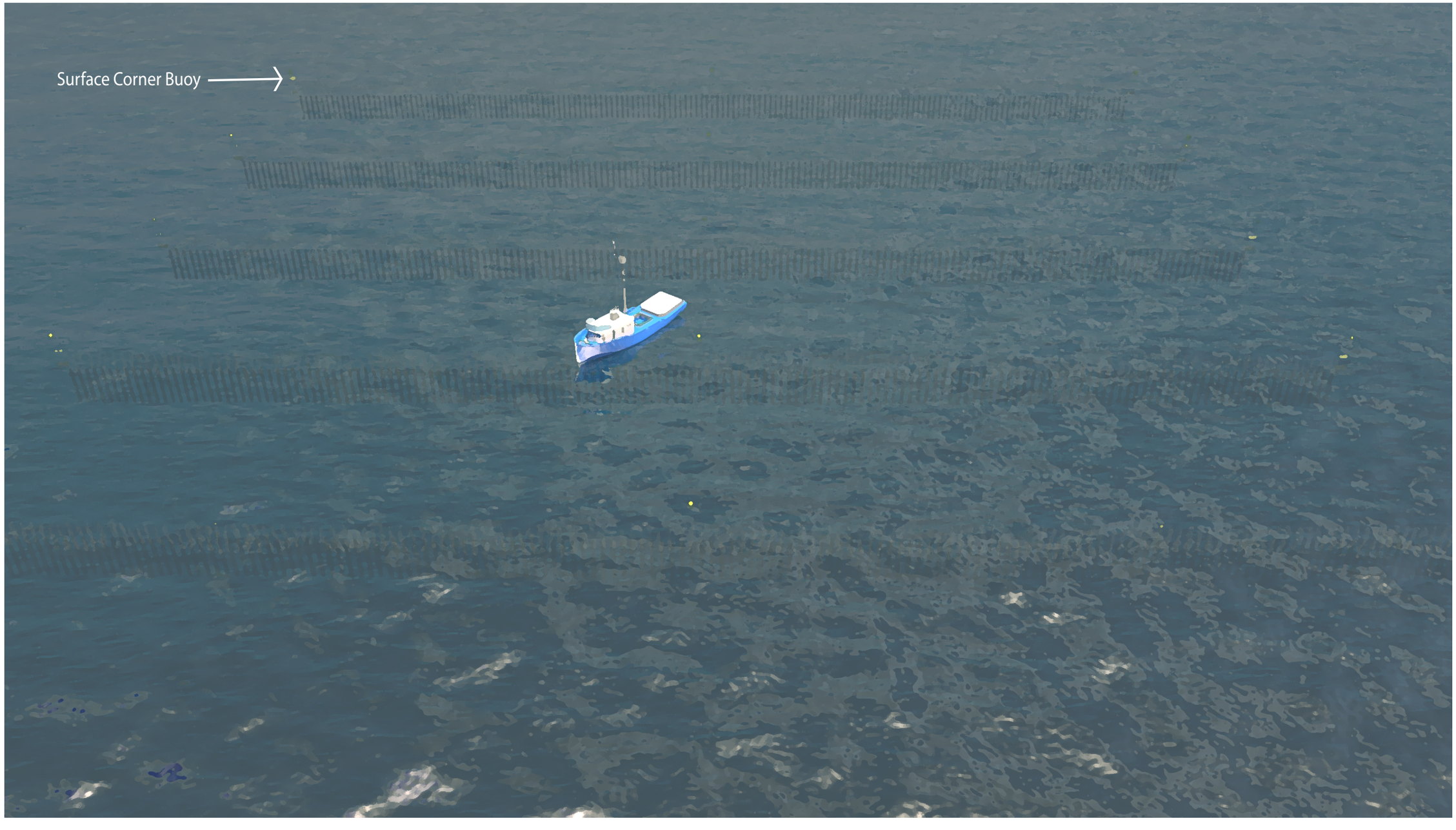

FIGURE 5

Simulated View of Parcel Array at the Surface

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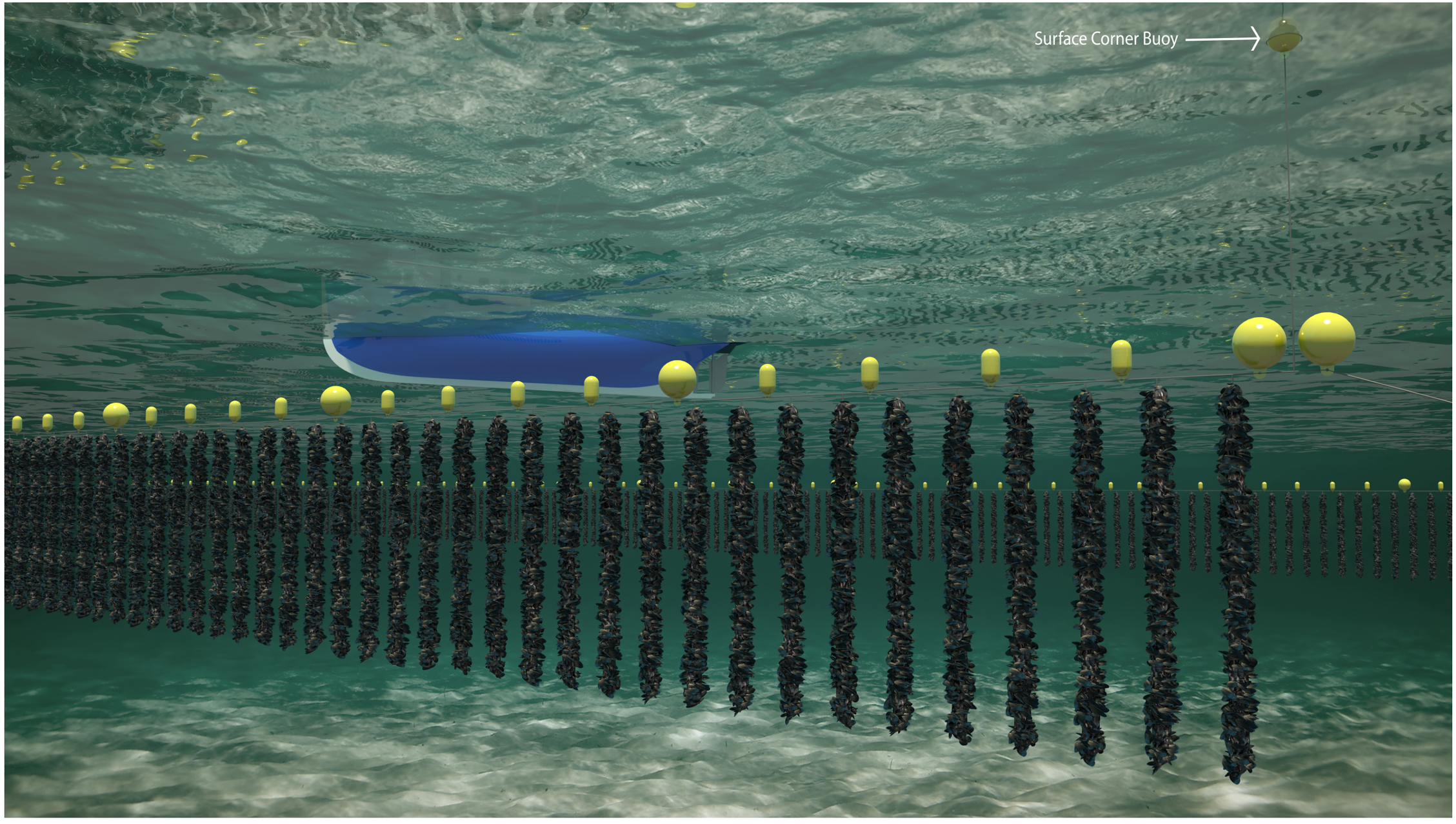

FIGURE 6
Simulated View of Parcel Array Underwater

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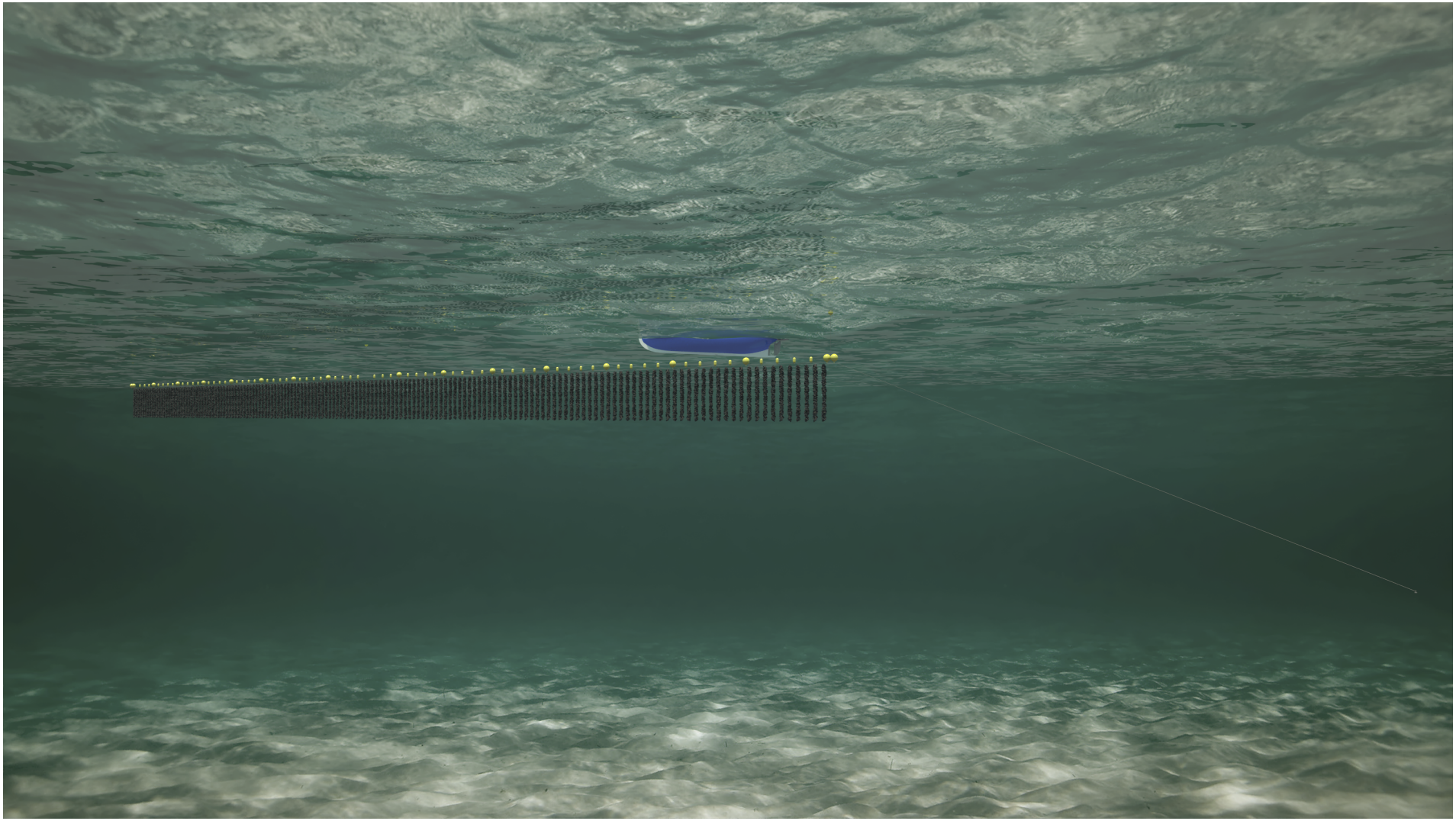

FIGURE 7

Simulated View of Parcel Array Underwater with Anchor Line

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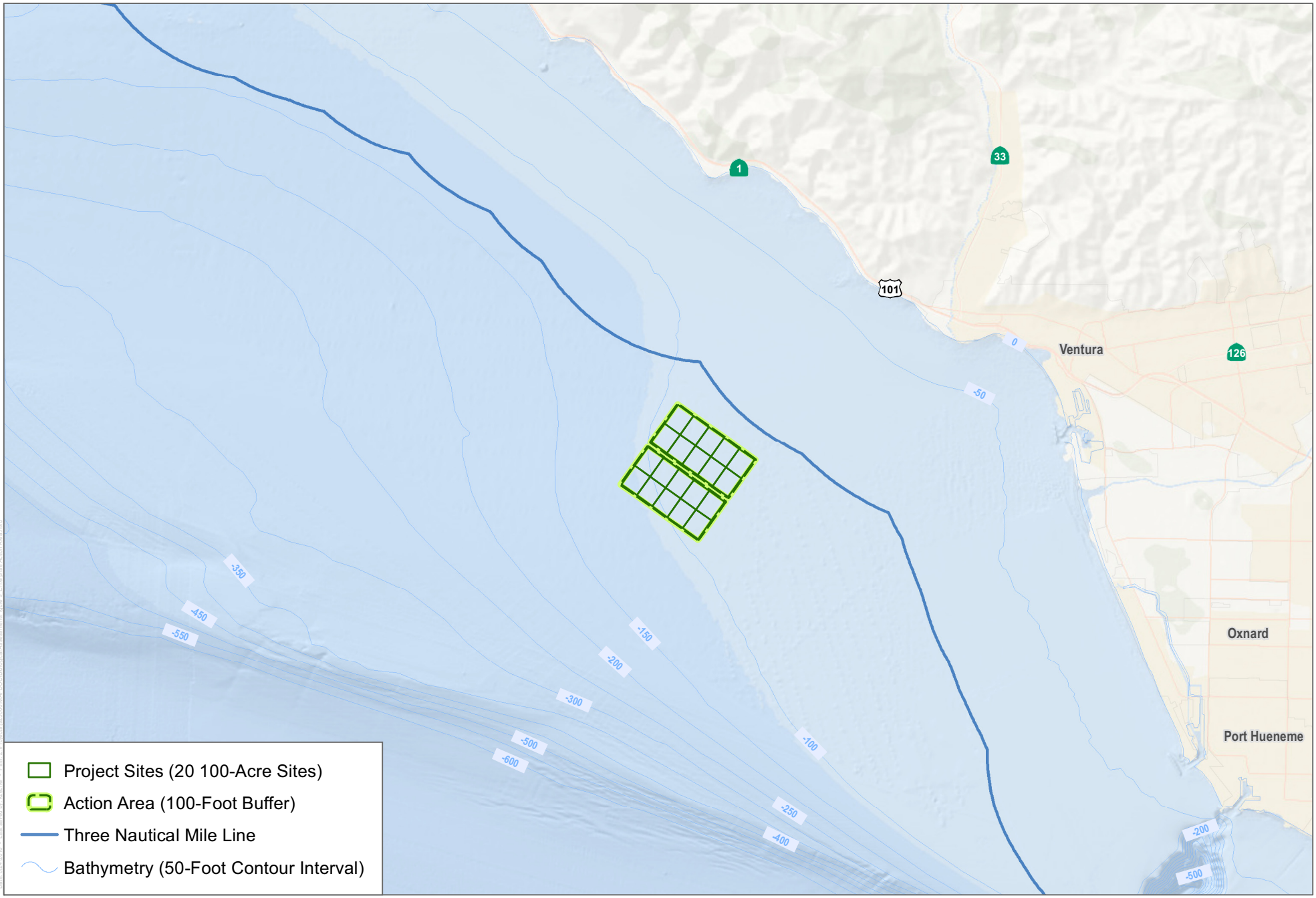

SOURCE: ESRI ArcGIS Online: World Ocean Base

DUDEK

0 1 2 Miles

FIGURE 8

Ventura Shellfish Enterprise Action Area

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3.0 REGULATORY SETTING

3.1 Federal Endangered Species Act (1973)

The federal Endangered Species Act (ESA) of 1973 (16 U.S.C. 1531 et seq.), as amended, is administered by the USFWS and NMFS. This legislation is intended to provide a means to conserve the ecosystems upon which endangered and threatened species depend and provide programs for the conservation of those species, thus preventing extinction of plants and wildlife. The ESA defines an endangered species as "any species that is in danger of extinction throughout all or a significant portion of its range." A threatened species is defined as "any species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range." Under the provisions of Section 9(a)(1)(B) of the ESA (16 U.S.C. 1531 et seq.), it is unlawful to "take" any listed species. Take is defined in Section 3(19) of the ESA as, "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct." A Final Rule published in the Federal Register on November 8, 1999 (64 FR 60727–60731), further defines "harm" as any act that kills or injures fish or wildlife, and emphasizes that such acts may include significant habitat modification or degradation that significantly impairs essential behavioral patterns (e.g., nesting or reproduction) of fish or wildlife. Further, the USFWS, through regulation, has interpreted the terms "harm" and "harass" to include certain types of habitat modification that result in injury to or death of species, which therefore are defined as forms of take. These interpretations, however, are generally considered and applied on a case-by-case basis and often vary from species to species.

In a case where a property owner seeks permission from a federal agency for an action that could affect a federally listed plant or wildlife species, the property owner and agency are required to consult with USFWS. Take prohibitions in Section 9 of the ESA (16 U.S.C. 1531 et seq.) do not expressly encompass all plants. Property owners may take listed plant species without violating the take prohibition if:

- The proposed development is private and does not require federal authorization or permit.
- There are no special federal regulations under Section 4(d) that prohibit take of the plant species.
- There are no state laws prohibiting take of the plant species.

Section 9(a)(2) of the ESA (16 U.S.C. 1531 et seq.) addresses the protections afforded to listed plants. In addition, the ESA provides protection to invertebrate species by listing them as threatened or endangered.

3.2 Marine Mammal Protection Act (1972)

The Marine Mammal Protection Act of 1972 (MMPA), as amended, establishes a federal responsibility for the protection and conservation of marine mammal species by prohibiting the "take" of any marine mammal. The MMPA defines "take" as the act of hunting, killing, capture, and/or harassment of any marine mammal, or the attempt at such. The MMPA also imposes a moratorium on the import, export, or sale of any marine mammals, parts, or products within the U.S. The USFWS and NMFS are jointly responsible for implementation of the MMPA; USFWS is responsible for the protection of sea otters, and NMFS is responsible for protecting pinnipeds (seals and sea lions) and cetaceans (whales and dolphins).

Under Section 101(a)(5)(D) of the MMPA, an incidental harassment permit may be issued for activities other than commercial fishing that may impact small numbers of marine mammals. An incidental harassment permit covers activities that extend for periods of not more than 1 year, and that will have a negligible impact on the impacted species. Amendments to the MMPA in 1994 statutorily defined two levels of harassment. Level A harassment is defined as any act of pursuit, torment, or annoyance that has the potential to injure a marine mammal in the wild. Level B harassment is defined as harassment having potential to disturb marine mammals by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering.

3.3 Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act)

The Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. Sections 1801−1884) of 1976, as amended in 1996 and reauthorized in 2007, is intended to protect fisheries resources and fishing activities within 200 miles of shore. The amended law, also known as the Sustainable Fisheries Act (Public Law 104-297), requires all federal agencies to consult with the Secretary of Commerce on proposed projects authorized, funded, or undertaken by that agency that may adversely affect Essential Fish Habitat (EFH). The main purpose of the EFH provisions is to avoid loss of fisheries due to disturbance and degradation of the fisheries habitat. Managed fisheries found in the project vicinity include, but are not limited to California halibut, ridgeback prawn, sea cucumber trawl, and rock crab trawl fisheries, and set gill net for California halibut and white sea bass

Essential Fish Habitat is addressed in the Essential Fish Habitat Assessment Report for the Ventura Shellfish Enterprise.

4.0 FEDERALLY PROTECTED SPECIES AND CRITICAL HABITAT

4.1 Federally Protected Species

The following resources were used to determine which federally listed, proposed, or federally recognized (i.e., NMFS Species of Concern) species had a potential to occur in the Action Area: NOAA California Species List Tools (NOAA 2018a), NOAA Find a Species Website (NMFS 2018a, filtered for West Coast Region), Channel Islands Bird Checklist (Collins 2011), USFWS Information for Planning and Consulting (USFWS 2018a), USFWS Environmental Conservation Online System (USFWS 2018b), the NOAA Section 6 Program Website (NOAA 2018b), NMFS Species of Concern (NMFS 2018), Environmental Sensitivity Index (ESI 2010), and California Natural Diversity Database (CNDDB; CDFW 2018). The NOAA Species List Tools (NOAA 2018a) and CNDDB (CDFW 2018) were queried for the 7.5-minute U.S. Geological Survey quadrangle that bordered the Pacific Ocean from the Ventura County line south to Port Hueneme, which included Pitas Point, White Ledge Peak, Ventura, Oxnard, and Oxnard OE W.

Information on species distribution, behavior, and habitat preferences was obtained from sources such as NOAA Find a Species Website (NMFS 2018a), Marine Mammal Stock Assessment Reports (e.g., Allen and Angliss. 2014), Marine Mammals of the World: A Comprehensive Guide to Their Identification (Jefferson et al. 2008), Point Blue Conservation Science Whale Alert Map (PBCS 2018), Large Cetacean Analysis for the Santa Barbara Channel Region (Cascadia 2011), Marine Mammal Commission (MMC 2007, 2018), Marine Mammal Haulouts and Rookeries (CDFW 2009), California Bird Records Committee (CBRC 2018), USFWS Recovery Plans, USFWS 5-Year Reviews and/or Federal Registers. Additional resources are reported within the species account information.

The database searches returned a total of 68 species. Of these species, 8 cetaceans, 1 mustelid, 2 pinnipeds, 3 birds, 5 sea turtles, 2 sharks, 8 fish, and 2 invertebrates have a federal status of Endangered or Threatened. Other species that are covered only under the MMPA (no other federal designation) include 21 cetaceans and 4 pinnipeds. Species that are only covered under NMFS Species of Special Concern include 1 shark, 8 fish and 3 invertebrates. Although NMFS Species of Concern designation is not protected under the ESA, this BA includes these species for a complete analysis of species with a recognition from a federal agency.

Based on Dudek's habitat suitability analysis, 12 species have a moderate to high potential to occur in the Action Area. Appendix B provides Dudek's habitat suitability analysis and an assessment of the species potential to occur in the Action Area, including species not expected to occur or a low potential to occur. Section 4.2, below, provides species descriptions and assessments for those species with a moderate to high potential to occur.

4.2 Status of the Species and their Habitat in the Action Area

This section describes the status, basic life history, and potential for occurrence for federally-listed, proposed, or federally recognized species that are identified as potentially affected by the Project Actions as described above.

4.2.1 Federally-Listed Species

4.2.1.1 Cetaceans

Gray Whale

Gray whales (*Eschrichtius robustus*) of the Eastern North Pacific Stock were delisted from the ESA in 1994 (59 FR 31094-31095) but are protected by the MMPA. This species occurs in coastal waters along the west coast of North America from Mexico to Alaska, and in eastern Siberia. Gray whales usually feed along the Bering, Chukchi, and Beaufort seas during the summer, and winter along breeding and calving areas off the coast of Baja California. Calves are born from January to February (NMFS 2018a). During their northward migration from Baja to Alaska, cow-calf pairs stay particularly close to shore to avoid predation by orcas (*Orcinus orca*) (NMFS 2014). Gray whales are bottom feeders that consume benthic amphipods (epibenthic fauna such as mysids, amphipods, polychaete tubeworms). Since this species is a bottom feeder, gray whales are restricted to shallow continental shelf waters (Jefferson et al. 2008). Juvenile gray whales often are found in Santa Barbara Harbor and along the coastline and have been observed in the surf at Ventura Point (J. Davis IV, pers. obs). In Santa Barbara, gray whales are seen during their northward migration within 3 nautical miles from shore, frequently travelling along the kelp line within close proximity to Coal Oil Point where surveys take place for four months beginning in February (Gray Whales Count 2018). Data shows an upward trend for gray whales over the last five years from 736 whales in 2013 to 1,052 whales in 2017. More whales means an increase in the chance for interaction between ships and fishing gear. Ship strikes, entanglement, habitat degradation, whale watching harassment, low-frequency noise disturbance and impacts from commercial/industrial development are the largest threats to gray whales (NMFS 2018c). In California, ship strikes of gray whales are the most commonly reported followed by fin, blue, humpback, and sperm whales (NOAA 2017b).

Potential for Occurrence. High potential to occur. This species is a frequent visitor to the Ventura coastline and the Santa Barbara Channel and is commonly observed during migration, especially during the northward migration from Baja to Alaska. Gray whales are often observed close to shore, and there have been many regular occurrences in the Action Area on a yearly basis (PBCS 2018). The local whale watching boat, The Condor Express, has sighted 12 gray whales within 5 miles of the project area since the start of the 2018 gray whale season in the Santa Barbara Channel (Condor Express 2018, PBCS 2018). Whales are traveling northward at about 2.5 miles from shore as seen for example on the local whale watching trip in Santa Barbara Channel on March 15, 2018 (Condor Express 2018). Gray whale migration routes overlap with the Action Area and encompass the entire Santa Barbara Channel (Calambokidis et al. 2015; NOAA 2012; NOAA 2018e).

Humpback Whale

The humpback whale (*Megaptera noaengliaea*) is a federally-listed endangered species and is protected by the MMPA. Humpback whales occur throughout the North Pacific. North Pacific breeding areas fall broadly into three regions: 1) western Pacific (Japan and Philippines); 2) central Pacific (Hawaiian Islands); and 3) eastern Pacific (Central America and Mexico). Along the U.S. west coast, one stock is currently recognized that includes individuals that appear to be part of two separate feeding groups, a California and Oregon feeding group and a northern Washington and southern

British Columbia feeding group. Humpbacks from both groups have been matched to breeding areas off Central America, mainland Mexico, and Baja California. The population is estimated at approximately 1,918 animals for the California/Oregon/Washington stock (NOAA 2015). Migrating individuals from the Central America Distinct Population Segment (DPS) may migrate through the Action Area on their way to feeding grounds located off the Pacific Northwest (NMFS 2018a). This species stays near the surface of the ocean when migrating and prefers shallow waters when feeding and calving. This species can be seen close to shore when conditions allow for prey switching from krill to small schooling fish, which inhabit nearshore areas. Humpbacks are commonly found feeding in the Santa Barbara Channel during summer and fall, with some observations closer to shore in the Ventura Area. Typically, humpback whales utilize predictable habitats offshore along the continental shelf break and slope where upwelling occurs where they feed on krill (Yen et al. 2004). However, when conditions change and krill is not available, humpback whales are known to prey switch and feed on small schooling fish, which occur in nearshore waters (Fleming et al. 2016). In July 2017, a humpback found its way into Ventura Harbor (VC Star 2017). In addition, this species is strongly associated with the 200 meter isobath (Cascadia 2011). Threats to humpback whales include ship strikes, entanglement in fishing gear, whale watch harassment, and habitat impacts (NMFS 2018c). On the west coast of the United States, ship strikes are an important cause of mortality for baleen whales, including humpback, blue, fin and gray whales (Berman-Kowalewski et al. 2010).

Potential for Occurrence. Moderate to high potential to occur. Foraging and migration habitat is present in the Action Area. Numerous observations of this species have been documented within the Santa Barbara Channel both close to shore and near the Channel Islands (PBCS 2018). NOAA's cetacean mapping tool indicates humpback whale feeding habitat is close to the Action Area and is prevalent in the Santa Barbara Channel (NOAA 2018e). The project area is situated near feeding Biologically Important Areas (BIAs) and encompasses moderate humpback whale predicted densities for the Santa Barbara Channel (Calambokidis et al. 2015). Habitat-based density models show high predicted density in the action area (Becker et al. 2016), and Becker et al. (2017) show a marked seasonal difference in the area, with the highest predictions for this species in winter and spring for the Santa Barbara Channel.

Fin Whale

The fin whale (*Balaenoptera physalus physalus*) is a federally-listed endangered species and also is protected by the MMPA. Fin whales occur worldwide, primarily in temperate to polar latitudes and are less common in the tropics. They are one of the more commonly seen whales in the Northern Hemisphere. Its distribution is not well known, but it generally migrates poleward to feed in the summer and to the subtropics to breed in the winter (Jefferson et al. 2008). The location of the winter breeding grounds is unknown. Fin whales feed on krill, small schooling fish, copepods and squid (NOAA 2018a). They are usually solitary or travel in pairs, but on feeding grounds there can be groups of up to 20, with 100 or more whales loosely grouped (Carwardine et al. 1998). The California/Oregon/Washington stock has approximately 3,200 fin whales. Fin whales prefer deeper, offshore waters and are a fast swimming species. This species is more commonly associated with the 200 meter isobath, which is approximately 7.4 miles from the Action Area (Cascadia 2011). Threats to this species include ship strikes, entanglement and ocean noise pollution (NOAA 2018a). On the west coast of the United States, ship strikes are an important cause of mortality for baleen whales, including humpback, blue, fin and gray whales (Berman-Kowalewski et al. 2010).

Potential for Occurrence. Moderate potential to occur. This species has been observed migrating and feeding through the Santa Barbara Channel on many occasions with one occurrence (12 individuals) noted within 1 mile of the Action Area in 2011 (PBCS 2018; Cascadia 2011). Resources (krill, small schooling fish and squid) are likely present in the Action Area. The project area is situated within moderate fin whale predicted densities within the Santa Barbara Channel (Becker et al. 2016; Calambokidis et al. 2015).

4.2.1.2 SEA TURTLES

Loggerhead Sea Turtle

The loggerhead sea turtle (*Caretta caretta*) is a federally-listed endangered species, and also is protected by the MMPA. The North Pacific Ocean DPS occurs in tropical to temperate waters in the Pacific Ocean. Loggerhead sea turtles migrate from nesting grounds in Japan and Australia to feeding grounds located along the west coast from central to North America. Nesting occurs mainly on open beaches or along narrow bays having suitable sand, and often in association with other species of sea turtles. They choose ocean beaches with high wave energy, narrow, steep slopes, and coarse-grain sand for their nests. There are no known nesting locations that occur along the western seaboard of the U.S. or Hawaii (NMFS and USFWS 1998a). The closest known loggerhead nesting beaches in the North Pacific Ocean are located in Japan (NMFS and USFWS 2007). Baja California has the largest known aggregations of loggerhead sea turtles. Migration occurs along nearshore coastal waters (neritic zone). Loggerhead sea turtles typically feed on benthic invertebrates in hard bottom habitats, although fish and plants are occasionally consumed (NMFS and USFWS 1998a). During ideal conditions (water temperature/break), this species is known to migrate along the coast of California, including the Santa Barbara Channel. Sightings of this species along the U.S. west coast typically are of juveniles measuring 20-60 centimeter shell length (NMFS and USFWS 1998a). Loggerhead sea turtles are subject to several threats including loss of nesting habitat; disorientation of hatchlings by beachfront lighting; degradation of foraging habitat; marine pollution and debris; ship strikes; disease; and incidental take from commercial trawling, longline, and gill net fisheries (NMFS and USFWS 1998a).

Potential for Occurrence. High potential to migrate. Although there is no suitable feeding habitat (hard bottoms, benthic invertebrates) within the Action Area, during migration they may enter the Action Area. This species has been observed at San Clemente Island (NMFS and USFWS 2007). Loggerhead sea turtles are not expected to nest in the Action Area. No beach habitat is present in the Action Area and the Santa Barbara Channel area is outside of nesting range.

Green Sea Turtle

The green sea turtle (*Chelonia mydas*) is a federally-listed threatened species, and also is protected by the MMPA. The Eastern Pacific DPS ranges from Baja California to southern Alaska. However, the green sea turtle is more common from San Diego southward. This species forages in the open ocean when migrating as well as shallow waters of lagoons, bays, estuaries, mangroves, eelgrass, and seaweed beds. They are herbivorous and feed primarily on seagrasses and algae. Green sea turtles are generally found in shallow waters except when migrating. It is a regular visitor in the waters off the southwest coast of the United States. Residents occur in the San Gabriel River, Long Beach (NMFS and USFWS 1998b). The closest known nesting occurrences are in Mexico (NMFS and USFWS 1998b). This species requires open beaches

with a sloping platform and minimal disturbance for nesting. Green sea turtles have strong nesting site fidelity and often make long distance migrations between feeding grounds and nesting beaches. Threats to the green sea turtle include commercial harvesting, loss of nesting habitat; disorientation of hatchlings by beachfront lighting; nest predation by native and non-native predators; degradation of foraging habitat; marine pollution and debris; ship strikes; and incidental take from commercial fishing operations (NMFS and USFWS 1998b).

Potential for Occurrence. High potential to occur. They have been captured at Sterns Wharf in Santa Barbara harbor and at the Channel Islands. This species may migrate and/or forage in the Action Area. Green sea turtles are not expected to nest in the Action Area.

4.2.2 OTHER NON-LISTED SPECIES PROTECTED UNDER THE MMPA

4.2.2.1 Cetaceans

Common Minke Whale

The common minke whale (*Balarnoptera acutorostrata*) is protected by the MMPA. Minke whales are found throughout the world in polar, temperate, and tropical waters in both coastal and offshore habitats (NMFS 2018a). They are the smallest baleen whale in North American waters. It migrates seasonally and travels great distances. Common minke whales are the smallest baleen whale in North American waters. Some individual minke whales are residents in California waters. They are often solitary but sometimes travel in groups of 2-3 individuals (NMFS 2018a). This species feeds on copepods, krill, and small schooling fish. Minke whales are a normally cryptic species but are sometimes curious and will approach vessels (especially stationary vessels). Minke whales are subject to the following threats including entanglement (gill nets, seine nets, herring weirs, lobster traps, driftnets, longlines, and trawls), habitat disturbance, human interactions, noise pollution, and ship strikes (NMFS 2018a).

Potential for Occurrence. Moderate potential to occur. Foraging and migration habitat is present in the Action Area. Minke whales feed on euphausiids, copepods and small schooling fish, which are present in the Channel. In addition, this species has been recorded since 1988 in the Santa Barbara Channel and within 1 mile of the Action Area, although this species is usually in slightly deeper waters (PBCS 2018). Stock reports for the California/Oregon/Washington Stock show minke whales in close proximity to the northern Channel Islands, within the Santa Barbara Channel (NMFS 2016c).

Common Bottlenose Dolphin

The common bottlenose dolphin (*Tursiops truncatus*) is protected by the MMPA. Bottlenose dolphins have a worldwide distribution ranging from 45°N to 45°S latitude and are found in temperate and tropical waters. Coastal populations often migrate into bays, estuaries, and river mouths. Offshore populations inhabit pelagic waters along the continental shelf. The common bottlenose dolphin, as its name suggests, is a common coastal species, and a generalist feeder (squid, fish and crustaceans) (Jefferson et al. 2008). Common bottlenose dolphins are comprised of two sub-populations: coastal bottlenose dolphins and offshore bottlenose dolphins. Coastal bottlenose dolphins are known to

regularly occur within 1 kilometer of shore (Carretta et al. 1998). In southern California, they are found within 500 m of the shoreline 99% of the time and within 250 m 90% of the time (NMFS 2017g). On the other hand, offshore bottlenose dolphins inhabit areas at distances greater than a few kilometers from the mainland (NMFS 2011a). They may travel alone or in groups and commonly work together to herd prey. They are active at the surface and will approach ships and even other whales to bow ride as an energy efficient mode of transportation (NMFS 2018a). They interact with fisheries and are often seen following shrimp trawlers (Jefferson et al. 2008). Common bottlenose dolphins are subject to the following threats including entanglement (gill nets, driftnets, longlines, and trawls), habitat degradation, noise pollution, pollution from oil spills and chemicals, and ship strikes.

Potential for Occurrence. High potential to occur; specifically for offshore bottlenose dolphin populations. This species has many occurrences throughout the Santa Barbara Channel and within or directly adjacent to the Action Area (PBCS 2018). Habitat-based density models show high predicted density for this species in the action area (Becker et al. 2016).

Long-beaked Common Dolphin

The long-beaked common dolphin (*Delphinus capensis capensis*) is protected by the MMPA. Long-beaked common dolphins are commonly found along the U.S. west coast, from Baja California (including the Gulf of California) northward to about central California. Long-beaked and short-beaked common dolphins are similar species but have different habitat preferences. Long-beaked common dolphins prefer coastal waters. Long-beaked common dolphins are not as abundant as short-beaked common dolphins. They select shallower areas in tropical, subtropical, and warmer temperate to cool waters closer to the coast (within 50-100 nautical miles (90-180 km)) and the continental shelf (NMFS 2018a). This species will sometimes come close to shore within waters that are only a few meters deep (Jefferson et al. 2008). Long-beaked common dolphins usually travel in pods of 100-500 individuals, but have been seen numbering in the thousands. They are active at the surface and will approach ships to bow ride as an energy efficient mode of transportation (NMFS 2018a). Long-beaked common dolphins are subject to the following threats: entanglement (gill nets, driftnets, longlines, and trawls).

Potential for Occurrence. High potential to occur. Foraging resources (small schooling fish and squid) are likely present in the Action Area. This species has been recorded multiple times and in great numbers (e.g., occurrences with 1,500 individuals) in the Santa Barbara Channel, including the Action Area (PBCS 2018). Habitat-based density models show high predicted density for this species in the action area (Becker et al. 2016; Douglass et al. 2014).

Short-beaked Common Dolphin

The short-beaked common dolphin (*Delphinus delphis delphis*) is protected by the MMPA. Short-beaked common dolphins inhabit warm tropical to cool temperate waters that are primarily oceanic and offshore. Off the U.S. west coast, the majority of the populations are found off California, especially during the warm-water months. This species occurs along the continental slope in waters 650-6,500 feet (200-2,000 m) deep (NMFS 2018a). This species is often associated with areas of upwelling and areas of steep sea-bottom, and as an offshore species they are commonly associated with pilot whales (Jefferson et al. 2008). Short-beaked common dolphins prefer deeper, offshore habitat. Short-beaked common dolphins travel in pods of hundreds to thousands of individuals. They are

active at the surface and will approach ships and even other whales to bow ride as an energy efficient mode of transportation (NMFS 2018a). Short-beaked common dolphins are subject to the following threats: entanglement (gill nets, driftnets, longlines, and trawls).

Potential for Occurrence. Moderate to high potential to occur. Foraging resources (small schooling fish and squid) are likely present in the Action Area. This species has been recorded multiple times and in great numbers (e.g., occurrences with 1,500 individuals) in Santa Barbara Channel and adjacent to the Action Area (PBCS 2018). Habitat-based density models show high predicted density in the action area (Becker et al. 2016; Douglass et al. 2014), and indicated a marked seasonal difference in the area, with the highest predictions for this species in summer and fall for the Santa Barbara Channel (Becker et al. 2017; Campbell et al. 2014).

Pacific White-sided Dolphin

The Pacific white-sided dolphin (*Lagenorhynchus obliquidens*) is protected by the MMPA. Pacific white-sided dolphins are found in temperate waters in the North Pacific and they utilize waters over the continental shelf to the deep open ocean (NMFS 2018a). In North America, in the Pacific they range from the Gulf of Alaska to the Gulf of California. Pacific white-sided dolphins exhibit seasonal inshore/offshore and north/south movements, but are generally non-migratory. This species feeds mostly on cephalopods and small schooling fish in deep offshore waters but also on the continental shelf (Jefferson et al. 2008). They are often observed working together in pod sizes of 10-100 individuals working together to herd schools of fish. Pacific white-sided dolphins are subject to several threats: entanglement in fishing gear (gillnets, longline), pollution, noise (will react to pingers), and ship strikes (NMFS 2018a). They will often bow ride with vessels as a method of energetically efficient transportation.

Potential for Occurrence. Moderate potential to occur. Foraging habitat is present in the Action Area. In addition, this species has numerous occurrences within the Santa Barbara Channel (mostly offshore, this species is commonly associated with other deep-water cetaceans such as Risso's dolphins and Northern right whale dolphins (NMFS 2018a)) and a few occurrences in the Action Area (PBCS 2018). Habitat-based density models show high predicted density for this species in the action area (Becker et al. 2016), particularly in the fall (Campbell et al. 2014; Douglass et al. 2014).

4.2.2.2 Pinnipeds

California Sea Lion

The California sea lion (*Zalophus californianus*) is protected by the MMPA. It inhabits the eastern North Pacific Ocean from central Mexico to Canada. This species is present along the west coast from the Tres Marias Islands off Puerto Vallarta, throughout the Gulf of California and the Baja peninsula, north to Alaska. Males (adults, subadults, and juveniles) undertake a northward migration to Central California and Washington after the breeding season in southern rookeries. They are generalist opportunistic feeders (squid and fishes in areas of upwelling) and utilize the continental shelf and slope, but have also been observed in deeper oceanic waters (Jefferson et al. 2008). California sea lions prefer shallow coastal and estuarine waters and sandy beaches for haul out sites but will also haul out on marina docks, jetties, and buoys (NMFS 2018a). On land, they are wary of humans, but in the water they are curious, bold

and will approach boats looking for fish. They will take fish from commercial fishing gear, sport fishing lines, and fish passage facilities at dams and rivers. They are less wary of people because they associate people with an easy meal. They may also be curious about construction activities. California sea lions are subject to several threats: entanglement in fishing gear (gillnets, longline), pollution, ship strikes and human caused injuries.

Potential for Occurrence. High potential to occur. This species has known haulouts along all of the Channel Islands and rookeries at San Nicholas Island (CDFW 2009, NMFS 2018a).The project site is within their distribution range (Lowry and Carretta 1999; NOAA 2018a). California sea lions mostly forage near mainland coastlines, the continental shelf, and seamounts. Adult females feed between 10–100 km from shore (Lowry and Carretta 1999) while adult males may forage up to 450 km from shore (Weise et al. 2006).

Pacific Harbor Seal

The Pacific harbor seal (*Phoca vitulina*) is protected by the MMPA. It is widespread in coastal areas of the Northern Hemisphere, in temperate and polar habitats. It is generally non-migratory and inhabits areas from the coast to the continental slope (Jefferson et al. 2008). On the U.S. west coast, this species is found in coastal and estuarine waters from Canada to Baja California, Mexico. Harbor seals inhabit temperate coastal habitats and use rocks, reefs, beaches, and drifting glacial ice for hauling out and pupping sites (NMFS 2018a). Diving averages less than 35 meters and they are generalist feeders (a variety of fish, cephalopods and crustaceans) (Jefferson et al. 2008). On land, harbor seals are very wary and shy, and will stampede into the water when disturbed. In the water, they are curious but cautious and will peer at people/boats. Harbor seals are subject to several threats: incidental capture in fishing gear (gillnets, trawls, purse seines, weirs), ship strikes, pollution, power plant entrainment, and harassment by humans when on land.

Potential for Occurrence. High potential to occur. Harbor seals have known haulouts and rookeries at Carpinteria Bluffs (Santa Barbara County) and Point Mugu (Ventura County); and haulouts from Point Conception to Santa Barbara and along all of the Channel Islands (CDFW 2009).

4.3 Critical Habitat

No designated critical habitat for federally-listed threatened and endangered species occurs within the Action Area (USFWS Environmental Online System (USFWS 2018b), NOAA Critical Habitat Maps (NOAA 2018c)).

5.0 EFFECTS OF THE ACTION

5.1 Effects of the Project Actions

This section analyzes all of the potential effects to listed species from Project Actions. As described in NMFS (2009) and 50 CFR 402.02, **direct effects** are those that have direct or immediate effects on the species or its habitat during construction. These effects include temporary changes in marine wildlife behavior from construction noise; and temporary construction disturbance to feeding habitat. **Indirect effects** are those that are caused by or will result from the Project Action later in time, after completion of initial construction, but still reasonably certain to occur. These effects include marine mammal disturbance due to inadvertent spills or introduction of chemical pollutants; release of invasive species, parasites, and pathogens from seed stock; effects on sediment quality due to biodeposits and changes in benthic invertebrate species; phytoplankton consumption, and fouling organisms and non-native species. Effects that may occur **both** during construction (direct effects) and later in time (indirect effect) include entanglement in aquaculture gear; vessel strikes; noise disturbance from vessels, and interference with migration or feeding routes. Each of these effects is discussed more in detail below. In addition, further assessments and mitigation measures aimed at avoiding, reducing, or remedying the effect of Project Actions are recommended below.

Direct and Indirect Effects (Occurring During and After Construction)

- **Potential for Marine Wildlife Entanglement in Aquaculture Gear**. The Project Actions may result in marine mammal entanglement. Mussel aquaculture utilizes various ropes in the water column that may pose an entanglement risk to cetaceans and sea turtles. In contrast to fishing gear, however, there are far fewer documented entanglement cases in mussel aquaculture gear. Interactions and entanglements with longline aquaculture gear worldwide are rare, and close approaches by protected species are seldom documented (Price et al. 2016). West coast entanglement summaries for 2015 and 2016 report no entanglements from mussel aquaculture fisheries (NOAA 2017c). There have been no reported marine mammal entanglements associated with Santa Barbara Mariculture, which has operated a 25-acre mussel aquaculture farm in the Santa Barbara Channel, using similar cultivation techniques, for over a decade (CDFG 2018).

  Reported entanglements are predominantly from crab, gillnet and spiny lobster fisheries. Fixed fisheries gear (e.g., pot and trap gear) is the most commonly recognized and reported gear type causing entanglements since 2000. Documented entangled animals and disentanglement efforts in the Pacific Northwest have mostly involved gray whales and humpback whales and have involved both gill nets and crab gear. While not as common, both fin and blue whales are sometimes entangled in gill nets and crab gear based on a few stranded animals and scarring on live animals (NOAA 2014). More recently, from 2014 to 2017, the majority of the whale entanglements involved humpback whales and most of the entanglements were from commercial Californian and Washington Dungeness crab traps, and gillnet fisheries (NOAA 2017c). Large whale species appear to be more vulnerable to entanglement than smaller cetacean species, such as dolphins and porpoises, which are more prone to be caught as bycatch in nets due to their smaller size (Benjamins et al. 2014). Furthermore, juveniles are more likely to be entangled due to their inquisitive nature and inexperience. The

proposed mussel culture techniques have some significant differences as compared to crab and fishing gear that reduce the potential for marine mammal entanglement. As opposed to fishery gear, the mussel aquaculture gear is stationary, the lines are larger, and the gear is not designed to catch or ensnare fish. Further, as described below, the lines will be highly tensioned, which reduces the risk of marine mammals being caught in slack lines. Therefore, the project design is expected to pose a much smaller risk to marine mammal entanglement compared to longline fishing methods.

Cetaceans also have different ways in which they can perceive mussel farm lines and navigate around them. For example, odontocetes, such as harbor porpoises, are able to use echolocation to detect the lines (Lloyd 2003; Nielson et al. 2012), and minke whales are able to detect and avoid ropes that are white or black (Kot et al. 2012).No entanglements have been reported for pinnipeds with this method of mussel aquaculture (Lloyd 2003, Clement 2013).

Entanglements involving sea turtles and cetaceans have occurred in mussel aquaculture operations in Australia, New Zealand, Iceland, South Korea and Canada (Young et al. 2015). Entanglement risk is highest at mussel farms that employ mussel spat collecting ropes, as these ropes are thinner and more flexible making them more conducive to entanglement (Keeley et al. 2009). The majority of entanglements have involved these thinner mussel spat collector ropes or buoy lines connected to them. To avoid this concern, Mitigation Measure BIO-4 requires all mussel spat to be provided by land-based hatcheries certified by the California Department of Fish and Wildlife (or collected from grow-out lines) and will prohibit spat collector ropes. The project will only utilize grow-out ropes, which are thicker and more tightly anchored and tensioned (Lindell 2014; Moore & Wieting, 1999; Price et al. 2017).

Lines with spat or mature muscles will be freely hanging (not looping ropes), thereby allowing wildlife to traverse through the area. These lines will likely be heavy enough and under sufficient tension to prevent loose lines from becoming entangled and forming loops or knots along the longline. In addition, it is anticipated that when muscles are harvested, the lines will immediately be re-seeded with spat. Project design specifications are also proposed to minimize protected marine mammal and sea turtle entanglement. The longlines that will be used are a thick (1-inch-diameter) tensioned (to approximately 800 pounds) rope that is not conducive to wrapping around or entangling protected species. The mussel grow-out ropes themselves are typically planted with seed 3 inches thick and may grow to be stiff with byssus at diameters of 10 inches or more at harvest, thus making them very unlikely sources of entanglement. As an additional precaution, grow-ropes will be attached to the headrope with a low-breaking-strength twine (4-millimeter (0.16-inch) diameter; <1,000 pounds), which will facilitate rapid detachment in the unlikely event of any marine mammal interaction with the longline (see Mitigation Measure BIO-2).

Other potential entanglement points include (1) two vertical lines to the surface buoys marking each end of the headrope and (2) one pull-up buoy line for servicing at the midpoint. To minimize these potential entanglements, a 1,100-pound breakaway link will be installed between these buoys and the vertical lines, similar to strategies used to mitigate potential entanglement in trap fisheries in the northeastern United States (NOAA 2008). Buoy lines between the surface and headrope are generally under tension partially equivalent

(0 to 10 kilograms (0 to 22 pounds)) to their full buoyancy (42 kilograms (93 pounds)). Overall, the longline configuration produces a fairly rigid structure under tension, with stout lines and little slack.

Other mitigation measures have been incorporated into the project to further minimize the potential for marine mammal entanglement. The project will incorporate a marine wildlife entanglement plan to regularly check equipment for evidence of marine mammal entanglement (MM BIO-1) and require a qualified marine wildlife observer to be present during construction activities that can halt activities if marine mammals are observed (MM BIO-3). Further details regarding these measures are found in the mitigation measures provided in Section 5. After the incorporation of these mitigation measures and given the lack of documented marine mammal entanglement incidents associated with the proposed aquaculture cultivation method, impacts associated with marine mammal entanglement are considered insignificant.

- **Ship Strikes Due to Increased Activity**. Vessel strikes are known to be a hazard to a number of marine species, particularly whales. Project Actions may result in an additional 20 to 40 small boats traveling to lease sites on an average of 3 times per week to daily and would therefore contribute to increased boat traffic in the area during both construction and regular operations. Between 1988 and 2012, there were 100 documented large whale ship strikes along the California coast (NOAA 2017b). Large whale species are vulnerable to collisions with all vessel types, classes and sizes (NOAA 2017b); however, most collisions are associated with large container and freight ships due to their mass and the speed at which they transit the shipping lanes (Silber et al. 2010). When large vessels such as container ships are involved, the crew may be unaware a strike has occurred. As such, the number of ship strikes to whales is likely under reported. Most cases where whales were known to be severely hurt or killed occurred at vessel speeds of 14 knots or more and were caused by large ships of 80 meters or more in length (Laist et al., 2001). However, collisions with smaller boats, such as those that would be used for the aquaculture operations, do have the potential to injure or kill marine wildlife, especially when travelling at high speeds (Ritter 2012). Large container or freight ships will not be used during construction of the mussel farm nor during regular maintenance. To address this concern, the project will require continuous education regarding how to properly interact with marine mammals if encountered during operations (MM BIO-5) and include vessel management requirements if vessels observe marine mammals in close proximity to the vessel (MM BIO-6). After incorporation of these mitigation measures, impacts associated with ship strikes are considered insignificant.
- **Interference with Migration or Feeding Routes.** The Project Actions will result in increased human activity and the establishment of aquaculture facilities across 2,000 acres. Available habitat within Southern California Bight includes 400 miles of recessed coastline from Point Conception, Santa Barbara County to Cabo Colnet, Mexico, (SCCWRP 2016) and comprises over 6 million acres. Increased human activity and facilities during construction and operation may deter marine wildlife from using previously open and unoccupied areas for feeding or migration in different spatial and temporal ways. As a result, marine wildlife may be forced to seek feeding or open migration routes outside of the Action Area, thereby causing wildlife to expend time and energy seeking these resources. The project site is within the northward migration route for gray whales but it is largely unknown how many marine species perceive and respond to man-made structures in the ocean (Price et al. 2017). Habitat exclusion can range from low to high risk depending upon

the location and density of mussel farms. Existing studies have demonstrated the potential for species to be excluded from foraging habitats. Lloyd (2003) describes how curtains of mussel growing lines may act as barriers and impede hunting behavior in dolphins (dusky, common, and Hector's dolphins) by interfering with sonar signals for finding prey and communicating with other members of the pod. Dusky dolphins rarely enter mussel farms (Markowtiz et al. 2004). Whales and some dolphins tend to be more sensitive, while pinnipeds and both common and bottlenose dolphins seem attracted to the underwater arrays (Clement 2013). Dusky dolphins were observed foraging adjacent to mussel farms pointing to the suggestion that fish may be attracted to the structure (Price et al. 2017). Most studies were conducted in nearshore waters and it is uncertain how, or even if these results, pertain to offshore longline mussel farms in deep open ocean locations. However, this effect would be minimal due to the expansive open ranges that are open for marine wildlife in the greater region, and the project site is not located within critical habitat.

Direct Effects (Construction-Related Effects)

- **Changes in Marine Wildlife Behavior from Construction**. Disturbance to marine wildlife such as construction-related noise could occur from anchor installation and array set up. Noise effects may have a variety of indirect effects on marine wildlife species, including increased stress, weakened immune systems, altered feeding behavior, altered mother-infant relationships, displacement due to startle, degraded communication with conspecifics (e.g., masking), damaged hearing from extremely loud noises, and increased vulnerability to predators (MMC 2007; NMFS 2016c; Thomsen 2009). Another potential effect is abandonment of an area due to human disturbance which has been shown in several species (Lloyd 2003). The NOAA Fisheries criteria distinguishes between impulse sound, such as that from impact pile driving, and continuous sounds, such as that from vibratory pile driving. The Level A (injury) and Level B (disturbance) threshold levels used by NOAA Fisheries are summarized in Table 2 for cetaceans (whales, dolphins, and porpoises) and pinnipeds (seals and sea lions). NOAA is developing comprehensive guidance on sound characteristics likely to cause injury and behavioral disruption in the context of the Marine Mammal Protection Act (MMPA), Endangered Species Act (FESA) and other statutes. Until formal guidance is available, NOAA Fisheries uses conservative thresholds of received sound pressure levels from broad band sounds that may cause behavioral disturbance and injury, and the criterion levels specified in Table 1 are specific to the levels of harassment permitted under the MMPA (NMFS 2018e). Project Activities will temporarily disturb and alter the seafloor habitat from the placement of screw anchors used to hold the lines, ropes, floats, and buoys. Construction-related noise with the installation of sand screw anchors is very low in the water, with only a 50 horsepower hydraulic power pack on the boat, stipulating that noise will not approach NOAA thresholds. Furthermore, rotation speeds are also very low, which minimizes entanglement of marine species. The anchor installation disturbs less than 1 square meter of sea bed on installation and once installed no rope or chain touches the sea floor which also minimizes seabed disturbance (Fielder Marine Services, New Zealand, Pers.comm). Marine species that are the focus of this assessment are highly mobile and have the ability to temporarily avoid the project site during construction activities. Therefore, noise impacts associated with installation of equipment are considered insignificant.

Table 1
NOAA Fisheries Acoustic Thresholds

Criterion	Criterion Definition	Threshold
In-Water (Excluding Tactical Sonar and Explosives)		
Level A	PTS (injury) conservatively based on TTS	190 dB $_{rms}$[1] for pinnipeds 180 dB $_{rms}$ for cetaceans
Level B	Behavioral disruption for impulsive noise (e.g., impact pile driving)	160 dB $_{rms}$
Level B	Behavioral disruption for non-pulse noise (e.g., vibratory pile driving, drilling)	120 dB $_{rms}$
In-Air		
Level A	PTS (injury) conservatively based on TTS	None established
Level B	Behavioral disruption for harbor seals	90 dB $_{rms}$
Level B	Behavioral disruption for non-harbor seal pinnipeds	100 dB $_{rms}$

Indirect Effects (After Completion of Initial Construction)

- **Oil Spills.** Construction and harvesting operations (and the use of any heavy equipment) could result in water-quality effects due to chemical-compound pollution (fuel, oil, lubricants, inadvertent spills, and other materials) in the event of an oil spill. As with any mechanized machinery, there is a small risk of accidental discharge of fuel, lubricants, or hydraulic fluids, which could affect marine wildlife in the area and result in injury and/or mortality to wildlife in the area of the contaminant through ingestion, physical contact that reduces survival functions (e.g., oiled wildlife), or a reduction in suitable feeding habitat. Although spills of this nature are detrimental to aquatic organisms, it is expected that the impacts would be negligible because of the limited occurrence of spills and corrective actions.
- **Marine Debris**. The project has the potential to create marine debris if aquaculture gear breaks free through poor maintenance or damage from storm or wave activity. Entanglement may occur if aquaculture gear comes loose, washes away, or otherwise escapes into the environment as a result of tide, wind, or wave action. Additional risk may occur if derelict fishing gear, lines, and other materials become entangled in the longline arrays of this project, which could compromise structural integrity and/or exacerbate the risk of marine wildlife entanglements. There is also a risk that marine debris could be ingested by gray whales and sea turtles. To address this concern, Mitigation Measure BIO-10 incorporates and aquaculture gear monitoring and escapement plan to routinely check and maintain aquaculture gear to prevent breakage and quickly retrieve any gear that breaks free. Further, Mitigation Measure BIO-11 incorporates a decommissioning plan to require timely removal of aquaculture gear once shellfish operations cease on a parcel. Upon incorporation of the proposed mitigation, impacts associated with marine debris are considered insignificant.

[1] RMS refers to the sound pressure level that is square root of the sum of the squares of the pressure contained within a defined period from the initial time to the final time. For marine mammals, the RMS pressure historically has been calculated over the period of the pulse that contains 90% of the acoustical energy.

- **Release of Potentially Invasive Species, Parasites, and Pathogens from Seed Stock**. Mussel aquaculture practices have the potential to introduce invasive species, parasites, and pathogens into the environment via contaminated seed stock, which could have detrimental effects on the California marine ecosystem. However, this project will use spat from hatcheries certified by CDFW to not contain invasive species, parasites or pathogens of concern or will be collected directly from grow-out lines. Seed stock, other than those obtained from State waters, must be inspected and certified before planting in compliance with Sections 15201 and 15600 of the Fish and Game Code. Mediterranean mussels are a non-native, but naturalized species. In fact, this mussel is now one of the most abundant mussel species between Marin County and San Diego (Suchanek et al. 1997). Given the widespread nature of this species, the proposed mussel farm would have a negligible effect on the surrounding environment. Furthermore, benthic characteristics of the project site demonstrate a lack of available suitable substrate for any further establishment of mussels beyond the project site, as the closest substrate where mussels could establish beyond the project site is several miles away.
- **Disturbance/ Displacement of the Benthic Environment.** Effects on sediment quality underneath shellfish aquaculture gear could be impacted from biodeposits and changes to the benthic invertebrate species composition. The Project Actions have the potential to disturb or alter the seafloor habitat by the deposition of biological materials resulting from dislodged or discharged shells, shell fragments, and deposits from the growing operation accumulating on the seafloor beneath the aquaculture structures. Such material typically includes feces and pseudofeces from the cultivated shellfish, as well as fouling organisms such as algae, barnacles, sponges, and other invertebrates that accumulate on the project equipment and subsequently become dislodged by natural processes, or due to harvesting or cleaning operations. Cultivated shellfish or shells from can also be dislodged from the structure during growth, storm events, predation by marine wildlife, and cleaning and harvesting activities. The accumulation of material including shell fragments, intact shells, fouling organisms, and feces can alter the physical and chemical characteristics of the bottom substrate, and can affect the benthic community and sediment-dwelling organisms that may be sensitive to conditions such as substrate composition and chemistry. Accumulation of material could also attract organisms that would change the composition of the benthic community. Other potential benthic impacts can include increased loads on sediment dissolved oxygen and redox conditions, and changes to nutrient cycling resulting in a decrease in benthic species abundance and sediment porosity (Pearson and Rosenberg 1978; Wilding and Nickell 2013; Wilding 2012). The effect on benthic nitrogen cycling is determined by biogeochemical and physical variables, such as water depth, current velocities, and bottom type and composition (CFGC 2018). Shellfish are able to alter the biogeochemical process in the water column by stimulating nitrification (Souchu et al. 2001).Mussel farms that are located in areas with greater water depths and current speeds, spread bio-deposits over a larger area without posing the risk of enhanced sediment nutrient release (Stadmark & Conley 2011). A local mussel farm, the Santa Barbara Mariculture Company, with thirteen years in operation, conducted benthic analysis testing. This sediment analysis testing examined grain size, and levels of benthic epifaunal and infaunal biodiversity both within the farm and outside of the farm, and found no significant benthic impact (CFGC 2018). Given the conditions at the Ventura Shellfish Enterprise project site, with the significant depth, wave action and mixing, this potential impact is unlikely to be significant and bioaccumulation is expected to be dispersed over a larger area. To confirm this conclusion, Mitigation

Measure BIO-9 has been incorporated, which requires monitoring of sediment quality and composition to evaluate any benthic impacts associated with the project.

Installation of the anchors proposed with the project also has the potential to displace benthic invertebrates. However, the adverse impacts to epifauna and infauna would be minimal. Each anchor would only have a footprint of less than one square meter. The total habitat area that would be disturbed by the proposed project would be small and regionally insignificant when compared to the overall amount of habitat available in the area. Further, many benthic invertebrates are mobile and would quickly recolonize the area after installation of the anchors. Therefore, impacts associated with benthic disturbance are considered insignificant.

- **Fouling Organisms and Nonnative Species.** The submerged structures of the Project Actions can provide hard substrate habitat for invasive "fouling organisms." Fouling organisms, such as invasive algae, sea squirts, and mussels, can pose economic and ecological risks to the marine environment. For example, the invasive carpet sea squirt (*Didemnum vexillum*) reproduces rapidly and fouls marine habitats (including shellfish aquaculture operations and fishing grounds), ship's hulls, and maritime structures. Like other fouling organisms, they are found on hard substrates that include floats, moorings and ropes, steel chain and ship hulls. They overgrow other marine organisms such as tunicates, sponges, macro algae, hydroids, anemones, bryozoans, scallops, mussels, and oysters. Where these colonies occur on the seabed, they likely cover the siphons of infaunal bivalves and serve as a barrier between demersal fish (or benthic feeding grey whales) and their prey. However, the invasive carpet sea squirt is not present in the Channel Islands area. The nearest known occurrences are in Monterey Bay and Mission Bay in San Diego (Woods Hole Science Center 2007). Further, there is a lack of available substrate within or near the project site suitable for colonization by fouling organisms, as these invasive species cannot attach themselves to the sandy bottom substrate at the project site.
- **Carrying Capacity** (Phytoplankton Consumption). Mussels feed primarily on phytoplankton filtered from the water column. Each individual is capable of filtering over 20-gallons of seawater per day (Okumus et al. 2002). Hence, in some circumstances, large concentrations of mussels found in mussel farms can remove a significant proportion of available phytoplankton from the water column in an area, causing localized phytoplankton depletion (Okumus et al. 2002). Other studies suggest that nutrient regeneration in the water column within mussel farms is high, as phytoplankton consumed by the mussels results in released nutrients supporting new phytoplankton production (CFGC 2018). Ventura Shellfish Enterprise has adopted the methodology utilized by CDFW to evaluate carrying capacity impacts associated with Santa Barbara Mariculture Company's mussel aquaculture farm, whereby the standing stock of phytoplankton biomass outside the facility is determined and compared with the filtration/consumption rate of mussels within the farm. The results of the Santa Barbara Mariculture Company indicated that total production of the fully built-out farm would not have an adverse impact on phytoplankton in the Santa Barbara Channel (CFGC 2018). Similarly, calculations for the Ventura Shellfish Enterprise mussel farm indicate that no adverse impact on phytoplankton in the Santa Barbara Channel would occur (Appendix C).

5.1.1 FEDERALLY-LISTED SPECIES

5.1.1.1 Cetaceans

Gray Whale

Direct Effects

As described in Section 4.0, gray whales and their calves forage and travel in close proximity to shore during their northward migration. Due to their size, behavior, and occurrence close to shore, gray whales are likely to be affected by the Project Actions. The gray whale is a frequent visitor to the Santa Barbara Channel and may migrate directly along the path of the project site. As a result, gray whales may experience both direct and indirect effects from the Project Actions. If Project Actions will occur during the migration period, adults (and particularly calves) have the potential for entanglement in aquaculture gear. However, gray whales routinely swim through kelp and are adept at navigating obstacles, given they are accustomed to coastal areas. Absent mitigation, entanglement could adversely affect this species. However, with incorporation of **MM BIO-1 through BIO-5**, the effect would be reduced.

As described in Section 4.0, one of the main threats to gray whales is from ship strikes. Project Actions will involve an increase in boat traffic both within the Project Action Area and routes to and from the Ventura Harbor. Ship strike risk may also increase at nighttime when whales are resting, unaware of ship presence, and are less visible to staff onboard. Absent mitigation, the Project Actions have the potential to result in injury and/or mortality to gray whales from ship strikes, which would adversely affect this species. However, with incorporation of **MM BIO-6**, the effect would be reduced.

Project Actions have the potential to interfere with gray whale migration and feeding routes. However, the Santa Barbara Channel measures over 20 miles wide and the Project Action Area would be under 2 miles wide. Due to the expansive open ranges that are available for grey whales in the greater region, the Project Actions interference with migration and feeding routes would not adversely affect this species.

Project Actions have the potential to result in changes of gray whale migration or feeding behavior during construction from noise or disturbance to benthic feeding areas. Although noise effects will be very low, gray whales may temporarily avoid construction areas. Absent mitigation, construction activities may adversely affect this species. However, with incorporation of **MM BIO-3, MM BIO-5 and MM BIO-6**, the effect would be reduced.

Indirect Effects

Project Actions have the potential to result in inadvertent oil spills. Any grey whales traversing through areas that enter areas containing material from oil spills or other pollutants may experience immediate health effects. Absent mitigation, Project Activities may adversely affect this species. However, with incorporation of **MM BIO-7**, the effect would be reduced.

Project Actions have the potential to result in the release of invasive species, parasites, and pathogens. Absent mitigation, Project Activities may adversely affect this species through reducing its access to prey within the Project Area. However, with incorporation of **MM BIO-4**, **MM BIO-8**, and **MM BIO-10** the effect would be reduced.

Determination of Effects

Project Actions have the potential to result in direct and indirect effects to grey whale individuals and/or their migration and feeding habitats. The highest risk to this species includes entanglement in gear and vessel strikes. Construction activities are anticipated to be relatively brief (several weeks) within each plot which would cause temporary changes to grey whale feeding and migrating behavior. In addition, due to the availability of feeding habitat in the Santa Barbara Channel, Project Actions are not anticipated to interfere with gray whale migration and feeding routes. Additional Project effects to this species include the potential effects on sediment quality from aquaculture farms or fouling organisms. Measures to avoid and minimize any potential adverse effects to grey whale are discussed above and include **MM BIO-1 through BIO-11**. With implementation of these measures, the effects of the Project Actions would not jeopardize the continued existence of this species. As such, the Project Actions **may affect, but is not likely to adversely affect** the grey whale.

Humpback Whale and Fin Whale

Humpback and fin whales are anticipated to experience similar effects as those described for grey whales, with the exception of effects to sediment quality and the fouling of organisms. As described below, these species are expected to be directly and indirectly effected by the Project Actions from entanglement, ship strikes, interference with migration or feeding routes, changes in behavior from construction activities, oil spills, and release of invasive species. Given recent reports, humpback whales may in fact be more susceptible to entanglements, given their size, large appendages relative to body size ratio, and propensity to roll when entangled (NOAA 2018f).

Direct Effects

Humpback and fin whales may transit directly along the path of the project site. If Project Actions occur during the migration period, individuals have the potential for entanglement in aquaculture gear. Absent mitigation, entanglement would adversely affect this species. However, with incorporation of **MM BIO-1 through BIO-5**, the effect would be reduced.

Project Actions will involve an increase in boat traffic both within the Project Action Area and routes to and from the Ventura Harbor. Ship strike risk may also increase at nighttime when whales are resting, unaware of ship presence, and are less visible to staff onboard. Absent mitigation, the Project Actions have the potential to result in injury and/or mortality to humpback and fin from ship strikes, which would adversely affect these species. However, with incorporation of **MM BIO-6**, the effect would be reduced.

Project Actions have the potential to interfere with humpback and fin whale migration and feeding routes. However, the Santa Barbara Channel measures over 20 miles wide and the Project Action Area would be under 2 miles wide. Due to the expansive open ranges that are available for these in the greater region, the Project Actions interference with migration and feeding routes would not adversely affect these species.

Project Actions have the potential to result in changes of humpback and fin whale migration or feeding behavior during construction from noise or avoidance of suitable feeding areas. Although, noise effects will be very low, these

species may temporarily avoid construction areas. Absent mitigation, construction activities may adversely affect this species. However, with incorporation of **MM BIO-3, MM BIO-5 and MM BIO-6**, the effect would be reduced.

Indirect Effects

Project Actions have the potential to result in inadvertent oil spills. Any humpback or fin whales traversing through areas that enter areas containing material from oil spills or other pollutants may experience immediate health effects. Absent mitigation, Project Activities may adversely affect these species. However, with incorporation of **MM BIO-7**, the effect would be reduced.

Determination of Effects

Project Actions have the potential to result in direct and indirect effects to humpback and fin whale individuals and/or their migration and feeding behaviors. The highest risk to these species includes entanglement in gear and vessel strikes. Construction activities are anticipated to be relatively brief (several weeks) within each plot which would cause temporary changes to humpback and fin whale feeding and migrating behavior. In addition, due to the availability of feeding habitat in the Santa Barbara Channel, Project Actions are not anticipated to interfere with these species' migration and feeding routes. Additional Project effects to these species include the release of invasive species, parasites, and pathogens from seed stock. Measures to avoid and minimize any potential adverse effects to the humpback and fin whale are discussed above and include **MM BIO-1 through BIO-11**. With implementation of these measures, the effects of the Project Actions would not jeopardize the continued existence or recovery of these species. As such, the Project Actions **may affect, but are not likely to adversely affect** the humpback and fin whales.

5.1.1.2 Sea Turtles

Direct Effects

Loggerhead and green sea turtles may traverse the Project Action Area during migration. Should marine debris (e.g., fishing nets or wire not a part of the Project Actions) become entangled on the aquaculture long lines, sea turtles may become entangled leading to injury and/or mortality. Absent mitigation, entanglement would adversely affect these species. However, with incorporation of **MM BIO-1 through BIO-5 and MM BIO-10**, the effect would be reduced.

Project Actions will involve an increase in boat traffic both within the Project Action Area and routes to and from the Ventura Harbor. Absent mitigation, the Project Actions have the potential to result in injury and/or mortality to sea turtles from ship strikes, which would adversely affect these species. However, with incorporation of **MM BIO-6**, the effect would be reduced.

Project Actions have the potential to interfere with sea turtle migration routes. However, the Santa Barbara Channel measures over 20 miles wide and the Project Action Area would be under 2 miles wide. Due to the expansive open ranges that are available for these in the greater region, the Project Actions interference with migration routes would not adversely affect these species.

Project Actions have the potential to result in changes of sea turtle migrating behavior during construction from noise or avoidance of migratory routes. Although noise effects will be very low, these species may temporarily avoid construction

areas. Artificial lighting during construction activities and regular operations can be disorienting to sea turtles (as well as seabirds and migratory birds). Absent mitigation, construction activities may adversely affect this species. However, with incorporation of **MM BIO-3, MM BIO-5, MM BIO-6 and MM BIO-12**, the effect would be reduced.

Indirect Effects

Project Actions have the potential to result in inadvertent oil spills. Any sea turtles traversing through areas that enter areas containing material oil spills or other pollutants may experience immediate health effects. Absent mitigation, Project Activities may adversely affect these species. However, with incorporation of **MM BIO-7**, the effect would be reduced.

Determination of Effects

Project Actions have the potential to result in direct and indirect effects to sea turtle individuals and/or their migration behaviors. The highest risk to these species includes entanglement in fugitive nets and fishing line that may become attached to aquaculture gear. Construction activities are anticipated to be relatively brief (several weeks) within each plot which would cause temporary changes to sea turtle and migrating behavior. In addition, due to the availability of open ocean in the Santa Barbara Channel, Project Actions are not anticipated to interfere with these species' migration routes. Additional Project effects to these species include possible ship strikes and the release of invasive species. Measures to avoid and minimize any potential adverse effects to sea turtles are discussed above and include **MM BIO-1 through BIO-12**. With implementation of these measures, the effects of the Project Actions would not jeopardize the continued existence or recovery of these species. As such, the Project Actions **may affect, but are not likely to adversely affect** the loggerhead and green sea turtles.

5.1.2 OTHER NON-LISTED SPECIES PROTECTED UNDER THE MMPA

5.1.2.1 Cetaceans

The common minke whale, common bottlenose dolphin, long-beaked common dolphin, short-beaked common dolphin, and pacific white-sided dolphin are anticipated to experience similar effects as those described for humpback and fin whale. However, these dolphins are resident that may be present in the Santa Barbara Channel year-round. As described below, these species are expected to be directly and indirectly effected by the Project Actions from entanglement, ship strikes, interference with migration or feeding routes, changes in behavior from construction noise, potential oil spills, and release of invasive species, parasites, and pathogens from seed stock. There are few documented cases of interactions between cetaceans and shellfish farms. However, in Australia, studies of bottlenose dolphins indicate that they avoid mussel farms in shallow nearshore waters and the displacement of habitat causes a reduction in fecundity (Kemper et al. 2003). This study involved coastal bottlenose dolphins, and it is unknown if displacement of habitat will occur in offshore waters for offshore bottlenose dolphins. Similarly, in New Zealand, dusky dolphins were seen avoiding mussel leases in shallow waters (they utilize shallow waters for foraging) which may indicate that placing mussel farms in nearshore waters affects their ability to forage. In Chile, a bay used by Chilean dolphins was completed filled in with mussel lines and the dolphins ceased to use the area for foraging (Kemper et al. 2003). These studies occur in shallow coastal waters and for different species than those that occur on the project site but it habitat displacement may occur to offshore species as well, such as bottlenose dolphins,

common dolphins, pacific white-sided dolphins and minke whales in the project area. If these species are prevented from foraging in the project area, it would be a small reduction in their overall foraging area and would not adversely affect these species.

Direct Effects

The common minke whale may migrate along the Project Action Area and many dolphins are year-round residents. If Project Actions occur during the common minke whale migration period, individuals have the potential for entanglement in aquaculture gear. In addition, dolphins have the potential for entanglement year-round. Normally adept at maneuvering around objects, individuals have the potential for entanglement in loose fishing nets, debris and other ghost gear that could become attached to the mussel aquaculture gear. Absent mitigation, entanglement may adversely affect these species. However, with incorporation of **MM BIO-1 through BIO-5 and MM BIO-10**, the effect would be reduced.

Project Actions will involve an increase in boat traffic both within the Project Action Area and routes to and from the Ventura Harbor. Ship strike risk may also increase at nighttime when migrating common minke whales may be resting, unaware of ship presence, and are less visible to staff onboard. In addition, dolphins are known to bow-ride which may result in accidental ship strikes to these species. Absent mitigation, the Project Actions have the potential to result in injury and/or mortality, which would adversely affect these species. However, with incorporation of **MM BIO-6**, the effect would be reduced.

Project Actions have the potential to interfere with common minke whale migration routes. In addition, foraging areas for the common minke whale and dolphins may be disrupted from Project Actions. However, the Santa Barbara Channel measures over 20 miles wide and the Project Action Area would be under 2 miles wide. Habitat displacement could occur for these species, but it would be a small reduction in their overall foraging area. Due to the expansive open ranges that are available for these in the greater region, the Project Actions interference with migration and feeding routes would not adversely affect this species.

Project Actions have the potential to result in changes of common minke whale migration along with whale and dolphin feeding behavior during construction from noise or avoidance of suitable feeding areas. These species may temporarily avoid construction areas or experience more long lasting and adverse effects, as described above. Absent mitigation, construction activities may adversely affect this species. However, with incorporation of **MM BIO-3, MM BIO-5 and MM BIO-6**, the effect would be reduced.

Indirect Effects

Project Actions have the potential to result in inadvertent oil spills. Any common minke whales or dolphins traversing through areas that enter areas containing material from oil spills or other pollutants may experience immediate health effects. Absent mitigation, Project Activities may adversely affect these species. However, with incorporation of **MM BIO-7**, the effect would be reduced.

Project Actions have the potential to result in the release of invasive species, parasites, and pathogens. Absent mitigation, Project Activities may adversely affect these species. However, with incorporation of **MM BIO-4** and **MM BIO-8**, the effect would be reduced.

Determination of Effects

Project Actions have the potential to result in direct and indirect effects to the common minke whale, common bottlenose dolphin, long-beaked common dolphin, short-beaked common dolphin, and pacific white-sided dolphin. The highest risk to these species includes entanglement in gear (loose fishing nets, debris, or other ghost gear that has become entangled in the aquaculture array) and vessel strikes. Construction activities are anticipated to be relatively brief (several weeks) within each plot which would cause temporary changes to whale and dolphin feeding and/or migrating behavior. In addition, due to the availability of feeding habitat in the Santa Barbara Channel, Project Actions are not anticipated to interfere with these species' migration and feeding routes. Additional Project effects to these species include the release of invasive species. Measures to avoid and minimize any potential adverse effects to the common minke whale and dolphins are discussed above and include MM BIO-1 through BIO-11. With implementation of these measures, the effects of the Project Actions would not jeopardize the continued existence of these species. As such, the Project Actions may affect, but are not likely to adversely affect these species.

5.1.2.2 Pinnipeds

Pinnipeds, including the California sea lion and Pacific harbor seal, are expected to experience similar effects as those described for small cetaceans. Similar to dolphins, pinnipeds are resident and are present in the Santa Barbara Channel year-round. As described below, these species are expected to be directly and indirectly effected by the Project Actions from entanglement, ship strikes, interference with feeding routes, changes in behavior from construction activities (disturbance), invasive species, parasites, and pathogens, altered marine food chains/habitat due to fouling the water and changes to the benthic fauna (Kemper et al. 2003). Other affects may include predator control.

Direct Effects

Pinnipeds may be present year round in the Project Action Area. There have been no reported interactions between pinnipeds and shellfish aquaculture (Kemper et al. 2003) indicating a very low possibility of an impact; however, individuals have the potential for entanglement in loose fishing nets, debris and other ghost gear that could become attached to the mussel aquaculture array. Absent mitigation, entanglement may adversely affect these species. However, with incorporation of **MM BIO-1 through BIO-5 and MM BIO-10**, the effect would be reduced.

Project Actions will involve an increase in boat traffic both within the Project Action Area and routes to and from the Ventura Harbor. Absent mitigation, the Project Actions have the potential to result in injury and/or mortality, which would adversely affect these species. However, with incorporation of **MM BIO-6**, the effect would be reduced.

Project Actions have the potential to interfere with pinniped feeding routes. However, the Santa Barbara Channel measures over 20 miles wide and the Project Action Area would be under 2 miles wide. Due to the expansive open ranges that are available for these in the greater region, the Project Actions interference with migration and feeding routes would not adversely affect this species.

Project Actions have the potential to result in changes of pinniped feeding behavior during construction from noise or avoidance of suitable feeding areas. These species may temporarily avoid construction areas or experience more long lasting and adverse effects, as described above. Absent mitigation, construction activities may adversely affect this species. However, with incorporation of **MM BIO-3, MM BIO-5 and MM BIO-6**, the effect would be reduced.

Predator control is unlikely to be needed for this project given the feeding preferences of pinnipeds in the area. However, if predator control is required, **MM BIO-13** will be incorporated.

Indirect Effects

Project Actions have the potential to result in inadvertent oil spills or other pollution. Any pinnipeds traversing through areas that contain material from oil spills may experience immediate health effects. Absent mitigation, Project Activities may adversely affect these species. However, with incorporation of **MM BIO-7**, the effect would be reduced.

Project Actions have the potential to result in the release of invasive species, parasites, and pathogens. Absent mitigation, Project Activities may adversely affect these species. However, with incorporation of **MM BIO-4** and **MM BIO-8**, the effect would be reduced.

Determination of Effects

Project Actions have the potential to result in direct and indirect effects to pinnipeds, including the California sea lion, and Pacific harbor seal. The highest risk to these species includes vessel strikes. Construction activities are anticipated to be relatively brief (several weeks) within each plot which would cause temporary changes to pinniped feeding behavior. In addition, due to the availability of feeding habitat in the Santa Barbara Channel, Project Actions are not anticipated to interfere with these species' feeding routes. Additional Project effects to these species include the release of invasive species, parasites, and pathogens from seed stock. Measures to avoid and minimize any potential adverse effects to pinnipeds are discussed above and include **MM BIO-1 through BIO-11**. With implementation of these measures, the effects of the Project Actions would not jeopardize the continued existence of these species. As such, the Project Actions **may affect, but are not likely to adversely affect** pinnipeds.

5.2 Mitigation Measures

MM BIO-1 **Marine Wildlife Entanglement Plan.** No less than once per month, each grower/producer operating on a VPD lease shall visually inspect all ropes, cables, and equipment via depth/fish finders to determine if any entanglement of a marine mammal has occurred and to ensure that (a) no lines have been broken, lost or removed; (b) all longlines, anchor lines, and buoy lines remain taught and in good working condition; and (c) any derelict fishing gear or marine debris that collects in the growing gear is removed and disposed of at an identified onshore facility. All equipment and materials accidentally released or found to be missing from the facility during monthly inspections, including buoys, floats, lines, ropes, chains, cultivation trays, wires, fasteners, and clasps, shall be searched for, collected, properly disposed of onshore, and documented in the annual inspection report. Monitoring shall occur monthly for the first two years following deployment and, in the event

that there are no marine wildlife entanglements within the first two years, may be reduced to quarterly inspections thereafter.

Inspections shall include recordings by depth/fish finder or ROV surveys of lines and/or monitoring performed by SCUBA divers. Recorded video shall be provided along with the annual report described above. Any maintenance issues including wear, loosening, or fatigue of materials shall be remedied as soon as possible. All incidents of observed whale entanglement shall be immediately reported to SOS WHALe. Any other marine wildlife (i.e., other marine mammals, turtles) observed to be entangled will be immediately reported to NOAA Fisheries Marine Mammal Stranding Network Coordinator, West Coast Region, Long Beach Office. Only personnel who have been authorized by NOAA Fisheries and who have training, experience, equipment, and support will attempt to disentangle marine wildlife. If possible, the grower/producer shall document and photograph entangled wildlife and the entangling gear material so as to modify gear and avoid any future entanglements.

MM BIO-2 **Entanglement Prevention.** Grow-ropes will be attached to the head rope with a low-breaking-strength twine (4-millimeter (0.16-inch) diameter; <1,000 pounds), which will facilitate rapid detachment in the unlikely event of any interaction with the longline. A 1,100-pound breakaway link will be installed between surface marking buoys and the vertical lines.

MM BIO-3 **Marine Wildlife Observer**. A Marine Wildlife Observer shall be present on each project construction vessel during all construction activities, including the installation of long lines and anchoring systems. The observer shall monitor and record the presence of all marine wildlife (marine mammals and sea turtles) within 100 yards of the work area. The observer shall have the authority to halt operations if marine wildlife are observed or anticipated to be near a work area and construction activities have the potential to result in injury or entanglement of marine wildlife. In addition, all work (including vessel motors) will be halted if a cetacean is observed within the monitoring area or if a pinniped or sea turtle is observed within 50 yards of the work area. Work may commence after the observed individuals have moved out of the monitoring area.

Observers' reports on marine mammal monitoring during construction activities shall be prepared and submitted to NOAA Fisheries on a monthly basis. Reports shall include such information as the (1) number, type, and location of marine mammals observed; (2) the behavior of marine mammals in the area of potential sound effects during construction; (3) dates and times when observations and in-water project construction activities were conducted; and (4) dates and times when in-water construction activities were suspended because of marine mammals.

VPD shall prepare a list of qualified marine wildlife observers who meet the following minimum qualifications: visual acuity in both eyes (correction is permissible) sufficient to discern moving targets at the water's surface with ability to estimate target size and distance; (2) use of binoculars or

spotting scope may be necessary to correctly identify the target; (3) advanced education in biological science, wildlife management, mammalogy, or related fields (bachelor's degree or higher is preferred); (4) experience and ability to conduct field observations and collect data according to assigned protocols (this may include academic experience); (5) experience or training in the field identification of marine mammals (cetaceans and pinnipeds) and sea turtles; and (6) ability to communicate orally, by radio or in person, with project personnel to provide real time information on marine wildlife observed in the area, as needed.

MM BIO-4 **Cultivation of Spat Off site.** Only hatchery-reared mussel spat grown at a facility certified by CDFW will be used in order to ensure that spat are free of introduced invasive species, parasites, and pathogens of concern; however, natural mussel spat collected on farm grow-out lines and buoys may also be harvested and cultivated.

MM BIO-5 **Marine Wildlife Education.** Each grower/producer will be required to provide bi-annual (twice per year) marine wildlife education to its employees regarding proper procedures relating to marine wildlife. The training curriculum will include identifying the presence of specified marine wildlife and procedures for avoiding impacts to marine wildlife during operations. These procedures will include (1) reducing speed and observing the distances from marine life specified in MM BIO-6; (2) providing a safe path of travel for marine mammals that avoids encirclement or entrapment of the animal(s) between the vessel and growing apparatus; (3) if approached by a marine mammal, reducing speed, placing the vessel in neutral and waiting until the animal is observed clear of the vessel before making way; (4) avoiding sudden direction or speed changes when near marine mammals; (5) refraining from approaching, touching or feeding a marine mammal; and (6) immediately contacting their supervisor and other identified parties/agencies identified in MM BIO-1 should an employee observe an injured marine mammal.

MM BIO-6 **Vessel Management.** Vessels in transit to and from the growing area shall maintain a distance of 100 yards from any observed cetacean and 50 yards between any observed pinniped or sea turtle. If cetaceans are observed within 100 yards or pinnipeds or sea turtles observed within 50 yards, the vessel shall reduce speeds to 12 knots or less until it is the appropriate distance (as required by this condition) from the particular marine life. If a cetacean is heading into the direct path of the vessel (i.e., approaching a moving vessel directly into the bow), the vessel shall shut off the engine until the cetacean is no longer approaching the bow and until a greater separation distance is observed. If small cetaceans are observed bow-riding, and the vessel is operating at speeds of 12 knots or less, the vessel shall remain parallel to the animal's course and avoid abrupt changes in direction until the cetaceans have left the area.

Each sighting of a federally listed threatened or endangered whale or turtle shall be recorded and the following information shall be provided:

a. Date, time, coordinates of vessel
b. Visibility, weather, sea state

c. Vector of sighting (distance, bearing)
d. Duration of sighting
e. Species and number of animals
f. Observed behaviors (feeding, diving, breaching, etc.)
g. Description of interaction with aquaculture facility

MM BIO-7 **Spill Prevention and Response**. Discharges of feed, pesticides, or chemicals (including antibiotics and hormones) in ocean waters are prohibited. Fuel, lubricants and chemicals must be labeled, stored and disposed of in a safe and responsible manner, and marked with warning signs. Precautions shall be taken to prevent spills, fires and explosions, and procedures and supplies shall be readily available to manage chemical and fuel spills or leaks. Each grower/producer shall comply with the Spill Prevention and Response Plan (SPRP) for vessels and work barges that will be used during project construction and operations. Each grower/producer operating in the project area shall be trained in, and adhere to, the emergency procedures and spill prevention and response measures specified in the SPRP during all project operations. The SPRP shall provide for emergency response and spill control procedures to be taken to stop or control the source of the spill and to contain and clean up the spill. The SPRP shall include, at a minimum: (a) identification of potential spill sources and quantity estimates of a project specific reasonable worst case spill; (b) identification of prevention and response equipment and measures/procedures that will be taken to prevent potential spills and to protect marine and shoreline resources in the event of a spill. Spill prevention and response equipment shall be kept onboard project vessels at all times; (c) a prohibition on at-sea vessel or equipment fueling/refueling activities; and (d) emergency response and notification procedures, including a list of contacts to call in the event of a spill; (e) assurance that all hydraulic fluid to be used for installation, maintenance, planting, and harvesting activities shall be vegetable based.

MM BIO-8 **Invasive Species.** Grower/producers operating in the project area shall be required to receive training from NMFS to identify potential invasive species and how to properly dispose of such invasive species if discovered.

MM BIO-9 **Sediment Quality Monitoring Plan.** A Sediment Quality Monitoring Plan shall be developed requiring monitoring of sediment conditions within the project area, including monitoring the quantity, type, and distribution of biological materials (such as shellfish, shell material, and fouling organisms) that accumulate on the seafloor. Monitoring will also include an evaluation of any changes to oxygen demand of benthic infaunal and epifaunal communities, and changes to the chemical and biochemical conditions of seafloor sediments along with a description of performance standards to meet.

If performance standards are not met, corrective actions will be outlined. The Plan will include reporting requirements, including annual report submittals to NOAA and NMFS for review. If performance standards are met for a period of time, the plan will provide for appropriately scaling down monitoring and intervals over time.

MM BIO-10 **Aquaculture Gear Monitoring and Escapement Plan.** Include in overall management plan an aquaculture gear monitoring and escapement plan. Any farm gear that has broken loose from the farm location shall be retrieved. The farm site shall be visited at minimum twice per month to examine the aquaculture gear for potential loss or non-compliant deployment, including inspections for fouling organisms. Any organisms that have a potential to cover the sea floor will be removed and disposed of at an identified upland facility. A Marine Debris Management Plan shall also be prepared that includes (a) a plan for permanently marking all lines, ropes, buoys, and other facility infrastructure and floating equipment with the name and contact information of the grower/producer; (b) a description of the extent and frequency of maintenance operations necessary to minimize the loss of materials and equipment to the marine environment resulting from breakages and structural failures; and (c) a description of the search and cleanup measures that would be implemented if loss of shellfish cultivation facility materials, equipment, and/or infrastructure occurs.

MM BIO-11 **Decommissioning Plan**. A decommissioning plan for the timely removal of all shellfish, structures, anchoring devices, equipment, and materials associated with the shellfish cultivation facility and documentation of completion of removal activities will be a requirement of each permit or sub-permit. Financial assurances to guarantee implementation of the plan will be in place and reviewed periodically.

MM BIO-12 **Lighting.** All growing area operations shall be completed during daylight hours. No growing area operations will be conducted at night and no permanent artificial lighting of the shellfish cultivation facility shall occur, except for that associated with the use of navigational safety buoys required by the U.S. Coast Guard.

MM BIO-13 **Predator Control.** Potential predator species will be identified. Specified humane methods of predator deterrence will be utilized, favoring non-lethal methods. No controls, other than non-lethal exclusion, shall be applied to species that are listed as threatened or endangered.

MM NAV-1 **Update NOAA Charts.** VPD to submit to the NOAA Office of Coast Survey: (a) the geographical coordinates of the facility boundaries obtained using a different geographic position unit or comparable navigational equipment; (b) as-built plans of the facility and associated buoys and anchors; (c) each grower/producer's point of contact and telephone number; and (d) any other information required by the NOAA Office of Coast Survey to accurately portray the location of the shellfish cultivation facility on navigational charts.

MM NAV-2 **Notice to Mariners.** No less than 15-days prior to the start of in-water activities associated with the installation phase of the project, VPD shall submit to (a) the U.S. Coast Guard (for publication in a Notice to Mariners); and (b) the harbormasters (for posting in their offices of public noticeboards), notices containing the anticipated start date of installation, the anticipated installation schedule, and the coordinates of the installation sites. During installation, VPD shall also make radio broadcast announcements to the local fishers' emergency radio frequency that provide the current installation location and a phone number that can be called for additional information.

5.3 Cumulative Effects

Section 7 (FESA) regulations require a federal agency taking an action to provide an analysis of cumulative effects when requesting initiation of formal consultation. Cumulative effects include the effects of future state, tribal, local, or private actions, not involving a federal action, that are reasonably certain to occur in or adjacent to the project site. Future federal actions that are unrelated to the Proposed Action are not considered in this analysis, because they require separate consultation pursuant to Section 7. Federal actions may include granting a permit for a project, authorizing funds for a project, or implementing a project. For the purposes of this BA, cumulative effects are defined as environmental change that results from the incremental effects of several projects that may be individually minor, but that become significant when considered collectively. There are no known actions (Federal, State or Tribal) slated to occur in or immediately adjacent to the project area.

5.4 Compensatory Mitigation

No impacts requiring compensatory mitigation will result from implementation of the Project Actions.

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6.0 CONCLUSIONS

This BA forms the basis for the conclusions presented below regarding the effects of the Project Actions on thirteen species with a potential to occur in the action area. Based on a review of the current status of these species, the effects of the Project Actions, and recommended measures to avoid and minimize effects to listed species, the Project Actions may **affect, but are not likely to adversely affect** each of these species. Table 2 below summarizes the effects determination for the Project Actions.

Table 2
Summary of Effects Determinations

Federally Protected Species	No Effect	May Affect, But Is Not Likely to Adversely Affect	Is Likely to Adversely Affect
Balarnoptera acutorostrata Common Minke Whale		✓	
Balaenoptera physalus physalus Fin Whale		✓	
Caretta caretta Loggerhead Sea Turtle		✓	
Chelonia mydas Green Sea Turtle		✓	
Delphinus capensis capensis Long-beaked Common Dolphin		✓	
Delphinus delphis delphis Short-beaked Common Dolphin		✓	
Eschrichtius robustus Gray Whale		✓	
Lagenorhynchus obliquidens Pacific White-sided Dolphin		✓	
Megaptera novaeangliae Humpback Whale		✓	
Phoca vitulina Pacific Harbor Seal		✓	
Tursiops truncatus Common Bottlenose Dolphin		✓	
Zalophus californianus California Sea Lion		✓	

As noted in the Nationwide Permit (NWP) 48 Decision Document (USACE 2017) recently approved by the Corps, which considered shellfish aquaculture uses nationwide, "Compared to the disturbances and degradation caused by coastal development, pollution, and other human activities in coastal areas, commercial shellfish aquaculture activities present relatively mild disturbances to estuarine and marine ecosystems." The Decision Document

concludes that impacts from most aquaculture projects would be *de minimis* on the surrounding environment. This determination is generally reaffirmed in the Corps' 2015 Programmatic Biological Assessment (USACE 2015) that considered new and existing shellfish aquaculture in Washington State, as well as the 2016 Programmatic Biological Opinions from NOAA's NMFS (NMFS 2012f) evaluating the same, which concluded that impacts would be minor upon imposition of identified conservation measures. Notably, the above analyses evaluated shellfish aquaculture at a larger scale than that proposed by the project. NWP 48 covers most shellfish aquaculture projects nationwide and the Programmatic Biological Evaluation evaluated environmental impacts associated with a total of 38,400 commercial aquaculture acres in Washington.

With implementation of the mitigation measures identified in this BA, including measures for navigational safety **MM BIO-14** and **MM BIO-15**, the Project Actions are not expected to directly or indirectly reduce, in any appreciable manner, the likelihood of survival or recovery of the species described above by reducing its reproduction, numbers, or distribution. The measures proposed to offset anticipated effects provide reasonable protections to avoid and minimize adverse effects of the Project Actions. Additionally, no designated critical habitat is present within the Action Area.

Overall, the Project Actions would not result in permanent impacts to ESA-listed or MMPA species, based on: (1) the nature and extent of the activities proposed to be implemented; (2) avoidance and minimization measures proposed in this BA; (3) the relative size of the Project Actions within the Santa Barbara Channel; and (4) the temporary nature of construction activities. See Dudek (2018) for an assessment of Essential Fish Habitat for this project.

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APPENDIX A

Essential Fish Habitat Assessment

APPENDIX B

Federally Protected Species Potential to Occur

Scientific Name	Common Name	Federal Status[1]	Distribution and Primary Habitat Associations	Potential to Occur
Marine Mammals[2]				
Cetaceans				
Balarnoptera acutorostrata	Common minke whale	MMPA	Worldwide distribution. Polar, temperate, and tropical waters in both coastal and offshore habitats (NMFS 2018a).	**Moderate** potential to occur. Foraging and migration habitat is present in the Action Area. Some individuals are residents in California waters. Minke whales feed on euphausiids, copepods and small schooling fish, which are present in the Channel. In addition, this species has been recorded since 1988 in the Santa Barbara Channel and within 1 mile of the Action Area (PBCS 2018).
Balaenoptera borealis borealis	Sei whale	Endangered, MMPA	Worldwide distribution in subtropical, temperate, and subpolar waters. This species prefers deeper waters far from the coastline (NMFS 2018a). This species' habitat preference is the continental shelf edge and slope (NMFS 2018a).	Low potential to occur. This species may traverse through the Action Area during migration. In general, sei whales migrate annually from cool and subpolar waters in summer to temperate and subtropical waters for winter, where food is more abundant. Foraging resources (krill, copepods, small schooling fish, cephalopods) are likely present in the Action Area.
Balaenoptera edeni	Bryde's whale	Proposed Endangered, MMPA	Prefers highly productive tropical, subtropical and warm temperate waters worldwide.	Low potential to occur. This species may be found in all oceans from 40°S to 40°N; however, some populations migrate seasonally while others are resident and do not migrate (NMFS 2018). Year-round residents appear to be present along the west coast of Baja California, Mexico (Kenyon 1971). Foraging resources (krill, copepods, small schooling fish, crustaceans) are likely present in the Action Area. This species displays a preference for subtropical and tropical zones, inhabiting waters 16°C (60°F) or warmer) (Jefferson et al. 2008).
Balaenoptera musculus musculus	Blue whale	Endangered, MMPA	Worldwide, from sub-polar to sub-tropical latitudes; generally occurs more offshore than other whales (NMFS 2018a).	Low potential to occur. This species has been observed migrating and feeding through the Santa Barbara Channel on many occasions, with several occurrences within the Action Area (PBCS 2018). In general, this species migrates poleward to feed in the summer and to the tropics to breed in the winter (Jefferson et al. 2008). Most occurrences are north of Santa Rosa and western Santa Cruz Island along the 200 meter isobath (Cascadia 2011), approximately 7.4 miles east of the Action Area. In addition, foraging resources (predominantly krill) are likely present in the Action Area.
Balaenoptera physalus physalus	Fin whale	Endangered, MMPA	Worldwide, primarily in temperate to polar latitudes and less common in the tropics.	**Moderate** potential to occur. This species has been observed migrating and feeding through the Santa Barbara Channel on many occasions, with one occurrence (12

Scientific Name	Common Name	Federal Status[1]	Distribution and Primary Habitat Associations	Potential to Occur
				individuals) noted within 1 mile of the Action Area in 2011 (PBCS 2018; Cascadia 2011). This species' distribution is not well known, but it generally migrates poleward to feed in the summer and to the subtropics to breed in the winter (Jefferson et al. 2008). Resources (krill, small schooling fish, squid) are likely present in the Action Area. This species is more commonly associated with the 200 meter isobath, which is approximately 7.4 miles from the Action Area (Cascadia 2011)
Berardius bairdii	Baird's beaked whale	MMPA	Throughout the North Pacific Ocean and adjacent seas. This species prefers deep, cold waters of 3,000 feet (nearly 1,000 meters) or greater and may occur near shore along narrow continental shelves. Beaked whales are deep divers that prefer submarine canyons, seamounts, and continental slopes (NMFS 2018a).	Low potential to occur. Migration and distribution are poorly known (Jefferson et al. 2008). Suitable foraging resources (e.g., deep water and bottom-dwelling crustaceans, cephalopods, gadiform fish; Jefferson et al. 2008) are not likely present in the Action Area. This species prefers deep waters that are not present within the Action Area. This species has been observed far south of the Channel Islands, and west of Point Conception (Baumann-Pickering et al. 2013).
Delphinus capensis capensis	Long-beaked common dolphin	MMPA	Coastal habitats; prefers shallower tropical, subtropical, and warmer temperate to cool waters closer to the coast (within 50-100 nautical miles (90-180 km)) and the continental shelf (NMFS 2018a).	**High** potential to occur. Foraging resources (small schooling fish and squid) are likely present in the Action Area. This species has been recorded multiple times and in great numbers (e.g., occurrences with 1,500 individuals) in the Santa Barbara Channel, including the Action Area (PBCS 2018). This species displays a habitat preference for coastal waters, sometimes coming close to shore within waters that are only a few meters deep (Jefferson et al. 2008).
Delphinus delphis delphis	Short-beaked common dolphin	MMPA	Warm tropical to cool temperate waters, primarily oceanic and offshore. Species also occurs along the continental slope in waters 650-6,500 feet (200-2,000 m) deep (NMFS 2018a).	**Moderate** potential to occur. Foraging resources (small schooling fish and squid) are likely present in the Action Area. This species has been recorded multiple times and in great numbers (e.g., occurrences with 1,500 individuals) in Santa Barbara Channel and adjacent to the Action Area (PBCS 2018). This species is often associated with areas of upwelling and areas of steep sea-bottom (Jefferson, Webber and Pitman 2008).
Eschrichtius robustus	Gray whale (Eastern North Pacific stock)	MMPA	Occurs in coastal waters along the west coast of North America from Mexico to Alaska and in eastern Siberia. Usually feeds along the Bering, Chukchi, and Beaufort seas during the summer, and winters along breeding and calving areas off the coast of	**High** potential to occur. This species is a frequent visitor to the Ventura coastline and Santa Barbara Channel and commonly observed during migration, especially during the northward migration from Baja to Alaska. This species is a bottom feeder (epibenthic fauna such as mysids, amphipods, polychaete tube worms) and so are restricted

Scientific Name	Common Name	Federal Status[1]	Distribution and Primary Habitat Associations	Potential to Occur
			Baja California. Calves are born from January to February (NMFS 2018a). During their northward migration from Baja to Alaska, cow-calf pairs stay particularly close to shore to avoid predation by orcas (NMFS 2014). Bottom feeder that consumes benthic amphipods.	to shallow continental shelf waters (Jefferson et al. 2008). Gray whales are often observed close to shore and has multiple occurrences in the Action Area (PBCS 2018).
Eubalaena glacialis	North Pacific right whale	Endangered, MMPA	Pacific Ocean between 20°N and 60°N latitude, from temperate to subpolar waters. Primarily occurs in shelf or coastal waters (NMFS 2018a).	Low potential to occur. Distribution is not well known but they appear to have a northward migration in the spring and a southward migration in the fall. This species is extremely rare with likely less than 50 individuals in U.S. waters (MMC 2018) and a scattered distribution throughout its range (NMFS 2018a). Suitable foraging resources (zooplankton) may be present within the Action Area. The most recent and closest occurrences for this species include 2 possible individuals sighted near San Miguel Island (February 2015), 10 individuals off Monterey (May 2016, PBCS 2018), and 1 individual off La Jolla (April 2017, MMC 2018). This species is historically known to inhabit offshore waters in depths sometimes greater than 2,000 m (Jefferson, Webber and Pitman 2008).
Grampus griseus	Risso's dolphin	MMPA	Temperate, subtropical, and tropical waters generally greater than 3,300 feet (1,000 m) and seaward of the continental shelf and slopes (NMFS 2018a).	Low potential to occur. Suitable foraging resources (cephalopods and crustaceans) may be present within the Action Area. This species has been observed in the Santa Barbara Channel, with many occurrences located south and northwest of the Action Area (PBCS 2018). This species prefers deeper waters on the continental shelf and slope, between 30° and 45° latitude (Jefferson et al. 2008), and is unlikely to occur in the Action Area.
Globicephala macrorhynchus	Short-finned pilot whale	MMPA	Prefers warmer tropical and temperate waters, typically within waters of 1,000 feet or more deep (NMFS 2018a).	Not expected to occur. Once common around the Channel Islands, a strong El Nino in 1982-1983 brought changes to the ecosystem affecting prey and this species disappeared from the area (Jefferson et al. 2008). This species inhabits areas with a high density of squid, their preferred prey. The most recent documented sighting occurred in October 2014 off Dana Point, Orange County, CA (OC Register 2018). This species prefers deep waters and is unlikely to occur in the Action Area.
Kogia breviceps	Pygmy sperm whale	MMPA	Worldwide distribution. Prefers tropical, sub-tropical and temperate waters. Most	Not expected to occur. In addition, based on shipboard surveys from 1991 to 2014, this species has only been

Scientific Name	Common Name	Federal Status[1]	Distribution and Primary Habitat Associations	Potential to Occur
			common along waters seaward of the continental shelf edge and slope. Mostly forages in mid- and deep-water environments (NMFS 2018a).	sighted a handful of times (including unidentified *Kogia* sp.) off the coast of Central and Southern California (NMFS 2017a). This species prefers deep waters (outer continental shelf and beyond) and therefore is unlikely to occur in the Action Area.
Kogia sima	Dwarf sperm whale	MMPA	Worldwide; prefers tropical, sub-tropical, and temperate waters. Most common along the continental shelf edge and slope (NMFS 2018a).	Not expected to occur. This species inhabits warmer waters in offshore areas, and there is no evidence of migrations. Dwarf sperm whales feed on deep-water cephalopods (Jefferson, Webber and Pitman 2008). Based on shipboard surveys from 1991 to 2014, *Kogia* sp. have only been sighted a handful of times off the coast of central and southern California (NMFS 2017b). This species prefers deep waters and is unlikely to occur in the Action Area.
Lagenorhynchus obliquidens	Pacific white-sided dolphin	MMPA	North Pacific Ocean; cool, temperate waters from the continental shelf to the deep open ocean (NMFS 2018a).	**Moderate** potential to occur. Exhibits seasonal inshore/offshore and north/south movements. Foraging habitat is present in the Action Area. This species feeds mostly on cephalopods and small schooling fish in deep offshore waters but also on the continental shelf (Jefferson, Webber and Pitman 2008). In addition, this species has numerous occurrences within the Santa Barbara Channel and a few occurrences in the Action Area (PBCS 2018).
Lissodelphis borealis	Northern right-whale dolphin	MMPA	Endemic to deep, cold temperate waters of the North Pacific Ocean from Baja California to the Gulf of Alaska; generally in waters over the continental shelf and slope colder than 66°F (NMFS 2018a).	Low potential to occur. Although foraging habitat (i.e., for market squid) is present in the Action Area, this species has several scattered observations within the Santa Barbara Channel and no known observations within the Action Area (PBCS 2018). Northern right-whale dolphins are an open ocean species and are known only to come nearshore where there are deep submarine canyons (Jefferson, Webber and Pitman 2008).
Mesoplodon densirostris	Blainville's beaked whale	MMPA	Worldwide in temperate and tropical waters; prefers deep waters (WDC 2018).	Not expected to occur. Blainville's beaked whale has the most extensive distribution of the genus and inhabits depths between 200 to 1,000 m (Jefferson, Webber and Pitman 2008), where squid are plentiful. This species prefers deep waters and is unlikely to occur in the Action Area.
Mesoplodon stejnegeri	Stejneger's beaked whale	MMPA	North Pacific Ocean; prefer cold temperate and subarctic waters; generally found in	Not expected to occur. Inhabiting the North Pacific basin, this species is primarily oceanic but also inhabits the continental slope. It feeds on deep-water squid (Jefferson,

Scientific Name	Common Name	Federal Status[1]	Distribution and Primary Habitat Associations	Potential to Occur
			deep, offshore waters from 2,500-5,000 feet deep (NMFS 2018a).	Webber and Pitman 2008). This species prefers deep waters and is unlikely to occur in the Action Area.
Megaptera novaeangliae	Humpback whale	Threatened (Mexico DPS) and Endangered (Central America DPS), MMPA	Worldwide distribution from the equator to sub-polar latitudes; feeding areas for the Mexico DPS occur off the coast of central California; Migrating individuals from the Central America DPS may migrate through the Action Area on their way to feeding grounds located off the Pacific Northwest (NMFS 2018a). This species stays near the surface of the ocean when migrating and prefers shallow waters when feeding and calving. This species can be seen close to shore when conditions allow for prey switching from krill to small schooling fish, which inhabit nearshore areas.	**Moderate to high** potential to occur. Foraging and migration habitat is present in the Action Area. Numerous observations of this species have been documented within the Santa Barbara Channel both close to shore and near the Channel Islands (PBCS 2018). In addition, this species is strongly associated with the 200 meter isobaths (Cascadia 2011).
Orcinus orca	Killer Whale (Southern Resident DPS – consisting of pods J, K, and L, Eastern North Pacific Transient Stock, and Eastern North Pacific Offshore Stock)	Endangered MMPA (all populations)	The Southern Resident DPS reside for part of the year in the inland waters of Washington State and British Columbia and have been known to travel to coastal sites as far south as central California (71 FR 69054-69070). Transient forms (Eastern North Pacific Transient Stock) of the species prefer coastal waters from Alaska through California, and offshore forms (Eastern North Pacific Offshore Stock) can be found from Mexico to Alaska (71 FR 69054-69070). In general, this species is most abundant in colder waters and high latitudes; fairly abundant in temperate waters; lower densities in tropical, subtropical, and offshore waters (NMFS 2018a, 70 FR 69903-69912).	Low potential to occur. Foraging resources (primarily fish) are present in the Action Area, which could be prey for offshore stocks that occasionally visit the area (feed primarily on sharks). Residents have only been observed as far south as Monterey Bay. However, transients (which prey on marine mammals) are more common in the Santa Barbara Channel, with more occurrences nearer to the islands than the shore (PBCS 2018).
Peponocephala electra	Melon-headed whale	MMPA	Primarily in deep waters throughout the tropical areas of the world (NMFS 2018a).	Not expected to occur. The Action Area is located outside of this species' known range. The closest habitat occurs in Baja. This species is rarely found nearshore. They feed on squid and small fish deep in the water column (Jefferson, Webber and Pitman 2008). This species prefers deep waters and is unlikely to occur in the Action Area.
Phoceonoides dalli	Dall's porpoise	MMPA	North Pacific open ocean, prefers temperate to boreal waters than are more than 600 feet	Low potential to occur. This species feeds on mid-water fish and squid in offshore waters, only using nearshore

Scientific Name	Common Name	Federal Status[1]	Distribution and Primary Habitat Associations	Potential to Occur
			(180 meters) in depth and temperatures between 36-63°F (NMFS 2018a).	waters if there are deep-water features such as canyons (Jefferson, Webber and Pitman 2008). Although there are many scattered observations of this species in the Santa Barbara Channel (predominantly north of Santa Cruz Island), the closest occurrences near the Action Area occurred in 2007 (PBCS 2018). This species prefers deep waters and unlikely to occur in the Action Area.
Phocoena phocoena	Harbor porpoise	MMPA	North temperate and subarctic coastal and offshore waters; commonly found in bays, estuaries, harbors, and fjords less than 650 feet deep. Along the North American coast, range from central California to the Beaufort Sea (NMFS 2018a).	Not expected to occur. The Action Area is located outside of this species' known range. The Action Area may have their preferred prey species (cephalopods and small schooling fish) but the southern range of the species extends only to Point Conception. A shallow-water species, they normally inhabit waters less than 100 m (Jefferson, Webber and Pitman 2008). In addition, the closest incidental observation of the species were located along the Gaviota coast in 1992 (PBCS 2018).
Physeter catodon (=microcephalus)	Sperm whale	Endangered, MMPA	Worldwide; prefer deep waters and consumes deep water species (e.g., squid, sharks, skates, and fish) (NMFS 2018a)	Not expected to occur. A somewhat migratory species, sperm whales inhabit continental slope and oceanic waters with steep drop-offs where they prey on cephalopods (Jefferson, Webber and Pitman 2008). Although a few incidental observations of this species has occurred in the Santa Barbara Channel (dated 2002, 2004, and 2016; PBCS 2018), this species prefers deep waters and is unlikely to occur in the Action Area.
Pseudorca crassidens	False killer whale	MMPA	Ranges in the U.S. in Hawaii, along the west coast, and mid-Atlantic coast. Prefer tropical to temperate waters deeper than 3,300 feet (1,000 meters) (NMFS 2018a).	Not expected to occur. False killer whales are found in deep, offshore waters, and sometimes occur on the continental shelf (Jefferson, Webber and Pitman 2008). They feed on cephalopods and fish which are present in the Channel. However, this species prefers deep waters and is unlikely to occur in the Action Area.
Stenella coeruleoalba	Striped dolphin	MMPA	Mainly found seaward of the continental shelf from 50°N to 40°S latitude. Prefer highly productive tropical to warm temperate waters (52-84°F) that are oceanic and deep; often occurs in areas of upwelling and convergence zones (NMFS 2018a).	Not expected to occur. Primarily a warm water species that can be associated with convergence zones. They feed on fish in pelagic zones, along the continental slope or oceanic regions (Jefferson, Webber and Pitman 2008). This species prefers open oceans, has been recorded west of the Channel Islands (NMFS 2017c), and is unlikely to occur in the Action Area.
Steno bredanensis	Rough-toothed dolphin	MMPA	Worldwide; found primarily in deep waters throughout tropical and warmer temperate areas. Two recognized stock occur in Hawaii and Northern Gulf of Mexico (NMFS	Not expected to occur. This warm open ocean species rarely ranges north of 40° N (Jefferson, Webber and

Scientific Name	Common Name	Federal Status[1]	Distribution and Primary Habitat Associations	Potential to Occur
			2018a). May be a specialist feeder on mahi mahi (*Coryphaena hippurus*).	Pitman 2008). Suitable deep water habitats are absent in the Action Area.
Tursiops truncatus	Common bottlenose dolphin	MMPA	Worldwide ranging from 45°N to 45°S latitude; found in temperate and tropical waters. Coastal populations migrate into bays, estuaries, and river mouths. Offshore populations inhabit pelagic waters along the continental shelf.	**High** potential to occur. A common coastal species and a generalist feeder (Jefferson, Webber and Pitman 2008). This species has many occurrences throughout the Santa Barbara Channel and within or directly adjacent to the Action Area (PBCS 2018). This species is also known to regularly occur within 1 kilometer of shore (Carretta et al. 1998).
Ziphius cavirostris	Cuvier's beaked whale	MMPA	Worldwide in temperate, subtropical, and tropical waters; prefer deep pelagic waters (typically 3,300 feet or deeper along the continental slope and edge or deep geologic features)(NMFS 2018a).	Not expected to occur. This widely distributed species is found in offshore waters, especially deep waters near the continental slope, necessary for catching deep-sea squid.(Jefferson, Webber and Pitman 2008). This species prefers deep waters and unlikely to occur in the Action Area.
Mustelids				
Enhydra lutris nereis	Southern sea otter	Threatened, MMPA	North Pacific Ocean; occurs in only two areas of California: the mainland coastline from San Mateo County to Santa Barbara County, and San Nicholas Island, Ventura County (USFWS 2015).	Low potential to occur. One of four disjunct remnant populations, the central/southern California population sea otters are found in shallow, nearshore waters along the coast (Jefferson, Webber and Pitman 2008). This species known range is both north and south of the Action Area and this species usually occurs within 2 kilometers (1.2 miles) of shore (USFWS 2015). However, it is possible that foraging/travelling individuals may traverse the Action Area.
Pinnipeds				
Arctocephalus philippii townsedii	Guadalupe fur seal	Threatened, MMPA	Tropical waters of the Southern California/Mexico region. This non-migratory species breeds along rocky coastal habitats and associated caves (NMFS 2018a).	Low potential to occur. This species has known haulouts and breeding colonies (rookeries) along the Channel Islands, San Miguel Island (CDFW 2009), and Guadalupe Island, Mexico (where most of the known rookeries are located)(NMFS 2018a). This species travels great distances to foraging areas for lanternfish and squid and therefore may traverse and/or forage in the Action Area. They are highly pelagic species and foraging areas are not well known. They prefer far offshore to deep oceanic areas for feeding (Jefferson, Webber and Pitman 2008).
Callorhinus ursinus	Northern fur seal	MMPA (Depleted – Eastern Pacific Stock)	Open ocean for foraging and rocky beaches for reproduction. Haul out habitat may include rocky or sandy beaches (NMFS 2018a).	Low potential to occur. Northern fur seals migrate from the Bering Sea southward to the North Pacific to feed in the winter. This species is known to haulout and breed at San Miguel Island (NMFS 2018a, CDFW 2009). This

Scientific Name	Common Name	Federal Status[1]	Distribution and Primary Habitat Associations	Potential to Occur
				species has the potential to forage on fish and squid in the Action Area, however, they are one of the most pelagic pinnipeds and their foraging is usually offshore at the edge of the continental shelf and slope (Jefferson, Webber and Pitman 2008).
Eumetopias jubatus	Steller sea lion	Endangered (Western DPS) and Delisted due to Recovery (Eastern DPS), MMPA	North Pacific Ocean, mainly around coasts to outer continental shelf and slope. Prefer cold temperate to sub-arctic waters. Haul-outs and rookeries usually on beaches, ledges, and rocky reefs (NMFS 2018a).	Low potential to occur. On the west coast of North America, Steller sea lions range from the Aleutian Islands to Central California (formally southern California). This species is rarely seen south of Monterey Bay (Jefferson, Webber and Pitman 2008). Although foraging resources (fishes and cephalopods) are present in the Action Area, the closest known rookery is located at Año Nuevo Island off the coast of central California (Allen and Angliss 2014).
Mirounga augustirostris	Northern elephant seal	MMPA	Eastern and central North Pacific Ocean most of the year (9 months); prefer sandy beaches when on land. Range from Alaska to Mexico and typically breed in the Channel Islands or Baja California (NMFS 2018a).	Low potential to occur. This species migrates to and from their rookeries twice a year. Rookeries range from Baja to northern California (Jefferson, Webber and Pitman 2008). In addition, this species is known to haulout and breed at the Channel Islands (NMFS 2018a, Lowry et al. 2014, CDFW 2009). This species is a deep diver (300-800 meters) and prefers to forage in deeper pelagic waters, often with seamounts and other underwater features (Jefferson, Webber and Pitman 2008). Foraging resources (e.g., squid, fishes) are present in the Action Area. However, when present at the Channel Islands, they are spending their time molting. Their preferred foraging areas are north of the islands.
Phoca vitulina	Pacific harbor seal	MMPA	Generally non-migratory. On the U.S. west coast this species is found in coastal and estuarine waters from Canada to Baja California, Mexico. Temperate coastal habitats and uses rocks, reefs, beaches, and drifting glacial ice for hauling out and pupping sites (NMFS 2018a).	**High** potential to occur. This species is non-migratory and inhabits the coast to the continental slope (Jefferson, Webber and Pitman 2008). Harbor seals have known haulouts and rookeries at Rincon Point (Santa Barbara County) and Point Mugu (Ventura County); and haulouts from Point Conception to Santa Barbara and along all of the Channel Islands (CDFW 2009). Diving averages less than 35 meters and they are generalist feeders (Jefferson, Webber and Pitman 2008).
Zalophus californianus	California sea lion	MMPA	Eastern North Pacific Ocean from central Mexico to Canada; shallow coastal and estuarine waters; prefers sandy beaches for haul out sites but will also haul out on marina docks, jetties, and buoys (NMFS 2018a).	**High** potential to occur. This species is present along the west coast from Puerto Vallarta to Alaska. Males (adult, subadult and juveniles) undertake a northward migration to Central California and Washington after the breeding season in southern rookeries are generalist feeders (Jefferson, Webber and Pitman 2008).This species has

Scientific Name	Common Name	Federal Status[1]	Distribution and Primary Habitat Associations	Potential to Occur
				known haulouts along all of the Channel Islands and rookeries at San Nicholas Island (CDFW 2009, NMFS 2018a). California sea lions are generalist opportunistic feeders and utilize the continental shelf and slope, but have also been observed in deeper oceanic waters (Jefferson, Webber and Pitman 2008).
Birds				
Brachyramphus marmoratus (nesting)	Marbled murrelet	Threatened	Breeds along the coast from Santa Cruz County north to Alaska. Nests in old-growth coastal forests, sea-facing talus slopes, or cliffs (Nelson 1997). During migration and winter (mostly July to February), occurs from Baja California to Alaska during the non-breeding season, in nearshore and protected coastal waters. Usually feeds nearshore within 5 kilometers (3 miles) and in waters less than 60 meters (197 feet) deep. Dives and pursues prey (opportunistic feeder) by flying underwater. This species is opportunistic and feeds on fish, crustaceans, and squid (Nelson 1997).	Low potential to feed. Suitable foraging habitat is present within the Action Area. However, while this species occurs regularly north of Point Conception, it occurs far less frequently farther south (CLO 2018, Lehman 2018, Garrett and Dunn 1991). In addition, the Action Area is located 3 miles off the coast of Ventura County, at the very edge of where this species potentially occurs. Not expected to nest. The Action Area occurs in open water, and nesting habitat is absent.
Phoebastria albatrus	Short-tailed albatross	Endangered	Nests on several isolated islands of the northwestern Pacific, but travels over much of the northern Pacific to forage in open waters for squid, fish, fish eggs, shrimp, and crustaceans.	Very low potential to forage. This species forages widely throughout the North Pacific Ocean and Bering Sea (USFWS 2018e). The global population is extremely low (approximately 1,200 individuals), and this species is an extremely rare visitor to offshore waters along the California coast, with only 43 records in the state since the 1970s (USFWS 2018e, CBRC 2018). The majority of occurrences are from north of Point Conception, but several have been observed farther south, with the nearest reports being of 1 subadult at Prisoner's Harbor, Santa Cruz Island, in July 2005, and 1 subadult at Santa Barbara Island in February and March 2002 (CBRC 2018). Not expected to nest. The Action Area occurs in open water, so nesting habitat is absent.
Sternula antillarum browni (nesting colony)	California least tern	Endangered	Breeding range extends from the San Francisco Bay Area south to Baja California, Mexico, including nesting colonies in coastal Santa Barbara and Ventura counties. May migrate coastally or over open water.	Low potential to forage. The site is farther from shore and in deeper water than where this species prefers to forage. Individuals may occasionally pass through the Action Area during migration.

Scientific Name	Common Name	Federal Status[1]	Distribution and Primary Habitat Associations	Potential to Occur
			Forages in shallow estuaries and lagoons. During the nesting season, foraging primarily takes places within 2 miles of shore and in waters less than 60 feet deep (USFWS 2006). Nests on sandy beaches or exposed tidal flats.	Not expected to nest. The Action Area is in open water, and nesting habitat is absent.
Sea Turtles[3]				
Caretta caretta	Loggerhead sea turtle (North Pacific Ocean DPS)	Endangered	Occurs in tropical to temperate waters in the Pacific Ocean. Nesting in the Pacific basin occurs along Japan and Australia, where it nests on ocean beaches, usually with high energy, narrow, steeply slopes, and coarse-grain sand. Migrates from nesting grounds in Japan and Australia to feeding grounds located along the west coast from central to north America. Baja California has the largest known aggregations of loggerhead sea turtles. Migrates along nearshore coastal waters (neritic zone). Typically feeds on benthic invertebrates in hard bottom habitats, although fish and plants are occasionally consumed (NMFS and USFWS 1998a).	**High** potential to feed and migrate. During ideal conditions (water temp/break), this species is known to migrate along the coast of California including the Santa Barbara Channel. Although there is no suitable feeding habitat (hard bottoms, benthic invertebrates) within the Action Area, during migration they may enter the Action Area. Sightings of this species along the U.S. west coast typically are of juveniles measuring 20-60 centimeter shell length (NMFS and USFWS 1998a). This species has also been observed at San Clemente Island (NMFS and USFWS 2007). Not expected to nest. Nesting occurs mainly on open beaches or along narrow bays having suitable sand, and often in association with other species of sea turtles. No beach habitat is present in the Action Area and the Santa Barbara Channel is outside of nesting range. There are no known nesting habitats that occur along the western seaboard of the U.S. or Hawaii (NMFS and USFWS 1998a). The closest known loggerhead nesting beaches in the North Pacific Ocean are located in Japan (NMFS and USFWS 2007).
Chelonia mydas	Green sea turtle (East Pacific DPS)	Threatened	Eastern Pacific Ocean range. This species forages in the open ocean as well as shallow waters of lagoons, bays, estuaries, mangroves, eelgrass, and seaweed beds	**High** potential to occur. Green sea turtles are generally found in shallow waters except when migrating. They have been observed at Sterns Wharf in Santa Barbara harbor and at the Channel Islands. This species may migrate and/or forage in the Action Area. A regular visitor in the waters off the southwest coast of the US. Residents occur in the San Gabriel River, Long Beach (NMFS and USFWS 1998b).

Scientific Name	Common Name	Federal Status[1]	Distribution and Primary Habitat Associations	Potential to Occur
				Not expected to nest. This species requires open beaches with a sloping platform and minimal disturbance for nesting. The closest known nesting occurrences are in Mexico (NMFS and USFWS 1998b).
Dermochelys coriacea	Leatherback sea turtle (Western Pacific Population)	Endangered	Pacific Ocean pelagic marine waters; foraging habitat unknown. This population migrates from their nesting grounds in the Indo-Pacific to feeding areas off the Pacific coast of North America.	Not expected to occur. This species migrates to the west coast of North America to forage on jellyfish, salps and pyrosomes. They utilize both open ocean and coastal habitats. Despite the Channel Islands area not being within the Final Critical Designated Habitat for Leatherback sea turtles, this species could nonetheless migrate and/or forage in the Action Area. This species has been observed in Monterey Bay (NMFS and USFWS 1998c). Not expected to nest. Nesting for the Western Pacific Population occurs in Indonesia. Their preferred nesting beaches are typically on continent shores and have unobstructed, often deep offshore access (NMFS and USFWS 1998c).
Eretmochelys imbricata	Hawksbill sea turtle	Endangered	Circumtropical oceans (generally 30°N to 30°S latitude), including the Pacific Ocean pelagic marine waters	Not expected to occur. This species is rare to nonexistent in most localities (NMFS and USFWS 1998d) but may migrate and/or forage (specialist sponge carnivore) in Action Area. However, the Action Area is a sandy bottom habitat, and this species is typically found feeding in the vicinity of rock or reef habitats in shallow tropical waters. No sighting have been documented in recent history (NMFS and USFWS 1998d). Not expected to nest. Hawksbill sea turtles nest high up on the beach under/in dune vegetation, commonly in pocket beaches without a lot of sand. The largest remaining concentrations of nesting hawksbills occur on remote oceanic islands of Australia and the Indian Ocean. Other known nesting sites include Hawaii. American Samoa, Guam, Republic of Palau, Commonwealth of the Northern Mariana Islands, Republic of the Marshall Islands, and the Federated States of Micronesia (NMFS and USFWS 1998d).
Lepidochelys olivacea	Olive Ridley sea turtle	Threatened[4]	Pacific Ocean pelagic marine waters; foraging habitat unknown (NMFS and USFWS 1998d).	Low potential to occur. This species distribution ranges from Southern California to Northern Chile. Olive Ridley sea turtles are mostly pelagic but will also inhabit coastal areas. This species feeds on algae, lobster, crabs, tunicates,

Scientific Name	Common Name	Federal Status[1]	Distribution and Primary Habitat Associations	Potential to Occur
				mollusks, shrimp, and fish. Olive Ridley sea turtles may migrate and/or forage in the Action Area. This species has been observed in the Los Angeles Harbor (NMFS and USFWS 1998e). Not expected to nest. In the eastern Pacific, the largest nesting concentrations occur in southern Mexico and northern Costa Rica, with some nesting as far north as southern Baja California. This species nests on continental margins, and exhibits an unusual nesting habit called "arribada" whereby up to thousands of turtles come ashore at the same time to nest.
Sharks/Rays				
Carcharhinus longimanus	Oceanic whitetip shark	Threatened	Worldwide, in tropical and sub-tropical waters and found up to 30°N and 30°S latitude (USFWS 2018c). This species is pelagic, mostly offshore in open ocean or along the continental shelf. They are opportunistic feeders and top predators, and prefer fish and cephalopods (NMFS 2018a).	Not expected to occur. Action Area is outside of this species known range.
Cetorhinus maximus	Basking shark	NMFS Species of Concern	Inhabits tropical and arctic waters but most commonly observed in coastal temperate waters. This species is a filter feeder, forages at the surface, and consumes zooplankton (NMFS 2018b).	Low potential to occur. This species is not common, and has had a dramatic decline since the mid-1900's from fishing and the eastern Pacific population has not rebounded (NMFS 2018b). The Action Area is located at the southernmost extent of their range.
Manta birostris	Giant manta ray	Threatened	Inhabits temperate, subtropical and temperate waters, utilizing all habitats: offshore, oceanic and coastal areas.. This species feeds mainly on zooplankton and can be found diving to depths of 10 – 1,000 meters (NMFS 2018a).	Low potential to occur. Manta rays can be found in temperatures as low as 19°C (66.2ºF). Santa Barbara Channel waters are not normally warm enough for this species. Last year in Ventura waters, only the month of August was warm enough for this species (NOAA 2018d).
Fish				
Acipenser medirostris	Green Sturgeon (southern DPS)	Threatened, NMFS Species of Concern	Ranges from Alaska to Mexico and spawns in the Rogue River, Klamath River Basin and the Sacramento River. Spawns in deep pools in large, turbulent, freshwater rivers; adults live in oceanic waters, bays, and estuaries, feeding on benthic invertebrates (NMFS 2015a).	Low potential to occur. Adults may migrate and/or forage in the project vicinity. There is very little data on green sturgeon use from Monterey south to the Mexican border. The area may be used minimally by the southern DPS (NOAA 2009).

Scientific Name	Common Name	Federal Status[1]	Distribution and Primary Habitat Associations	Potential to Occur
Catostomus santaanae	Santa Ana Sucker	Threatened	Small, shallow, cool, clear streams less than 7 meters (23 feet) in width and a few centimeters to more than a meter (1.5 inches to more than 3 feet) in depth; substrates are generally coarse gravel, rubble, and boulder (USFWS 2011)	Not expected to occur. Habitat is unsuitable for this species. This species inhabits freshwater streams only.
Gadus microcephalus	Pacific cod (Salish Sea Population)	NMFS Species of Concern	This specific population inhabits Puget Sound, the Strait of Juan de Fuca and the Strait of Georgia. They feed on krill, shrimp, sand lance and crabs. They are often found over sandy bottoms and eelgrass may play a role in habitat selection (NMFS 2011a).	Not expected to occur. Although the Action Area is a sandy bottom substrate, no eelgrass is present at these depths. The Action Area not within the species known range.
Eucyclogobius newberryi	Tidewater goby	Endangered	Brackish water habitats along the California coast from Agua Hedionda Lagoon, San Diego County, to the mouth of the Smith River (USFWS 2005).	Not expected to occur. Unsuitable habitat for tidewater goby, as they are a freshwater and brackish water species Rincon Creek, Santa Clara River and Ventura River are the closest known locations of this species to the Action Area.
Merluccius productus	Pacific hake (Georgia Basin DPS)	NMFS Species of Concern	The Georgia Basin DPS includes three stocks: the highly migratory stock that ranges from southern California to Queen Charlotte Sound, a central-south Puget Sound Stock and a Strait of Georgia stock (NMFS 2009a).	Not expected to occur. The highly migratory stock range includes southern California waters were the Action Area is located. The highly migratory stock spawns in the winter in California and migrates northward to feed as far north as Vancouver Island in the summer and spring. They are found at moderate depths of up to 3,000 feet (910 meters) (NMFS 2009a).
Oncorhynchus keta	Chum salmon	Threatened	Inhabits the lowermost reaches of rivers and streams, open ocean for anadromous form. Historical distribution included as far south as Monterey, however presently major spawning populations are found only as far south as Tillamook Bay, Oregon (NMFS 2017d).	Not expected to occur. The Action Area not within the species' known range.
Oncorhynchus kisutch	Coho salmon (Puget Sound/Strait of Georgia ESU)	NMFS Species of Concern	Inhabits streams and freshwater tributaries with gravel substrates, open ocean for anadromous form. This species distribution is from central California to Alaska (NMFS 2016a).	Not expected to occur. The Action Area not within the species' known range.
Oncorhynchus mykiss	Steelhead trout-Oregon Coast ESU	NMFS Species of Concern	Ranges from Asia, through Alaska and south to Southern California. This is a coastal species (NMFS 2008).	Not expected to occur. Oceanic range is unknown. However, spawning rivers only occur in rovers basins on the coast of Oregon from the Columbia River south to Cape Blanco (NMFS 2008).

Scientific Name	Common Name	Federal Status[1]	Distribution and Primary Habitat Associations	Potential to Occur
Oncorhynchus mykiss irideus	Southern steelhead-Southern California DPS	NMFS Species of Concern	This DPS includes watersheds from the Santa Maria River to the U.S. Mexican border, coast and inland habitats. Clean, clear, cool, well-oxygenated streams; needs relatively deep pools in migration and gravelly substrate to spawn, open ocean for anadromous form (NMFS 2016b).	Low potential to occur. Adults may migrate and/or forage in project vicinity Steelhead were observed in 2017 occupying the Ventura River (A. Dransfield, pers. comm.).
Oncorhynchus nerka	Sockeye salmon (Snake River ESU and Ozette Lake ESU)	Endangered (Snake River) and Threatened (Ozette Lake)	In the U.S., these populations occur in Oregon and Washington, and critical habitat is designated for this species in Snake River and Ozette Lake. This species inhabits riverine, marine and lake environments (lakes are a requirement), and feed on aquatic insects and plankton (NMFS 2015b).	Not expected to occur. The Action Area is outside of species range.
Oncorhynchus tshawytscha	Chinook salmon (Central Valley Fall, Late-fall run ESU)	NMFS Species of Concern	In the U.S., Chinook salmon ranges from Alaska to California. This ESU spawns in the Sacramento River and San Joaquin River. Chinook salmon require deeper and larger freshwater streams than other salmonids; open ocean for anadromous form. They range from Alaska to Southern California, and feed on aquatic insects, amphipods, crustaceans, and, once they are large enough, fish (NMFS 2010).	Not expected to occur. The Action Area not within the species' known range.
Sebastes levis	Cowcod	NMFS Species of Concern	The species ranges from central Oregon to central Baja California and Guadalupe Island, Mexico. Inhabits deep shelf and upper continental slope, inhabiting depths of 65 to 1,600 feet (20 to 500 meters) in rocky areas, and feeds on squid, octopus and other fish (NMFS 2009b).	Low potential to occur Unsuitable habitat for cowcod, individuals may migrate through the area. Southern California has been recognized as the center of distribution of the species since the 1880s (Eigenmann and Beeson 1894).
Sebastes paucispinus	Bocaccio (Southern DPS)	NMFS Species of Concern	Ranges from Baja California to Alaska; most common between 160-820 feet in depth, but found up to 1,560 feet in depth. This species feeds on other fish species (mainly other rockfish) (NMFS 2007b).	Not expected to occur. This species prefers deep waters and is unlikely to occur in the Action Area.
Sebastes ruberrimus	Yelloweye rockfish	Threatened	Yelloweye rockfish range from northern Baja California to Alaska. This species is associated with rocky reefs, kelp canopies, and artificial structures like oil platforms.	Not expected to occur. This species prefers deep waters, is more common from Central California northward, and is unlikely to occur in the Action Area.

Scientific Name	Common Name	Federal Status[1]	Distribution and Primary Habitat Associations	Potential to Occur
			Adults prefer deeper waters and rocky bottoms. This species is commonly found in depths of 300 to 590 feet (91 to 180 meters)(NMFS 2017e).	
Sphyrna lewini	Scalloped hammerhead shark	Threatened	In the east Pacific, scalloped hammerhead sharks range from southern California to Ecuador. Inhabits coastal warm temperate and tropical seas, ranging from intertidal to depths of up to 1000 meters. Adults are common at seamounts (Miller et al. 2013).	Low potential to occur Adults may migrate and/or forage in the project vicinity.
Thaleichthys pacificus	Pacific eulachon (Southern DPS)	Threatened	Ranges from Northern California to Alaska and into the southeastern Bering Sea. Critical habitat is designated for the Southern DPS in northern California in Mad River, Redwood Creek and Klamath River. Anadromous fish, endemic to northeastern Pacific Ocean. In the US, most euchalon production originates in the Columbia River Basin (NMFS 2011b).	Not expected to occur. The Action Area is outside of this species' known range. No records at the Channel Islands, Critical habitat extends as far south as the Mad River, Northern California (NMFS 2011b).
Invertebrates				
Haliotis corrugate	Pink abalone	NMFS Species of Concern	Ranges from Point Conception to Baja California. This species required sheltered waters with depths from 20 to 118 feet (6 - 36 m) (NMFS 2007c).	Not expected to occur. Suitable habitat not present. Very low population numbers.
Haliotis cracherodii	Black abalone	Endangered	This species feeds predominantly on kelp and inhabits rocky, low intertidal zones up to 6 meters deep (NMFS 2009c) Their range extends from Point Area in Mendocino County to Northern Baja California.	Not expected to occur. Suitable habitat not present. Very low population numbers. The nearest critical habitat to the Action Area is at Anacapa Island (NMFS 2011c).
Haliotis fulgens	Green abalone	NMFS Species of Concern	Ranges from Point Conception to Baja California. This species is found in rock crevices in shallow water on exposed coast from the low intertidal to depths of 60 feet (18 m) (NMFS 2009d).	Not expected to occur. Suitable habitat not present. Very low population numbers.
Haliotis kamtschatkana	Pinto abalone	NMFS Species of Concern	Ranges from Sitka, Alaska to Point Conception. This species is usually found in the tidal zone up to 30 feet but can be at depths of up to 330 feet. Pinto Abalone are associated with kelp beds in exposed areas (NMFS 2014).	Not expected to occur. Suitable habitat not present. Very low population numbers. The Action Area is not within this species known range.

Scientific Name	Common Name	Federal Status[1]	Distribution and Primary Habitat Associations	Potential to Occur
Haliotis sorenseni	White abalone	Endangered	Open low- or high-relief rock or bolder areas interspersed with sand channels. This species inhabits rocky pinnacles and deep reefs in Southern California; especially those off the Channel Islands (Hobday and Tegner 2000).	Not expected to occur. Suitable habitat not present. Observed along the coastline in Santa Barbara County and the Channel Islands. They usually occur at depths of 20-60 meters and to be most abundant between 25-30 meters (80-100 feet)(Hobday and Tegner 2000).

Notes:

[1] **Federal Status:** MMPA = Marine Mammal Protection Act (50 CFR Part 216); Depleted species population stock is below optimum sustainable populations; NMFS Species of Concern = National Oceanic and Atmospheric Administration (NOAA) National Marine Fisheries Service (NMFS) Species of Concern (not federally listed or protected under the Endangered Species Act).

[2] The best potential to occur assessment has been provided given the paucity of information available for marine mammals, especially whales. Low potentials to occur do not negate the possibility of a given whale species occurring in the Action Area.

[3] Sea turtles are highly migratory and much of their geographic range and/or foraging habitat in the Pacific Ocean is unknown (e.g., see NMFS and USFWS 1998a)

[4] Endangered status provided to the breeding colony populations on the Pacific Coast of Mexico.

APPENDIX C

Phytoplankton Population Impact Calculations

Appendix C

PHYTOPLANKTON POPULATION IMPACT STATEMENT AND CALCULATION

Adapted from Santa Barbara Mariculture Company MND calculations for estimating the maximum effect of a mussel farm on phytoplankton (CDFG 2018).

Estimating the Maximum Effect of a Mussel Farm on Phytoplankton:
Use estimates of maximum clearance rates of mussels, scale up to show how much water passes through mussels in the farm and using minimum flow rates assess how much phytoplankton is removed by the mussel farm. This will be a MAXIMUM estimate of the effects of a mussel farm on phytoplankton. We use the maximum clearance rate for mussels in the mariculture study of Brigolin *et al.,* (2009). From their table 2, they use a maximum clearance rate (CR_max) of 107 liters / (day g DW). Source info for the CR_max estimates are in Brigolin *et al.,* (2009). Table 2 also provide various conversion ratios for wet to dry weight (17.4; which includes the shell weight).

Ventura Shellfish Enterprise wants to grow a maximum of 22,000,000 pounds of mussels at a time (this is the maximum amount the plots can produce, assuming all plots are leased and all arrays are at the grow-out stage simultaneously). This is equivalent to 9,979,032 kg or 573,507 kg DW (using the conversion rate above).

The maximum volume of seawater flowing through mussels is 1.0e9 liters/day or ~1e6 m3 / day (=573,507 kg DW * 107 liters/(day g DW)). This assumes the mussels are filtering seawater at their maximum rate.

573,507 kg DW * 107 liters = ~61,365,249 m3/day

The turnover time (how long it takes the entire volume seawater at the farm to go through mussels) is equal to: Turnover time through mussels = volume_farm / farm_clearance_rate
Note: 1 ac = 4047m2

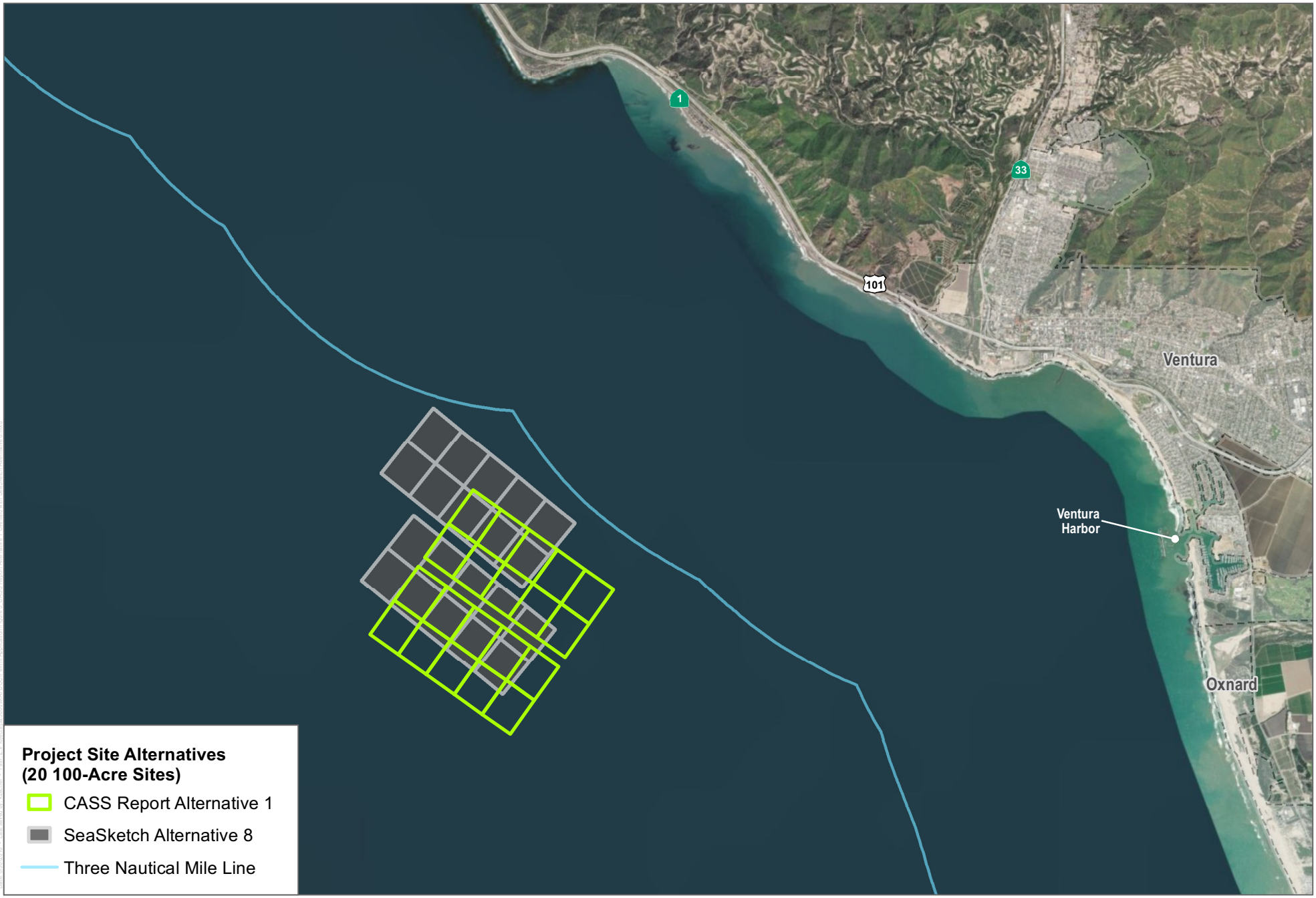
Volume_farm = Area(= 2000 acres) * Depth (=30m) = 2000 acres * 4047m2 = 8,094,000 m3/acre

The turnover time is therefore equal to...= volume_farm / farm_clearance_rate = (8,094,000 m3/acre) * 30 m = 242,820,000 m3/ (61,365,249 m3/day) = 2 days

So how does this 2 day turnover time compare with how long seawater is resident in the farm itself? To do this we will use a MINIMUM velocity scale (10 cm/s) to assess MAXIMUM residence time of water in the farm. The minimum flow rate estimate comes from many years of measurements off Arroyo Burro by the SBC LTER. It is the ratio of the two time scales that is important here.

Max_res_time = Farm_size(sqrt(2000acres)) / Min_Speed(10 cm/s ~10 km/d) = 0.0136 km / 10 km/d = 0.00136 day = 0.03 hour = ~2 min.

Note that the time scales differ by orders of magnitude (2 min & 2 d) and the mussels will not clear much of the water passing through the farm.



SOURCE: NAIP 2016

DUDEK

0 3,600 7,200 Feet

FIGURE 5

CASS Report Alternative 1 Overlaid with SeaSketch Alternative 8

Ventura Shellfish Enterprise Project