INITIAL STUDY and
DRAFT MITIGATED NEGATIVE DECLARATION

Prepared Pursuant to the
California Environmental Quality Act

PROJECT: Hog Island Oyster Company Shellfish Farm in Arcata Bay
(Application Number 2020-03)

LEAD AGENCY: Humboldt Bay Harbor, Recreation, and Conservation District
P.O. Box 1030,
Eureka, CA 95502
(707) 443-0801

February 5, 2021

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Section 1.0 Introduction

1.1 Purpose of this Document

This initial study (IS) assesses the environmental effects of developing a new shellfish culture operation by Hog Island Oyster Company (HIOC) in Arcata Bay, California. The name of the project is HIOC Shellfish Farm in Arcata Bay (the HIOC Project). This IS was prepared pursuant to the requirements of the California Environmental Quality Act (CEQA) and in compliance with the State CEQA Guidelines (Title 14, California Administrative Code, Section 1400 et seq.).

The Humboldt Bay Harbor, Recreation, and Conservation District (District) is the state lead agency under CEQA. The District must evaluate the environmental impacts of the HIOC Project when considering whether to approve the HIOC Project. The IS serves as an informational document to be used in planning and decision-making, and does not recommend approval or denial of the HIOC Project.

1.2 Scope of this Document

This document evaluates the HIOC Project's potential impacts related to the following topics:

- aesthetics
- agricultural and forestry resources
- air quality
- biological resources
- cultural resources
- energy
- geology and soils
- greenhouse gas emissions
- hazards and hazardous materials
- hydrology and water quality
- land use and planning
- mineral resources
- noise
- population and housing
- public services
- recreation
- transportation
- tribal cultural resources
- utilities and service systems
- wildfire
- mandatory findings of significance

1.3 Impact Terminology

The following general terms are used in this IS to describe the significance of impacts that could result from the HIOC Project:

- The HIOC Project is considered to have *no impact* if the analysis concludes that the HIOC Project could not affect a particular resource topic.

- An impact is considered *less than significant* if the analysis concludes that the HIOC Project would cause no substantial adverse change to the environment and that impacts would not require mitigation.
- An impact is considered *less than significant with mitigation* if the analysis concludes that the HIOC Project would cause no substantial adverse change to the environment with the inclusion of mitigation measures identified by the lead agency.
- An impact is considered *significant* if the analysis concludes that the HIOC Project would cause substantial adverse change to the environment that could not be reduced to less-than significant levels by the inclusion of identified mitigation measures.

1.4 General Information

1. **PROJECT TITLE:** Hog Island Oyster Company (HIOC) Shellfish Farm in Arcata Bay
2. **LEAD AGENCY/CONTACT NAME AND ADDRESS:** Humboldt Bay Harbor, Recreation and Conservation District, P.O. Box 1030, Eureka, CA 95502-1030. Adam Wagschal, Deputy Director, (707) 443-0801, awagschal@humboldtbay.org
3. **PROJECT LOCATION:** Tidelands in Arcata Bay, California (parcel 506-121-001-000)
4. **PROJECT SPONSOR'S NAME AND ADDRESS:** Hog Island Oyster Company, 20215 Shoreline Hwy 1, Marshall, CA 94940. John Finger, Owner, (415) 602-9281, john@hogislandoysters.com.
5. **GENERAL PLAN DESIGNATION:** Natural Resources
6. **ZONING:** Natural Resources/Water
7. **DESCRIPTION OF THE PROJECT:** refer to Section 3.0 below
8. **SURROUNDING LAND USES AND SETTING:** refer to Section 2.0 below

9. OTHER PUBLIC AGENCIES WHOSE APPROVAL IS REQUIRED:

Level	Agency	Type of Approval, Permit or Consultation
Local	Humboldt Bay Harbor, Recreation & Conservation District	Harbor District Permit
State	California Coastal Commission	Coastal Development Permit
State	North Coast Regional Water Quality Control Board	Clean Water Act Section 401 Water Quality Certification*
Federal	United States Army Corps of Engineers	Clean Water Act Section 404* and Rivers and Harbors Act Section 10
Federal	National Marine Fisheries Service	Consultation on Endangered Species Act Section 7 and Magnuson-Stevens Act
Federal	U.S. Fish and Wildlife Service	Consultation on Endangered Species Act Section 7
*Note: Corps of Engineers issued a final rule in January 2021 stating that "In general, the placement of bivalve shellfish mariculture structures on the bottom of a navigable waterbody, or into the substrate of a navigable waterbody does not result in discharges of dredged or fill material into waters of the United States that are regulated under Section 404 of the Clean Water Act." (86 FR 2744). Because of uncertainty associated with implementation of this final rule, Clean Water Act approvals may or may not apply to this project.		

10. HAVE CALIFORNIA NATIVE AMERICAN TRIBES TRADITIONALLY AND CULTURALLY AFFILIATED WITH THE PROJECT AREA REQUESTED CONSULTATION PURSUANT TO PUBLIC RESOURCES CODE SECTION 2108.3.1? IF SO, HAS CONSULTATION BEGUN? The following tribes have been contacted, consistent with Assembly Bill 52, to understand whether they will want to be consulted on for the proposed HIOC Project:

- Wiyot Tribe – Eddie Koch and Ted Hernandez
- Bear River Band of the Rohnerville Rancheria – Erika Cooper
- Blue Lake Rancheria – Janet Eidsness

The tribes received a pre-consultation email on December 8, 2020.

Section 2.0 Surrounding Land Uses and Setting

Humboldt Bay is a complex ecosystem and valuable resource for California and the nation because of its natural resources, aesthetic appeal and recreational opportunities, ecological services, economic benefits, and vital transportation links. Visitors and Humboldt County residents value Humboldt Bay for its natural and anthropogenic attributes. The biota that use the bay are diverse and ecologically important locally and globally. The habitat in the bay provides resources for strong commercial fisheries, including crabs, bivalves, and finfish, and habitat for shorebird and waterfowl migrants (i.e., the Pacific Flyway). The Humboldt Bay area hosts more than 400 plant species, 300 invertebrate species, 100 fish species, and 260 bird species, including those that rely on the bay as they travel the Pacific Flyway. Based on 2019 estimates, the largest nearby urban concentrations are in Arcata to the north (population approximately 18,431) and Eureka to the south (population approximately 26,710) (U.S. Census Bureau. 2020). Smaller towns along the peninsula, from north to south, include Manila, Samoa, and Fairhaven (Figure 1).

The upland area adjacent to the HIOC Project is relatively undeveloped, especially to the north near the Mad River Slough. There are several trail systems that include the Ma-le'l Dunes Park that travel along the Pacific Ocean. The dunes are Bureau of Land Management (BLM) land and the south parking lot for the park is located approximately 0.5 miles west of the HIOC Project (Figure 2). North of the Ma-le'l Dunes Park is Humboldt Bay National Wildlife Refuge land owned by the U.S. Fish and Wildlife Service (USFWS). To the east of this refuge there are agricultural, pasture, and ranching lands and State Highway 255. Finally, along the northern and northeastern shoreline of Arcata Bay there is the Mad River Slough Wildlife Area and McDaniel Slough Restoration Project owned by the California Department of Fish and Wildlife (CDFW), which is located approximately 0.8 miles northeast of the HIOC Project. This area connects to the Arcata Marsh and Wildlife Sanctuary. There is a portion of the Mad River Slough Wildlife Area that is emergent wetlands located west of the HIOC Project parcel, approximately 700 feet from the nearest proposed culture area.

The majority of the nearby upland development is to the west of the HIOC Project. There is an old mill site (Sierra Pacific Industries lumber mill) that operated from approximately 1950 to 2016 (Figure 2). The current owner purchased the site in 2017 and has plans to create a business park, including a cannabis grow site. There are also several small businesses and lodging located along the New Navy Base Road that runs along the shoreline of Arcata Bay. Single family residences increase closer to Manila, which are located approximately 0.25 miles from the HIOC Project parcels and approximately 0.5 miles from proposed shellfish aquaculture activities. Based on 2019 estimates, the town of Manila has a population of approximately 784 (City-Data 2020).

Humboldt Bay encompasses roughly 17,759 acres at mean high water (MHW) and is separated into three geographic segments: South Bay, Entrance Bay, and Arcata Bay. The HIOC Project is located in Arcata Bay next to the Mad River Slough (Figure 1). Figure 1 also shows the geographic extent of Arcata Bay and the start of Entrance Bay used in this analysis. Arcata Bay is approximately 8,481 acres (1,127 acres subtidal and 7,354 acres intertidal) at MHW, with a tidal range of approximately -2.0 feet to +8.5 feet mean lower low water (MLLW).

Figure 1: HIOC Project Vicinity Map

Figure 2: Upland Habitat and Developed Areas adjacent to the HIOC Project

According to the Coastal and Marine Ecological Classification Standards (CMECS) mapped in 2009, native eelgrass (*Zostera marina*) is the dominant habitat of Arcata Bay (38.6%) followed by mudflats (27.7%) (NOAA 2012). Eelgrass in Arcata Bay is primarily limited by depth (Gilkerson 2008). Surveys at the project site in 2009 (NOAA 2009) and 2020 (Lumis 2020) did not find eelgrass growing at higher elevations where culture is proposed (Figure 3). As described below (Section 3.4), the HIOC Project is located in mudflat habitat at an elevation range of +1.6 feet to +4.6 feet MLLW. By siting the activities at elevations that primarily avoid eelgrass and incorporating the recommended 5-meter (16 foot) buffer from eelgrass beds based on California Eelgrass Mitigation Policy (CEMP) guidance for eelgrass beds , impacts to eelgrass will be fully avoided by the shellfish aquaculture gear.[1]

Major changes in Humboldt Bay that have resulted in impacts to the habitat of Arcata Bay include diking and filling of salt marsh habitat from the 1880s to the 1980s, which resulted in significant impacts, including channel confinement, gradient increase, and ongoing erosion of residual salt marsh habitat (Schlosser and Eicher 2012). The amount of salt marsh habitat in Humboldt Bay is less than 10% of what it was historically (from 9,000 acres to about 900 acres currently). Portions of the diked former tidelands around Humboldt Bay, particularly in the Arcata Bottoms, are used for agriculture, primarily livestock grazing for dairy and beef production. The Mad River and Eel River deltas provide the primary agricultural resources in Humboldt County (HCDCDS 2003). Agricultural lands are protected under the California Land Conservation Act to preserve a maximum amount of open space and agricultural land for the state's economic resources, and maintain a food supply for future residents rather than have unnecessary conversions for urban use.

Arcata Bay is also the main location for shellfish aquaculture, which covers approximately 3.4% of the bay, both within eelgrass habitat and mudflats (NOAA 2012 based on 2009 field mapping). Arcata Bay and the Mad River Slough have a long tradition of oyster aquaculture, dating back over 100 years for the native oyster (*Ostrea lurida*) and into the 1950s for Japanese oyster species – Pacific oyster (*Crassostrea gigas*) and Kumamoto oyster (*C. sikamea*) (Barrett 1963). Both Japanese oyster species are still cultured in Humboldt Bay, as well as Manila clams (*Tapes philippinarum*).

There are five companies currently farming shellfish in the bay, using various methods to culture clams in subtidal areas and oysters in both subtidal and intertidal areas. There are approximately 90 raft type structures (or 2 acres) culturing shellfish in subtidal areas, 35 of which are managed by Pacific Seafood Company (Pacific) – previously known as Coast Seafoods Company. Additionally, there are approximately 287 acres of intertidal areas cultured, of which approximately 279 acres are managed by Pacific. Historically, as many as 1,000 intertidal acres were used for on-bottom oyster culture (SCH #2015082051). In the late 1990's, shellfish companies adopted near-bottom (i.e., cultch-on-longlines and rack and bag) methods and reduced the amount of acres cultured.

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[1] The CEMP definition for an eelgrass bed includes: "areas of vegetated eelgrass cover (any eelgrass within 1 m^2 quadrat and within 1 m [3 feet] of another shoot) bounded by a 5 m [16-foot] wide perimeter of unvegetated area" (NMFS 2014). The project will avoid eelgrass beds as defined by CEMP, including a 16-foot wide unvegetated perimeter around existing identified eelgrass beds.

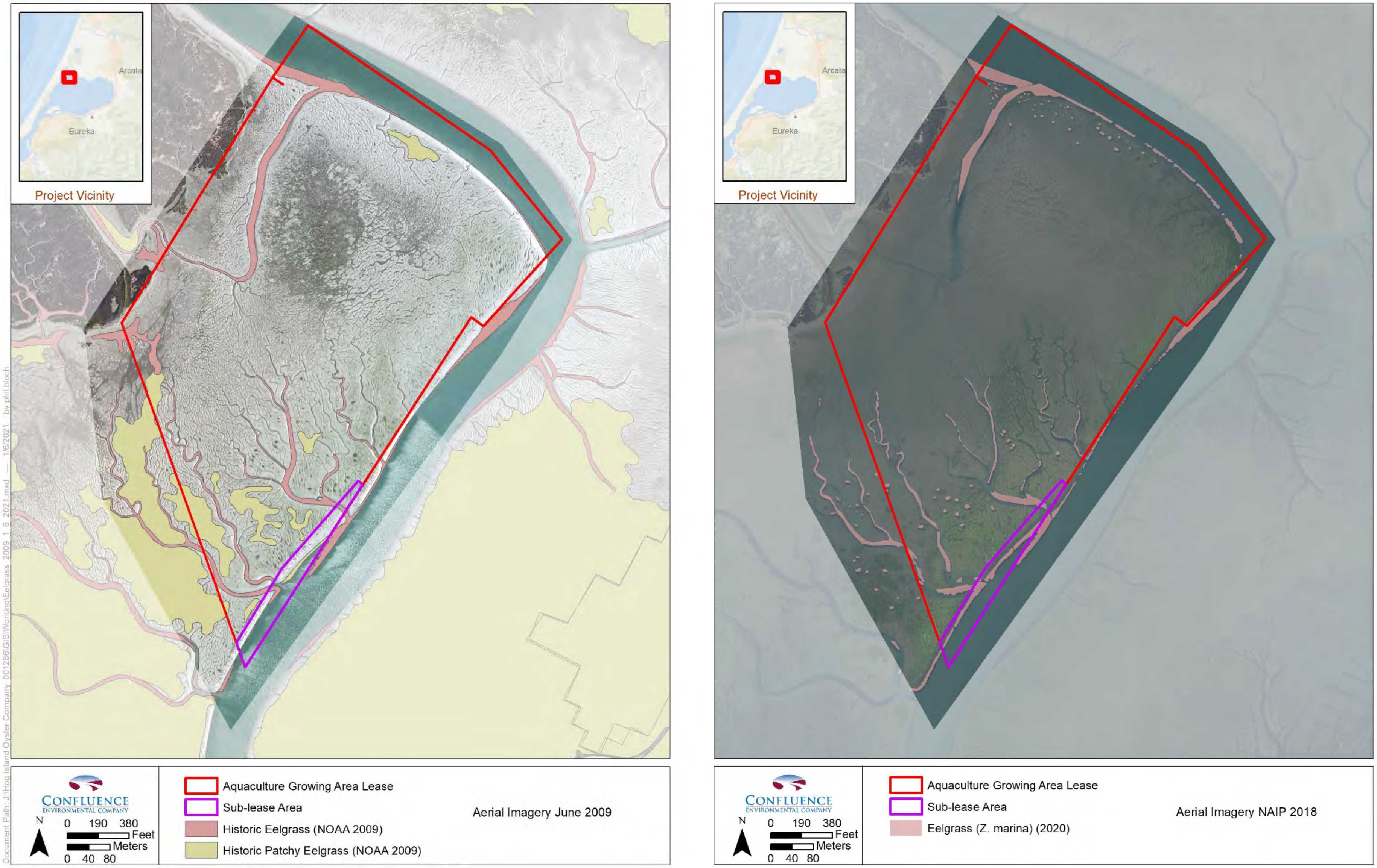


Figure 3: Eelgrass Current and Historical Presence in the HIOC Project Area

In addition to the existing culture, there are three other efforts aside from the HIOC Project underway in Humboldt Bay that may also allow for expanded shellfish culture operations. The first two are the District's Humboldt Bay Intertidal Mariculture Pre-Permitting Project and Yeung Oyster Farm. These projects are being analyzed in the same Draft Environmental Impact Report (DEIR) under SCH #2017032068, and include up to 136 acres of intertidal culture in Arcata Bay. The third project is the District's Humboldt Bay Subtidal Mariculture Pre-Permitting Project (SCH #2013062068), which was fully permitted in 2019 and allows for up to 20 acres of subtidal culture. These areas are currently being leased for shellfish and seaweed culture. As described below, the HIOC Project includes up to 30 acres of cultivation within approximately 40 acres available for shellfish aquaculture activities. Compared to the 3.4% of Arcata Bay that had shellfish aquaculture in 2009 (NOAA 2012 based on 2009 field mapping), the HIOC Project, Yeung Oyster Farm, and District Pre-Permitting Projects increase in cultivated footprint represents approximately 1.7% of Arcata Bay.

Section 3.0 Project Description

The following sections provide an overview of the HIOC Project, including:

- Project Scope and Goals
- Best Management Practices
- Project Area
- Proposed Species and Culture Methods
- Reporting

3.1 Project Scope and Objectives

HIOC has a total lease area of 110 acres. Within this area, HIOC seeks permitting to cultivate up to 30 acres within a 40-acre area available for shellfish aquaculture on leased, intertidal areas in northwest Arcata Bay. The project objectives are as follows:

- Produce premium oysters to meet demand from HIOCs restaurants as well as provide sustainable seafood for local markets.

- Develop a shellfish farm to complement HIOC's existing shellfish Hatchery Facility located near Samoa.

- Create additional job opportunities and sustainable economic development for Humboldt Bay and local jurisdictions.

- Locate oyster beds in areas with optimal growing conditions to maximize efficiency and limit the spatial footprint of the farm.

3.2 Mitigation Measures and Best Management Practices

HIOC seeks to avoid and minimize negative environmental impacts through adherence to specific mitigation measures and BMPs (Table 1). These have been developed over many years, with input from multiple agencies and other shellfish aquaculture companies in Humboldt Bay and other estuaries of California. Note that the specific mitigation measures are used to avoid or minimize potential environmental impacts will be discussed under the relevant topics within this IS document. The BMPs noted below are part of typical operations, and a result of federal and state laws that require these common practices.

Table 1. Proposed Mitigation Measures and Best Management Practices (BMPs)

#	Topic	Mitigation Measure or BMP
Mitigation Measures		
Mit-1	Marine Debris	HIOC will implement a marine debris management plan (Appendix A). At the time of harvest of each cultivation area, HIOC will carry out a thorough inspection to locate and remove any loose, abandoned or out of use equipment and tools. All floating bags and baskets will be marked or branded with the HIOC's name and phone number.
Mit-2	Eelgrass (*Zostera marina)* Protection	HIOC will install racks, intertidal longline systems, and other aquaculture gear at least 5 horizontal meters (or 16 feet) from native eelgrass beds (*Zostera marina*). This will not prevent continued cultivation in areas where eelgrass moves into the project site. HIOC is expected to install gear incrementally. Before gear is installed in new areas, eelgrass will be mapped in culture areas using unmanned aerial vehicles (UAV) and/or verified using ground surveys to identify eelgrass beds and establish 5 meter horizontal buffers. Eelgrass surveys will be considered valid pre-installation surveys if performed less than 2-years prior to gear installation.
Mit-3	Vessel Anchors	HIOC will anchor vessels outside of areas containing eelgrass.
Mit-4	Vessel Routes	HIOC will establish a vessel route to access its leases that avoids known native eelgrass (*Z. marina*) beds.
Mit-5	Pacific Herring (*Clupea pallasii*) Avoidance	In any cultivation beds within or adjacent to eelgrass beds (in the event that eelgrass moves into the project site), HIOC will conduct visual surveys for Pacific herring spawn prior to conducting activities during the herring spawning season (October to April). If herring spawn is present, HIOC will suspend activities in the areas where spawning has occurred until the eggs have hatched and spawn is no longer present (typically 2 weeks).
Mit-6	Cultural Resources	HIOC will comply with the Harbor District Protocol agreed upon between the Harbor District and the Blue Lake Rancheria, Bear River Band of Rohnerville Rancheria, and Wiyot Tribes regarding the inadvertent discovery of archaeological resources, cultural resources, or human remains or grave goods (Appendix B).
BMPs		
BMP-1	Vessel Maintenance and Fueling	HIOC will maintain all vessels used in culture activities to limit the likelihood of release of fuels, lubricants, or other potentially toxic materials associated with vessels due to accident, upset, or other unplanned events. HIOC will use marine grade fuel cans that are refilled on land, and HIOC carries oil spill absorption pads and seals wash decks or isolates fuel areas prior to fueling to prevent contaminants from entering the water.
BMP-2	Vessel Motors	HIOC will use highly efficient 4-stroke outboard motors. All motors will be muffled to reduce noise.
BMP-3	Fish and Wildlife	During vessel transit, harvest, maintenance, inspection, and planting operations, HIOC will avoid approaching, chasing, flushing, or directly disturbing shorebirds, waterfowl, seabirds, or marine mammals.
BMP-4	Bed Marking	HIOC culture beds will be marked with a long PVC pole to provide information to boaters of the location of shellfish aquaculture gear. HIOC will also inform the District of the location of the beds and they will be posted on the District's website.

3.3 Project Area

HIOC has executed two lease agreements for approximately 110 acres of intertidal area in the northwestern part of Arcata Bay, adjacent to the Mad River Slough channel (Figure 4). The majority of this area (~90 acres) is leased from Security National Properties Holding Company, LLC. HIOC has also entered into a sub-lease exchange with Humboldt Bay Oyster Company (HBOC), granting HIOC approximately 20 acres to the northwest of the main culture area in exchange for approximately 3 acres of culture area in the southern portion (identified as the "Sub-lease Area" on Figure 4). HBOC's operation is not included as part of this application. HIOC's lease boundaries would be clearly marked with a combination of 10-foot long by 2-inch wide white polyvinyl chloride (PVC) pipes that are marked vertically with the lease number and horizontally with two strips of reflective tape to mark corners.

Currently, there is no commercial scale aquaculture activity in the HIOC Project area, although there was some small pilot-level testing to ensure that shellfish would grow in this area. The HIOC Project area contains a stable mix of channels and high intertidal flats. The tidal elevation of the flats appears to be too high to sustain significant eelgrass resources, which persists primarily in the wetted channels and depressions in and adjacent to the project area. Reviews of historical mapping (NOAA 2012, Schlosser and Eicher 2012), and comparison to current mapping conducted in 2020 by University of California Santa Cruz (Lumis 2020), suggests that eelgrass distribution in the HIOC Project area is similar to the 2009 distribution (Figure 3). Continuous eelgrass beds are primarily confined to tidal channels in the Mad River Slough area. Current mapping of historic 'patchy' eelgrass beds suggests that these areas may be either smaller than depicted historically, the mapping units were defined differently than the current CEMP eelgrass bed definition, or historic mapping may have overstated the area of these patches. It is notable that there are also differences in methods, and eelgrass is dynamic and varies both seasonally and annually throughout Humboldt Bay. The HIOC Project area is at a sufficiently high tidal elevation (above +1.6 feet MLLW) where eelgrass is not expected to be consistently present in the areas proposed for culture until sea level rise may make conditions suitable for eelgrass to persist outside of the channels and depressions on-site.

3.4 Proposed Species and Culture Methods

HIOC proposes to grow the three species of oyster that have been historically cultivated in Arcata Bay – Pacific oysters (*Crassostrea gigas*), Kumamoto oysters (*Crassostrea sikimea*), and the native "Olympia" oyster (*Ostrea lurida*) – with a primary focus on Pacific oysters. HIOC's hatchery and nursery operations are already permitted to produce these species and will provide a steady, local seed supply.

HIOC will employ exclusively near-bottom culture methods, using bags or baskets on intertidal longlines (up to 27 acres), with a small amount (up to 3 acres) of "raised rack and bag" culture. The intertidal longline methods include the use of SEAPA-type culture baskets or "tipping bags." These methods are described in more detail below (Section 3.4.1). The proposed HIOC Project would be phased in over a 5-year period, with an initial focus on those areas already classified as Conditionally Approved by the California Department of Public Health (Appendix C). Harvested oysters would be processed at HIOC's Hatchery Facility in Samoa, California, and sold primarily within HIOC's family of California seafood restaurants.

Proposed culture areas will avoid eelgrass beds by working at higher tidal elevations ranging from +1.6 feet to +4.6 feet MLLW and incorporating a 16-foot buffer from eelgrass when installing shellfish aquaculture gear.

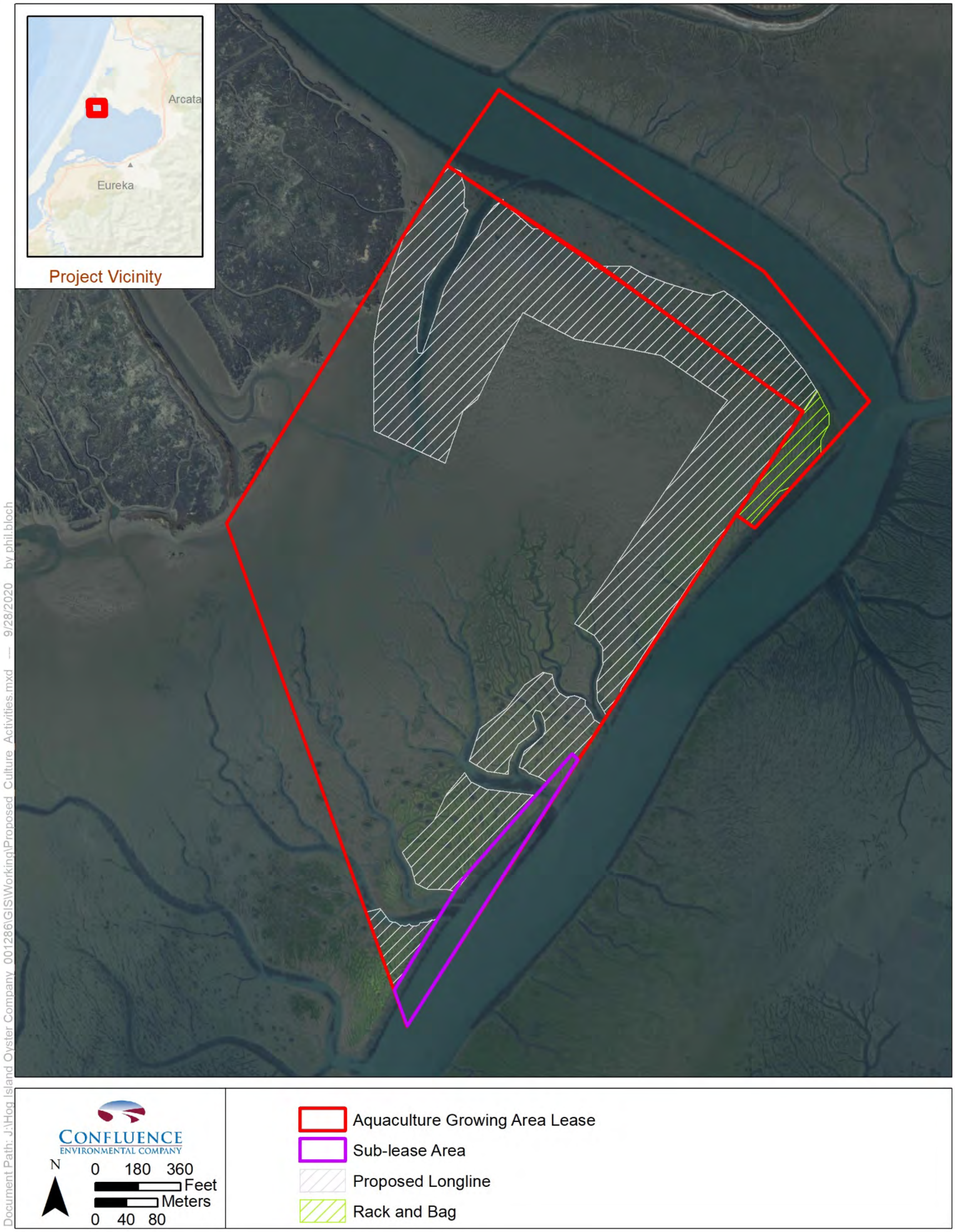


Figure 4: Project Map and Vicinity

3.4.1 Intertidal Longline Systems

The primary culture method would be intertidal longlines equipped with either SEAPA-type culture baskets (Figure 5) or tipping bags (Figure 6). The potential interactions with the surrounding environment and SEAPA-type culture or tipping bags are very similar. These culture methods are treated the same in recent permitting efforts with the California Coastal Commission (CCC) and Corps in Tomales Bay (Corps 2019, CCC 2019), and recent literature discussing potential environmental effects are coming to similar conclusions (discussed below in Section 4.0). These intertidal longline systems may be deployed with or without floats that harness tidal energy to “tumble” the oysters. HIOC proposes up to 27 acres of this longline culture system, installed over a 5-year timeline. Basket-on-longline systems (distinct from cultch-on-longline) have emerged as a lower impact method for shellfish culture, allowing farm labor to maintain gear and animals with minimal impact to the surrounding benthic environment due to less need to access the culture plots by foot (Dumbauld and McCoy 2015).

Figure 5: Intertidal Longline Systems with SEAPA-style Baskets at Low Tide
Note: photo taken at the HIOC Tomales Bay operation.

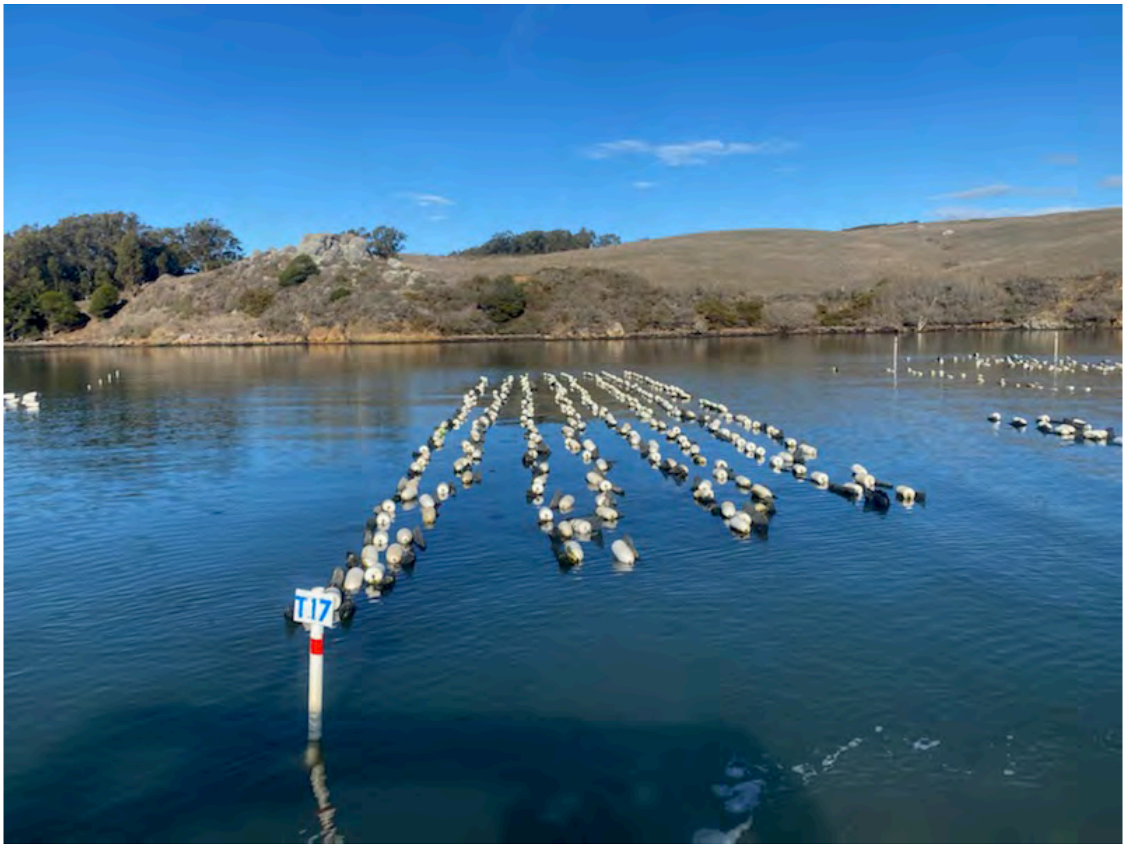


Figure 6: Tipping Bags with Floats at High Tide

Note: photo has floats when the tide is high for flipping action; taken at the HIOC Tomales Bay operation.

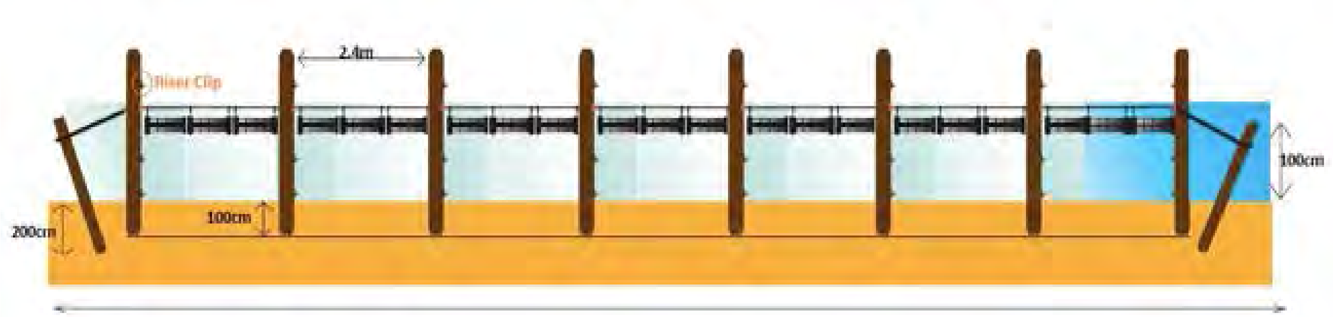
Intertidal longline systems used by HIOC are proposed to be 100 to 300 feet long, where possible, with anchor posts at both ends and supporting posts typically every 8 feet. Individual lines are spaced at approximately 3 feet, with an additional space of 15 feet between grouped blocks of 4 lines to provide easement for boat access – also called a boat easement. The anchor posts are proposed to be galvanized steel pipe T-stakes, or other suitable materials, and are used to maintain line tension. The supporting posts in between are proposed to be made of schedule 80, 2-inch PVC. Intertidal longline systems can be 1 foot to 4 feet in elevation above the ground. Lines between the posts are plastic coated with a steel core. Covering that inner line is an outer sleeve that reduces wear.

Intertidal longline systems can hold either bags or baskets, with or without floats. Longline support posts and anchors (endposts) are driven using sledgehammers, hand-held post pounders, and/or a gas or pneumatic hand-held post pounder. Posts are removed by first loosening them by twisting with a pipe wrench and then tying a clove hitch around pipes and pulling them out using a boat-mounted crane. Material used in end posts has a serviceable life of at least 15 years. Based on these general layout and construction parameters, Table 2 (provided below) gives an estimate of how much gear might be associated with the proposed farm layout.

Table 2. Proposed Gear Quantities for Intertidal Longline System Lengths and Areal Groupings

Longline Units	# of SEAPA Baskets	# of Tipping Bags	# of Vertical Support Pipes (2" diameter)
100-foot Longline	40	80	12
300-foot Longline	120	240	37
A block of 8x300-foot Longlines (~one acre)	960	1,920	296

Tipping bags attached on longlines are made of durable VEXAR and are typically 2-foot by 3-foot with ½-inch mesh. These bags are attached to the line using a stainless-steel snap hook or plastic clip that connects to a plastic bearing. Bags attached to long lines have a small crab float attached to them opposite of the attachment to the long line. Floats are attached to the bag using 3/8-inch poly line. SEAPA baskets are typically 2-foot by 4-foot by 1.5-foot in diameter and are made of HDPE. After stocking the bags or baskets with oysters they are transported to the growing areas via work vessel. The vessel runs alongside the longlines and bags/baskets are clipped directly onto the line. Additional details and images on the installation of intertidal longline systems can be found in Figure 7.



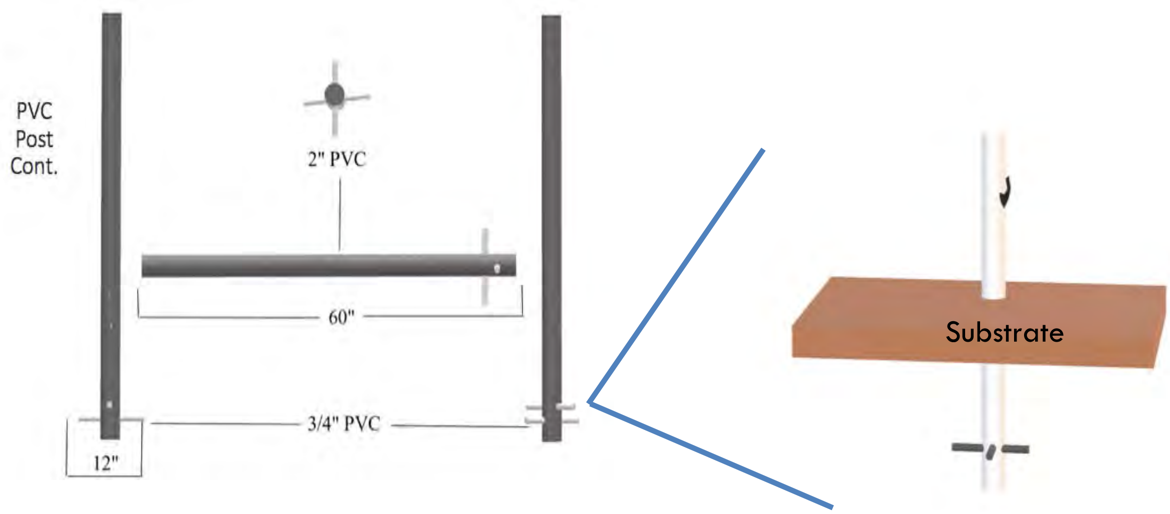


Figure 7: Longline Schematic with Anchor System and Pole Spacing between Anchors
Note: typical 4 by 100-foot longline sets with 15-foot boat easements. Top = tipping bags with float; Bottom = SEAPA baskets.

3.4.2 “Rack and Bag” System

HIOC also proposes up to 3 acres of “raised rack and bag” systems (Figure 8). Racks are proposed to consist of a 2-foot by 8.5-foot rebar frame to which 4, ½-inch VEXAR mesh bags measuring 2-foot by 3-foot are attached. After racks are stocked with oysters they are placed into the rows by a work vessel during a high tide. On the next low tide series (usually the same or following day), the racks are organized and placed into the notch on their 4 PVC pipe legs. PVC pipe legs are typically 12 inches to 24 inches above grade. A row of racks is typically 100 feet to 300 feet long with 2.5 feet between each rack (front to back). Rows of racks run parallel to each other. There are proposed to be two rows of racks with 3 feet of space between them (left to right) and then a 12 feet to 15 feet space until the next two rows (Figure 9). Racks are monitored and tipped monthly during their grow-out period. On a quarterly basis after initial planting, racks can be culled and graded. The harvest of racks entails the crew removing the racks from their PVC legs and placing them on a vessel for transport, usually done with 2 feet to 3 feet of water to allow the vessel to come up alongside the rows of racks for easier handling by the crew. All culling and grading would take place at HIOC’s Hatchery Facility. Final harvest of racks is typically 9 to 12 months after the initial planting date.

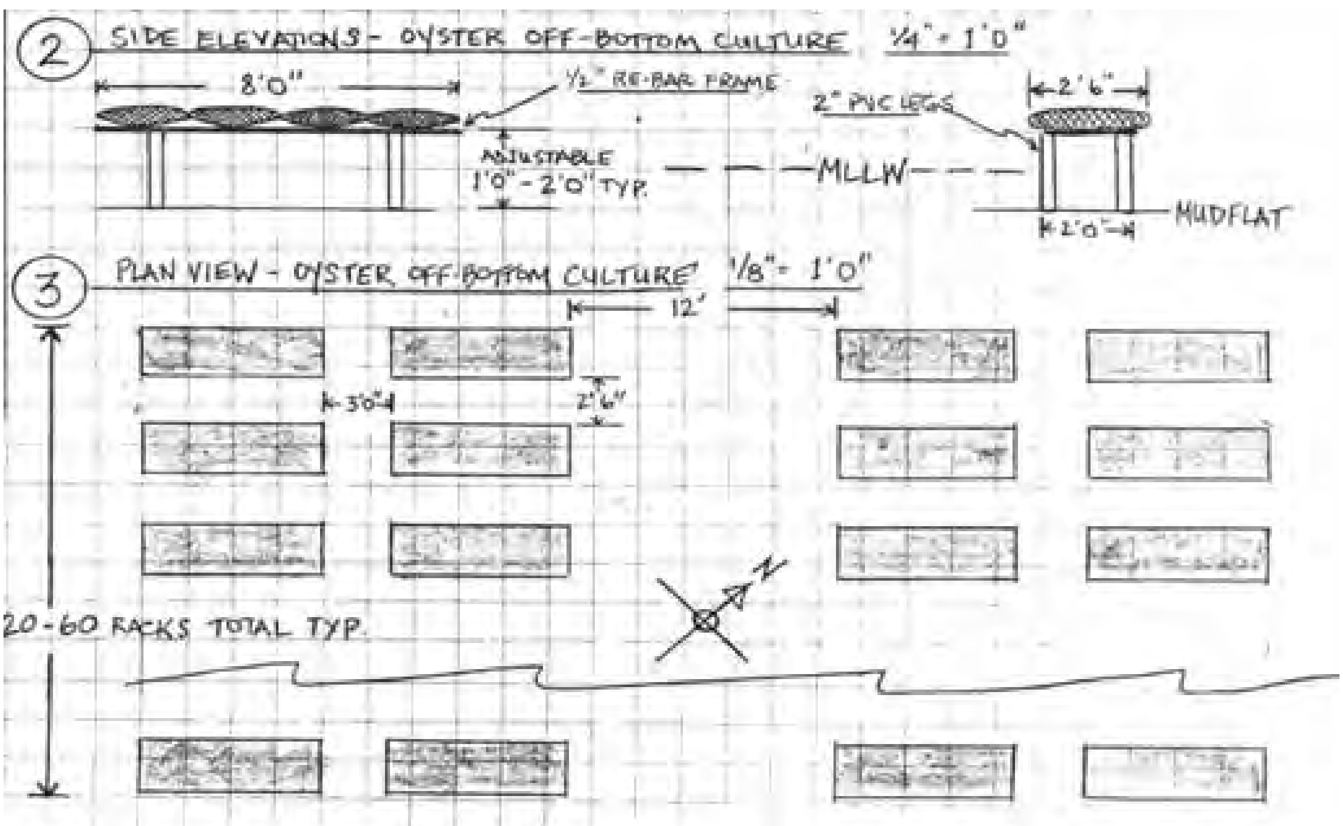


Figure 8: Raised Rack and Bag Culture Schematic

Figure 9: Aerial View of Rack and Bag
Note: photo taken at the HIOC Tomales Bay operation.

3.4.3 Planting, Harvest, and Maintenance Activities

The typical production cycle includes "planting out" baskets of seed oysters, bi-weekly to monthly checks on equipment condition and shellfish growth and health, and harvest. To maintain optimal stocking densities baskets will be periodically collected, returned to HIOC's Hatchery Facility, graded, and redistributed to additional baskets. Harvest involves a final collecting of baskets, which are processed, graded, and prepared for distribution at HIOC's facility. Depending on the species, harvest may occur anywhere from one year (*C. gigas*) to two or three years (*C. sikimea* and *O. lurida*) after planting.

HIOC's planting, harvest and maintenance activities would be carried out on these lease areas either during low tides when cultivation gear is exposed and HIOC staff can walk within the culture areas or via skiffs (in the case of accessing culture areas at higher water levels). To move staff, shellfish and equipment between cultivation areas and HIOC's Hatchery Facility, HIOC would make use of a variety of different outboard motor powered, flat bottomed skiffs. Maintenance activities on HIOC's lease areas will include periodically flipping, shaking, inspecting and collecting cultivation equipment (cultivation baskets, racks) for sorting. This activity is carried out primarily using hand labor and tools.

3.4.4 Vessel Use and Transit Route

HIOC would make use of several vessels, including low draft, 20-foot and 24-foot skiffs and possibly a custom 40-foot vessel equipped with a hydraulic crane for assisting in planting and harvest operations during higher tides. HIOC estimates that these vessels make up to two round trips weekly between HIOC's Hatchery Facility and the project site (Figure 10).

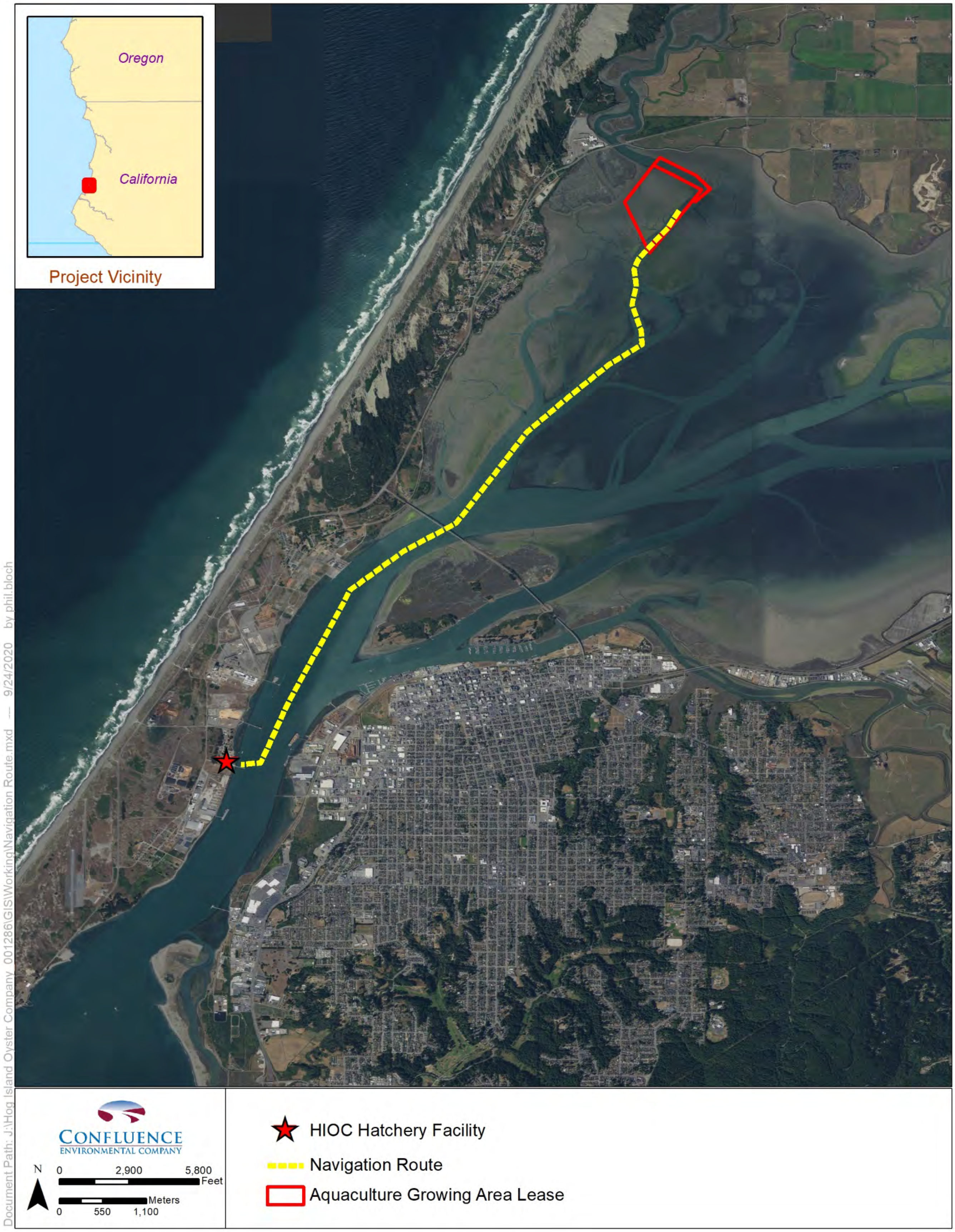


Figure 10: Proposed Transit Route for HIOC Project

Section 4.0 Checklist and Evaluation of Environmental Impacts

ENVIRONMENTAL FACTORS POTENTIALLY AFFECTED: The environmental factors checked below would be potentially affected by this project, involving at least one impact that is a "Potentially Significant Impact" as indicated by the checklist on the following pages.

❑ Aesthetics	❑ Agricultural and Forestry Resources	❑ Air Quality
✓ Biological Resources	❑ Cultural Resources	❑ Energy
❑ Geology/Soils	❑ Greenhouse Gas Emissions	❑ Hazards & Hazardous Materials
❑ Hydrology/Water Quality	❑ Land Use/Planning	❑ Mineral Resources
❑ Noise	❑ Population/Housing	❑ Public Services
❑ Recreation	❑ Transportation	❑ Tribal Cultural Resources
❑ Utilities/Service System	❑ Wildfire	❑ Mandatory Findings of Significance

DETERMINATION: On the basis of this initial evaluation:

❑ I find that the proposed Project **would not** have any significant effects on the environment, and a **NEGATIVE DECLARATION** will be prepared.

✓ I find that although the proposed Project could have a significant effect on the environment, there will not be a significant effect in this case because revisions in the Project have been made by or agreed to by the Project proponent. A **MITIGATED NEGATIVE DECLARATION** will be prepared.

❑ I find that the proposed Project **may** have a significant effect on the environment, and an **ENVIRONMENTAL IMPACT REPORT (EIR)** is required.

❑ I find that the proposed Project **may** have a "potentially significant impact" or 'potentially significant unless mitigated" impact on the environment, but at least one effect 1) has been adequately analyzed in an earlier document pursuant to applicable legal standards, and 2) has been addressed by mitigation measures based on the earlier analysis as described on attached sheets. An **EIR** is required, but it must analyze only those effects that remain to be addressed.

❑ I find that although the proposed Project could have a significant effect on the environment, because all potentially significant effects (a) have been analyzed adequately in an earlier **EIR** or **NEGATIVE DECLARATION** pursuant to applicable standards, and (b) have been avoided or mitigated pursuant to that earlier **EIR** or **NEGATIVE DECLARATION**, including revisions or mitigation measures that are imposed upon the proposed Project, nothing further is required.

_______________________________________ February 5, 2021

Humboldt Bay Harbor, Recreation and Conservation District — Date

I. AESTHETICS. Would the Project:	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less-than-Significant Impact	No Impact
A) Have a substantial adverse effect on a scenic vista?			X	
B) Substantially damage scenic resources, including, but not limited to, trees, rock outcroppings, and historic buildings within a state scenic highway?				X
C) In non-urbanized areas, substantially degrade the existing visual character or quality of public views of the site and its surroundings? (Public views are those that are experienced from publicly accessible vantage point." If the project is in an urbanized area, would the project conflict with applicable zoning and other regulations governing scenic quality?			X	
D) Create a new source of substantial light or glare, which would adversely affect day or nighttime views in the area?			X	

DISCUSSION

Aes-A: Scenic Vistas. State Highway 101, which travels along the eastern shoreline of Arcata Bay, is eligible for designation as a State Scenic Highway. Highway 101 is located approximately 3 miles from the proposed HIOC Project area. The closest road to the HIOC Project area is the New Navy Base Road, which transitions to State Highway 255 across the Mad River Slough, and then into Samoa Boulevard. These roads are not designated as State Scenic Highways, and the closest view from the road to the HIOC Project area is approximately 0.25 mile.

The HIOC Project would increase shellfish aquaculture operations in Arcata Bay, thereby potentially increasing the visibility of the operations to the public. The HIOC Project would also increase the presence of workers and vessels on the bay. HIOC gear would be located in intertidal areas and visible from the shoreline or the water (i.e., boaters) during low tide. However, shellfish aquaculture gear is an existing characteristic of the Arcata Bay. For example, the proposed HIOC culture area would occur adjacent to an existing rack and bag culture operation. The *Humboldt County General Plan*, adopted October 23, 2017, acknowledges that shellfish aquaculture is an important industry associated with port development (Policy ED-P11). The type of gear proposed by HIOC does not typically extend more than 2 feet above the surface of the bay, with the most exposure occurring during low tides. Based on daylight low tides, which are a smaller portion of the tidal cycle, gear would be visible for approximately 30% of the year. Overall, views of shellfish aquaculture operations are common in Arcata Bay and consistent with the current aesthetic character of the area. Therefore, this potential impact is expected to be less than significant.

Aes-B: Scenic Resources. No scenic resources would be damaged. Therefore, no impact is expected.

Aes-C: Visual Character. The HIOC Project would expand shellfish aquaculture operations within areas of Arcata Bay. The visual character would become less "natural" under the proposed project, but would be consistent aesthetically with current activities on the bay. For example, there is an existing rack-and-bag culture operation adjacent to the HIOC Project area. The majority of land to the north and northeast includes trails, wildlife preserves/sanctuaries, and agricultural land. The project will not significantly impact views from any residences, which are located at least 0.3 miles west of the HIOC Project area. The low profile of the gear used in the operations, and the fact that the gear will be submerged for large portions of the year, further minimizes the visual impact to the HIOC Project area, adjacent roadways, and surrounding properties. Therefore, this potential impact is expected to be less than significant.

Aes-D: Light or Glare. The HIOC Project would involve temporary increased lighting from vessels and workers to enable occasional work at night. The type of lighting would include flood lights potentially used for short intervals, boat spotlights for navigation, and crews with headlamps. Other light sources in the area include cars traveling along State Highway 255, and businesses located west of the project site. The project site is located at least 0.3 miles from any residences, thereby reducing the impact of any lighting on residential uses.

This lighting could be viewed by people on the shoreline, but because the lights would typically be distant from these viewers (by 0.25 mile or more), the effect would be negligible. People on the bay (i.e., boaters) would be exposed to the lights at a closer distance, but the increased lighting would generally improve boating safety, and views would not be adversely affected. Therefore, this potential impact is expected to be less than significant.

II. AGRICULTURAL AND FORESTRY RESOURCES. In determining whether impacts to agricultural resources are significant environmental effects, lead agencies may refer to the California Agricultural Land Evaluation and Site Assessment Model (1997) prepared by the California Dept. of Conservation as an optional model to use in assessing impacts on agriculture and farmland. Would the project:	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less-than-Significant Impact	No Impact
A) Convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance (Farmland), as shown on the maps prepared pursuant to the Farmland Mapping and Monitoring Program of the California Resources Agency, to non-agricultural use?				X
B) Conflict with existing zoning for agricultural use, or a Williamson Act contract?				X
C) Conflict with existing zoning for, or cause rezoning of, forest land (as defined in Public Resources Code section 12220(g)), timberland (as defined by Public Resources Code section 4526), or timberland zoned Timberland Production (as defined by Government Code section 51104(g))?				X
D) Result in the loss of forest land or conversion of forest land to non-forest use?				X
E) Involve other changes in the existing environment, which, due to their location or nature, could result in conversion of Farmland, to non-agricultural use?				X

DISCUSSION

Ag-A through Ag-E: There is no agricultural land, forest land, or area zoned as agricultural or forest land near the HIOC Project site that would be impacted. The HIOC Project would have a beneficial effect on agricultural resources by increasing the footprint of shellfish culture in Humboldt Bay. There would be no negative impacts on agricultural resources, and the proposed land use is consistent with existing zoning, including zones designated by the Humboldt County Code (Section 313-5.4). The use is also consistent with policies pertaining to this part of the bay described in the *Humboldt Bay Management Plan* under Section 2.3.2 (District 2007) and the goals described in the *Humboldt Bay Eelgrass Comprehensive Management Plan* under Section 3.2 (Merkel and Associates 2017). Therefore, no impact is expected.

III. AIR QUALITY. Where available, the significance criteria established by the applicable air quality management district or air pollution control district may be relied upon to make the following determinations. Would the Project:	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less-than-Significant Impact	No Impact
A) Conflict with or obstruct implementation of the applicable air quality plan?			X	
B) Result in a cumulatively considerable net increase of any criteria pollutant for which the project region is non-attainment under an applicable federal or state ambient air quality standard?			X	
C) Expose sensitive receptors to substantial pollutant concentrations?			X	
D) Result in other emissions (such as those leading to odors) adversely affecting a substantial number of people?			X	

DISCUSSION

Air-A and Air-B: Air Quality Standards. The HIOC Project area is located in the North Coast Air Basin and is under the jurisdiction of the North Coast Unified Air Quality Management District (NCUAQMD). The North Coast Air Basin is in "nonattainment" status with respect to particulate matter smaller than 10 microns in diameter (PM10) under California regulations, but is in attainment of all other State and federal ambient air quality standards.

Small vessels associated with shellfish aquaculture operations have combustion engines that generate particulate matter. The proposed HIOC Project would involve the use of several vessels, including low draft, 20-foot and 24-foot skiffs and possibly a custom 40-foot vessel equipped with a hydraulic crane for assisting in planting and harvest operations during higher tides. HIOC estimates that these vessels will make up to two round trips weekly between HIOC's Hatchery Facility and the HIOC Project site with highly efficient 4-stroke outboard motors. The vessel engines would contribute to a minor net increase in emissions of particulate matter. Given the small size and limited quantity of vessels, their contribution to PM10 levels in Humboldt Bay is negligible.

Moreover, the District lacks direct jurisdiction over air quality, and thus lacks direct authority to require mitigation for potential air quality impacts. However, the NCUAQMD regulates vessel engine emissions pursuant to several air quality plans. CEQA addresses circumstances such as this through reliance by lead agencies on the regulatory oversight of responsible agencies carrying out statewide policy. Specifically, State CEQA Guidelines Section 15064(h) establishes a procedure that allows lead agencies, including the District, to rely on the environmental standards promulgated by other regulatory agencies, such as the NCUAQMD, with respect to pollutant regulation. The NCUAQMD has adopted several air quality management plan elements, including a *PM10 Attainment Plan* (NCUAQMD 1995).

HIOC would comply with the *PM10 Attainment Plan* adopted by the NCUAQMD and all attendant regulations. This conclusion is supported by the following BMPs:

BMP-1 Vessel Maintenance and Fueling: HIOC will maintain all vessels used in culture activities to limit the likelihood of release of fuels, lubricants, or other potentially toxic materials associated with vessels due to accident, upset, or other unplanned events.

HIOC will use marine grade fuel cans that are refilled on land, and HIOC carries oil spill absorption pads and seals wash decks or isolates fuel areas prior to fueling to prevent contaminants from entering the water.

BMP-2 Vessel Motors and Other Motors: HIOC will use highly efficient 4-stroke outboard motors . All motors are muffled to reduce noise.

While these BMPs are not required to reduce impacts to be less than significant, these are standards that are used by HIOC and others in Humboldt Bay. Therefore, the impacts to air quality standards are expected to be less than significant.

Air-C and Air-D: Air Quality Effects on People. The HIOC Project would not create any substantial pollution concentrations or objectionable odors. Additionally, there are no sensitive receptors or a substantial number of people in the immediate vicinity of the HIOC Project area. The adjacent roadways (e.g., New Navy Base Road, State Highway 255, Samoa Boulevard) and associated car emissions would overwhelm any potential contribution to pollution or odors by the HIOC Project. Therefore, the impact is expected to be less than significant.

IV. BIOLOGICAL RESOURCES. Would the Project:	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less-than-Significant Impact	No Impact
A) Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special status species in local or regional plans, policies, or regulations, or by the California Department of Fish and Wildlife or U.S. Fish and Wildlife Service?		X		
B) Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, and regulations or by the California Department of Fish and Wildlife or U.S. Fish and Wildlife Service?		X		
C) Have a substantial adverse effect on state or federally protected wetlands (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means?			X	
D) Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites?		X		
E) Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance?				X
F) Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or State habitat conservation plan?				X

DISCUSSION

Bio-A: Effects on Candidate, Sensitive, or Special-status Species. The following species are identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations, by the CDFW as state-listed species, or by NMFS or USFWS under the Endangered Species Act (ESA).

Bio-A Existing Conditions – Species

Two species, Pacific herring (*Clupea pallasii*) and black brant (*Branta bernicla nigricans*) are also considered due to public concern for these species (e.g., Audubon Society, local hunters, CDFW pre-consultation), which are regulated under CDFW as the trustee agency for fish and wildlife resources (CEQA Guidelines 15386(a)). Effects to these species are also discussed under **Bio-D** (Effects to the movement of any native resident or migratory fish or wildlife species).

Common Name	Scientific Name	Status[1]
Fish		
Pacific lamprey	*Entosphenus tridentatus*	SSC
Green sturgeon, southern DPS	*Acipenser medirostris*	FT/CSSC. Designated critical habitat in Humboldt Bay.
White sturgeon	*A. transmontanus*	SSC
Coho salmon, southern Oregon, northern California ESU	*Oncorhynchus kisutch*	FT/ST
Chinook salmon, California coastal ESU	*Oncorhynchus tshawytscha*	FT
Steelhead, Northern California DPS	*Oncorhynchus mykiss*	FT
Coastal cutthroat trout	*Oncorhynchus clarki*	CSSC
Longfin smelt	*Spirinchus thaleichthys*	ST
Pacific herring	*Clupea pallasii*	N/A
Birds		
California brown pelican	*Pelecanus occidentalis californicus*	FP
Western snowy plover	*Charadrius nivosus*	FT/CSSC
Marbled murrelet	*Brachyramphus marmoratus*	FT/SE
Black brant	*Branta bernicla nigricans*	CSSC
Marine Mammals		
Harbor seal	*Phoca vitulina*	Protected under the Marine Mammal Protection Act (MMPA)
Harbor porpoise	*Phocaena phocaena*	Protected under the MMPA
California sea lion	*Zalophus californiaus*	Protected under the MMPA

Notes: DPS = Distinct Population Segment; ESU = Evolutionarily Significant Unit.
[1] Status abbreviations: FT = Federally listed as threatened; ST = State-listed as threatened; CSSC = California Species of Special Concern; FP = Fully protected in California.

A brief summary of these species and potential use of the HIOC Project area are described below. Potential effects to these species or habitat are provided after the summary of each species.

Pacific Lamprey. The Pacific lamprey is the largest lamprey in California, and adults can be up to 40 centimeters (cm) long, and is a highly valued resources by Native American tribes of the Pacific Northwest and California (CDFW 2020a). Pacific lamprey are widely distributed throughout the coast of California (e.g., Klamath and Eel rivers) and inland to watersheds in the Central Valley (e.g., San Joaquin River and Putah Creek). Similar to salmon, lamprey populations may be anadromous or resident and have a number of distinct runs.

Adult migrations through Humboldt Bay and into tributary streams have been documented in the spring. In 2011 to 2013, upstream Pacific lamprey migrants were collected by CDFW in the Freshwater Creek fish weir between February and June, and downstream migrants were observed between March and July (Ricker et al. 2014). There was no indication whether these lamprey were spring-run adults that spawned and immediately migrated back to the ocean or whether they had remained in the freshwater for a longer period of time.

Pacific lamprey spend most of their life in fresh or marine water, rather than estuaries. There are numerous tributaries to Humboldt Bay which Pacific lamprey may use to spawn. Estuaries are important to Pacific lamprey for foraging, holding, and transitioning from freshwater to marine waters, but interactions with lamprey in the HIOC Project area are considered negligible. Therefore, impacts to Pacific lamprey will not be further discussed below.

Green Sturgeon. The green sturgeon is a long-lived, slow-growing fish species. Mature males range from 4.5 to 6.5 feet in fork length and they do not mature until they are at least 15 years old, whereas mature females range from 5 to 7 feet in fork length and do not mature until they are at least 17 years old (Kelly et al. 2007). The maximum ages of adult green sturgeon are likely to range from 60 to 70 years. The southern distinct population segment (DPS) green sturgeon generally occur from Graves Harbor, Alaska to Monterey, California (Moser and Lindley 2007).

Moser and Lindley (2007) indicated that green sturgeon may use coastal bays as foraging habitat due to their high productivity. Based on acoustic tagging data conducted in 2007 and 2008 (USFWS unpublished data), green sturgeon move in channels, as would be expected for larger fish. However, 97% of observations occurred at two detection locations: Arcata Channel and North Bay Main Channel near the Samoa Bridge (Figure 11). Relatively few observations occurred in the Mad River Channel. A follow-up survey of sturgeon use of Humboldt Bay by NMFS and USFWS (Goldsworthy et al. 2016) indicated that the sturgeon primarily used the Arcata Channel and were observed feeding on northern anchovy (*Engraulis mordax*) approximately 3.2 to 6.6 feet below the water's surface in the channel. The fish were also observed in the intertidal zone for short forays, potentially following the anchovies into shallower habitat. These fish were originally tagged in the Sacramento River in 2011.

Tracking studies in San Francisco Bay suggest that directional movement of sturgeon in shallow areas (between 6 feet to 10 feet) occurs for less than 30 minutes at a time (Kelly et al. 2007). It is notable that mudflats in Humboldt Bay are typically shallower than the study in San Francisco Bay. In addition, the Kelly et al. (2007) study indicated that green sturgeon that exhibit non-directional movement, likely for foraging, are most common at depths ranging from 26.3 feet to 39.4 feet. The observations in Humboldt Bay (Figure 11) suggest that the large number of detections (148,997) near the extreme north end of Arcata Channel, likely represents an area where feeding is occurring. These detections are adjacent to an area occupied by existing culture (oyster cultch-on-longline culture with 2.5-foot spacing) and extensive mudflat habitat without shellfish aquaculture operations. Acoustic receivers in other channels have had low numbers of detections, showing that tagged sturgeon were present in the vicinity for a shorter duration compared to other areas. One interpretation of this data is that these areas were used primarily for migration activities. Overall, the HIOC Project area is not likely to be accessed significantly by green sturgeon except for some limited amounts of potential foraging behavior.

White Sturgeon. White sturgeon is also a long-lived, slow-growing anadromous fish. Mature males range from 2.5 feet to 3.5 feet and they do not reach sexual maturity until about 10 to 12 years, while mature females range from 3 feet to 4.5 feet and do not sexually mature until they are 12 to 16 years (CDFW 2020b). Maximum ages of adult white sturgeon have been known to be nearly 100 years, although more commonly, fish collected in California are no more than 27 years. White sturgeon generally occur from Alaska to Ensenada, Mexico (CDFW 2020b).

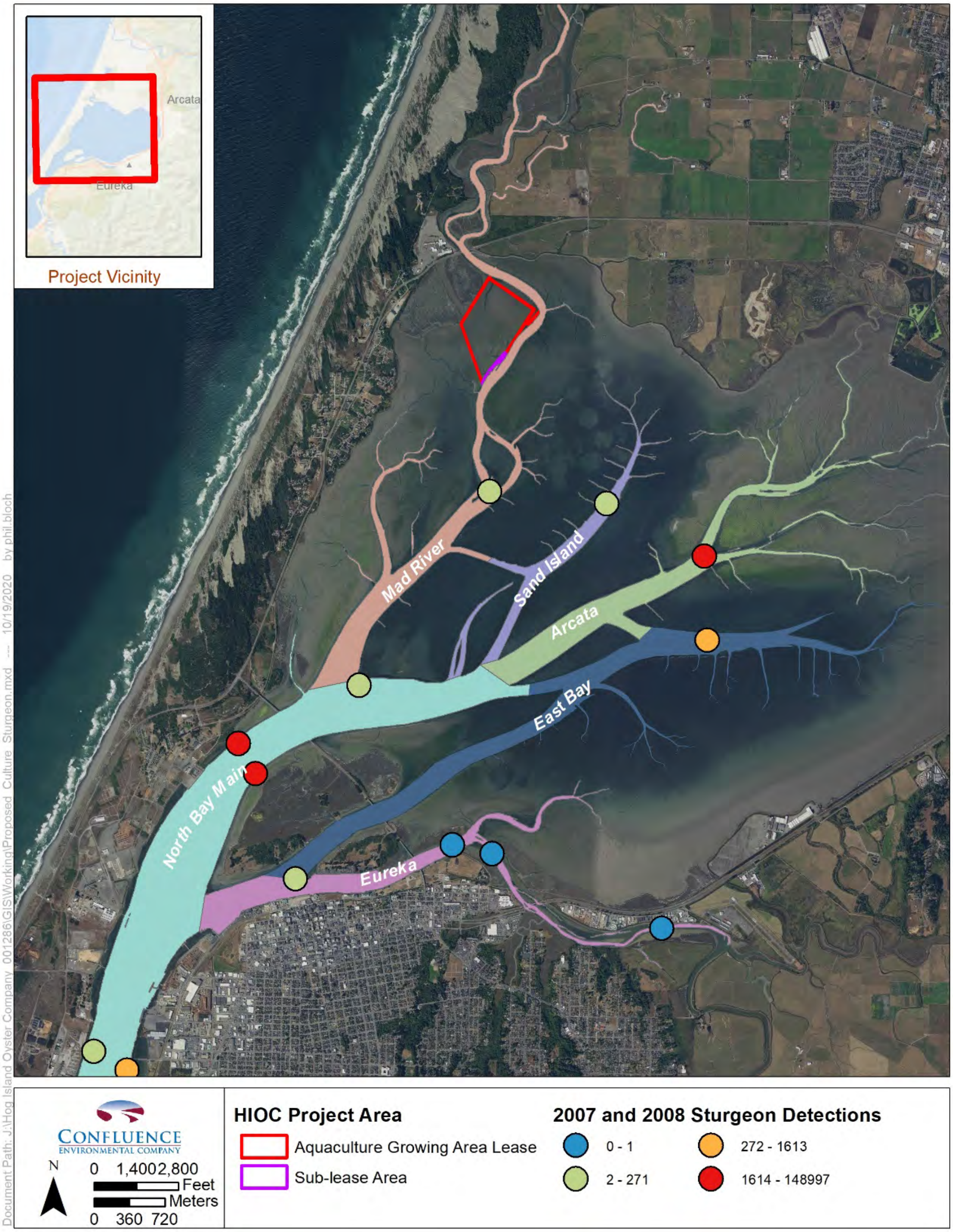


Figure 11. Green Sturgeon Use of Humboldt Bay
Source: USFWS unpublished data

The only known self-sustaining spawning population of white sturgeon in California is in the Sacramento River, although spawning is believed to also occur in the San Joaquin, Klamath, and Eel rivers (Israel et al. 2009). While white sturgeon are not expected to spawn in any of the Humboldt Bay tributaries, adults and sub-adults likely use the bay for foraging habitat. Similar to green sturgeon, burrowing shrimp are a key prey item for white sturgeon. Juvenile white sturgeon have been shown to prefer water greater than 41 feet in the Columbia River (McCabe and Tracy 1994). Juvenile and adult white sturgeon prefer deeper water, although they are occasionally found foraging in shallower habitats (Israel et al. 2009, CDFW 2020b).

Coho and Chinook Salmon, Steelhead, and Coastal Cutthroat Trout (Salmonids). Salmonid life history is characterized by periods of adult upstream migration, spawning and egg development, fry and juvenile development, juvenile downstream migration, and stream-estuary rearing. Adult salmonids are primarily in Humboldt Bay from November to April, and juveniles can be present year-round (Table 3). There are smaller spawning streams in Humboldt Bay, and a critical salmonid spawning area located in the Eel River, which is south of Humboldt Bay along the coast (Schlosser and Eicher 2012). There are no river mouths near the HIOC Project area.

Table 3. Timing of Salmonid use of Humboldt Bay

Species	Life Stage	Timing											
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Coho salmon	Adult	■	■	■								■	■
	Juvenile		■	■	■	■	■	■	░	░	░	░	░
Steelhead	Adult	■	■	■	■								■
	Juvenile	░	░	■	■	■	■	■	■	■	░	░	░
Chinook salmon	Adult	■										■	■
	Juvenile					■	■	■	■				
Coastal cutthroat	Adult	■	■	■	■								■
	Juvenile					░	░	■	■	■	░	░	

░ Based on limited description
■ Based on clear timing description

Sources: Wallace and Allen 2007, Schlosser and Eicher 2012, Pinnix et al. 2013, Ricker et al. 2014, Wallace and Allen 2015

Channels within marsh habitats may be of particular importance to juvenile salmonids because of the high insect and invertebrate prey resources and potential refuge from predators (Bottom et al. 2005). There is significant use of the tidal portions of Humboldt Bay tributaries, including Freshwater Creek, Elk River, Jacoby Creek, and Salmon Creek by juvenile salmonids (Wallace 2006, Wallace and Allen 2007, Wallace and Allen 2015). While this stream-estuary transition area is very important for salmonid survival, most of the Humboldt Bay sloughs are contained between levees and the adjacent marshes were converted to pasture lands over the last 150 years. The closest stream-estuary transition area to the HIOC Project area is Jacoby Creek, located over 3 miles to the southeast.

Once in Humboldt Bay, salmonids reside in freshwater estuaries and then migrate quickly to the ocean. A study by Pinnix et al. (2013) used acoustic transmitters that were surgically implanted into out-migrating coho salmon smolts. Although salmonids will migrate from freshwater to the ocean throughout the spring and summer, the data from Pinnix et al. (2013) indicates that individual coho salmon smolts will reside in Humboldt Bay an average of 15 to 22 days before migrating out to the open ocean. The researchers also reported that the coho salmon studied primarily used deep channels and channel margins during their migration. The average residence time for salmonids in the freshwater estuaries was reported by Wallace and Allen (2007) for juvenile salmonids, including Chinook salmon, coho salmon, cutthroat trout, steelhead, with typically a shorter residence time (i.e., 4 to 128 days) for coho salmon and Chinook salmon and longer residence time (i.e., 4 to 385 days) for steelhead and coastal cutthroat trout. Bay residence is associated with the mouth of spawning streams (e.g., Freshwater Creek, Elk River, Jacoby Creek, Salmon Creek) and then the migration route to the ocean, and none of these areas are close to the proposed shellfish aquaculture activities.

During out-migration, prey resource abundance in estuaries is critical to juvenile salmonid survival. Juvenile Chinook salmon and coho salmon have similar diets that primarily consist of fish and benthic invertebrates (Brodeur et al. 2007). As salmonids grow and move out to the open ocean, they transition from a less piscivorous diet (i.e., including more amphipods and crab larvae) to one that consists largely of high lipid content fish (Daly et al. 2011). Dungeness crab larvae may also be an important factor in seasonal migration in Humboldt Bay. For example, Wild and Tasto (1983) reported that the spring arrival of Dungeness crab larvae in nearshore ocean waters coincided with the northward migration of adult salmonids along the West Coast.

Longfin Smelt. Longfin smelt are small, pelagic fish (CDFW 2020c). Longfin smelt are known to occur in Humboldt Bay, but little is known regarding their distribution, abundance, or life history. The longfin smelt is a short-lived (generally 2 years) species. Adults spawn in low salinity or freshwater areas within the lower reaches of coastal rivers and the buoyant larvae are swept into more brackish waters where they rear and then move to marine waters. Spawning is believed to occur in tributary watersheds to Humboldt Bay between November and April when water temperatures are below 16°C. Longfin smelt forage on small organisms in the water column (e.g., phytoplankton, barnacle larvae, euphausids) and other small crustaceans (Gustafson et al. 2010), and are primarily pelagic fish. There is limited influence on these resources from the HIOC Project. Therefore, impacts to longfin smelt will not be further discussed below.

Pacific Herring. Pacific herring are small, pelagic fish (also considered forage fish, but not a special-status species as defined above). However, there is an important commercial and cultural fishery in California. The species is managed through the *Pacific Herring Fishery Management Plan* (CDFW 2020d). Herring use Humboldt Bay primarily for spawning and nursery habitat. Herring are present along the coast and make some exploratory excursions into Entrance Bay until they are ready to spawn. This is similar to the pattern of the San Francisco Bay herring stock (Moser and Hsieh 1992, Bollens and Sanders 2004). Adults will hold in deep channels of estuaries to ripen for up to two weeks and then move to shallow areas to spawn. Pacific herring were collected as part of the mid-water assemblage in North Bay between 2003 and 2005 (Pinnix et al. 2005). The general trend of herring abundance included low numbers in March, peak abundance from April through June, and then low numbers again from August to October. Overall, there are not many deep areas in Humboldt Bay for adult herring to remain long-term, but the bay is used extensively for nursery habitat of larval and juvenile fish.

Rabin and Barnhart (1986) reported that Pacific herring spawn in both North and South bays, but most spawning occurs in the northern end of the bay. The authors indicated that this is possibly due to an interaction between herring and freshwater inflows where low-salinity conditions may stimulate herring spawning. Although eelgrass is the principal substrate used for spawning in Humboldt Bay, the densest beds did not have spawn deposition during the most recent surveys (Mello 2007). A typical spawning event involves the deposition of herring eggs on approximately 300 acres of eelgrass in North Bay (Mello and Ramsay 2004). This represents less than 10% of available eelgrass used in each spawning event.

California Brown Pelican. The California Brown Pelican, a subspecies of the Brown Pelican (*Pelecanus occidentalis*), ranges widely along the U.S. West Coast. The Brown Pelican (entire species) was federally listed as endangered, and the California subspecies was listed as endangered by the State of California, due to widespread reproductive failures linked to environmental contaminants such as DDT. It was state and federally delisted in 2009. However, the subspecies remains protected by the State of California.

The California Brown Pelican nests in the Channel Islands, in southern California, as well as in Mexico, but occurs widely along the U.S. West Coast as far north as British Columbia, Canada (Jaques et al. 2008). They feed in estuaries and nearshore ocean waters, plunge-diving to capture small schooling fishes near the water's surface. Communal roosting occurs year-round as pelicans move up and down the coast, and this roosting appears to have several important functions such as predator detection and avoidance, assistance with finding prey, and socialization (Jaques et al. 2008). Pelicans roost on sandbars, pilings, jetties, breakwaters, and offshore rocks, sometimes in large communal roosts that can number in the thousands. In Humboldt Bay, roosting has been reported on Sand Island (high count of 350 pelicans in summer), oyster racks (high counts of just over a hundred pelicans in summer and fall), jetties, mudflats, and manmade structures (Jaques et al. 2008). They are most abundant in Humboldt Bay from summer through mid-fall (Nelson 1989).

Western Snowy Plover. The Western Snowy Plover nests along the Pacific coast from Damon Point, Washington to Bahia Magdalena, Baja California, Mexico (USFWS 2007). Degradation and use of habitat for human activities has been largely responsible for the decline in Snowy Plover breeding populations; other important threats to the Snowy Plover are mammalian and avian predators, and human disturbance (Page et al. 1995). In the Humboldt Bay region, Western Snowy Plovers primarily breed and winter on ocean-fronting beaches (Brindock and Colwell 2011) although small numbers of plovers have been documented nesting on gravel bars of the Eel River (Colwell et al. 2011). Nonbreeding Western Snowy Plovers infrequently occur on the interior of Humboldt Bay (Colwell 1994), but mostly in the South Bay on sandier substrates rather than on softer substrates associated with mudflats in North Bay.

Marbled Murrelet. The Marbled Murrelet occurs along the Pacific coast from Alaska to California, foraging nearshore in marine subtidal and pelagic habitats for small fish and invertebrates (USFWS 1992). Nesting occurs in mature, coastal coniferous forest with nest cups built on large branches in tall trees. In California, nesting occurs primarily in Del Norte and Humboldt counties, but occurs south to Santa Cruz County. The loss of old-growth forest is a primary reason for this species' decline (USFWS 1992). In California, Marbled Murrelets nest in redwoods greater than 200 years old (Nelson and Waaland 1997).

Marbled Murrelet forage in nearshore marine subtidal and pelagic habitats along the Pacific coast for small fish and invertebrates (USFWS 1992). The birds forage in nearshore waters usually within about 1.2 miles of the coastline. They feed on a variety of fish and marine invertebrates. They exhibit a breadth in diet that allows them to take advantage of whatever fish prey resources are available in their forage areas. An at-sea density of murrelets along the outer coast near the entrance to Humboldt Bay was reported as 3 to 5 birds per square kilometer (Miller et al. 2012).

Marbled Murrelets are unlikely to occur in the HIOC Project area, as their foraging habitat (i.e., subtidal channels and open bay habitats) does not overlap with the areas proposed for shellfish culture in Arcata Bay. Therefore, impacts to Marbled Murrelet will not be further discussed below.

Black Brant. The black brant is a sea goose that relies on Pacific coastal habitats. Brant nest in the arctic, including areas in Alaska and western Canada during the summer nesting season (Pacific Flyway Council 2018). The majority of the brant population (over 75%) migrate directly to wintering areas in Baja California and mainland Mexico, but approximately 10% of the population use coastal bays from Alaska to California for wintering (i.e., the Pacific Flyway). Black brant are a part of the Pacific Flyway, and managed as a hunted species with a population objective of 162,000 birds. The Pacific Flyway Management Plan, a joint management plan prepared for the Pacific Flyway Council, the Commonwealth of Russian States, the Dirección General de Conservación Ecológica de Recursos Naturales, the USFWS and the Canadian Wildlife Service, for the Pacific population of brant (*Brant Management Plan*) recommends protecting critical brant habitat in the species' range, including pursuing mitigation (i.e., avoidance, minimization, and compensatory mitigation) for loss or degradation of eelgrass beds, grit sites, and loafing sites.

Humboldt Bay is an important wintering area and spring staging site for brant in the Pacific Flyway. In the bay, black brant feed most commonly on native eelgrass (Ward et al. 1997, 2005; Moore et al. 2004). Eelgrass varies in quantity and quality, and is unavailable to brant during two high tides per day, making the achievement of energy demands challenging (Clausen 2000, Moore and Black 2006). Brant have been documented repeatedly returning to eelgrass beds that are relatively high in quality (high density, biomass, and nutrient content), and have been seen waiting over eelgrass beds until tides recede (Moore and Black 2006), suggesting that brant are making foraging decisions based on prior experience and performance. This observation also suggests that eelgrass quality is important to the ability of brant to meet energetic demands for migration.

Harbor Seal. Harbor seals are widely distributed throughout the northern Atlantic and Pacific oceans. They occur along coastal waters, river mouths, and estuaries (Burns 2008, Lowry et al. 2008).

Harbor seals consume a variety of prey, but small fishes predominate in their diet (Tallman and Sullivan 2004). In Northern California, pupping peaks in June and lasts about two weeks; pups are weaned in four weeks (Burns 2008). Foraging occurs in a variety of habitats, from streams to bays/estuaries to the open ocean (Eguchi and Harvey 2005). Harbor seals breed along the Humboldt County coast and inhabit the area throughout the year (Sullivan 1980). Harbor seals use Humboldt Bay as a pupping and haul-out area (Ougzin 2013, Archibald 2015). Other nearby haul-out sites are located in Trinidad Bay and the mouths of the Mad River (western bank) and Eel River (both banks). Harbor seals will also occasionally haul-out on mudflats near shellfish aquaculture sites. Note that the closest primary haul-out location to the HIOC project is more than 1.0 mile away towards the southern end of the Mad River channel (Ougzin 2013).

Harbor Porpoise. Harbor porpoises are distributed throughout the coastal waters of the North Atlantic, North Pacific Oceans, and the Black Sea. In the North Pacific, they range from Point Conception, California, to as far north as Barrow, Alaska, and west to Russia and Japan (Gaskin 1984, Angliss and Allen 2009, Carretta et al. 2009). Harbor porpoises from California to the inland waters of Washington have been divided into six stocks (Carretta et al. 2009), with three additional stocks occurring in Alaskan waters (Angliss and Allen 2009). Porpoises from Humboldt County are included in the SONCC stock that extends from Point Arena, California, to Lincoln City, Oregon (Carretta et al. 2009). Harbor porpoises have been observed throughout the year at the entrance to and within Humboldt Bay, usually as single individuals but sometimes in groups, with a maximum size of 12 animals (Goetz 1983). Abundance peaks between May and October, and porpoises are most abundant in Humboldt Bay during the flooding tide.

California Sea Lion. California sea lions are restricted to middle latitudes of the eastern North Pacific. There are three recognized management stocks: (1) U.S. stock from Canada to Mexico, (2) western Baja California stock, and (3) Gulf of California stock (Lowry et al. 2008, Carretta et al. 2009). Breeding colonies only occur on islands off southern California, along the western side of Baja California, and in the Gulf of California (Heath and Perrin 2008). California sea lions feed on fish and cephalopods, some of which are commercially important species such as salmonids, Pacific sardines (*Sardinops sagax*), northern anchovy, Pacific mackerel (*Scomber japonicus*), Pacific whiting (*Merluccius productus*), rockfish, and market squid (*Loligo opalescens*) (Lowry et al. 1991, Lowry and Carretta 1999, Weise 2000, Lowry and Forney 2005). California sea lions do not breed along the Humboldt County coast. However, non-breeding or migrating adults may occur in Humboldt Bay year-round.

<u>Bio-A Potential Impacts – Species and Habitat</u>

The following discussion includes potential HIOC Project-related impacts on the species discussed above. Note that based on the discussion within the existing conditions section, Pacific lamprey, longfin smelt, and marbled murrelets will not be discussed further because they do not overlap with the HIOC Project area or no impacts would occur to these species based on the proposed activities associated with a shellfish aquaculture operation. In addition, the discussion associated with potential impacts to resources identified under Bio-A concludes with a discussion of habitat impacts.

Bio-A1: Entanglement of Green and White Sturgeon. As an anadromous species, sturgeon swim among diverse structures in rivers, embayments, and the ocean. They have the sensory ability to detect structures and the swimming ability to avoid them, making it unlikely that green sturgeon would collide or become entangled with shellfish aquaculture gear or cultured shellfish. Shellfish culture has occurred for decades in West Coast embayments (including Humboldt Bay) where sturgeon occur, and there is no known record (anecdotal or otherwise) of a sturgeon ever becoming entangled in the gear or stranding in intertidal areas during feeding. Entanglements noted in the literature are associated with marine mammals with fishing gear or associated with deepwater floating culture off the West Coast (Price et al. 2016), not within intertidal areas.

Green sturgeon appear to be particularly common in the North Bay Main Channel and Arcata Channel (refer to Figure 11; USFWS unpublished data), and frequently migrate between the Samoa Bridge and Sand Island. Based on acoustic tagging data, it appears that sturgeon may be using the intertidal habitat above Arcata Channel for foraging, but limited acoustic data in the upper parts of the bay suggest that green sturgeon may have less use or lower residency times in Mad River Slough. Overall, the HIOC Project site is located in areas that are not significantly used by green sturgeon (refer to Figure 11 above). These observations, though limited, were confirmed in a field visit by NMFS and USFWS where the acoustic data indicated green sturgeon were feeding close to the Arcata Channel but not extending into the shallow areas to the north near the Mad River Slough where the HIOC Project area is located (Goldsworthy et al. 2016).

In addition, the tidal elevation of the HIOC project site reduces the potential for interactions with green sturgeon. The areas adjacent to tidal channels and subtidal channels are likely to be more frequently used than the higher elevation shallow intertidal habitat where aquaculture gear will be located. Green sturgeon will occasionally migrate from the major channels of North Bay onto the adjacent tideflats; however, observations of sturgeon in San Francisco Bay were most common at a mean depth of 17.4 feet (Kelly et al. 2007). Combined with these data, and direct observations from Humboldt Bay that indicate foraging into shallow areas adjacent to the main channels, it is unlikely that green sturgeon would occur in the shallow areas proposed for use by HIOC.

Patten and Norelius (2016) compared the difference between density of green sturgeon feeding pits with and without structured habitat in Willapa Bay, which has similar ecological characteristics as Humboldt Bay (i.e., extensive eelgrass beds and significant amounts of shellfish cultivation). Results of the study suggested that sturgeon feeding frequency is lower when eelgrass is present (>25% areal coverage). Feeding pit frequency was higher in areas with oyster cultch-on-longlines and no eelgrass but still lower compared to areas without gear. Overall, the study concluded that structured habitat (e.g., dense eelgrass, shellfish ground culture, oyster longlines) is not a preferred foraging area for green sturgeon, but these areas can be used by green sturgeon. More importantly, the study also confirmed that use of the shallow areas directly adjacent to channels was targeted by sturgeon during feeding.

Moser et al. (2017), studied green sturgeon benthic feeding habits by comparing feeding pit densities in areas with eelgrass (both native and non-native species), shellfish aquaculture (clam and oyster ground culture), and mudflat habitat without structure. Similar to the Patten and Norelius (2016) study, Moser et al. (2017) confirmed that green sturgeon have significant preference for bare intertidal mudflats compared to areas with bottom culture and areas where dwarf eelgrass (*Zostera japonica)* is abundant. Dwarf eelgrass is a non-native eelgrass species that tends to have smaller shoots and is found at higher tidal elevations than its native cogener. It is notable that shellfish culture methods from this study were ground culture, which has different potential effects from the culture methods that are proposed in the HIOC Project area. Compared to ground culture activities studied in the Moser et al. (2017) research, intertidal longline systems (e.g., SEAPA baskets and tipping bags) and rack and bag culture has a small portion of gear that is in the sediment and even the area with gear in the water column is a small portion of the total plot area. Across 30-acres of longline systems, PVC support posts and galvanized pipe end anchors will occupy a maximum of approximately 350 square feet and 26 cubic yards of intertidal habitat. Aquaculture gear would occupy approximately 114 cubic yards of the water column which represents approximately 0.11% of the water column at mean tide level. Feeding is observed in areas with this type of culture method that maintains mudflat areas without changing the sediment surface.

Use of key foraging habitat potentially used by sturgeon for shellfish aquaculture is naturally minimized due to the location of culture areas in shallow intertidal habitat. If sturgeon do occur in these areas, they would be able to access the mudflats between the intertidal longline systems, and even wider spaces within the boat rows. Sturgeon may encounter shellfish gear during foraging forays into intertidal areas. Sturgeon are particularly well-suited to navigate through and around shellfish aquaculture gear as their bony scutes provide protection from bumping and scraping against objects with which they may come in contact. Most importantly, shellfish gear is not designed to trap organisms and because gear tends to be planted in rows with spaces under and around the gear. Even during low water, sturgeon should be capable of exiting by moving along rows of gear or under the gear. Refer to Bio-A9 for additional discussion of circulation and sediment movement within longline gear.

No stranded or entangled sturgeon have been detected in any areas where intertidal longline systems or rack and bag culture occurs in the 25-year history since near-bottom culture methods were introduced into Humboldt Bay, or in other estuaries with a longer history of using near-bottom culture methods (Dumbauld et al. 2015). Documented stranding events of sturgeon tend to be associated with river flood flows where sturgeon become stranded in diversion structures (Thomas et al. 2013). The lack of either documented sturgeon strandings or longlines being dragged or damaged when sturgeon are resident in the bay (April-October) suggest that sturgeon are unlikely to be suffering mortality or injuries as a result of aquaculture activities. Further, proposed intertidal longline systems and rack and bag culture would be outside of areas where sturgeon have been observed in Humboldt Bay. Therefore, HIOC Project would have a less than significant impact to green sturgeon. Impacts to white sturgeon would be similar to those discussed above for green sturgeon and also less than significant.

Bio-A2: Impacts of Structures on Fish Species. There are certain species that tend to avoid structure while there are other species that tend to be structure-oriented. A review of the existing literature that evaluates activities similar to the proposed activity (i.e., near-bottom culture) does not support the conclusion that shellfish aquaculture adversely impacts fish. For example, Forrest et al. (2009), a review of over 200 papers associated with near-bottom shellfish aquaculture, indicated that effects to fish are often neutral or positive. Adding shellfish aquaculture gear to mudflat habitat in Arcata Bay can provide an increase in prey resources along the near channel habitat where many species appear to forage (discussed under Bio-A5 in more detail below).

The amount of fish that use oyster cultch-on-longlines was studied in Humboldt Bay by Pinnix et al. (2005), which compared eelgrass, oyster longlines, and open mudflat habitat. The study reported more fish in oyster longlines and eelgrass compared to mudflats, although it was skewed due to a couple of samples that had two orders of magnitude higher forage fish abundances. A more recent study that worked to expand upon the observations of the Pinnix et al. (2005) study through a Saltonstall-Kennedy Grant (Confluence et al. 2019) also reported elevated abundances of forage fish in culture vs. mudflat areas, of one order of magnitude.

Abundances of fish were similar in eelgrass sites with and without culture in the Pinnix et al. (2005) study; however, community composition was slightly different. Oyster longlines and rack and bag systems typically had more bottom-oriented or structure-oriented species such as sculpin, surfperch, and rockfish, while eelgrass had smaller species such as bay pipefish. These results agreed with other studies comparing fish communities in areas with shellfish aquaculture gear and eelgrass habitat (Hudson 2016, Confluence et al. 2019). Gear in the water column may also create flow refugia that larval forage fish utilize (Confluence et al. 2019). In contrast, Dumbauld et al. (2009) reported that a more common result is that community-level indices (abundance and diversity) are equivalent across habitats, reporting that: "few statistically significant differences in density were found among the >20 species of fish and crabs collected at intertidal locations."

Based on the amount of unstructured habitat or intertidal mudflats present in Arcata Bay (up to 2,806 acres), the amount of habitat affected (~1%) is a small portion of what is available. That does not mean that there is no change to these habitats, only that the change is limited to a relatively small component of Arcata Bay and the changed area will be used in a similar manner to other habitat types present (i.e., a transitional area from unstructured to structured habitat). The net change for the entire HIOC Project lease area in terms of added gear is a small proportion overall. The species that may avoid these areas are not limited by food availability. Additionally, the potential to increase food resources within culture areas, especially culture areas within unstructured habitat, may be a benefit to many of the higher trophic organisms using Arcata Bay. Therefore, the HIOC Project structures would have a less-than-significant impact to fish species.

Bio-A3: Impacts on Salmonids. Salmonids that use Humboldt Bay are either migrating to freshwater systems for spawning as adults or migrating from freshwater systems to the ocean as juveniles. Adult salmonids are primarily in Humboldt Bay from November to April, and juveniles can be present year-round (refer to Table 3 above). Salmonid spawning streams that drain into Arcata Bay include Freshwater Creek, Elk River, Salmon Creek and other smaller watersheds. The Eel River (south of Humboldt Bay) is also recognized as a critical spawning area for coho salmon, Chinook salmon, steelhead trout, and cutthroat trout (Schlosser and Eicher 2012). For the most part, salmonids likely use the main channels in Arcata Bay for migration but can also migrate into shallow areas for feeding.

The HIOC Project would not pose an impact to migration or feeding behavior for salmonids. Shellfish aquaculture gear, if present, is low profile and includes natural spaces between rows of gear to allow for migration. Based on radiotelemetry studies conducted by the USFWS (Brenkman et al. 2007), juvenile salmonids will orient to their perception of the bottom depth—whether that be relatively featureless sand or intertidal longline systems or rack and bag culture that are colonized with macroalgae. Depending on the tidal cycle, fish can easily swim over, around, or through shellfish aquaculture gear, if necessary. According to one study using coho salmon smolts (Pinnix et al. 2013), the fish typically remained in deeper water and the deepest portion of tidal channels where they were unlikely to encounter activities or gear related to shellfish aquaculture.

Juvenile salmonids, which will use shallow areas more frequently, have been shown to use shellfish aquaculture gear as nursery habitat and would not be impacted in terms of migration behaviors. For example, Simenstad and Eggars (1991) reported that densities of a harpacticoid copepod (*Tisbe* sp.), an important prey item for some juvenile salmonids, were enhanced in areas of oyster culture compared to bare mudflat. Densities of gammarid amphipods and cumaceans (principally *Cumella vulgaris*), which are important prey items for juvenile Chinook and coho salmon, were enhanced at one site but depressed at another site. Brooks (1995) found that *Corophium acherusicum*, another critical prey resource for salmonids, was enhanced in actively cultured oyster beds. Brooks (1995) also reported greater densities of gammarid amphipods and small tellinid clams. Finally, Rumrill and Poulton (2004) investigated differences in the benthic invertebrate community between near-bottom oyster cultch-on-longline plots, eelgrass control plots, and eelgrass reference sites in Humboldt Bay. Results of the study showed that invertebrate biomass was highest in the near-bottom oyster longline plots and lowest in some of the eelgrass reference sites. It was also noted that invertebrate biomass was lowest in on-bottom oyster sites that had been suction dredge harvested.

Research indicates that both adult and juvenile salmonids may not frequently use the intertidal portions where shellfish aquaculture occurs. If present, there is no indication that migration or feeding behavior would be impacted from the presence of longlines or rack and bag systems. It is notable that the current methods of longlines (e.g., tipping bags, SEAPA baskets, cultch-on-longline) are showing to be similar based on reviews by the federal agencies and other research (Confluence 2016, NMFS 2016, USFWS 2016, Ferriss et al. 2019). There is also a new study that is looking at fish use of shellfish culture areas in Hood Canal, Washington, that includes these various types of longline culture methods. The studies are reporting that there may be more feeding opportunities provided on shellfish gear compared to bare mudflats. Therefore, the HIOC Project would have a less-than-significant impact to salmonids.

Bio-A4: **Effects to Western Snowy Plover Foraging Habitat.** In the Humboldt Bay region, Western Snowy Plovers primarily breed and winter in ocean-fronting beaches (Brindock and Colwell 2011) although small numbers of plovers have been documented nesting in gravel bars of the Eel River (Colwell et al. 2011). Nonbreeding western snowy plovers are not expected to occur in intertidal habitats in Humboldt Bay. However, individuals may occasionally forage in the bay, particularly in the South Bay where sandier substrates occur south of the bay entrance. The HIOC Project area represents habitat that will be used infrequently, if at all, by western snowy plovers, and areas used for foraging will mainly remain available. Therefore, the HIOC Project is expected to have a less than significant impact on western snowy plovers. No critical habitat for western snowy plovers has been designated within the interior of Humboldt Bay (77 FR 36727) and, thus, the project will have no impact to critical habitat.

Bio-A5: **Effects to Roosting California Brown Pelicans.** California brown pelicans and other waterbirds, including double-crested cormorants (*Phalacrocorax auritus*) and terns (*Sterna* spp.), use docks, rafts, and other gear (e.g., SEAPA baskets) in Humboldt Bay as roosting habitat. During maintenance and harvesting, HIOC personnel will access the shellfish plots causing roosting pelicans and other birds to abandon their roosts. These disturbances have energetic costs associated with flight while searching for alternative roost sites. However, roost sites are not limited in Humboldt Bay due to the abundance of docks and other structures that receive limited (or no) human disturbance. Therefore, this impact is considered less than significant.

Bio-A6: Effects to Benthic Fauna. Changes to the benthic fauna from the addition of shellfish aquaculture gear has been studied by multiple authors throughout the West Coast. These studies generally support the assertion that aquaculture gear provides similar benefits to benthic invertebrate abundance and variation compared to other structured habitats (e.g., eelgrass). Hosack et al. (2006) reported that benthic invertebrates were strongly associated with habitat type, and structured habitats (oyster beds and eelgrass) had higher species abundance than other habitat types. Earlier work by Hosack (2003) reported that important fish prey organisms, such as harpacticoid copepods, exhibited higher densities in both dense eelgrass and oyster habitats than sand or mudflats. Similarly, Simenstad and Fresh (1995) noted that the diversity of epibenthic harpacticoid copepods was higher on active ground oyster culture plots with 3-year old oysters present compared to an inactive plot where oysters and eelgrass were present.

These observations parallel those of Ferraro and Cole (2007, 2011, 2012), Kellogg et al. (2018), and the recent analysis in the 2020 Nationwide Permit 48 (NWP 48) from the U.S. Army Corps of Engineers (Corps) under 85 FR 57298 (Corps 2020). The Ferraro and Cole (2007, 2011, 2012) work looked at oyster on-bottom culture in three different estuaries along the West Coast. The authors reported that oyster habitat had the highest values for mean species richness, abundance, and biomass of benthic invertebrates, and was considered the same as eelgrass habitat in terms of the potential to provide prey resources. In addition, both eelgrass and oyster habitats had significantly more prey resources than unstructured habitats such as mud or sandflats. The recent Kellogg et al. (2018) study in the Chesapeake Bay looked at benthic invertebrates as an indication of ecological health associated with floating and on-bottom culture gear. The study found no significant negative impacts on the benthic invertebrate community structure from the presence of gear or oysters, and number of invertebrates inside the farm sites were higher compared to outside.

Finally, the Corps (2020) NWP 48 analysis summarized the existing literature associated with impacts from shellfish aquaculture activities. The document included an understanding of the effects to benthic fauna both as encrusting organisms and within the substrate. Encrusting invertebrates occur on the gear placed in intertidal areas, and can include both non-native and native species (NRC 2010). Invertebrates in the substrate have been shown to support large populations of fish, crabs, and other animals (Dumbauld et al. 2015, Powers et al. 2007). Overall, the literature indicates that shellfish aquaculture can provide structured habitat that generally support a more diverse community compared to mud or sandflats.

As discussed above, Rumrill and Poulton (2004) investigated differences in the benthic invertebrate community between cultch-on-longline plots, eelgrass control plot, and eelgrass reference sites in Humboldt Bay. Results of the study showed that invertebrate biomass was highest in the experimental oyster longline plots and lowest in some of the eelgrass reference sites. It was also noted that invertebrate biomass was lowest in oyster ground culture sites that had been suction dredge harvested. In addition to biomass, the composition of the invertebrate communities was not significantly different between the longline plot and eelgrass control plot. This study provides evidence that oyster longline aquaculture using cultch-on-longline methods does not significantly change the species composition to benthic invertebrate communities compared to eelgrass habitat. Similar results would be expected for rack and bag systems. This same conclusion was also noted in Dumbauld et al. (2009), which concluded that the results of the Rumrill and Poulton (2004) work related to the similarity of benthic infaunal abundance in the culture plots compared to eelgrass plots: "may have arisen not simply due to flow dispersing biodeposits, but because both aquaculture and control areas included eelgrass, which has characteristic effects on sediment." In other words, the presence of eelgrass was the primary determinant in benthic infaunal abundance and not the added structure related to the shellfish gear.

The literature supports the conclusion that oyster aquaculture and gear provides similar foraging habitat and species composition as found in other structured environments (e.g., eelgrass), and may provide more benthic invertebrates and epibenthic invertebrates than mudflat habitat because of the addition of surface area for colonization by organisms. The literature indicates that these changes provide an advantage to smaller organisms or to organisms that use these areas as rearing habitat during certain life history stages. This conclusion is consistent with NMFS (2016), which stated that: "studies suggest that the forage-related impacts of disturbance to and suppression of eelgrass resulting from shellfish culture have very limited impacts on forage, because managed shellfish sites are themselves inhabited by forage species." Therefore, the HIOC Project would have a less-than-significant impact to the benthic fauna community.

Bio-A7: Fouling Organisms and Nonnative Species. Fouling and non-indigenous species (NIS) concerns are associated with either the introduction of new NIS organisms to Humboldt Bay or providing habitat for and supporting the continuing expansion for NIS that are established in Humboldt Bay. There is also a concern that the cultured species themselves are non-native and could lead to naturalization into the bay. Boyd et al. (2002) conducted a census of NIS throughout Humboldt Bay from August 2000 to December 2001. Fouling invertebrates were sampled at 21 intertidal sites and 5 marina locations. Benthic invertebrates were collected at 87 stations. Fish were surveyed using seines, traps, and trawls at over 300 locations. Out of 95 organisms identified in Humboldt Bay, 14 species were found in oyster growing areas. The species identified were from nine different groups: (1) marine algae, (2) sponges, (3) anemones, (4) a limpet, (5) Pacific oysters (cultured), (6) a copepod commonly found in oysters, (7) amphipods, (8) bryozoans, and (9) a tunicate (*Botrylloides* sp.).

The list of NIS sampled from Humboldt Bay were compared to surveys of NIS in San Francisco Bay (Cohen and Carlton 1995). The majority of introductions were from the long history of maritime commerce, including both commercial shipping and shellfish aquaculture, in Humboldt Bay (e.g., introductions from ballast water or in marine algae historically used as packing material for oysters). Boyd et al. (2002) indicated that most organisms were likely present in Humboldt Bay for over 100 years, except for more recent introductions of some tunicates. New introductions that were identified are primarily associated with commercial shipping activity, especially from vessels that transit between San Francisco Bay and Humboldt Bay.

One of the main ways in which historic oyster operations contributed to NIS in Humboldt Bay was from the shells of oyster spat imported from Japan. Beginning in the 1930's, the California Department of Fish and Game (now CDFW) helped to introduce Pacific oysters from Japan to revive the oyster industry in Humboldt Bay (Barrett 1963). Legacy introductions from this activity are evident from the pattern of exotic marine algae species found in Humboldt Bay. The distribution of *Lomentaria hakodatensis* and *Sargassum muticum* was primarily reported in Entrance Bay and to a lesser extent in North Bay. Boyd et al. (2002) specifically noted that these species occurred in oyster growing areas of North Bay. During surveys by SHN (2015), *S. muticum* was observed but not considered common in the proposed Coast Seafoods shellfish farm expansion areas and *L. hakodatensis* was not reported. When *S. muticum* was observed, it was usually a single plant (~3 feet long) emanating from the sediment surface, likely attached to a rock or other structure just under the surface layer.

While there are legacy introductions from oyster operations in Humboldt Bay, current operations involve several stringent management measures to avoid introductions. Most seed for the farm will be provided by HIOC's Hatchery Facility, which is certified by CDFW. HIOC is also a participant in a disease prevention program (the "Shellfish High Health Program") sponsored by the Pacific Coast Shellfish Growers Association (PCSGA). This program requires examination of larval oyster seed from West Coast hatcheries by a USDA-certified Shellfish Pathologist. Interstate and foreign export into California must be certified and regulated by a CDFW permit. The hatcheries that export shellfish seed submit inspection reports on a regular basis to CDFW, and the importation of seed from established hatcheries is allowed only if the hatchery has a minimum 2-year history of documented absence of disease. Given these management measures to control for disease and NIS, it is unlikely that current oyster operations would result in new NIS introductions.

In terms of naturalization of the culture species into Humboldt Bay, there is limited evidence that there are wild sets of oysters outside of the farmed areas. The oyster species imported into California tolerate water temperatures below 70°F well enough to permit them to grow, but not necessarily to reproduce or for larvae to develop (Barrett 1963, Elliott-Fisk et al. 2005). This is why these species have to be incubated in hatcheries for several weeks before they are placed on the tideflats for grow-out. Structured habitat is also limiting in terms of locations where oysters can settle and grow. Recent reviews of potential effects from non-native oyster naturalization into bays in which they are planted has resulted in a conclusion that this is a low risk due to hydrography of the system (short residence time), lack of suitable substrate for settlement, including reviews from Drakes Estero (NRC 2009) and Willapa Bay (Carlton 1992). Based on the 80+ year history of culturing non-native oysters in

Humboldt Bay, there do not appear to be adverse impacts from non-native bivalves, displacement of native species, or significant establishment of Pacific oysters and Kumamoto oysters in areas outside of Humboldt Bay. A similar conclusion was reached in the Pre-Permitting Efforts (SCH #2017032068, SCH #2013062068).

Concerns about NIS were also raised for Drakes Estero where the existing shellfish aquaculture gear contained an invasive tunicate (*Didemnum* sp.). Mercer et al. (2009) surveyed the benthic community adjacent to cultured areas and reported that "the abundance of epifaunal organisms was not significantly affected by presence of the ascidian mats." None of the NIS identified in oyster growing areas in Humboldt Bay were considered invasive (Boyd et al. 2002), and these organisms are not expected to affect the native benthic community or the Humboldt Bay environment. On the contrary, the majority of literature related to organisms that colonize shellfish aquaculture gear are considered to provide additional food resources for fish and larger invertebrates (see discussion above). Therefore, the HIOC Project would have a less than significant impact related to fouling organisms and NIS.

Bio-A8: Effects to Carrying Capacity. Carrying capacity, also termed "ecological carrying capacity," is defined by Ocean Studies Board and NRC (2010) as:

> *The stocking or farm density above which 'unacceptable ecological impacts' begin to manifest. From a practical standpoint, this process begins with the level of culture that can be supported without leading to significant changes to ecological processes, species, populations or communities in the growing environment.*

The most robust carrying capacity analysis conducted in Humboldt Bay was created for the Pre-Permitting Project (District and SHN 2015). This included an analysis of up to 1,202 acres of shellfish aquaculture operations in Arcata Bay (or 55.02 metric tons dry tissue weight), which were all modeled as adults to maximize potential filtration pressure. According to the analysis, filtration pressure was shown to range between 5% and 9%, which indicates that the "vast majority of carbon fixed by phytoplankton remains available to non-cultured species." In addition, the phytoplankton turnover rate was calculated to replace itself several times per day. Overall, the analysis concluded that the existing and proposed culture would have some cumulative effect on Humboldt Bay food resources, but there is an abundance of food available and cultured species will not significantly affect the food resources in the bay. This was considered a conservative result, given that the analysis only calculated change to phytoplankton and did not account for other sources of carbon productivity (e.g., detritus, benthic microalgae, biodeposits). Note that this analysis was based on significantly more shellfish aquaculture operations than currently exist or are proposed in Humboldt Bay. The total acreage of existing intertidal shellfish aquaculture farms within Humboldt Bay is approximately 287 acres which, when combined with the HIOC Project's proposed 30 acres and the District's Pre-Permitting Project and Yeung Oyster Farm's proposed 136 acres of intertidal culture, would total 453 acres, or approximately 38% of the production previous analyzed by the District.

Other indicators of ecological carrying capacity include poor growth and high mortality of the oysters. There have been no reports of poor growing conditions for the existing cultured oysters in Arcata Bay. Therefore, impacts associated with carrying capacity are considered less than significant.

Bio-A9: Effects to Habitats. The HIOC Project proposes to grow oysters on up to 30 acres within a 40-acre area of intertidal habitat available for shellfish aquaculture within Arcata Bay and within a 110-acre lease area. The proposal is to add shellfish aquaculture gear over a 5-year period in areas that avoid eelgrass. As described above in Section 3.0 (Project Description), gear will not be present on this entire area. Intertidal longline systems are separated by approximately 3 feet, and grouped blocks of 4 lines are separated by 15 feet with a boat easement. Rack and bag systems are also separated by 3 feet with 12-foot boat easements.

Adding shellfish aquaculture gear to mudflat habitat will not change the habitat, but will change how species interact with the additional structured habitat. For example, macroalgae are generally more abundant in areas with aquaculture gear due to increased opportunities for attachment and structure present that can collect drift resources compared to the sandy substrate of intertidal sandflat habitat, although this additional resource would be reduced during harvest or maintenance activities. Other species interactions (e.g., benthic invertebrates, fish, birds, mammals) are discussed throughout this section. For example, adding shellfish aquaculture gear to mudflat habitat can provide an increase in prey resources along the near channel habitat where many species appear to forage. Conversely, there are species that use Humboldt Bay that prefer areas of unstructured habitat (e.g., flatfish, black brant). Overall, interactions between shellfish aquaculture gear and species in Arcata Bay is generally positive and species have used the area consistently over the 100-year history of aquaculture in Humboldt Bay.

Shellfish aquaculture can also cause changes to sediment quantity and sediment quality. Note that sediment quality, as it relates to historic dioxin and other contaminants, is discussed in Section VII below. Shellfish aquaculture gear has a localized effect on sediment distribution and tidal circulation. As water is slowed by frictional effects of the culture gear, sediment deposition and organic content can increase (Rumrill and Poulton 2004). Rumrill and Poulton (2004) reported a deposition of fine sediments in 5-foot spaced single-hung longlines using cultch-on-longline methods in May 2003 (up to 95 mm), which was eroded by July 2003 (down to 51 mm). The authors gave no indication whether this was a significant change or if this change persisted. Typically, the detection limit for this type of study is 80 mm (Hannam and Mouskal 2015), which indicates that this change observed by Rumrill and Poulton (2004) is minor. It is anticipated that longlines with tipping bags or SEAPA baskets and rack and bag areas will have similar, although possibly slightly greater, effects.

For example, a study was conducted in Willapa Bay on potential changes in water circulation around an intertidal longline system that included tipping bags (Confluence 2016) paired with previous work in the region (Banas and Hickey 2005). A boat-based Acoustic Doppler Current Profiler survey was conducted in Willapa Bay to measure current speed and direction up-current, down-current, and within culture beds. The major effects of the longlines with tipping bags included:

- Differences in current speeds and current direction within and outside of culture are not significant.
- Differences in current speeds and current direction up-current and down-current of culture are not significant.
- Current speed and direction with depth and at discrete distance intervals along each transect are highly variable.
- Complex circulation patterns exist because of a naturally complex seabed (eelgrass, channels, bed roughness).

Tidal currents would be one of the forces contributing to sediment transport and sediment distribution in the area of proposed tipping bag culture gear on the mudflat, but they are not the most active means for sediment transport. Studies have shown that sediment transport within channels and adjacent to channels is more active than on mudflats (Banas and Hickey 2005, Forrest et al. 2009). Intertidal longline systems, and other types of intertidal culture methods (e.g., rack-and-bag), are sited away from channels and high enough up (in elevation) on the mudflats that they will not interact significantly with the sediment being transported in the channels. In addition, sediment on the mudflats is relatively cohesive and cannot be readily eroded by tidal currents. Therefore, the intertidal longline systems and rack and bag areas do not have a significant effect on tidal currents or the sediment transport processes associated with tidal currents.

Most information on the potential for deposition to become significant conclude that this potential is small (<100 mm) and happens in an inconsistent manner so that localized changes of this magnitude would not have an adverse effect on the environment. The amount of sediment that potentially accumulates will depend on the orientation of the shellfish aquaculture gear in relation to wind-waves, and adjustments can be made to the gear to reduce this potential impact if it is observed by HIOC. Given the amount of mapping and monitoring that will occur during the project, if sediment accumulation is noted, then it would be quickly fixed.

Certain shellfish aquaculture practices can also impact eelgrass habitats, although these impacts are viewed by regulatory agencies as temporary and sustainable with shellfish aquaculture activities. According to the proposed reissuance and modification of Nationwide Permits (85 FR 57298) by the Corps (2020), "Bivalve shellfish mariculture activities and submerged aquatic vegetation have existed next to each other for hundreds of years (Ferriss et al. 2019), which demonstrates the temporary nature of the impacts of these activities on seagrasses and the resilience of seagrasses to the periodic disturbances caused by these activities." Additional positive effects to benthic invertebrates and fish that use these estuaries were identified by NMFS (2016) and others. HIOC will avoid impacts related to eelgrass through incorporation of the following mitigation measures:

Mit-1 Marine Debris: HIOC will implement a marine debris management plan (Appendix A). At the time of harvest of each cultivation area, HIOC will carry out a thorough inspection to locate and remove any loose, abandoned or out of use equipment and tools. All floating bags and baskets will be marked or branded with the HIOC's name and phone number.

Mit-2 Eelgrass Protection: HIOC will install racks, intertidal longline systems, and other aquaculture gear at least 5 horizontal meters (or 16 feet) from native eelgrass (*Zostera marina*). This will not prevent continued cultivation in areas where eelgrass moves into the project site.

HIOC is expected to install gear incrementally. Before gear is installed in new areas, eelgrass will be mapped in culture areas using unmanned aerial vehicles (UAV) and/or verified using ground surveys to identify eelgrass beds and establish 5 meter horizontal buffers. Eelgrass surveys will be considered valid pre-installation surveys if performed less than 2-years prior to gear installation.

Mit-3 Vessel Anchors: HIOC will anchor vessels outside of areas containing eelgrass.

Mit-4 Vessel Routes: HIOC will established a vessel route to access its leases that avoids known native eelgrass (*Z. marina*) beds (refer to Figure 10).

The HIOC Project would minimize potential interaction between eelgrass and shellfish aquaculture gear based on tidal elevation. According to the *Humboldt Bay Eelgrass Comprehensive Management Plan*, "the upper limits capable of supporting continuous eelgrass habitat were estimated to range from approximately 0.3 to 0.4 m MLLW [+1.0 to +1.3 feet MLLW], while patchy eelgrass associated with pool forming depressions and intertidal channels capable of retaining water during low-tide was found to extend up to 1.4 m MLLW [+4.6 feet MLLW]" (Merkel and Associates 2017). Other observations indicate eelgrass resources can occur as high as +1.5 m (+4.9 feet MLLW) in pooling environments (NOAA 2014), although eelgrass has not been observed that high in the intertidal in the HIOC Project area (Lumis 2020).

The tidal elevation where culture is being proposed (+1.6 feet to +4.6 feet MLLW) compared to the upper limit of continuous eelgrass in Arcata Bay (+1.0 feet to +1.3 feet MLLW) means that the proposed HIOC Project avoids the majority of potential eelgrass resources by culturing at a higher elevation. In addition, HIOC will use mitigation measures to avoid placing gear within existing eelgrass beds. While patchy eelgrass can extend up to +4.6 feet MLLW, the location of eelgrass in the HIOC Project area was mapped in 2020 and documented areas of both patchy and continuous eelgrass will be avoided. Further avoidance measures will be used during gear installation (i.e., Mit-2). Based on an evaluation of historical eelgrass data (Schlosser and Eicher 2012) and current eelgrass distribution, the tidal elevation of the mudflats where culture is proposed appears to be potentially too high to sustain eelgrass. The project incorporates buffers to eelgrass approved by the CCC and Corps in recent approvals for HIOC's shellfish farm in Tomales Bay (Corps 2019, CCC 2019). In evaluating shellfish aquaculture in Washington State, NMFS determined that shellfish aquaculture incorporating the proposed buffer "is not expected to diminish eelgrass density or function of existing eelgrass" (NMFS 2016).

If eelgrass does move into areas where gear is installed, post-installation, the literature supports a conclusion that culture operations will not significantly impact eelgrass and may provide some benefits, particularly for eelgrass located at the high intertidal elevations found within the project site. Potential recruitment of eelgrass into shellfish aquaculture plots is driven by three main mechanisms. First, by providing a larger boundary layer and slowing water current speed, shellfish may increase recruitment of floating seeds as they travel singly or within detached reproductive shoots. Retention of seedlings could be facilitated by the off-bottom aquaculture gear by affecting currents and potentially intercepting floating wrack, although the density and type of gear can also impede seed dispersal (Tallis et al. 2009). Additionally, seed dispersal is typically limited outside of an eelgrass bed; approximately 80% of seeds travel within 33 feet of parent plants (Ruckelshaus 1996, Orth et al. 2006). Most eelgrass adjacent to the HIOC Project would be located further than 33 feet from parent plants. Second, by filtering seawater and increasing sediment organic content, bivalves provide superior conditions for seed germination. Eelgrass seed germination is dependent on burial depth, with the highest germination occurring at the anaerobic/aerobic interface (Bigley 1981). Seeds buried below this depth have very low germination and are essentially lost from the population. The presence of shellfish may reduce currents thereby facilitating seed retention, sediment deposition and seed burial to a depth that is appropriate for germination. Third, shellfish may increase the survival of seedlings, which have very high mortality rates, by increasing light levels, nutrients, and protecting against erosion and herbivory (Ruckelshaus 1996, Orth et al. 2006).

While the primarily way in which the HIOC Project will mitigate for potential impacts to habitat is through avoidance of eelgrass and eelgrass-disturbing activities, eelgrass that moves into the culture area would not be restricted from colonizing into the farm. Shellfish aquaculture can work within eelgrass beds, and gear does not significantly change the system. In other words, shellfish gear works within the functions of the habitat and can even improve conditions for eelgrass. Upon incorporation of the above mitigation measures, the impacts to habitat will be less than significant.

Bio-C: Effects to Wetlands. Wetlands, including in Humboldt Bay, provide numerous functions including primary production, flood protection, nutrient removal/transformation, wildlife habitat and recreational opportunities. With the addition of shellfish culture, all these functions continue. Cultured shellfish can contribute to water quality by removing/converting nutrients and other matter in the water column. However, this is most beneficial in systems other than Humboldt Bay that are experience eutrophication. Kellogg et al. (2018) quantified the ecological benefits and impacts of oyster aquaculture in Chesapeake Bay. Water quality, especially related to nutrient removal, was one of the main measurements to understand effects associated with floating and on-bottom culture (i.e., caged grow-out areas). The study's results for water quality indicated that there were few impacts, positive or negative, detected from the oyster aquaculture operations. However, the authors calculated a removal of 21 to 372 pounds (lbs) of nitrogen and 3 to 49 lbs of phosphorus per farm per year. As stated by the Corps (2020; 85 FR 57336), "Oyster mariculture [aquaculture] activities may not provide identical ecological functions and services and functions as natural oyster reefs, but cultivated oysters do provide some of these functions and services without substantial investment of public funds (Kellogg et al. 2018) that may be needed for restoration activities." Similar concepts were discussed in other studies that provided an understanding of what benefits shellfish aquaculture can provide that have been lost due to the historical loss of shellfish biomass through overharvesting (e.g., NRC 2010, Alleway et al. 2019). Additionally, as described in other sections of this IS document, certain wildlife species benefit from the habitat provided by shellfish culture equipment and cultured shellfish. The HIOC Project does not include the removal of any wetlands, placement of fill, or any other interruption or impact to wetland areas. Therefore, the HIOC Project is expected to have a less than significant impact on wetlands.

Bio-D1: Effects to Wintering and Migrating Shorebird Populations. Studies have found that bird responses to the presence of shellfish aquaculture gear have been variable, with the abundance and density of some species being higher while other species numbers are lower. For example, Connolly and Colwell (2005) observed 17 different bird species using the intertidal habitat in Humboldt Bay associated with oyster cultch-on-longline culture. Abundance of most species (7 shorebirds and 4 wading birds) were shown to be more abundant on oyster longline plots compared to adjacent mudflat habitat not containing culture, and three species (marbled godwit [*Limosa fedoa*], long-billed curlew [*Numenius americanus*] and dunlin) showed mixed results depending on location. A consistent observation by shellfish growers on the West Coast for a variety of culture gear types is that Dunlin often roost on top of shellfish aquaculture gear. Great blue heron occur in Humboldt Bay, but a full study of interactions between these birds and other shorebirds has not been studied in the bay.

The only shorebird from the Connolly and Colwell (2005) study that showed lower abundance in longline plots was the black bellied plover. The authors concluded that the greater bird abundances on longline plots were likely in response to increased foraging opportunities or greater prey diversity present because shorebird densities are commonly correlated with the densities of their principal prey (see references cited within).

Mid-sized birds, such as Dunlin, can forage in slightly deeper water (by probing with their bills). Kelly et al. (1996) studied on-bottom culture and found that least sandpipers may forage on oyster bags and willets were attracted to aquaculture plots, while western sandpipers, black-bellied plovers, and dunlin often forage between oyster bags and were less abundant in aquaculture areas. The authors suggest that greater use of control plots by black-bellied plovers may be a result of greater abundance of their principal prey items, or factors related to reduced foraging efficiency related to their visual foraging methods.

Compared to the Kelly et al. (1996) study of on-bottom culture, both the Connolly and Colwell (2005) and HTH (2015) studies looked at shorebird use of near-bottom oyster cultch-on-longline aquaculture areas. No behavioral differences in shorebird use within the plot were observed (e.g., shorebirds readily foraged under the lines). Shorebirds were observed by HTH (2015) to first access the area when water levels were low enough for shorebirds to stand and forage, and they continued to forage until water levels rose to levels that forced them to cease foraging and leave the site. During the recordings, larger marbled godwits would arrive before small species (i.e., small sandpipers), as the smaller birds can only access the sites when fully exposed or in very shallow water. Although the camera imagery represents a small sample size, the images recorded using trail cameras that recorded images at fixed intervals throughout tidal cycles from HTH (2015) in Humboldt Bay areas where Pacific Seafood (formerly Coast Seafoods) grows oysters confirm the previous findings of Connolly and Colwell (2005), and suggest that shorebird foraging occurred irrespective of the presence of longlines. Shorebird presence in or out of aquaculture areas was primarily dependent on water levels and access to food resources in shallow water or exposed mudflat.

Although marine birds feed at shellfish aquaculture sites, the aquaculture sites themselves do not necessarily attract larger numbers of birds compared to non-cultured areas (Hilgerloh et al. 2001). For instance, Žydelis et al. (2006) found that natural environmental attributes were the primary determinants of densities of wintering surf scoters and white-winged scoters in Baynes Sound, British Columbia, where the primary type of cultivation is Manila clam culture. Moreover, the authors found that shellfish aquaculture variables did not necessarily predict bird densities for the scoter species studied. According to Žydelis et al. (2006), these findings suggest that winter scoter populations and the shellfish aquaculture industry may be mutually sustainable because there was no evidence of a negative impact on scoter populations at the current level of shellfish farming practiced in Baynes Sound. It is notable that in 2001, Baynes Sound had over 20% of habitat used for shellfish culture (Carswell et al. 2006).

The effect that shellfish aquaculture has on marine birds depends on the species involved, the type and intensity of cultivation activity, and the habitats affected. Most studies have described the effects of shellfish aquaculture as being neutral (Roycroft et al. 2004, Žydelis et al. 2006) or even beneficial (Kirk et al. 2007, Caldow et al. 2007, Žydelis et al. 2009). Culture gear may provide perching and resting areas for local birds (especially cormorants and gulls) when not occupied by personnel performing oyster culture duties.

In addition, HIOC would comply with the following BMP:

BMP-3 Fish and Wildlife: During vessel transit, harvest, maintenance, inspection, and planting operations, HIOC will avoid approaching, chasing, flushing, or directly disturbing shorebirds, waterfowl, seabirds, or marine mammals.

While there is no potential impact from the HIOC Project that would need to be mitigated regarding potential interactions with wintering and migrating shorebird populations, this is still a common BMP that provides consistency with federal laws. Based on the above analysis, potential impacts to wintering and migrating shorebird populations would be less than significant.

Bio-D2: Effects to Pacific Herring. Herring use Humboldt Bay primarily for spawning and nursery habitat. Herring broadcast spawn adhesive eggs on substrate and vegetation in Humboldt Bay. Herring spawn may adhere to any suitable substrate, including vegetation, rocks, shell fragments, and other hard surfaces (Barnhart 1988).

Rabin and Barnhart (1986) reported that Pacific herring spawn in both North and South bays, but most spawning occurs in the northern end of the bay. Eelgrass is the principal substrate used for spawning in Humboldt Bay. A typical spawning event involves the deposition of herring eggs on approximately 300 acres of eelgrass in North Bay (Mello and Ramsay 2004). This represents less than 10% of available eelgrass used in each spawning event. Spratt (1981) characterizes the herring population as "very small in relation to the spawning area available" suggesting that herring spawning in Humboldt Bay are unlikely to be limited by availability of suitable substrate.

There is some limited potential overlap between Pacific herring and the HIOC Project area. Adult herring use subtidal channels adjacent to spawning areas prior to spawning. Based on data and communications from CDFW about past and current spawning locations, the East Bay channel and Arcata channel are likely locations for pre-spawning holding activities (Mello 2007, Ray, pers. comm., 2015). The majority of spawning activities primarily occur in the East Bay area. These areas would be avoided by the HIOC Project. Limited spawning has been documented in the Mad River Slough area where the HIOC Project is proposed (Mello and Ramsay 2004, Mello and Stroud 2005, Mello 2007).

In addition, HIOC would comply with the following mitigation measure:

> **Mit-5 Pacific Herring:** In any cultivation beds within or adjacent to eelgrass beds (in the event that eelgrass moves into the project site), HIOC will conduct visual surveys for Pacific herring spawn prior to conducting activities during the herring spawning season (October to April). If herring spawn is present, HIOC will suspend activities in the areas where spawning has occurred until the eggs have hatched and spawn is no longer present (typically 2 weeks).

This mitigation would avoid interactions between herring spawn (if present) and shellfish aquaculture operations. Upon incorporation of the above mitigation measure, the impacts to Pacific herring will be less than significant.

Bio-D3: Effects to Marine Mammals. Harbor seals occur in Humboldt Bay and are known to haul out on mudflats in Arcata Bay. However, the primary haul-out locations are identified in South Bay associated with pupping locations (Gemmer 2002, Ougzin 2013). Ougzin (2013) documented that 88% of seals foraged within 8 miles of their primary haul-out site. The closest primary haul-out location to the HIOC project is more than 1.0 miles away near Sand Island, which indicates that the HIOC Project area is not a primary haul-out location but could be accessed for foraging. California sea lions also occur in Humboldt Bay and occasionally are observed loafing on artificial structures. These marine mammals are expected to primarily use channels for movement and foraging rather than the intertidal areas where shellfish aquaculture would be placed. Thus, the placement of aquaculture gear is not expected to occur in areas important to their movement. Further, even if moving through intertidal areas during high tides, shellfish aquaculture gear is not expected to restrict movements of marine mammals, as these species would readily navigate among the gear.

In addition, HIOC would comply with the following BMP:

BMP-3 Fish and Wildlife: During vessel transit, harvest, maintenance, inspection, and planting operations, HIOC will avoid approaching, chasing, flushing, or directly disturbing shorebirds, waterfowl, seabirds, or marine mammals.

While there is no potential impact from the HIOC Project that would need to be mitigated regarding potential interactions with marine mammals, it is still a common BMP that provides consistency with federal laws. Based on the above analysis, potential impacts to marine mammals would be less than significant.

Bio-D4: Effects to Black Brant. Black brant feed primarily on eelgrass. The HIOC Project will avoid eelgrass. While there may be portions of the mudflat that would be unavailable to birds during a low tide, these areas are not considered suitable foraging habitat for Black Brant.

This is supported by studies of black brant and shellfish aquaculture interactions have occurred in Humboldt Bay which evaluated shellfish farming activities within dense eelgrass beds. HT Harvey & Associates (HTH) conducted a survey in April 2015 (HTH 2015) within oyster longline aquaculture (aquaculture plots) and adjacent reference plots. The oyster longline aquaculture gear studied extends up to 3 feet above the sediment surface and occurs in eelgrass beds.

The HTH (2015) survey indicated that tidal height is the most influential driver in black brant use of an area. During high tides, black brant were observed at similar densities in aquaculture plots (mean density=1.0 birds/acre) and reference plots (mean density=1.3 birds/acre). During low tides, black brant were consistently observed at higher densities in reference plots (mean density=2.6 birds/acre) compared to aquaculture plots (mean density=0.1 birds/acre). Supplemental time-lapse recordings demonstrated that black brant forage in both aquaculture and reference plots when water is sufficiently high to swim, but are less abundant in plots with oyster longlines at lower tides when the gear is exposed. The study authors postulated that the presence of lines during low tide interfered with black brant movement and led to the birds preferentially using areas with eelgrass that were adjacent to near-bottom culture plots.

Monitoring in Humboldt Bay during the 2017-2018 wintering and migratory period found no significant difference in black brant usage in culture and adjacent reference plots (HTH 2018), suggesting that earlier observations may be the result of eelgrass abundance within culture areas rather than the presence of culture gear. HTH (2018) found that black brant use is comparable or higher within culture areas compared to adjacent areas, particularly during higher tides when feeding in eelgrass beds may not be available to black brant. It appears that brant may occur at higher concentrations in areas with aquaculture gear where feeding opportunities may exist during higher water levels. A previous study by HTH also evaluated brant utilization of existing shellfish aquaculture plots and concluded: "brant were not deterred from accessing foraging sites that were directly adjacent to aquaculture structure (e.g., along channels adjacent to aquaculture plots). This suggests that impact acreages used for impact assessment should include only the boundaries of the structures and not additional buffer areas that are not directly impacted by aquaculture practices" (HTH 2015).

Collectively, this evidence suggests that black brant's preferred method of foraging is in shallow water when tidal height provides sufficient access to rooted eelgrass. The presence of shellfish gear can affect their foraging only during relatively short periods when the gear impedes their ability to easily swim through aquaculture plots (i.e., when the gear starts to be exposed). All other times, feeding can occur in and around shellfish gear. Further, because brant appear to only avoid the area directly occupied by the shellfish gear, the 5 meter buffer from eelgrass beds required under Mit-2 should avoid any disturbance to brant foraging within existing eelgrass beds. Therefore, impacts to blank brant are considered less than significant.

Bio-E: Local Policies. There are numerous riparian habitats and other sensitive natural communities that have been identified by local governments, CDFW, and USFWS in the vicinity of the HIOC Project area. These natural communities provide habitat for year-round and migrant species, recreation, environmental interpretation, and preservation of aesthetic resources. The City of Arcata's Marsh and Wildlife Sanctuary also provides wastewater treatment. Specific areas managed by local, state or federal entities protecting riparian habitats and other sensitive natural communities include:

- The Humboldt Bay National Wildlife Refuge Complex, owned and managed by the USFWS. https://www.fws.gov/refuge/humboldt_bay/
- The Arcata Marsh and Wildlife Sanctuary, owned and managed by the City of Arcata. https://www.cityofarcata.org/340/Arcata-Marsh-Wildlife-Sanctuary
- CDFW Ecological Reserves and Wildlife Areas: https://wildlife.ca.gov/Lands/Places-to-Visit: Including the following areas in Humboldt County: Big Lagoon Wildlife Area, Eel River Wildlife Area, Elk River Wildlife Area, Fay Slough Wildlife Area, Headwaters Forest Ecological Reserve, Mad River Slough Wildlife Area, and South Spit Wildlife Area

Plans protecting biological resources in the vicinity of the HIOC Project include the Local Coastal Programs, the Open Space Element of the *Humboldt County General Plan*, comprehensive conservation plans (CCPs), and recovery plans for listed species.

Local Coastal Programs and other relevant documents include:

- District Humboldt Bay Management Plan, http://humboldtbay.org/sites/humboldtbay2.org/files/documents/hbmp2007/HumBayMgmtPLAN_print.pdf
- California Coastal Commission Sea Level Rise Policy Guidance, https://www.coastal.ca.gov/climate/slrguidance.html
- District Humboldt Bay Sea Level Rise Adaptation Planning Project, http://humboldtbay.org/humboldt-bay-sea-level-rise-adaptation-planning-project
- Humboldt Bay Area Plan of the Humboldt County Local Coastal Program, https://humboldtgov.org/1678/Local-Coastal-Plan-Update
- Humboldt Bay National Wildlife Refuge Comprehensive Conservation Plan, https://www.fws.gov/refuge/Humboldt_Bay/what_we_do/planning.html
- California Eelgrass Mitigation Policy (CEMP), https://www.cakex.org/sites/default/files/documents/cemp_oct_2014_final.pdf

- Humboldt Bay Eelgrass Comprehensive Management Plan, http://humboldtbay.org/eelgrass-management-plan

These plans and policies call for providing maximum public access and recreational use of the coast; protecting wetlands, rare and endangered habitats, environmentally sensitive areas, tidepools, and stream channels; maintaining productive coastal agricultural lands; directing new development to already urbanized areas; protecting scenic beauty; and locating coastal energy facilities such that they have the least impact. The District's Humboldt Bay Management Plan includes objectives to expand the amount of sustainable aquaculture within Humboldt Bay (District 2007).

One of the main focuses of the Local Coastal Programs and management plans is on eelgrass in Humboldt Bay, including the response to sea level rise. Sea level rise is likely to affect the distribution of eelgrass in the future. Humboldt Bay is predicted to experience the most rapid rates of relative sea level rise on the U.S. West Coast (Shaughnessy et al. 2012, Patton et al. 2017). Eelgrass is predicted to respond to sea level rise by moving upslope as deeper water habitats become unsuitable due to insufficient light levels, and higher elevation areas provide sufficiently brief exposure conditions to support eelgrass persistence (Merkel and Associates 2017). Projections for eustatic sea level rise suggest a rate of approximately 0.63 mm/year at Humboldt Bay, and 61 to 65 cm by 2100 for northern California (NRC 2012). As stated above, eelgrass may move upslope in response to sea level rise, including moving into the HIOC Project area. HIOC's existing shellfish farm in Tomales Bay provides empirical evidence that eelgrass beds that move into HIOC's farm area can thrive and continue to coexist with HIOC's shellfish cultivation (CCC 2019).

The District has led the development of the Humboldt Bay Eelgrass Comprehensive Management Plan (Merkel and Associates 2017). This plan provides an ecosystem based management approach to ensure the greatest benefits to eelgrass and eelgrass function by facilitating more efficient regulatory processes for projects in the bay and providing a long term eelgrass habitat conservation strategy. CEMP (2014) identifies eelgrass management and protection objectives and delineates the ways eelgrass resources should be characterized and protected. The project is consistent with CEMP methodologies, recommendations, and conservation measures.

The *Humboldt County General Plan* was adopted October 23, 2017. The Biological Resources section of the Conservation and Open Space Elements describes the policies for preservation of natural resources, management of production of resources, outdoor recreation, and public health and safety.

The HIOC Project, with inclusion of mitigation measures (see above for eelgrass-specific measures), would not conflict with described plans and policies. Therefore, there would be no impact.

Bio-F: Conservation Plans. Other than the plans and policies described above, there are no habitat conservation plans (HCPs) or other community plans that the HIOC Project would conflict with in terms of the proposed shellfish aquaculture activities. Therefore, there would be no impact.

V. CULTURAL RESOURCES. Would the project:	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less-than-Significant Impact	No Impact
A) Cause a substantial adverse change in the significance of a historical resource pursuant to §15064.5?		X		
B) Cause a substantial adverse change in the significance of an archaeological resource pursuant to §15064.5?		X		
C) Disturb any human remains, including those interred outside of formal cemeteries?		X		

DISCUSSION

CR-A through CR-C: Cultural Resources. The HIOC Project would be implemented in intertidal areas (mudflats) where no cultural or historic resources are known to be present. Although cultural and historic resources are not expected to occur, there are measures in place to provide an inadvertent discovery plan in the event that something is discovered. Very little soil disturbance would occur as part of the HIOC Project (i.e., the only soil disturbance would involve the installation of stakes and posts to support shellfish gear), although there would be some amount of disturbance when placing gear. HIOC would comply with the following mitigation measure:

> **Mit-6 Cultural Resources:** HIOC will comply with the Harbor District Protocol agreed upon between the Harbor District and the Blue Lake Rancheria, Bear River Band of Rohnerville Rancheria, and Wiyot Tribes regarding the inadvertent discovery of archaeological resources, cultural resources, or human remains or grave goods (Appendix B).

Additional information on the inadvertent discovery plan protocols are discussed below under tribal cultural resources. Potential impacts to cultural resources would be less than significant with mitigation incorporated.

VI. ENERGY. Would the project:	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less-than-Significant Impact	No Impact
A) Result in potentially significant environmental impact due to wasteful, inefficient, or unnecessary consumption of energy resources, during project construction or operation?				X
B) Conflict with or obstruct a state or local plan for renewable energy or energy efficiency?				X

DISCUSSION

Energy-A and Energy-B: Impacts from Energy Use. The information provided recently for the Pre-Permitting Project and Yeung Farm (SCH #2017032068) provides a detailed background into the state and regional energy resources and use. The main energy resource that would be used by HIOC is gasoline and diesel for vessels to transport employees, products, and culture gear.

The HIOC Project would result in up to two round trips weekly between HIOC's Hatchery Facility and the HIOC Project Area with highly efficient 4-stroke outboard motors. While these trips would consume fuel, the amount of fuel required is a negligible increase in regional demand and an insignificant amount relative to the more than 19 billion gallons of fuel sold in the state as of 2015 (California Energy Commission 2019). This fuel use would not result in the need for new or expanded sources of energy or infrastructure to meet the energy demands of the HIOC Project. Therefore, there no impact is anticipated.

VII. GEOLOGY AND SOILS. Would the project:	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less-than-Significant Impact	No Impact
A) Directly or indirectly cause potential substantial adverse effects, including the risk of loss, injury, or death involving:				
i) Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault? Refer to Division of Mines and Geology Special Publication 42.			X	
ii) Strong seismic ground shaking?				X
iii) Seismic-related ground failure, including liquefaction?			X	
iv) Landslides?				X
B) Result in substantial soil erosion or the loss of topsoil?				X
C) Be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction or collapse?				X
D) Be located on expansive soil, as defined by the California Building Code (2007), creating substantial direct or indirect risks to life or property?				X
E) Have soils incapable of adequately supporting the use of septic tanks or alternative wastewater disposal systems where sewers are not available for the disposal of wastewater?				X
F) Directly or indirectly destroy a unique paleontological resource or site or unique geological feature?		X		

DISCUSSION

Geo-A: Risks to People or Structures. There are numerous fault lines near the HIOC Project area, as well as the intersection of three tectonic plates. As such, the area is highly susceptible to seismic activity. However, the HIOC Project would not add any fixed structures to the landscape that would be susceptible to seismic damage, nor would it put existing structures at greater risk. The HIOC Project area is level and lacks structures that could become unstable and injure workers. The sediment could be subject to liquefaction, which would pose a minor risk to workers; however, the risk is considered very low, given that (1) liquefaction of the type that would be a risk to workers is uncommon, and there is no historical evidence of liquefaction in Humboldt Bay; (2) workers would be at the HIOC Project area only temporarily, and no people would inhabit the area; and (3) workers would be near vessels and safety equipment, including personal floatation devices. Therefore, impacts related to seismic risks are expected to be less than significant.

Geo-B: Erosion. Through a study of sedimentation at shellfish culture sites in Humboldt Bay similar to the proposed HIOC Project area, Rumrill and Poulton (2004) found that "fine sediments were deposited and eroded in an inconsistent manner." However, based on the study results, there appears to be a net increase in sediment accumulation, not a loss, at these sites. A minor amount of net sediment deposition, rather than erosion, is expected when shellfish gear is placed in tidelands. Therefore, no impact is expected.

Geo-C: Instability. The HIOC Project would not involve the construction of any permanent structures, and is not expected to affect the potential for onsite or offsite landslides, lateral spreading, subsidence, liquefaction, or collapse. Therefore, no impact is expected.

Geo-D: Expansive Soils. There may be expansive soils in the HIOC Project area; however, the project would not add enclosed or habitable structures (buildings) to the landscape. There would also be no substantial risk to life or property from HIOC Project development. Therefore, no impact is expected.

Geo-E: Wastewater Disposal. The HIOC Project does not involve the development of new wastewater disposal systems. Workers employed through the HIOC Project would use existing facilities (restrooms) at HIOC's Hatchery Facility, which has adequate wastewater capacity. Therefore, no impact is expected.

Geo-F: Unique Paleontological Resource. The HIOC Project is located in intertidal habitat of Humboldt Bay. While there may be tribal cultural resources, as described in Section V and Section XVIII, the proposed culture methods used by HIOC would not significantly disturb the sediment surface in this project area. HIOC would comply with the following mitigation measure:

> **Mit-6 Cultural Resources:** HIOC will comply with the Harbor District Protocol agreed upon between the Harbor District and the Blue Lake Rancheria, Bear River Band of Rohnerville Rancheria, and Wiyot Tribes regarding the inadvertent discovery of archaeological resources, cultural resources, or human remains or grave goods (Appendix B).

Additional information on the inadvertent discovery plan protocols are discussed below under tribal cultural resources. Potential impacts to unique paleontological resources would be less than significant with mitigation incorporated.

VIII. GREEN HOUSE GAS EMISSIONS. Would the project:	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less-than-Significant Impact	No Impact
A) Generate greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment?			X	
B) Conflict with any applicable plan, policy or regulation of an agency adopted for the purpose of reducing the emissions of greenhouse gases?				X

DISCUSSION

GHG-A: Greenhouse Gas Emissions. Greenhouse gas emissions would result from the use of small internal combustion engines associated with use of several vessels, including low draft, 20-foot and 24-foot skiffs and possibly a custom 40-foot vessel equipped with a hydraulic crane for assisting in planting and harvest operations during higher tides. HIOC estimates that these vessels make up to two round trips weekly between HIOC's Hatchery Facility and the HIOC Project Area with highly efficient 4-stroke outboard motors. The amount of greenhouse gases generated by these activities would be less than significant.

GHG-B: Plans, Policies, or Regulations Regarding Greenhouse Gases. State of California legislation (Senate Bill 375 and Assembly Bill 32) seeks to reduce greenhouse gas emissions through the practice of smart-growth or mixed-use development. The HIOC Project does not include any upland construction or mobile sources (other than the vessels described above) that could be a potentially significant source of greenhouse gas emissions. The HIOC Project would not conflict with plans, policies, or regulations on greenhouse gas emissions. Therefore, no impact is expected.

IX. HAZARDS AND HAZARDOUS MATERIALS. Would the project:	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less-than-Significant Impact	No Impact
A) Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials?			X	
B) Create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment?			X	
C) Emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school?				X
D) Be located on a site which is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, would it create a significant hazard to the public or the environment?			X	
E) For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project result in a safety hazard or excessive noise for people residing or working in the project area?				X
F) Impair implementation of, or physically interfere with an adopted emergency response plan or emergency evacuation plan?				X
G) Expose people or structures, either directly or indirectly, to a significant risk of loss, injury or death involving wildland fires?				X

DISCUSSION

Haz-A through Haz-C: Transport, Use, Release, or Emission of Hazardous Materials. The only hazardous materials that would be associated with the HIOC Project are fuel and lubricants for vessels and other motors, including for internal combustion engines for the vessels described above. Use of these materials is common in Humboldt Bay and does not represent a significant hazard to the environment or people. HIOC Project personnel would follow all current and standard safety and cleanup protocols for fueling and lubricating engines. To further minimize the potential for spills, common BMPs are used for anyone operating vessels in Humboldt Bay. HIOC uses the following BMPs in their standard operations:

BMP-1 Vessel Maintenance and Fueling: HIOC will maintain all vessels used in culture activities to limit the likelihood of release of fuels, lubricants, or other potentially toxic materials associated with vessels due to accident, upset, or other unplanned events.

HIOC will use marine grade fuel cans that are refilled on land, and HIOC carries oil spill absorption pads and seals wash decks or isolates fuel areas prior to fueling to prevent contaminants from entering the water.

BMP-2 Vessel Motors: HIOC will use highly efficient 4-stroke outboard motors. All motors are muffled to reduce noise.

Overall, potential impacts from hazardous materials used by the HIOC Project would be less than significant. Note that there would be no impact for Haz-C because the HIOC Project area is not within one-quarter mile of an existing or proposed school.

Haz-D: Known Hazardous Sites. Historic land uses around Humboldt Bay have contributed to legacy sediment contamination of both polychlorinated biphenyls (PCBs) and dioxins. The primary source of dioxins in Humboldt Bay is from wood preservative use at lumber mills until the 1980s, which included the use of pentachlorophenol (Zalewski 2011). These contaminants may bind to sediments and can be remobilized by ground disturbing activities.

Humboldt Bay is on the 303(d) list of water bodies impaired due to dioxin and PCB contamination and dairy cattle ranching (SWRCB 2020). There is a former pulp mill and operational lumber mill with known historic dioxin and PCB contamination that is located <0.5 miles from the HIOC Project area. Studies in the Mad River Slough area reported that dioxin concentrations in shellfish were at or below levels found in background conditions associated with food resources throughout the U.S. (PSI 2007). The Mad River Slough is also spot sampled by the Wiyot Tribe under U.S. EPA's CWA§106 program for water temperature, specific conductivity, salinity, dissolved oxygen concentration, pH, and turbidity (Wiyot Tribe 2020). Available years of data include 2004 to 2012 and then 2015. Based on the data summaries, the only water quality exceedances occurred for dissolved oxygen (<6.0 mg/L) on February 2, 2007, and August 24, 2007.

Because the HIOC Project area is located in intertidal habitat in Arcata Bay, it is unlikely that this area included historical uses that would have resulted in contamination. There are contaminated sites located on the margins of the bay next to the Mad River Slough, but hazardous materials are not expected to reach the HIOC Project sites at concentrations that would have any impact on the HIOC Project's workers. In addition, the project's proposed culture method, which only requires the installation of longline stakes within the sediment, limits the potential for sediment disturbance. Therefore, the potential impact is expected to be less than significant.

Haz-E: Aircraft/Airport-related Safety. The only nearby airport is Murray Field, which is a public airport approximately 4 miles from the nearest HIOC Project boundary. Airplanes landing and departing from this airport are not expected to be a hazard for the HIOC Project's workers. Therefore, no impact is expected.

Haz-F and Haz-G: Emergency Response and Fire Hazards. The HIOC Project would not have any effect on an adopted emergency response plan or emergency evacuation plan because it would not impede emergency response or evacuation routes or procedures. Also, because the HIOC Project area is in intertidal area, there is no risk of wildfires. Therefore, no impacts are expected.

X. HYDROLOGY AND WATER QUALITY. Would the project:	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less-than-Significant Impact	No Impact
A) Violate any water quality standards or waste discharge requirements or otherwise substantially degrade surface or ground water quality?			X	
B) Substantially decrease groundwater supplies or interfere substantially with groundwater recharge such that the project may impede sustainable groundwater management of the basin?				X
C) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river or through the addition of impervious surfaces, in a manner, which would:			X	
i) Result in substantial erosion or siltation no- or off-site;			X	
ii) Substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or off-site;			X	
iii) Create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff; or			X	
iv) Impede or redirect flood flows?			X	
D) In flood hazard, tsunamic, or seiche zones, risk release of pollutants due to project inundation?			X	
E) Conflict with or obstruct implementation of a water quality control plan or sustainable groundwater management plan?			X	

DISCUSSION

Hyd-A: Water Quality and Discharge Standards. The HIOC Project would increase shellfish aquaculture operations in Arcata Bay. The project would not involve waste discharge. No additives, feed, or chemicals will be used in shellfish aquaculture operations (other than fuel for the work vessels). Changes to water quality would be minor, include standard BMPs for vessel operation (see below), and would not violate any water quality standards.

BMP-1 Vessel Maintenance and Fueling: HIOC will maintain all vessels used in culture activities to limit the likelihood of release of fuels, lubricants, or other potentially toxic materials associated with vessels due to accident, upset, or other unplanned events.

HIOC will use marine grade fuel cans that are refilled on land, and HIOC carries oil spill absorption pads and seals wash decks or isolates fuel areas prior to fueling to prevent contaminants from entering the water.

BMP-2 Vessel Motors. HIOC will use highly efficient 4-stroke outboard motors. All motors will be muffled to reduce noise.

Therefore, the impact is considered less than significant.

Hyd-B: Groundwater. The HIOC Project would not involve the use of groundwater. Therefore, no impact is expected.

Hyd-C: Erosion and Siltation. Shellfish aquaculture has a localized effect on sediment distribution and tidal circulation. As water is slowed by frictional effects of the shellfish aquaculture gear, sediment deposition and organic content can increase (Rumrill and Poulton 2004, Forrest et al. 2009). A study of sedimentation at oyster cultch-on-longline sites in Humboldt Bay (Rumrill and Poulton 2004), which are similar to the gear proposed in the HIOC Project area, found that "fine sediments were deposited and eroded in an inconsistent manner." The greatest elevation change was an increase of 95 mm. Localized changes of this magnitude would not have an adverse effect on the environment. Therefore, this impact is considered less than significant.

Hyd-D: Flood Hazard. The HIOC Project would occur entirely in an intertidal area of Arcata Bay. The project will not result in any surface runoff or flooding, affect flood hazard areas, tsunami areas, or seiche zones. Therefore, no impact is expected.

Hyd-E: Water Quality Control Plan. Proposed HIOC Project activities would temporarily mobilize a minor amount of sediment. For example, when stakes are placed or a vessel comes in contact with the bay bottom, sediment may be mobilized. However, the amount of sediment mobilized from near-bottom shellfish aquaculture operations is very low compared to the quantities of sediment mobilized during stormy conditions (e.g., strong winds). There is also potential for release of hazardous materials from internal combustion engines. However, potential impacts would not be expected to substantially degrade water quality. Furthermore, shellfish are filter feeders, which have been found to have a positive impact on water quality. Ecosystem modeling and mesocosm studies indicate that restoring shellfish populations to even a modest fraction of their historic abundance could improve water quality and aid in the recovery of seagrasses (Newell and Koch 2004). However, this benefit is likely small due to the fact that the HIOC Project area is not showing signs of eutrophication.

Even more importantly, shellfish aquaculture operations area dependent on excellent water quality conditions to produce a quality product for human consumption. Because of this incentive, shellfish aquaculture companies like HIOC have consistently been heavily involved in policies and studies to improve water quality in the bays and estuaries where they have products (Dewey et al. 2011). Examples of some ancillary benefits of the shellfish aquaculture industry include:

- Working with local jurisdictions and regulators to identify and eliminate point and non-point source pollution, including agricultural, industrial, and municipal discharges.
- Participating and providing input on regulatory updates to ensure that high water quality standards are included in local, state, and federal policies.
- Lobbying state and federal legislatures for improvements to water quality and developing water quality standards (e.g., shellfish industry contribution to the enactment of the Clean Water Act in 1972).

- Maintaining ownership or leases of large aquatic areas and upland, thereby eliminating the risk of environmentally deleterious uses.
- Participating in and collecting water quality samples as part of monitoring programs with federal and state agencies (e.g., National Shellfish Sanitation Program) to track water quality trends and identify areas targeted for improvement. These efforts have directly resulted in numerous areas now being determined suitable for shellfish harvesting and have provided data for other target areas with opportunities for improvement.
- Donating to local and state organizations to improve water quality conditions within the estuaries that shellfish aquaculture occurs.
- Organizing and participating in beach cleanup events that collect marine debris from both shoreline development and shellfish aquaculture operations.
- Actively engaging in efforts to quickly remediate and clean up oil spills and other hazardous waste sites to protect water quality and the health of shellfish.

Therefore, the impact to water quality is considered less than significant.

XI. LAND USE AND PLANNING. Would the project:	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less-than-Significant Impact	No Impact
A) Physically divide an established community?				X
B) Cause a significant environmental impact due to a conflict with any land use plan, policy, or regulation adopted for the purpose of avoiding or mitigating an environmental effect?				X

DISCUSSION

Land-A: Division of Community. The HIOC Project involves shellfish aquaculture operations in Arcata Bay. There is no construction that would involve creating a physical barrier to movement dividing an established community. Therefore, no impact is expected.

Land-B: Land Use Policy Conflicts. The District's *Humboldt Bay Management Plan* designates the intertidal portion of the HIOC Project area for conservation and mariculture (*Humboldt Bay Management Plan* § 2.2). The HIOC Project area is within Arcata Bay, a sub-area of Humboldt Bay where aquaculture is identified as a generalized preferred use within the *Humboldt Bay Management Plan*. The *Humboldt Bay Management Plan* contemplates mariculture operations within the entire HIOC Project area, noting that the "use of the Bay for aquaculture or mariculture is expected to remain primarily within Arcata Bay, which includes areas that have been leased previously by the District, the cities, or the State of California for mariculture purposes . . . The combining use designation reflects a determination in this Plan that mariculture activities are generally appropriate within the designated area" (*Humboldt Bay Management Plan* § 2.3.3). The HIOC Project is also consistent with the plan's goal of supporting commercial aquaculture and the plan's policy to identify additional aquaculture activities (Policy HFA-5). The plan recognizes the need to balance harbor, recreation, conservation and mariculture uses of the bay.

The Humboldt County General Plan similarly states: "At the present time the North Bay is the heart of the local aquaculture industry, and the resource protection policies in this section and elsewhere in this plan are designed to foster the expected growth of this industry" (Humboldt County 2017). In summary, the HIOC Project would be consistent with zoning and adopted plans for the HIOC Project area as a permitted use. Therefore, no impact is expected.

XII. MINERAL RESOURCES. Would the project:	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less-than-Significant Impact	No Impact
A) Result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the State?				X
B) Result in the loss of availability of a locally important mineral resource recovery site delineated on a local general plan, specific plan or other land use plan?				X

DISCUSSION

Min-A and Min-B: Mineral Resources. The HIOC Project would increase shellfish aquaculture operations in Arcata Bay. It would have no effect on mineral resources. Therefore, no impact is expected.

XIII. NOISE. Would the project:		Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less-than-Significant Impact	No Impact
A)	Generation of a substantial temporary or permanent increase in ambient noise levels in the vicinity of the project in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies?			X	
B)	Generation of excessive groundborne vibration or groundborne noise levels?				X
C)	For a project located within the vicinity of a private airstrip or an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project expose people residing or working in the project area to excessive noise levels?				X

DISCUSSION

Noise-A through Noise-C: Noise. The HIOC Project would increase shellfish aquaculture operations on Arcata Bay. Its primary noise effect would be caused by the addition of small vessels with internal combustion engines. These would generate noise similar to that generated by other small vessels on the bay. The HIOC Project vessels would not be heard from sensitive receptors, especially considering a standard BMP used by HIOC for boat motors:

BMP-2 Vessel Motors. HIOC will use highly efficient 4-stroke outboard motors. All motors are muffled to reduce noise.

The project would also cause temporary noise effects during the installation of aquaculture gear, but the noise generated is likely similar to ambient noise conditions at shoreline locations (e.g., cars along the road along the shoreline or other boats on the water). Because the HIOC Project's noise generation would be typical of what already occurs in Humboldt Bay, noise impacts are expected to be less than significant.

XIV. POPULATION AND HOUSING. Would the project:		Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less-than-Significant Impact	No Impact
A)	Induce substantial unplanned population growth in an area, either directly (e.g., by proposing new homes and/or businesses) or indirectly (e.g., through extension of roads or other infrastructure)?				X
B)	Displace substantial numbers of existing people or housing, necessitating the construction of replacement housing elsewhere?				X

DISCUSSION

Pop-A through Pop-B: Population and Housing. The HIOC Project would increase shellfish aquaculture operations on Arcata Bay. It is not expected to have any effect on population and housing. It may create as many as 4 to 6 new jobs, but those jobs are expected to be filled primarily by people who already live in the region. The effect would not be substantial. Therefore, no impacts are anticipated.

XV. PUBLIC SERVICES. Would the project result in substantial adverse physical impacts associated with the provision of new or physically altered governmental facilities, need for new or physically altered governmental facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, response times or other performance objectives for any of the public services:	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less-than-Significant Impact	No Impact
A) Fire protection?				X
B) Police protection?				X
C) Schools?				X
D) Parks?				X
E) Other public facilities?				X

DISCUSSION

Pub-A through Pub-E: Public Services. The proposed HIOC Project would not create increased demand for public services. Approximately 4 to 6 people would be employed; they would likely already live in the local community and so would not represent a new burden on public services. The effect would not be substantial. Therefore, no impacts are expected.

XVI. RECREATION. Would the project:	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less-than-Significant Impact	No Impact
A) Would the project increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated?				X
B) Does the project include recreational facilities or require the construction or expansion of recreational facilities which might have an adverse physical effect on the environment?				X

DISCUSSION

Rec-A: Recreation. The HIOC Project would not increase use of existing neighborhood and regional parks or other recreational facilities. Approximately 4 to 6 people would be employed by the HIOC Project, but they would likely already live in the local community and so would not represent a new burden on recreational facilities. The impact to existing neighborhood and regional parks or other recreational facilities from the HIOC Project are considered to be no impact.

Rec-B: Recreational Facilities. The HIOC Project does not include recreational facilities. Approximately 4 to 6 additional people would be employed by the project, but they would likely already live in the local community and so would not represent a new burden on recreational facilities. Even with the additional people employed by the project, they would not result in an expansion of a recreational facility. Hence, no impacts are expected.

XVII. TRANSPORTATION. Would the project:	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less-than-Significant Impact	No Impact
A) Conflict with a program, plan, ordinance or policy addressing the circulation system, including transit, roadway, bicycle and pedestrian facilities?				X
B) Conflict or be inconsistent with CEQA Guidelines Section 15064.3, subdivision (b)?				X
C) Substantially increase hazards due to a geometric design features (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment)?		X		
D) Result in inadequate emergency access?				X

DISCUSSION

Trans-A, Trans-B, and Trans-D: Traffic Levels, Patterns, and Emergency Access. The HIOC Project would not increase the local population. Up to 4 to 6 people employed under the project would park at HIOC's Hatchery Facility or along adjacent streets to the facility. HIOC's existing facility includes at least 40 parking spaces and there is ample parking available for new employees. The potential impacts would occur only in Humboldt Bay, as discussed below under Trans-C, and is limited to areas outside of navigation channels (i.e., in intertidal areas where vessel activity is limited). There would not be a conflict with circulation system, transit, roadways, pedestrian facilities, CEQA guidelines, or emergency access. Therefore, no impact is expected.

Trans-C: Hazards. The HIOC Project does not add to road features (e.g., sharp curves or dangerous intersections), but does add gear to the intertidal environment in Humboldt Bay. In terms of potential transportation hazards, there is the potential for interaction with recreational vessels. Recreation and shellfish aquaculture are both identified as preferred general uses in Arcata Bay (District 2007), although recreational use of the bay is mostly separated from shellfish aquaculture use by both timing and type of habitat. For example, there is an informal boat launch located approximately 1,500 feet from the nearest corner of the lease area and potential gear that would be placed in higher intertidal habitat (+1.6 feet to +4.6 feet MLLW). While recreational boaters primarily use the channels and not intertidal habitats, the addition of shellfish aquaculture gear could interfere with the movement of vessels (e.g., boats, kayaks) within those intertidal areas.

This interference would occur only when the tides are high enough for vessels to move through the intertidal areas, but so low that that the vessels couldn't move readily over the gear. Shellfish aquaculture gear proposed by HIOC would extend from the bay bottom by a maximum of 3 feet based on the height of the poles (refer to Figures 5-8 above). Tipping bags can extend slightly higher depending on tidal or wave action. This gear is likely to be exposed approximately 30% of the year, during which time boaters would be naturally restricted from the area during low tide events. When the area is inundated, shallow-draft vessels could access the HIOC Project area. Empty space among the gear would allow smaller watercraft (e.g., kayaks) to move about, but in some cases only in two directions (e.g., parallel to rows of longlines or racks). Vessel movement in subtidal areas, including in the primary navigation channels in Arcata Bay, would not be affected.

To minimize potential hazards, beds will be marked with long PVC poles. There are 12- to 15-foot rows between blocks of 4 longlines or 2 rows of racks for boats to use (i.e., boat easements), and HIOC will inform the District of the location of beds in Arcata Bay, as per BMP-4. While there may be some delays or restricted movement of vessels within specific intertidal areas, these measures are in place to avoid conflicts with recreational boaters.

BMP-4 Bed Marking. HIOC culture beds will be marked with a long PVC pole to provide information to boaters of the location of shellfish aquaculture gear. HIOC will also inform the District of the location of the beds and they will be posted on the District's website.

The HIOC Project may also result in accidental loss of shellfish aquaculture gear or other debris into Humboldt Bay. Because the equipment is placed in intertidal areas, it is subject to various natural forces including tide, wind, waves and ultraviolet radiation. As a result, there is potential for equipment to become loose, wash away or otherwise escape into the environment. Escaped shellfish aquaculture gear may pose a hazard to users of the bay, including boaters (kayakers, stand-up paddle boarders, canoers, wind surfers) and scuba divers. When encountered, marine debris associated with shellfish gear may damage boat bottoms or engines, snag on trailing lines or otherwise impair navigation. Recreational users of the bay may encounter escaped gear in shallow intertidal areas, which may then make transit of these areas more hazardous, particularly if escaped gear is wholly or partially buried in the substrate and thus hidden from view.

HIOC routinely inspects intertidal longline systems and rack and bag culture during monthly maintenance work and during harvest. Any pipes or racks disturbed during the harvest are re-secured or removed if damaged. Any identified loose pipes or debris are removed from the culture area. During replanting, pipes and racks are straightened out and replaced as needed. Debris management was incorporated into the HIOC Project as a mitigation measure:

Mit-1 Marine Debris. HIOC will implement a marine debris management plan (Appendix A). At the time of harvest of each cultivation area, HIOC will carry out a thorough inspection to locate and remove any loose, abandoned or out of use equipment and tools. All floating bags and baskets will be marked or branded with the HIOC's name and phone number.

Overall, the impacts to transportation hazards will be less than significant with mitigation incorporated.

XVIII. TRIBAL CULTURAL RESOURCES. Would the project:	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less-than-Significant Impact	No Impact
A) Would the project cause substantial adverse change in the significance of a tribal cultural resource, defined in Public Resources Code section 21074 as either a site, feature, place, cultural landscape that is geographically defined in terms of the size and scope of the landscape, sacred place, or object with cultural value to a California Native American tribe, and that is:				
i) Listed or eligible for listing in the California Register of Historical Resources, or in the local register of historical resources as defined in Public Resources. Code Section 5020.1(k), or		X		
ii) A resource determined by the lead agency, in its discretion and supported by substantial evidence, to be significant pursuant to criteria set forth in subdivision (c) of Public Resources Code Section 5024.1. In applying the criteria set forth in subdivision (c) of Public Resource Code Section 5024.1, the lead agency shall consider the significance of the resource to a California Native American tribe.		X		

DISCUSSION

Tribe-A: Tribal Cultural Resources. As discussed under cultural resources above, the HIOC Project would be implemented in intertidal areas (mudflats). While there is very little soil disturbance that would occur as part of the HIOC Project (i.e., the only soil disturbance would involve the installation of stakes and posts to support shellfish gear), there is the potential that placement of gear could disturb cultural or archeological resources. In order to protect potential impacts, HIOC would comply with the following mitigation measure:

Mit-6 Cultural Resources: HIOC will comply with the Harbor District Protocol agreed upon between the Harbor District and the Blue Lake Rancheria, Bear River Band of Rohnerville Rancheria, and Wiyot Tribes regarding the inadvertent discovery of archaeological resources, cultural resources, or human remains or grave goods (Appendix B).

The measures detailed out in Appendix B, and provided recently in the Pre-Permitting Project and Yeung Oyster Farm (SCH #2017032068), include an inadvertent discovery plan, including the following protocols:

1. The party who made the discovery shall be responsible for immediately contacting, by telephone, the District.
2. Ground-disturbing activities shall be immediately stopped if potentially significant historic or archaeological materials are discovered. Examples include, but are not limited to, concentrations of historic artifacts (e.g., bottles, ceramics) or prehistoric artifacts (chipped

chert or obsidian, arrow points, groundstone mortars and pestles), culturally altered ash-stained midden soils associated with pre-contact Native American habitation sites, concentrations of fire-altered rock and/or burned or charred organic materials, and historic structure remains such as stone-lined building foundations, wells or privy pits. Ground-disturbing HIOC Project activities may continue in other areas that are outside the discovery locale.

3. An "exclusion zone" where unauthorized equipment and personnel are not permitted shall be established (e.g., taped off) around the discovery area plus a reasonable buffer zone by the District, or party who made the discovery.
4. The discovery locale shall be secured (e.g., 24-hour surveillance) as directed by the District if considered prudent to avoid further disturbances.
5. Upon learning about a discovery, the District shall be responsible for immediately contacting by telephone the contacts listed below to initiate the consultation process for its treatment and disposition:
    a. Tribal Historic Preservation Officers (THPOs) with Blue Lake Rancheria, Bear River Band, and Wiyot Tribe; and
    b. Other applicable agencies involved in HIOC Project permitting (e.g., the Corps, California Coastal Commission, etc.).
6. In cases where a known or suspected Native American burial or human remains are uncovered, the Humboldt County Coroner (707-445-7242) shall also be notified immediately.
7. Ground-disturbing HIOC Project work at the find locality shall be suspended temporarily while the District, THPOs, a consulting archaeologist, and other applicable parties consult about appropriate treatment and disposition of the find. Ideally, a treatment plan may be decided within 3 working days of discovery notification and the field phase of a treatment plan may be accomplished within 5 days after its approval, however, circumstances may require longer periods for data recovery.
8. Any and all inadvertent discoveries shall be considered strictly confidential, with information about their location and nature being disclosed only to those with a need to know. The District shall be responsible for coordinating any requests by or contacts to the media about a discovery.
9. Ground-disturbing work at a discovery locale may not be resumed until authorized in writing by the District.
10. Final disposition of all collected archaeological materials shall be documented in a data recovery report and its disposition decided in consultation with Tribal representatives.

Therefore, potential impacts to tribal cultural resources would be less than significant with mitigation incorporated.

XIX. UTILITIES AND SERVICE SYSTEMS. Would the project:	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less-than-Significant Impact	No Impact
A) Require or result in the relocation or construction of new or expanded water, wastewater treatment or storm water drainage, electric power, natural gas facilities, the construction or relocation of which could cause significant environmental effects?				X
B) Have insufficient water supplies available to serve the project and reasonably foreseeable future development during normal, dry and multiple dry years?				X
C) Result in a determination by the wastewater treatment provider, which serves or may serve the project that it does not have adequate capacity to serve the project's projected demand in addition to the provider's existing commitments?				X
D) Generate solid waste in excess of the capacity of local infrastructure, or otherwise impair the attainment of solid waste reduction goals?				X
E) Comply with federal, state, and local management and reduction statutes and regulations related to solid waste?				X

DISCUSSION

Util-A through Util-C: Wastewater and Stormwater. HIOC Project employees would use the restrooms at the existing HIOC Hatchery Facility. The HIOC Project would not discharge wastewater or stormwater or involve consumption of water. Therefore, no impact is expected.

Util-D and Util-E: Solid Waste. The gear proposed by HIOC for the HIOC Project can be re-used for several years. However, the project would generate waste that would go to a landfill. This waste would include gear from shellfish aquaculture operations that is worn past re-use and other disposable materials. Local landfills would have the capacity to accept this relatively small amount of waste. The HIOC Project would maintain compliance with federal, state, and local statutes and regulations related to solid waste. Therefore, no impacts are expected.

XX. WILDFIRE. If located in or near state responsibility areas or lands classified as very high fire hazard severity zones, would the project:	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less-than-Significant Impact	No Impact
A) Substantially impair an adopted emergency response plan or emergency evacuation plan?				X
B) Due to slope, prevailing winds, and other factors, exacerbate wildfire risks, and thereby expose project occupants to, pollutant concentrations from a wildfire or the uncontrolled spread of wildfire?				X
C) require the installation or maintenance of associated infrastructure (such as roads, fuel breaks, emergency water sources, power lines or other utilities) that may exacerbate fire risk or that may result in temporary or ongoing impacts to the environment?				X
D) Expose people or structures to significant risks, including downslope or downstream flooding or landslides, as a result of runoff, post-fire slope instability, or drainage changes?				X

DISCUSSION

Wildfire-A through Wildfire-D: The proposed HIOC Project occurs in intertidal habitat of Arcata Bay. Due to the presence of water, the HIOC Project does not pose a risk of creating wildfires. No impact is expected.

XXI. MANDATORY FINDINGS OF SIGNIFICANCE.	Potentially Significant Impact	Less than Significant with Mitigation Incorporated	Less-than-Significant Impact	No Impact
A) Does the project have the potential to substantially degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, substantially reduce the number or restrict the range of a rare or endangered plant or animal or eliminate important examples of the major periods of California history or prehistory?		X		
B) Does the project have impacts that are individually limited, but cumulatively considerable? ("Cumulatively considerable" means that the incremental effects of a project are considerable when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects).		X		
C) Does the project have environmental effects, which will cause substantial adverse effects on human beings, either directly or indirectly?				X

DISCUSSION

Findings-A: No. With the mitigation measures described above, the HIOC Project would not degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, reduce the number or restrict the range of a rare or endangered plant or animal, or eliminate important examples of the major periods of California history or prehistory.

Findings-B: No. As generally described above, shellfish aquaculture activities do not intrinsically have significant environmental effects. The assessment above, and in Appendix D, is applicable within the context of current and other planned activities in Humboldt Bay. Improvements to water quality by having an industry that is dependent on excellent water quality conditions is a benefit to the bay overall. An assessment of cumulative effects on Arcata Bay (Appendix D) concludes that the project will not result in significant cumulative environmental effects. With the mitigation measures described throughout this IS document, the potential cumulative impacts are expected to be less than significant.

Findings-C: No. The HIOC Project would increase the amount of shellfish aquaculture in Arcata Bay and no aspect of the project is expected to cause substantial adverse effects on human beings, either directly or indirectly.

Section 5.0 Reference List

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Appendix A
Marine Debris Management Plan

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APPENDIX A: MARINE DEBRIS MANAGEMENT PLAN

Hog Island Oyster Company (HIOC) worked closely with local citizens to address marine debris management in Tomales Bay. HIOC will participate in organizing bay-wide cleanups with growers and other interested parties in Humboldt Bay. HIOC also helps organize a yearly bay clean-up event on California Coastal Clean Up Day.

The specific action items that are part of the marine debris management plan include:

- Regularly educate staff on the issues of marine debris. Ensure that all staff do not litter.
- Growers must strive to continually improve gear, so that breakage and scattering of debris is minimized
- Avoid the use of any single-use materials. Minimize waste generation, practicing the principals of reduction, re-use, recycling and recovery. Purchase materials with a long a life span, preferably reusable but at least recyclable
- Secure all buoys/floats properly to minimize loss.
- When tossing out loose bags or bundles of lightweight seed bags ensure that all bags are either heavy enough not to drift away or secured/anchored to prevent drifting or movement. All loose bags shall be secured within two weeks of being tossed out if not sooner.
- Avoid leaving tools, loose gear and construction materials on leases and surrounding area for longer than one week. All materials staged on leases shall be secured to prevent movement and or burial.
- If a culture method is unsuccessful, or is not in use for over a period of one year all materials will be promptly removed.
- At a minimum, leases and surrounding areas shall be patrolled for lost and broken gear monthly. Patrols should occur as soon as possible or at least within two-weeks of any high wind or storm event.
- Growers will participate in quarterly bay clean-ups, which include walking the bay, shoreline and wetlands, to get to hard to reach areas. An itemized list of any, and all debris (including shellfish gear), collected will be recorded and communicated to other growers. With the goal being to reduce the total volume of debris that is accumulating in Tomales Bay.
- Growers will work with and collaborate with local community and other coastal clean-up people/organizations to coordinate bay wide clean-up efforts. All trash will be collected (including non-shellfish items) at all times.
- A review of lease escrow accounts shall occur on a regular basis to ensure that adequate funds are available to clean up abandoned leases. Growers shall retain the right to perform the clean-up of any abandoned leases themselves, so as to not decrease the balance in the escrow account.

Appendix B

Protocols for Inadvertent Archaeological Discoveries for Ground Disturbing Project Permits, Leases, and Franchises

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Appendix B: Protocols for Inadvertent Archaeological Discoveries for Ground Disturbing Project Permits, Leases, and Franchises

Hog Island Oyster Company (HIOC) has a total lease area of 110 acres. Within this area, HIOC seeks permitting to cultivate oysters in up to 30 acres within a 40-acre area available for shellfish aquaculture on leased, intertidal areas in northwest Arcata Bay near the Mad River Slough. The following information was revised from recent permitting documents related to shellfish aquaculture projects in Humboldt Bay. The information and protocols described in this document are modified from the Humboldt Bay Harbor, Recreation and Conservation District (the District) documents (SCH #2015082051 and #2017032068).

Humboldt Bay is the ancestral heartland of the Wiyot Indians, whose native language is affiliated with the Algonquian language family and who had occupied the bay area for at least 2,000 years by the time the first recorded European maritime explorers entered the bay in 1806 and the first American towns were established in 1850. There are hundreds of known and undiscovered archaeological sites around Humboldt Bay that evidence Wiyot history and prehistory. Today, citizens of Wiyot ancestry are affiliated with three federally-recognized tribes located in the ancestral homeland: Blue Lake Rancheria, Bear River Band of the Rohnerville Rancheria, and the Wiyot Tribe at Table Bluff Reservation.

B.1 Applicable Laws

A number of state and federal historic preservation laws, regulations and policies address the need to manage potentially significant and/or sensitive (e.g., human remains) archaeological and Native American resources identified during permit review or discovered inadvertently.

- California Environmental Quality Act (CEQA) - Requires analysis by the Lead Agency under CEQA, to determine if a proposed project will cause a significant impact to "historical resources" including archaeological and Native American sites. Project approval may be conditional, for example, avoidance or mitigation (data recovery) of known archaeological resources, monitoring of ground disturbing activities in identified sensitive areas by local tribal representatives and/or professional archaeologists, and implementation of protocols for inadvertent archaeological discoveries.

- Section 106 of the National Historic Preservation Act (NHPA) - Requires analysis by the Lead Federal Agency and consultation with the California State Historic Preservation Officer (SHPO), Advisory Council on Historic Preservation (ACHP), culturally affiliated Native American tribes, and others, as appropriate, to "resolve adverse effects" on "historic properties" including archaeological and Native American sites. Section 106 is the key federal historic preservation law, and final approval of the undertaking may be conditional as specified in a legally binding agreement among the parties.

Several laws and their implementing regulations spell out evaluation criteria to determine what constitutes a significant site or a significant discovery:

- California Register of Historical Resources criteria (California Code of Regulations, Title 14, Chapter 3, Section 15064.5), for archaeological and Native American resources qualifying for consideration under CEQA.

- National Register of Historic Places criteria (36 CFR 63), qualifying for consideration under NHPA Section 106 and the National Environmental Policy Act (NEPA).

State laws call for specific procedures and timelines to be followed in cases when human remains are discovered on private or non-federal public land in California. It includes penalties (felony) for violating the rules for reporting discoveries, or for possessing or receiving Native American remains or grave goods:

- Section 7050.5 of the California Health and Safety Code and Section 5097.98 of the Public Resources Code (PRC) outline requirements for handling inadvertent discoveries of human remains, including those determined to be Native American with or without associated grave goods, found on private or non-federal public lands. PRC 5097.99 (as amended by SB 447) specifies penalties for illegally possessing or obtaining Native American remains or associated grave goods.

Another California law imposes strong civil penalties for maliciously digging, destroying or defacing a California Indian cultural or sacred site:

- California NHPA of 2002 (Chapter 1.76 of the PRC 5097.993 - 5097.994), imposes civil penalties including imprisonment for up to one year and/or fines up to $10,000 per violation, for persons who unlawfully and maliciously excavate upon, remove, destroy, injure, or deface a Native American historic, cultural, or sacred site that is listed or may be listed in the California Register of Historic Resources.

B.2 Standard Operating Procedures

The following standard operating procedures for addressing inadvertent archaeological discoveries shall apply to all phases and aspects of work carried out under the authority of the District for those parties that obtain a permit, lease, or franchise for projects that involve ground-disturbing activities within its jurisdiction. It shall apply as well to the District's activities involving ground disturbances. In all cases, these standard operating procedures shall apply to their respective employees, officers and agents, including contractors whose activities may potentially expose and impact significant or sensitive resources.

The intent is to avoid or minimize direct or indirect impacts to significant archaeological or Native American discoveries that may qualify for inclusion in the California Register of Historical Resources and/or the National Register of Historic Places.

These standard operating procedures are intended to serve as standard guidelines to the District for compliance with CEQA, NHPA Section 106, and NEPA requirements for considering inadvertent archaeological discoveries.

Responsibility for Retaining Services of As-Needed Professional Archaeologist

If an inadvertent discovery of archeological resources, human remains and/or grave goods occurs, the District or those parties that obtain a permit, lease, or franchise shall be responsible for retaining as-needed services of a qualified Archaeologist, meaning the individual meets the Secretary of the Interior's Professional Standards for an Archaeological Principal Investigator and/or is listed as Registered Professional Archaeologist (see website at www.rpanet.org). The professional will provide as-needed services to conduct rapid assessments of potentially significant archaeological finds discovered during the HIOC Project implementation.

Designated Points of Contact (POC) for Notification of Discoveries

The District, those entities that obtain a permit, lease, or franchise from the District, their construction contractor(s), and other applicable local, state or federal agencies shall each designate a representative who shall act as its official Point of Contact (POC) and who shall be notified immediately upon the inadvertent discovery of an archaeological find or the inadvertent discovery of human remains and /or grave goods during HIOC Project implementation.

The federally-recognized Blue Lake Rancheria, Bear River Band of the Rohnerville Rancheria, and Wiyot Tribe each has citizens that recognize Wiyot ancestry. Each Tribe's appointed Tribal Historic Preservation Officer (THPO) is designated as the POC (Table B-1) and shall be immediately notified by the District's POC should an archaeological site (with or without human remains) be inadvertently discovered. The District POC is also listed below.

Table B-1. Designated Tribal and Harbor District Points of Contact

Tribe	Address	Office Telephone	Cultural Staff*
Blue Lake Rancheria	428 Chartin Road P.O. Box 428 Blue Lake, CA 95525	(707) 668-5101x1037 Fax (707) 688-4272 Cell (530) 623-0663	Janet Eidsness, THPO
Bear River Band of the Rohnerville Rancheria	266 Keisner Road Loleta, CA 95551	(707) 733-1900x233 Fax (707) 733-1972 Cell (707) 502-5233	Erika Collins, THPO
Wiyot Tribe	1000 Wiyot Drive Loleta, CA 95551	(707) 733-5055x107 Fax (707) 733-5601	Ted Hernandez, THPO
Harbor District	601 Startare Drive Eureka, CA 95501	(707) 443-0801 Fax (707) 443-0800 Cell (707) 496-2088	Adam Wagschal, Deputy Director

*Contacts identified as of 11/24/2020
THPO = Tribal Historic Preservation Officer

B.3 Inadvertent Archaeological Discovery (General)

The general inadvertent archaeological discovery measures detailed out in this section were recently provided in the Pre-Permitting Project and Yeung Oyster Farm (SCH #2017032068), and include the following:

1. The party who made the discovery shall be responsible for immediately contacting, by telephone, the District.
2. Ground-disturbing activities shall be <u>immediately</u> stopped if potentially significant historic or archaeological materials are discovered. Examples include, but are not limited to, concentrations of historic artifacts (e.g., bottles, ceramics) or prehistoric artifacts (chipped chert or obsidian, arrow points, groundstone mortars and pestles), culturally altered ash-stained midden soils associated with pre-contact Native American habitation sites, concentrations of fire-altered rock and/or burned or charred organic materials, and historic structure remains such as stone-lined building foundations, wells or privy pits. Ground-disturbing HIOC Project activities may continue in other areas that are outside the discovery locale.
3. An “exclusion zone” where unauthorized equipment and personnel are not permitted shall be established (e.g., taped off) around the discovery area plus a reasonable buffer zone by the District, or party who made the discovery.
4. The discovery locale shall be secured (e.g., 24-hour surveillance) as directed by the District if considered prudent to avoid further disturbances.
5. Upon learning about a discovery, the District shall be responsible for immediately contacting by telephone the contacts listed below to initiate the consultation process for its treatment and disposition:
    a. THPOs with Blue Lake Rancheria, Bear River Band, and Wiyot Tribe; and
    b. Other applicable agencies involved in HIOC Project permitting (e.g., the Corps, California Coastal Commission, etc.).
6. In cases where a known or suspected Native American burial or human remains are uncovered, the Humboldt County Coroner (707-445-7242) shall also be notified immediately.
7. Ground-disturbing HIOC Project work at the find locality shall be suspended temporarily while the District, THPOs, a consulting archaeologist, and other applicable parties consult about appropriate treatment and disposition of the find. Ideally, a treatment plan may be decided within 3 working days of discovery notification and the field phase of a treatment plan may be accomplished within 5 days after its approval, however, circumstances may require longer periods for data recovery.
8. Any and all inadvertent discoveries shall be considered strictly confidential, with information about their location and nature being disclosed only to those with a need to

know. The District shall be responsible for coordinating any requests by or contacts to the media about a discovery.

9. Ground-disturbing work at a discovery locale may not be resumed until authorized in writing by the District.
10. Final disposition of all collected archaeological materials shall be documented in a data recovery report and its disposition decided in consultation with Tribal representatives.

Appendix C

Sampling Plan for Hog Island Oyster Company (HIOC) and Humboldt Bay Oyster Company (HBOC)

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SAMPLING PLAN
FOR
HOG ISLAND OYSTER COMPANY (HIOC)
HUMBOLDT BAY OYSTER COMPANY (HBOC)

HIOC TRACT A AND
HBOC 2020 SUBLEASE PARCEL
IN HUMBOLDT BAY

March 2020

I. INTRODUCTION

The main goal of this sampling plan is to define sampling criteria and conditions, including general adverse pollution condition(s) (APC), that meet standards of the National Shellfish Sanitation Program (NSSP, 2017) for a potential water quality evaluation of proposed shellfish lease area. The potential water quality evaluation is for purposes of classifying the shellfish growing area in accordance with the NSSP for the issuance of a Shellfish Growing Area Certificate. A completed certificate application for this area has not been submitted nor accepted by the California Department of Public Health (CDPH) as of March 3, 2020. CDPH classifies growing areas and assesses water quality using fecal coliform concentrations (FC) in the growing area in conformance with NSSP standards and conditions. CDPH has agreed to train and certify water quality samplers, coordinate to set up preliminary water quality stations and define general APC sampling targets. Once a completed growing area application is accepted by CDPH, a formal sanitary survey of the area including evaluations of actual and potential pollution sources can commence and the water quality data that has been collected in accordance with conditions of this sampling plan will be evaluated for purposes of classifying the area.

There are two adjacent proposed shellfish areas, HIOC Tract A (Tract A) and HBOC 2020 Sublease Parcel (Sublease Parcel). **Tract A** is a 94 acre trapezoid-shaped parcel in Humboldt Bay approximately 1,300 feet southeast of the Mad River Slough bridge (Highway 255). The area is primarily on mud flats west of the Mad River Channel. The southeastern edge of the tract enters the channel. The northern border of the tract is parallel to the south side of the Mad River Channel and the eastern border of the tract is parallel to the west side of the Mad River Channel after the first meander (bend). **Sublease Parcel** is a 20 acre L-shaped parcel that wraps around the northern and upper eastern borders of Tract A. The entire northern border of Tract A is shared with Sublease Parcel. The entire outer edge border (the side opposite to Tract A) is in the Mad River Channel.

A large tidal channel connected to the Mad River Channel enters the proposed areas near the northwest corner of the both parcels and exits approximately in the center of the western perimeter line of Tract A.

The east side of the proposed growing areas overlap portions of a currently *Conditionally Approved* classified growing area in rainfall Zone C represented by Water Quality (WQ) Sampling Station 20 and in rainfall Zone E represented by WQ 26 and WQ 25 (not shown on map). The remaining portion of the proposed area is unclassified and therefore considered *Prohibited*.

This sampling plan will use existing WQ 20 and WQ 26 for monitoring FC, along with WQ 81, established on December 2, 2019, and WQ 83, established February 25, 2020 (Table 1). These new stations are in and adjacent to the aforementioned unnamed tidal channel inside the proposed area near the western perimeter line and northwestern perimeter corner, respectively. These new stations are preliminary and may not be the final compliance stations for the growing area when it is classified. These sampling stations were selected with the intent to capture potential sources of pollution in accordance with APC sampling. After initial samples are collected, there is flexibility to target additional adverse conditions not currently defined in this plan. There may be additional pollution sources not accounted for by the preliminary stations. If there are additional pollution sources or the proposed stations are not sufficient to address all potential sources of pollution, additional WQ stations may need to be added.

A previous version of this Sampling Plan (January 2020) established WQ 82 because it was written only considering the classification request for Tract A. This version replaces WQ 82 with WQ 83 to incorporate Sublease Parcel because the position of the new station is more representative of the two areas combined.

The primary goal of this sampling plan is to evaluate water quality in the unclassified portions of Tract A and Sublease Parcel under adverse conditions. Additional goals are to compare the FC results from new stations WQ 81 and WQ 83 to existing stations WQ 20 and WQ 26 to evaluate which stations would best represent the proposed growing area. In order to compare WQ at the stations, samples should be collected from the stations on the same date and as close in time as possible. Stations 20, 26, 81 and 83 should be sampled and evaluated using the APC sampling strategy, as described in Section II. A. below.

If it is determined that stations WQ 81 and/or WQ 83 are closer to potential pollution sources and best represent the proposed growing area or additional best representative sampling stations are identified, then 30 samples from each station would need to be collected under conditions defined in Section II below, in accordance with the NSSP Model Ordinance Chapter IV @.02 requirements for a new growing area. At least 5 samples must be collected per calendar year to ensure current data is used in determining a geometric mean for classification.

For purposes of classifying the growing area, water quality monitoring can only be conducted by persons who have been trained by CDPH staff in the procedures outlined in the sampling protocol (Table 2). Samples collected by persons not trained by CDPH staff will not be used in the data set to classify the growing area.

Table 1. Water Quality Stations.

WATER QUALITY STATION	LATITUDE	LONGITUDE	DESCRIPTION
WQ Station #20	40.8588	-124.141	Mad River Channel Below First Meander
WQ Station #26	40.85376	-124.147	HIOC Tract West of Mad River Channel
WQ Station #81	40.85959	-124.1486	HIOC Tract West Tidal Channel
WQ Station #83	40.868677	-124.145613	Mad River Channel Southeast of Northwest Tidal Channel
WQ Station #82 (INACTIVE)	40.86214	-124.1465	HIOC Tract Northwest Tidal Channel (INACTIVE)

Table 2. Company Personnel Currently Certified to Collect Samples.

COMPANY NAME	CERTIFIED SAMPLER NAME	DATE OF CERTIFICATION
HBOC	Colin Goetz	October 28, 2019
HBOC	Todd Van Herpe	October 28, 2019
HIOC	Lucas Sawyer	January 13, 2020
HIOC	Justin Mojnnier	January 13, 2020
HIOC	Chad Martel	January 13, 2020

II. SAMPLING FOR *CONDITIONALLY APPROVED* EVALUATION

A. ADVERSE POLLUTION CONDITION SAMPLING

Samples to be used for evaluating the classification should be collected during adverse conditions as defined below whenever possible. Samples collected on consecutive days after a rainfall event are encouraged. This sample strategy can show how long it takes for water quality samples to reduce to acceptable levels of FC after rainfall events, if such impacts exist.

Adverse conditions are defined as:

1. Sub-threshold Rainfall: Any period of rainfall less than or equal to 0.50 inches in 24-hours as close to 0.50 inches as possible.

2. Storm Period: Any period 6 to 24 hours following a recorded moving maximum 24-hour rainfall total of 0.50 to 3.0 inches.

3. Post-storm Period: Any period 24 hours to 5 days following a recorded moving maximum rainfall total of >0.50 inches in 24 hours, on a daily basis.

    a. Samples collected more than 24 hours after a maximum recorded 24-hour rainfall total greater than 3.0 inches are useful for determining a rainfall closure length.

All samples must be collected on an Ebb (outgoing) tide. An ebb tide is defined as any period between one hour after the high tide point and up until the low tide point.

For purposes of determining the maximum moving 24-hour rainfall total, the rain gauge at the NWS Eureka California station (https://www.wrh.noaa.gov/eka/obs/getcgr.php?wfo=eka&sid=eka&obs=eka) should be used, or an alternate rain gauge selected by CDPH if the NWS gauge is unavailable.

B. ADVERSE POLLUTION CONDITION STANDARDS

The NSSP standards for the APC strategy for the *Conditionally Approved* classification are: the geometric mean cannot exceed 14 most probable number per 100 milliliters (MPN/100 ml) and no more than 10 percent of samples can exceed 43 MPN/100 ml, with a minimum of 30 samples collected and analyzed prior to evaluating the classification.

C. DRY PERIOD SAMPLING

During dry periods, samples may be collected and will count towards the minimum 30 samples for classification indicated above. No more than one sample per day may be collected per station for the classification dataset. If the proposed areas are classified but there is insufficient data to evaluate the effect of rainfall on water quality, conservative rainfall rules will be instituted and any measurable rainfall will result in closure of the areas. The conservative rainfall rules will be in place until sufficient data is collected during adverse conditions to determine alternate rainfall thresholds and closure lengths.

All samples must be collected on an Ebb (outgoing) tide. An ebb tide is defined as any period between one hour after the high tide point and up until the low tide point. Any samples not collected on the ebb tide will not be utilized in the classification data set.

III. SAMPLING PLAN PROVISIONS

The following provisions of Section III need to be met in order for collected water quality samples to be used for determining the appropriate shellfish growing area classification.

1. Hog Island Oyster Company (HIOC), Humboldt Bay Oyster Company (HBOC) or CDPH-trained designee will arrange for the collection, transportation and analysis of all samples necessary for this initial sampling of the proposed growing area in accordance with the standards and guidelines in the current edition of the NSSP Model Ordinance (2017), and for associated costs.

2. HIOC, HBOC or CDPH-trained designee will follow the applicable water sampling procedures outlined in Appendix A to this plan.

3. HIOC, HBOC or CDPH-trained designee will provide its sampling personnel with all equipment and supplies needed for sample collection, preservation, and transportation to the laboratory named below. A list of equipment and supplies needed is included in the sampling protocol provided as Appendix A to this plan.

4. Laboratory analyses will be microbiological analyses of water samples for fecal coliform bacteria according to the NSSP approved method.

5. Any laboratory utilized by HIOC, HBOC or CDPH-trained designee to perform analysis of shellfish and shellfish growing waters must be evaluated by the Food and Drug Administration or by the Environmental Laboratory Accreditation Program (ELAP) and found in conformance with NSSP provisions. The closest laboratory to the proposed area is: Humboldt County Public Health Laboratory (529 I Street, Eureka, CA 95501).

6. HIOC, HBOC or CDPH-trained designee will transport or arrange for the shipment of samples to the laboratory. Immediately after collection, samples shall be packed in an insulated cooler kept at 1°-10° C with frozen gel packs (not wet ice). The sample must arrive at the laboratory at or below the water temperature of the sample's collection site. Samples must arrive at the laboratory such that laboratory staff can begin the testing procedure within 30 hours of sample collection. It is highly preferable to have samples arrive at the laboratory within four (4) hours of collection. The submitter shall direct the laboratory to analyze samples for fecal coliform and

salinity; the latter may be omitted if the submitter can provide reliable field measurements for salinity.

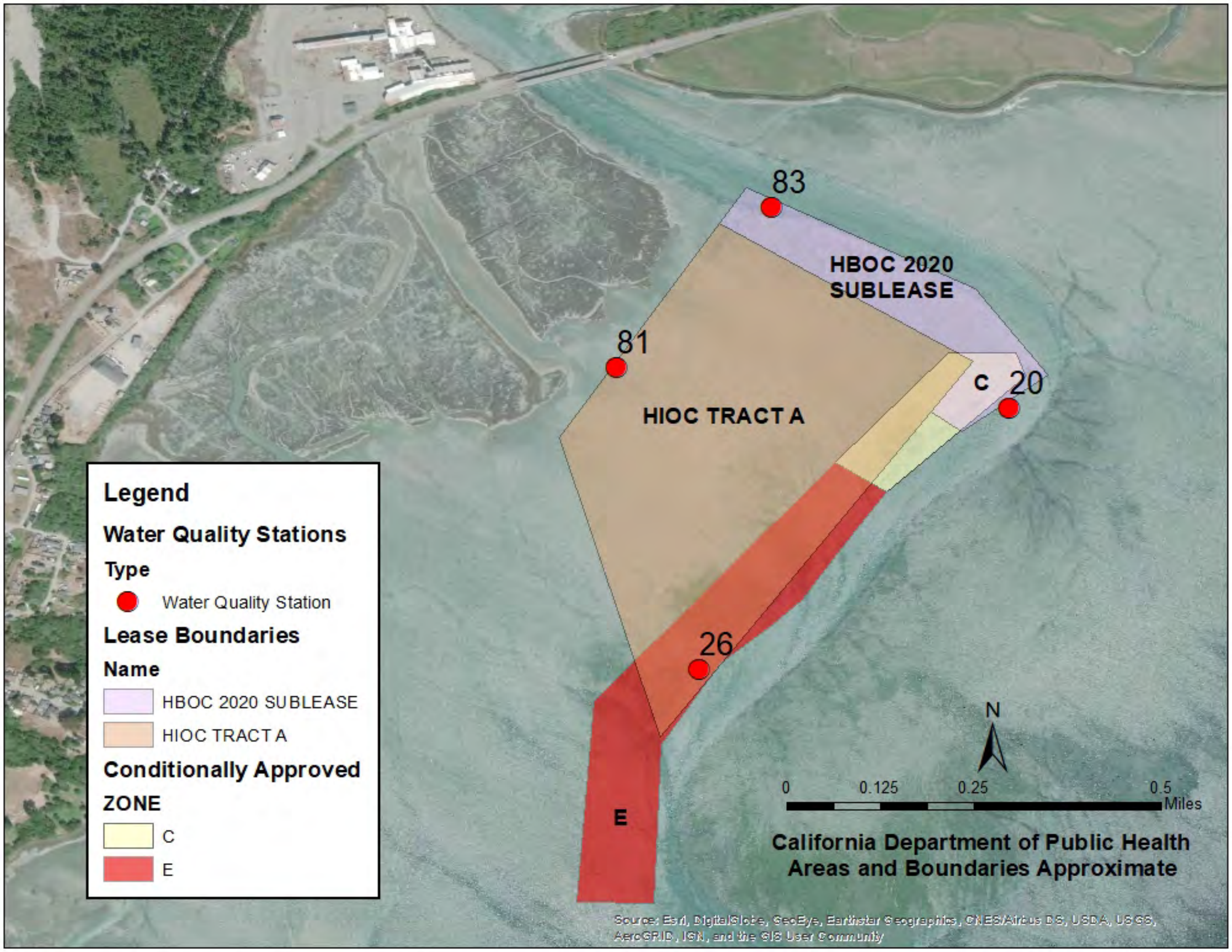
7. Upon completion of the analysis of each set of samples submitted by HIOC, HBOC or CDPH-trained designee, HIOC or HBOC will direct the laboratory to transmit a report of its results by email as soon as possible to shellfishpreharvest@cdph.ca.gov.

8. This plan may be revised by CDPH at any time because of changing conditions or other new information that it shall state in writing to HIOC and HBOC.

IV. REFERENCES

NSSP 2017. Guide for the Control of Molluscan Shellfish: 2017 Revision. National Shellfish Sanitation Program. United States Food and Drug Administration.

Figure 1. Map of the proposed areas overlaid onto the current *Conditionally Approved* area along the Mad River Channel.



APPENDIX A

WATER QUALITY SAMPLING PROTOCOL UNDER ADVERSE POLLUTION CONDITIONS

A. EQUIPMENT AND SUPPLIES NEEDED BY SAMPLER:

1. Sterile water sample bottles (approximately 110 mL or larger size) as provided by an ELAP or FDA certified laboratory, with numbered labels, one per sample plus several extras.
2. Laboratory Submission Form (Figures 2 and 3).
3. Water sampling pole (a broom handle with a radiator hose clamp bolted to one end to hold a sample bottle is sufficient).
4. Water thermometer, Celsius, capable of reading to nearest 1/2 degree.
5. Water bucket (optional).
6. Cooler or insulated shipping container with frozen gel packs.
7. Clipboard or other writing surface.
8. Pen or pencil.
9. Watch.
10. Sample station map.
11. Vessel in safe operating condition with required safety and personal flotation equipment.

NOTE: Appropriate sample bottles and lab slips may be obtained from the certified shellfish laboratory at which grower has established an account.

B. WATER SAMPLING PROCEDURES (INSTRUCTIONS TO SAMPLER)

1. General Requirements

   a. Collect samples at Water Quality Stations 81, 83, 20 and 26 under conditions according to Section II of this Sampling Plan.

   b. All samples should be collected on an Ebb (outgoing) tide. An ebb tide is defined as any period between one hour after the high tide point and up until the low tide point.

   c. Provide ample notification to selected laboratory to ensure that the scheduled sample(s) will be analyzed. Provide the following information: type (e.g. shellfish growing water) and number of samples you will send, date and approximate time of delivery to lab.

   d. Ensure that enough sterile sample bottles and Laboratory Submission Forms are on hand. Any sample bottles on hand must be stored in a clean, dry place free of vermin or other possible source of contamination.

e. If weather or other conditions are hazardous, postpone sampling until the next safe opportunity (appropriate tide when growing area is open). If a sampling is postponed, notify the laboratory as soon as possible by telephone.

2. Sample Collection Procedures

a. Carefully remove cap and hold in one hand so inside surfaces of cap and bottle are not touched or otherwise contaminated.

b. Avoiding visible debris or floating material, dip bottle underwater, mouth down, and with a slow sweeping motion to one side, turn bottle right side up to fill. Take sample beneath the surface about six inches and no deeper than one foot.

c. Bring bottle to surface and tip out a little water to produce a small, about one-quarter inch, amount of air space.

d. Carefully replace cap, without contaminating the sample, and screw on tight. If a sample bottle accidentally becomes contaminated, do not use; sample with another bottle and discard contaminated bottle.

e. Record on the Laboratory Submission Form the station number, sampling time and bottle cap number.

f. Place sample bottle in cooler. Use frozen gel packs in cooler, not wet ice, to avoid possible contamination of sample from contact with melt water.

g. Collect an additional sample at the first station and label it "Temperature Blank". This sample should be handled identically to all other samples. Upon receipt of the samples, the laboratory will check the temperature of the Temperature Blank to ensure it is within the proper temperature range.

h. Record water temperature at each station, to the nearest 1/2 degree Celsius, and salinity, if applicable. Take temperature of water collected in a bucket or alongside boat; do not insert thermometer or anything else into sterile sample bottle.

i. Complete the Laboratory Submission Form for each group of samples.

j. Transport or ship samples so they are delivered to the laboratory as soon as possible, and no more than 24 hours after first sample was collected (maximum holding time is 30 hours for lab processing). Samples should be kept in a cooler with frozen gel packs or placed in a refrigerator adjusted to a temperature of 4° Celsius (39° F). Samples must be held in a container capable of maintaining a temperature of 1° - 10° C (Do not use wet or dry ice). The sample must arrive at the laboratory at or below the water temperature of the sample's collection site (measured in step 2.h.).

Any questions regarding this sampling plan should be directed to Steve Etter at (510) 412-4631 or Steve.Etter@cdph.ca.gov or mailed to: Environmental Management Branch, California Department of Public Health, 850 Marina Bay Parkway, MS G165, Richmond, CA 94804.

Figure 2. Example of HBOC Humboldt County PHL laboratory submission form.

HUMBOLDT COUNTY PUBLIC HEALTH LABORATORY

ELAP CERTIFICATION # 2033
JEREMY CORRIGAN, LABORATORY MANAGER
529 I Street Eureka, CA 95501, Phone:(707) 268-2179, Fax: (707) 445-7640
Email: HCPHL@co.humboldt.ca.us

Water Chain of Custody for **Humboldt Bay Oyster Company** **Client# 97**

Collected By:	**FOR LAB USE ONLY**
Date/ Time Delivered:	Received By:
Delivered By:	Date/ Time Received:
Phone:(707) 442-2727 Primary Contact Todd Van Herpe Cell: (707) 499-2388	Scan & email a copy of results to: terry@hogislandoysters.com, lucas@hogislandoysters.com, hboc@suddenlink.net, and the CDPH Group

Lab Test #	Lab Sample Location #	BOTTLE # No Neutralizer	Date/Time Collected	Site# Sampled	Site Salinity g/100g	Site Temp °C	Sample Type/ Test
	23338			20			Sea Water/ A-1 15 tube MTF
	23339			26			Sea Water/ A-1 15 tube MTF
	23340			81			Sea Water/ A-1 15 tube MTF
	23627			83			Sea Water/ A-1 15 tube MTF

Comments/ other:

☐Check here if samples received on ice	Temp Blank Bottle #	Date/Time Collected	Initials: Temp (1°C-10°C):	**Temperature Control** ☐**SN:112008318 LAB** ☐**SN:112008370 Rm 135**

Figure 3. Example of HIOC Humboldt County PHL laboratory submission form.

HUMBOLDT COUNTY PUBLIC HEALTH LABORATORY
ELAP CERTIFICATION # 2033
JEREMY CORRIGAN, LABORATORY MANAGER
529 I Street Eureka, CA 95501, Phone:(707) 268-2179, Fax: (707) 445-7640
Email: HCPHL@co.humboldt.ca.us

Water Chain of Custody for **Terry Sawyer, Hog Island Oyster Company Client# 338**

Collected By:	**FOR LAB USE ONLY**
Date/ Time Delivered:	Received By:
Delivered By:	Date/ Time Received:
Phone:(415)669-1149 Phone: (415) 609-6514 Primary Contact Lucas Sawyer Cell: (415) 250-0217	Scan & email a copy of results to: terry@hogislandoysters.com, lucas@hogislandoysters.com, hboc@suddenlink.net, and the CDPH Group

Lab Test #	Lab Sample Location #	BOTTLE # No Neutralizer	Date/Time Collected	Site# Sampled	Site Salinity g/100g	Site Temp. °C	Sample Type/ Test
	23338			20			Sea Water/ A-1 15 tube MTF
	23339			26			Sea Water/ A-1 15 tube MTF
	23340			81			Sea Water/ A-1 15 tube MTF
	23627			83			Sea Water/ A-1 15 tube MTF

Comments/ other:

☐Check here if samples received on ice	Temp Blank Bottle #	Date/Time Collected	Initials: Temp (1°C-10°C):	Temperature Control ☐SN:112008318 LAB ☐SN:112008370 Rm 135

Appendix D
Cumulative Impacts Analysis

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Appendix D: Cumulative Impacts Analysis

Section 15130 of the California Environmental Quality Act (CEQA) Guidelines states that cumulative impacts shall be discussed where they are significant. This analysis will cover the following topics where there was more than "no impact" identified in the Hog Island Oyster Company (HIOC) Project Initial Study (IS):

- aesthetics
- air quality
- biological resources
- cultural resources
- geology and soils
- greenhouse gas emissions
- hazards and hazardous materials
- hydrology and water quality
- noise
- transportation
- tribal cultural resources

CEQA Guidelines further state that the cumulative impacts analysis shall reflect the level and severity of the impact and the likelihood of occurrence, but not in as great a level of detail as that necessary for the project alone. Section 15355 of the Guidelines defines cumulative impacts to be "two or more individual effects which, when considered together, are considerable or which compound or increase other environmental impacts." Cumulative impacts represent the change caused by the incremental impact of a project when added to other proposed or committed projects in the vicinity.

The CEQA Guidelines (Section 15130[b][1]) state that the information utilized in an analysis of cumulative impacts should come from one of two sources:

1) A list of past, present, and probable future projects producing related cumulative impacts, including, if necessary, those projects outside the control of the agency; or

2) A summary of projections contained in an adopted general plan or related planning document designed to evaluate regional or area-wide conditions.

D.1 Overview of Shellfish Aquaculture in Arcata Bay

Potential cumulative impacts for the 30-acre HIOC Project are limited to Arcata Bay. In Arcata Bay, currently, there are five other companies that farm approximately 287 acres of intertidal shellfish and 90 raft structures, or approximately 2 acres, of subtidal shellfish areas (Figure D-1; Table D-1). Note that there are additional proposed shellfish aquaculture projects and recently approved projects included in this cumulative impacts analysis, as described in detail below. These additional projects are also identified on Figure D-1 and Table D-1.

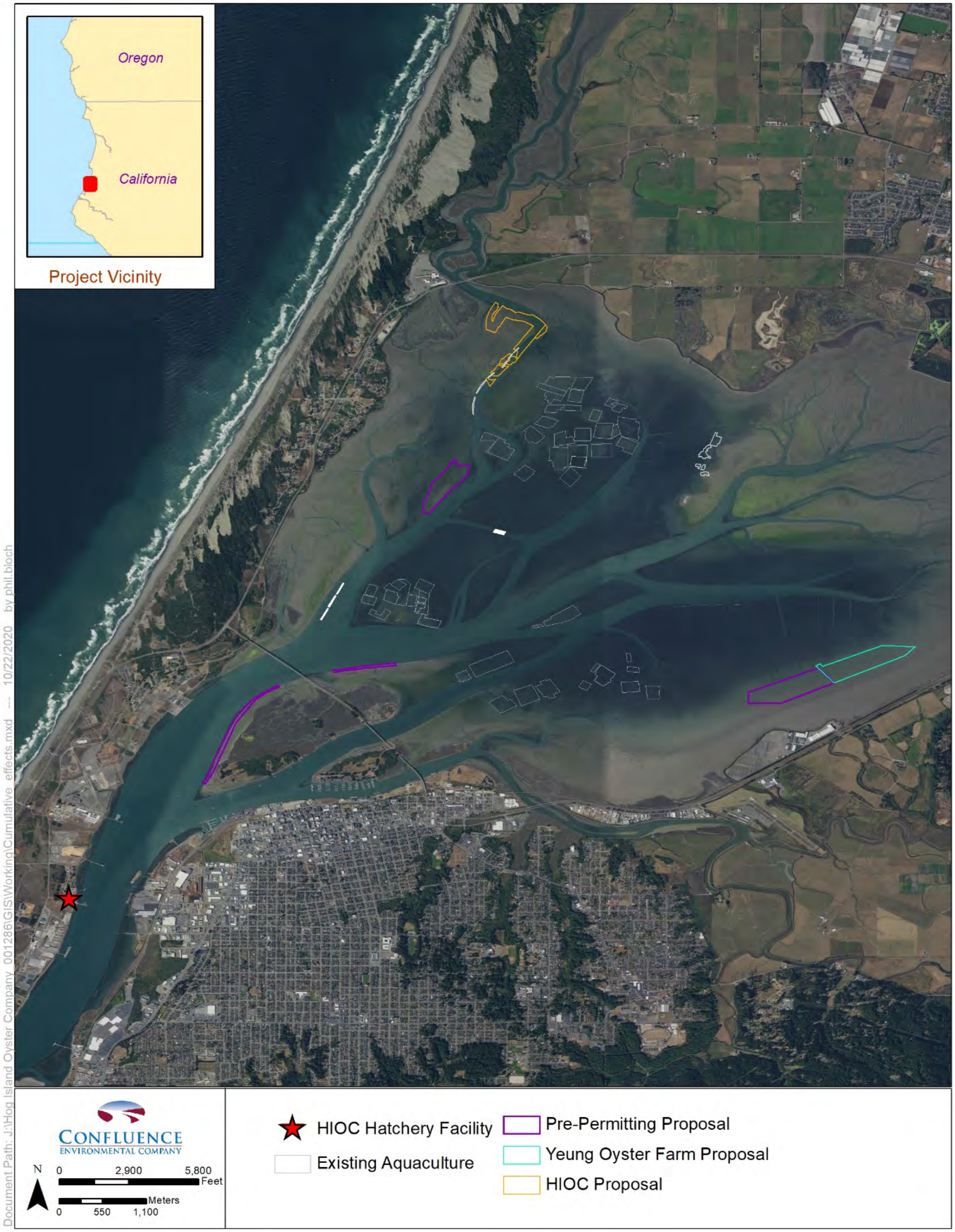

Figure D-1: Existing and Proposed Shellfish Aquaculture in Humboldt Bay.

Table D-1. Existing and Proposed Shellfish Aquaculture Activities in Arcata Bay

Project	Status	Intertidal Area	Subtidal Rafts
Pacific Project*	Existing	279 acres**	35 rafts (~0.8 acres)
Other Companies	Existing	8 acres	55 rafts (~1.2 acres)
HIOC Project	Proposed	30 acres	0 rafts
Yeung Oyster Farm	Proposed	46 acres	0 rafts
Pre-Permitting Project	Proposed	90 acres	20 acres***
Total Existing & Proposed		453 acres	90 rafts (~2 acres) and 20 acres of additional subtidal culture

* Pacific (or Pacific Seafood Company – previously known as Coast Seafoods Company)
** Pacific is currently reducing its intertidal area from 293 acres to 279 acres.
*** There are 20 acres available for culture but only 3.1 acres of maximum allowable surface area for subtidal rafts identified in District (2015).

In addition to the HIOC Project, there are two other proposals to expand intertidal and subtidal shellfish culture operations in Arcata Bay: (1) the Yeung Oyster Farm, and (2) the Humboldt Bay Harbor, Recreation and Conservation District's (District's) Mariculture Intertidal Pre-Permitting Project (Pre-Permitting Project). Both the Pre-Permitting Project and Yeung Oyster Farm are being analyzed in the same Draft Environmental Impact Report (DEIR) under SCH #2017032068. According to District (2020), the Pre-Permitting Project and Yeung Oyster Farm would increase production of Kumamoto oysters (*Crassostrea sikimea*) and Pacific oysters (*Crassostrea gigas*) by up to 136 acres in Arcata Bay. Finally, the Humboldt Bay Harbor, Recreation and Conservation District (the District) has approved 20 acres of subtidal culture for shellfish nurseries and native macroalgae in Arcata Bay (District 2015; SCH #2013062068), which includes a maximum of 3.1 acres of allowable surface area for subtidal rafts.

Culture methods used by HIOC and other companies are similar, and include a variety of intertidal longline systems and rack and bag culture. Longline culture is the dominant form both currently used and proposed in Arcata Bay, using a combination of cultch-on-longline, SEAPA baskets, and tipping bags. While tipping bags are not currently used in the bay, they are considered similar to SEAPA baskets in terms of potential interactions with the environment. There are also several areas that use rack and bag culture as an alternative to intertidal longline systems, although this represents a smaller portion (approximately 2.3% of acreage proposed or approved for aquaculture) of the culture methods used. Finally, subtidal culture (raft culture) or oyster wet storage on pallets in intertidal areas are used for either a nursery area to boost the size of oysters prior to planting or for maturing Manila clam seed. Manila clam seed is only allowed in subtidal culture areas of Humboldt Bay. Note that this cumulative impacts analysis focuses on the intertidal areas of Arcata Bay rather than the subtidal culture areas in both Arcata and Entrance bays. There is no subtidal culture proposed by HIOC.

The cumulative amount of potential human presence would also increase with the various shellfish aquaculture activities. The HIOC Project would result in approximately two additional roundtrip vessel trips per week to maintain the proposed oyster beds. On a very broad scale, over a 15- to 20-acre area, shellfish aquaculture operations include approximately 1 hour per week for operation, maintenance, planting, and harvesting. This activity is concentrated primarily during the low tidal cycle, so there would be 4 to 6 hours of activity a day during a typical weeklong tide run in multiple locations of Arcata Bay. Comparatively, there can be some activity when oyster plots are inundated at shallow depths (e.g., harvesting), but it is more limited compared to when the plots are exposed and "dry."

The general timelines provided in the District Humboldt Bay Mariculture Pre-Permitting Project Draft Environmental Impact Report (District 2020), as modified, can be applied to all shellfish aquaculture projects in Arcata Bay (Table D-2). Note that the information was simplified to encompass the variety of methods used in the bay. While these timelines provide some basic estimates that can be used in the cumulative impacts analysis, it is also important to understand that activities are spread throughout the bay and at varying times of the year. This provides natural staggering of activities and spatial variation for short-term impacts to the surrounding environment. Similarly, farms are not installed all at the same time. For example, the HIOC Project would be installed over a 5-year period. Similar timeframes would be expected for the Yeung Oyster Farm and Pre-Permitting Project.

Table D-2. Frequency of Activity by Intertidal Culture Method

Method	Type of Visit	Area (acre)	# of Visits per Year	Frequency
Longlines	Install Lines	443	0.2	Once every 5 years
	Inspections/ Grade Oysters		12	Once per month
	Plant and Harvest		0.5	Plant and harvest once per 2 years
Rack and Bag	Place Racks	10	0.2	Once every 5 years
	Inspections		12	Once per month
	Plant and Harvest		0.5	Plant and harvest once per 2 years
Source: modified from District 2020				

D.2 Shellfish Aquaculture and Aquatic Habitats in Humboldt Bay

The cumulative amount of potential spatial overlap with habitat in Arcata Bay from existing culture, the HIOC Project, Yeung Oyster Farm, and Pre-Permitting Project is equivalent to approximately 7.2% of the eelgrass habitat (out of 3,983 acres) and 6.2% of the intertidal habitat (out of 7,354 acres) overall (Table D-3). Note that in the table below, the habitat categories add up to 6,789 acres, which does not include saltmarsh habitat for the intertidal areas overall because there is no overlap between saltmarsh and shellfish aquaculture It is important to understand that overlap with habitat is not a quantification of impact because impacts occur in discrete areas of each culture area.

Table D-3. Overlap of Existing and Proposed Shellfish Aquaculture with Habitats in Arcata Bay

Area	Habitat	
	Mudflats	Eelgrass
Arcata Bay (including Mad River and portions of Central Humboldt Bay) (acre)	2,802.4	3,984.0
Culture Area (acre)	165.8	286.5
Percentage with Shellfish Culture (%)	5.9%	7.2%
Source: NOAA 2012, District 2016, District 2020		

D.3 Cumulative Impacts: Aesthetics

Existing and proposed shellfish aquaculture in Arcata Bay will have similar impacts on aesthetics compared to the HIOC Project considered individually. Aquaculture gear is low profile, produces minimal glare, is often submerged, and the use is consistent with the character of Arcata Bay. Because shellfish aquaculture has to occur at a specific depth in the bay (typically between -2 feet and +4.6 feet mean lower low water [MLLW]), there are often operations next to each other. That is the case with the HIOC Project, the Yeung Oyster Farm, and many areas proposed for the Pre-Permitting Project, in that new areas used for shellfish aquaculture operations would be adjacent to another operation. Another important consideration for aesthetics is that the Pacific Project is currently reducing from 293 acres down to 279 acres used for shellfish aquaculture. While there are some areas that are being proposed to increase in use for shellfish aquaculture within Arcata Bay, there are other areas (especially within eelgrass) that have reduced in terms of aquaculture gear and human presence. In general, shellfish aquaculture gear has limited visibility from most public vantage points, even when culture is adjacent to roadways and bridges, as is the case for the HIOC Project. Therefore, under cumulative conditions, this impact is expected to be less than significant.

D.4 Cumulative Impacts: Air Quality

Existing and proposed shellfish aquaculture in Arcata Bay will have similar air quality impacts as the HIOC Project. All aquaculture activities are expected to comply with adopted air quality plans and North Coast Unified Air Quality Management District (NCUAQMD) regulations with respect to particulate matter. The same best management practices (BMPs) proposed for the HIOC Project would be expected for other shellfish companies.

BMP-1 Vessel Maintenance and Fueling: HIOC will maintain all vessels used in culture activities to limit the likelihood of release of fuels, lubricants, or other potentially toxic materials associated with vessels due to accident, upset, or other unplanned events.

HIOC will use marine grade fuel cans that are refilled on land, and HIOC carries oil spill absorption pads and seals wash decks or isolates fuel areas prior to fueling to prevent contaminants from entering the water.

BMP-2 Vessel Motors: HIOC will use highly efficient 4-stroke outboard motors. All motors will be muffled to reduce noise.

Overall, vessel use at the level expected for all existing and proposed shellfish aquaculture activities would still contribute only minor amounts of particulate matter. Therefore, under cumulative conditions, this impact is expected to be less than significant.

D.5 Cumulative Impacts: Biological Resources

This section considers the following cumulative impacts: (1) habitats, (2) benthic communities, (3) carrying capacity, (4) structures and fish, (5) green sturgeon, (6) salmonids, (7) Pacific herring, (8) black brant, (9) roosting birds, (10) nesting birds, (11) wigeon and other waterfowl, (12) migratory birds, and (13) marine mammals.

D.5.1 Habitats

The intertidal footprint of existing and proposed shellfish aquaculture in Arcata Bay is provided in Table D-3. The HIOC Project will avoid adding gear to eelgrass beds, including use of a 5 meter (16-foot) buffer from eelgrass beds, but will be located on mudflats near the Mad River Slough. The Pacific Project (i.e., the largest area of shellfish aquaculture in Arcata Bay) is located primarily in eelgrass beds. Other shellfish farms, both existing and proposed, are primarily located outside of areas with eelgrass, although there are smaller existing farms that occur in eelgrass beds. The addition of shellfish aquaculture gear can have implications for changes to both mudflat and eelgrass habitats, as discussed below.

The cumulative amount of shellfish aquaculture activities in unstructured (mudflat) habitat would be approximately 165.8 acres or 5.9% of the available habitat (refer to Table D-3). While tidal currents are one of the forces that contribute to sediment transport and sediment distribution, studies have shown that sediment transport within channels and adjacent to channels is more active than over mudflats (Banas and Hickey 2005, Forrest et al. 2009). Oyster longline plots, and other types of intertidal culture methods (e.g., rack and bag systems), are sited away from channels and high enough in tidal elevation on the mudflats that they will not interact significantly with sediment being transported in the channels. In addition, mudflat sediments are relatively cohesive and are not readily eroded by tidal currents.

Erosion and deposition near shellfish aquaculture gear is possible, but these small-scale processes are difficult to quantify. Rumrill and Poulton (2004) found that sediment deposition occurred in the vicinity of oyster cultch-on-longlines, while no deposition occurred in control plots. Sediment build-up was evident around PVC stakes, with soft, flocculant material deposited. These disruptions are expected to be highly localized and consistent with the existing range of normal storm/wave activity. Similarly, microtopographic changes in intertidal beds may occur in areas used for frequent access by workers walking across the tideflats. These changes may result in ponded areas near near-bottom aquaculture, but are insignificant on a landscape scale compared to sediment distribution from storm events (Figure D-2).

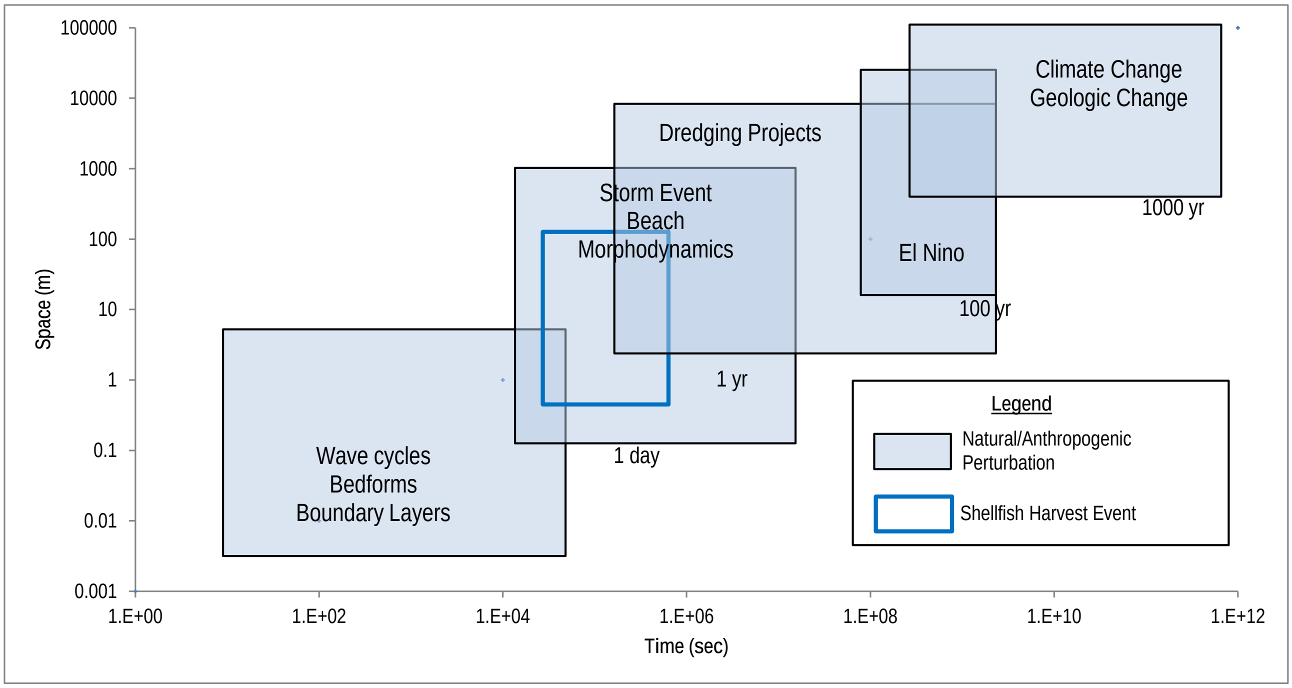

Figure D-2: Scale and Frequency of Factors that Influence Sediment Distribution
Source: de Vriend 1991

Dumbauld et al. (2015) suggested that shellfish aquaculture creates short-term 'pulse' disturbances that may alter the benthic substrate in intertidal areas in a manner consistent with storm events. Figure D-2 is a representation modified from de Vriend (1991) of this type of sediment disturbance compared to the scale and frequency of natural events or another anthropogenic disturbance like a dredging project. Dumbauld et al. (2015) reported that the magnitude of temporary effects from shellfish aquaculture is within a range where natural recovery is anticipated to occur relatively quickly, especially because it is within a type of environment that is dynamic in nature (e.g., intertidal areas that are constantly affected by waves, wind, and tidal energy). While sediment dynamics respond to a variety of influences over time, existing data suggests that sediment changes due to shellfish aquaculture are likely minor in relation to natural sediment dynamics that drive the geophysical structure and functions of nearshore habitats (Forrest and Creese 2006, Forrest et al. 2009).

The cumulative amount of shellfish aquaculture activities in eelgrass habitat would be approximately 286.5 acres or 7.2% of available habitat (refer to Table D-3). There are two studies that have been conducted on a large scale that have looked at the relationship between eelgrass and shellfish aquaculture: (1) Dumbauld and McCoy (2015) in Willapa Bay, and (2) Merkel and Associates (2020) in Humboldt Bay. Willapa Bay is similar to Humboldt Bay in many respects.

For example, it has a large tidal exchange, well-mixed water column, is relatively shallow (62% is intertidal), and has nine small rivers contributing to the total watershed. Most importantly, there is significant overlap between shellfish aquaculture and eelgrass habitat in Willapa Bay. Continuous eelgrass habitat covers up to 38% of the bay, and shellfish aquaculture overlaps with up to 22% of the bay (Dumbauld and McCoy 2015).

Dumbauld and McCoy (2015) modeled eelgrass density in Willapa Bay, Washington. A number of parameters were modeled, including: (1) distance to mouth, (2) distance to channel, (3) salinity, (4) elevation, (5) cumulative wave stress, and (6) shellfish aquaculture. The model results indicated that eelgrass density was lower in oyster aquaculture beds, but the impact directly associated with aquaculture represented less than 1.5% of the total predicted eelgrass in Willapa Bay. This is related to variable timing and spatial extent of activities in Willapa Bay, where there is recovery in areas that experience impacts before additional impacts occur, and impacts occur in small portions of the bay that allow for recovery of the eelgrass habitat overall. Further, this minor change may be offset by other important ecological functions provided. This has been raised through several studies and reviews that recognize there are tradeoffs associated with shellfish aquaculture, but the benefits to species that use the habitat predominantly outweigh the minor impacts and recovery cycle (Forrest et al. 2009, NMFS 2016, Ferriss et al. 2019, Corps 2020).

Preliminary observations from monitoring being carried out for the Pacific Project indicate that eelgrass area increased at all sites throughout the bay from 2018 to 2019, including both culture and reference sites (Merkel and Associates 2020). There was no detectable effect of the introduction of culture in areas with eelgrass on eelgrass cover. Preliminary evaluation of the effect of longlines with SEAPA baskets and cultch-on-longlines on eelgrass density (turions per square meter) indicate that there may be reduced eelgrass densities in areas where longlines are installed in eelgrass, although this effect may be related to natural fluctuation of eelgrass within Humboldt Bay. Eelgrass distribution in Humboldt Bay is partially controlled by tideflat elevation, and several sites being monitored as part of the Pacific Project are at or near the maximum elevation for eelgrass in Humboldt Bay. The expansion or contraction of eelgrass at this upper margin may be controlled by weather and tide conditions throughout the year.

There are short-term habitat changes associated with shellfish aquaculture both in mudflats and eelgrass beds, but these changes do not significantly alter the function of that habitat. This is what Dumbauld et al. (2015) described as "pulse impacts." In other words, there are short-term impacts associated with shellfish aquaculture in eelgrass beds, such as disturbance during a harvest event, but it does not result in a permanent change to the system compared to adding a dike or levee (termed by Dumbauld et al. 2015 as a "press impact"). Eelgrass grows in and around shellfish aquaculture gear and mudflats function in a similar manner but with added structure to the system. Notably, unlike the shellfish farms evaluated in the Dumbauld et al. (2015) and Merkel and Associates (2020) studies, the HIOC Project does not propose to cultivate shellfish in eelgrass beds. Additional changes associated with adding gear to Arcata Bay is provided below in relation to benthic communities, fish, birds, and marine mammals.

In addition to the research that indicates these impacts would be minimal on a landscape scale, there are also avoidance measures that would be used by HIOC to mitigate for potential impacts to mudflats and eelgrass habitat. These include:

Mit-1 Marine Debris: HIOC will implement a marine debris management plan (Appendix A). At the time of harvest of each cultivation area, HIOC will carry out a thorough inspection to locate and remove any loose, abandoned or out of use equipment and tools. All floating bags and baskets will be marked or branded with the HIOC's name and phone number.

Mit-2 Eelgrass Protection: HIOC will install racks, intertidal longline systems, and other aquaculture gear at least 5 horizontal meters (or 16 feet) from native eelgrass (*Zostera marina*). This will not prevent continued cultivation in areas where eelgrass moves into the project site.

HIOC is expected to install gear incrementally. Before gear is installed in new areas, eelgrass will be mapped in culture areas using unmanned aerial vehicles (UAV) and/or verified using ground surveys to identify eelgrass beds and establish 5 meter horizontal buffers. Eelgrass surveys will be considered valid pre-installation surveys if performed less than 2-years prior to gear installation.

Mit-3 Vessel Anchors: HIOC will anchor vessels away from eelgrass plants.

Mit-4 Vessel Routes: HIOC will establish a vessel route to access its leases that avoids known native eelgrass (*Z. marina*) beds.

Upon incorporation of these mitigation measures, the HIOC Project is not expected to contribute to cumulative eelgrass impacts in Arcata Bay.

Buffers from existing eelgrass beds have been developed as a protective measure based on the potential for eelgrass seed dispersal, observed eelgrass bed annual expansion, and the distance at which plants are genetically different (Ruckelshaus 1994, Ruckelshaus 1996, and Washington DNR 2013). These metrics suggest that eelgrass beds are expected to expand a maximum of 4 to 5 meters per year. Therefore, the expectation is that activities that are more than 4 or 5 meters away from eelgrass beds are beyond the annual colonization potential of the eelgrass bed thereby protecting the bed from direct impacts and providing a buffer for potential expansion of the eelgrass bed. In evaluating shellfish aquaculture in Washington State, NMFS determined that shellfish aquaculture incorporating the proposed buffer "is not expected to diminish eelgrass density or function of existing eelgrass" (NMFS 2016).

Shellfish companies also avoid eelgrass or minimize impacts in eelgrass habitat by rotating their farmed footprint. For areas where cultivation occurs directly in eelgrass, there are measures used to minimize impacts to eelgrass. These include:

- Financial contributions to regional restoration efforts

- Contribute to improving water quality by requiring regional wastewater treatment to meet regulatory requirements
- Relocation of existing/ongoing aquaculture away from high value fish, bird or eelgrass use areas in Humboldt Bay
- Increased longline spacing (i.e., 10 feet) in existing or new aquaculture areas

Based on the above analysis, under cumulative conditions, impacts to habitat are expected to be less than significant with mitigation.

D.5.2 Benthic Communities

Adding structure to mudflat and eelgrass habitats can change the composition of benthic communities. The majority of studies related to changes from increased biodeposition and the resulting changes to community structure are related to rack and bag culture in France, which consists of culture at densities that far exceed what is proposed on a cumulative basis in Arcata Bay. For example, the areal extent of culture in Pertuis Charentais (SW France), which includes Marennes-Oléron Bay, extends over 9,884 acres (Bouchet and Sauriau 2008), which is orders of magnitude greater than what is proposed for the cumulative amount of intertidal aquaculture in Arcata Bay (~452 acres). Even in these estuaries where oyster culture encompasses a large portion of the estuary, there is not a clear indication that effects are negatively affecting the stability of the benthic communities (Leguerrier et al. 2004).

Rumrill and Poulton (2004) investigated differences in the benthic invertebrate community between near-bottom oyster cultch-on-longline plots, eelgrass control plots, and eelgrass reference sites in Arcata Bay. Results of the study showed that invertebrate biomass was highest in the near-bottom oyster longline plots and lowest in some of the eelgrass reference sites. It was also noted that invertebrate biomass was lowest in on-bottom oyster sites that had been suction dredge harvested. Note that this was a historical method used in Humboldt Bay before culture transitions to near-bottom methods using longlines and rack and bag systems.

In addition to biomass, Rumrill and Poulton (2004) reported that the composition of the invertebrate communities was not significantly different between the near-bottom cultch-on-longline plots and eelgrass control plots. This study provides evidence that oyster longline aquaculture in eelgrass habitat does not significantly change the species composition compared to eelgrass habitat. This same conclusion was also noted in Dumbauld et al. (2009), indicating that the similarity of benthic infaunal abundance in the culture plots compared to eelgrass plots in Willapa Bay, Washington: "may have arisen not simply due to flow dispersing biodeposits, but because both aquaculture and control areas included eelgrass, which has characteristic effects on sediment." In other words, the presence of eelgrass was the primary determinant in benthic invertebrate abundance and not the added structure related to the longline gear.

In a more recent study of the benthic invertebrate community in Arcata Bay, Confluence et al. (2019) reported that invertebrate communities are not significantly affected by the presence of aquaculture gear. Taxa abundance was analyzed by habitat pair and season. The results suggested that there were not significant differences in mean number of taxa, with and without aquaculture for eelgrass habitat (Figure D-3). In the winter, there was slightly higher total taxa in areas without aquaculture, but this relationship was not significant. Compared to eelgrass habitat, there were larger differences in mean number of taxa within habitat pairs for mudflat habitat, with higher numbers of taxa sampled from areas with aquaculture compared to areas without aquaculture. This information suggests that near-bottom aquaculture potentially has positive changes associated with the addition of shellfish aquaculture gear in mudflat habitat and limited changes for eelgrass habitat, although overall the functions of habitat with and without gear area maintained for the benthic invertebrate communities.

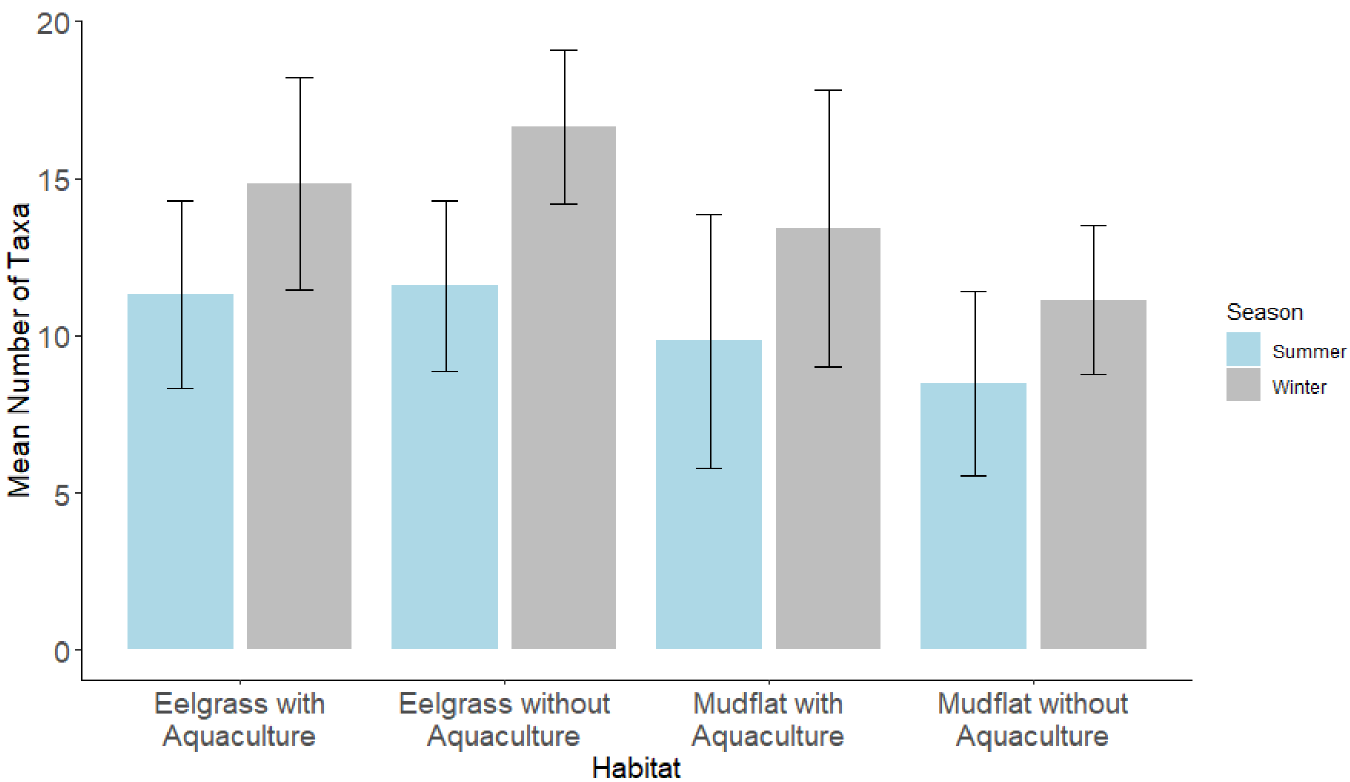

Figure D-3: Invertebrate Taxa Encountered with Each Habitat Pair by Season

Source: Confluence et al. 2019

Note: error bars represent standard deviation in mean number of taxa

Several studies agree with these conclusions, including a study in Chesapeake Bay, Virginia, which looked at benthic invertebrates as an indication of ecological health associated with over 15 acres of floating and on-bottom culture gear (Kellogg et al. 2018). The study found no significant negative impacts on the benthic invertebrate community structure from the presence of gear or oysters, and number of invertebrates inside the farm sites were higher compared to outside.

Invertebrate communities are used as a measure of ecological health within the system. Shellfish aquaculture operations affect invertebrate communities in both negative and positive ways. Most of the literature indicates that, while there are changes to communities, these changes are considered temporary negative changes (i.e., pulse disturbance with a short-term recovery) and longer positive changes in terms of the functions that are provided to higher organisms (e.g., prey for fish and wildlife). These positive changes may also include increased species diversity and species abundance as compared with similar habitats without shellfish aquaculture. The existing literature for Humboldt Bay and other studies associated with shellfish aquaculture support the conclusion that cumulative impacts to benthic communities are expected to be less than significant.

D.5.3 Carrying Capacity

Carrying capacity, also termed "ecological carrying capacity," is defined by Ocean Studies Board and NRC (2010) as:

> *The stocking or farm density above which 'unacceptable ecological impacts' begin to manifest. From a practical standpoint, this process begins with the level of culture that can be supported without leading to significant changes to ecological processes, species, populations or communities in the growing environment.*

There are examples where estuaries have been overstocked on occasion (e.g., Marennes-Oléron Basin), which resulted in poor growth and high mortality of the oysters (Bouchet and Sauriau 2008). The stocking densities in the Marennes-Oléron Basin were orders of magnitude higher than what is proposed in Humboldt Bay, even on a cumulative scale. It is in the oyster farmer's (and regulatory body's) interest to ensure that stocking densities within Arcata Bay do not exceed ecological carrying capacity or production carrying capacity.

Carry capacity is analyzed both through modeling studies and growth studies. The most robust carrying capacity analysis conducted in Humboldt Bay was created for the Pre-Permitting Project (District and SHN 2015); which at the time combined the Intertidal Pre-Permitting Project, Subtidal Pre-Permitting Project, Yeung Oyster Farm, and Pacific Project. The analysis included up to 1,202 acres of shellfish aquaculture operations in Arcata Bay (or 55.02 metric tons dry tissue weight), which were all modeled as adults to maximize potential filtration pressure. According to the analysis, filtration pressure was shown to range between 5% and 9%, which indicates that the "vast majority of carbon fixed by phytoplankton remains available to non-cultured species." In addition, the phytoplankton turnover rate was calculated to replace itself several times per day. The analysis concluded that the existing and proposed culture would have some cumulative effect on Humboldt Bay food resources, but there is an abundance of food available and cultured species will not significantly affect the food resources in the bay. This was considered a conservative result, given that the analysis only calculated change to phytoplankton and did not account for other sources of carbon productivity (e.g., detritus, benthic microalgae, biodeposits). The cumulative impacts of the HIOC Project, when combined with other existing and proposed shellfish farms in Arcata Bay, would result in significantly less potential filtration pressure compared to what was originally analyzed, as the amount of farmed acreage would only be 38% of that evaluated in the Pre-Permitting Project study.

Other indicators of ecological carrying capacity include poor growth and high mortality of shellfish in culture plots or within the natural community. Although no studies have been conducted in Humboldt Bay, there have been growth studies that can be compared to carrying capacity models in two separate locations of Washington State: (1) Totten Inlet and (2) Willapa Bay.

NewFields (2009) developed a carrying capacity model for Totten Inlet associated with the North Totten Inlet Mussel Farm. Totten Inlet has the highest concentration of shellfish aquaculture in South Puget Sound (22% of the intertidal area is used by shellfish aquaculture) and has relatively confined circulation. There was public concern for an additional 1.4 acres of shellfish aquaculture in the system. The model indicated that, despite the amount of culture operations in Totten Inlet, the percentage of phytoplankton consumption by filter feeders is approximately 1.5% of the spring/summer production (NewFields 2009). A growth study by Ruesink et al. (2013) also reported that growth is uninhibited by dense culture operations in Totten Inlet. Shellfish aquaculture in Humboldt Bay is cultivated on a smaller portion of the intertidal area (6.2% of the intertidal portion of bay) as compared to Totten Inlet (22% or 1,335 acres of active culture within the intertidal portion of the inlet).

In Willapa Bay, concerns were raised that the conversion from on-bottom to near-bottom culture methods using an intertidal longline system with tipping bags was impacting the growth of an adjacent on-bottom farm (Confluence 2017). A study was conducted to measure chlorophyll concentrations and oyster growth, and then provide an understanding of available food resources. The ultimate conclusion was that food resources are abundant in the northern portion of Willapa Bay, and growth measurements were consistent both inside and outside of the flip-container culture area. This was consistent with a growth study by Ruesink et al. (2003) in the bay. The authors reported that, due to the longer residence times at the southern end of Willapa Bay and other potential contributing factors (e.g., riverine input, eelgrass detritus), growth was slower compared to the northern end where there was a consistent supply of food from the ocean. An update on the growth study provided through the Ruesink Lab (2013), indicated that growth in the southern portion of Willapa Bay in 2003 showed no difference from south to north even though food concentrations were lower in the south. Hypotheses for these differences in results included changes in weather and nearshore oceanic properties, but food limitation was not a problem. Shellfish aquaculture in Humboldt Bay is also cultivated on a smaller portion of the intertidal area (6.2% of the intertidal portion of the bay) compared to Willapa Bay (22% of the intertidal portion of the bay). Therefore, impacts associated with carrying capacity are expected to be the same or less than those in Willapa Bay and Totten Inlet.

There have been no reports of poor growing conditions for the existing cultured oysters in Arcata Bay. In fact, since the carrying capacity analysis was conducted by District and SHN (2015), there has been an overall reduction of shellfish aquaculture activities in Arcata Bay (from approximately 301 acres to 287 acres). The HIOC Project would add up to 30 acres over the next 5 years. Other proposed projects would add up to 136 acres, although it is not clear how long it would take to develop these areas because growers have not been identified yet for these culture areas. More importantly, as noted above, the cumulative total is well below the values studied by District and SHN (2015), and the carrying capacity analysis indicated that cultured shellfish were only using a fraction of the phytoplankton resources in Humboldt Bay.

Both the literature and the carrying capacity analysis for Humboldt Bay support the conclusion that cumulative impacts to carrying capacity are expected to be less than significant.

D.5.4 Structures and Fish

As described above, the cumulative amount of shellfish aquaculture activities in unstructured habitat would be approximately 167 acres or 6.0% of the available habitat (refer to Table D-3). There are certain species (e.g., California halibut) that tend to avoid structure and prefer open sand- or mudflat habitat and others that are structure-oriented (e.g., fish in the families Cottidae and Embiotocidae). However, the majority of species that use the shallow intertidal areas of Arcata Bay are small fish that are using the area as nursery habitat (Pinnix et al. 2005, Schlosser and Eicher 2012). Increased structured habitat, especially adjacent to main channels, can improve conditions for smaller fish. This is discussed below in terms of the potential to increase forage areas for small fish.

On a scale more representative of potential cumulative impacts, there is literature that has looked at food-web implications, especially in areas where shellfish aquaculture is a dominant portion of the estuary (e.g., France). For example, Leguerrier et al. (2004) reported that near-bottom culture in an intertidal mudflat in Marennes-Oléron Bay covering 4,448 acres (or 16% of the bay), and at densities of 200 oysters/m^2, could benefit fish and crabs due to an enhanced food supply. Similarly, Castel et al. (1989) indicated that the presence of oysters on rack-and-bag structures covering 2,471 acres of intertidal habitat augmented meiofauna biomass in the Bay of Arcachon (France). Castel et al. (1989) also reported a reduction in macrofaunal abundance associated with the racks, but indicated that this may have been a product of increased predation, which benefited the slightly larger organisms (e.g., fish and birds) rather than the benthic invertebrates present in the sediment. According to a literature review of near-bottom aquaculture by Forrest et al. (2009), changes to fish are often viewed as neutral or positive.

Increased diversity and nursery habitat provided by oyster aquaculture is considered by many researchers to be an improved ecological function compared to sand or mudflat habitat. The increase in ecological function provided by the placement of oysters in areas of mud or sandy habitat is also considered an improved condition or passive mitigation, similar to how the transplant or expansion of eelgrass into mud or sandy habitats would be considered an improved condition or serve as mitigation. There are a number of examples in the literature – as described above – where oyster culture in estuaries, at much higher proportions than is being cumulatively proposed in Arcata Bay, supports the food-web within that system (e.g., Leguerrier et al. 2004, Dubois et al. 2007, Lin et al. 2009, Preikshot et al. 2015). The amount of unstructured habitat altered is a relatively minor portion of the overall intertidal habitat in Arcata Bay (~6.0% of mudflat habitats) and the scale of shellfish aquaculture proposed supports a conclusion that positive changes would occur from the increase in benthic invertebrates present. Overall, cumulative impacts to fish are expected to be less than significant.

D.5.5 Green Sturgeon

Sturgeon are a relatively large species (4.5 to 7 feet in length) that likely use Humboldt Bay during non-spawning migrations. Sturgeon move into estuaries up and down the West Coast taking advantage of foraging opportunities in bays and estuaries along the way. During the summer and early fall months, sturgeon will remain in bays for weeks to months at a time. Based on acoustic receiver data, the primary habitats where sturgeon would be located in Humboldt Bay include the main channels and near channel habitats (Figure D-4). Sturgeon are more likely to use unstructured near-channel habitat, of which proposed culture would overlap with approximately 4.1% of habitats within 75 meters of main channels in Arcata Bay. Please refer to the IS document for additional details.

In terms of the likely interaction between sturgeon and shellfish aquaculture culture, the areas adjacent to tidal channels and subtidal channels are likely to be more frequently used by green sturgeon compared to the higher elevation shallow intertidal habitat. For example, Kelly et al. (2007) reported that sturgeon in San Francisco Bay were most common at a mean depth of 17 feet during directional movement and between 26 feet and 39 feet during non-directional movement. It is notable that mudflats in Humboldt Bay are typically shallower than the study in San Francisco Bay, which includes oyster culture locations in Arcata Bay. Observations from Humboldt Bay also indicate that sturgeon may reach seasonally high abundances and actively forage in portions of Arcata Channel. During mobile tracking of green sturgeon, NMFS staff postulated that several individuals were feeding either within or immediately adjacent to existing aquaculture beds near Arcata Channel (Goldsworthy et al. 2016). Therefore, by avoiding cultivation within channel areas, use of key foraging habitat potentially used by green sturgeon for shellfish aquaculture is minimized.

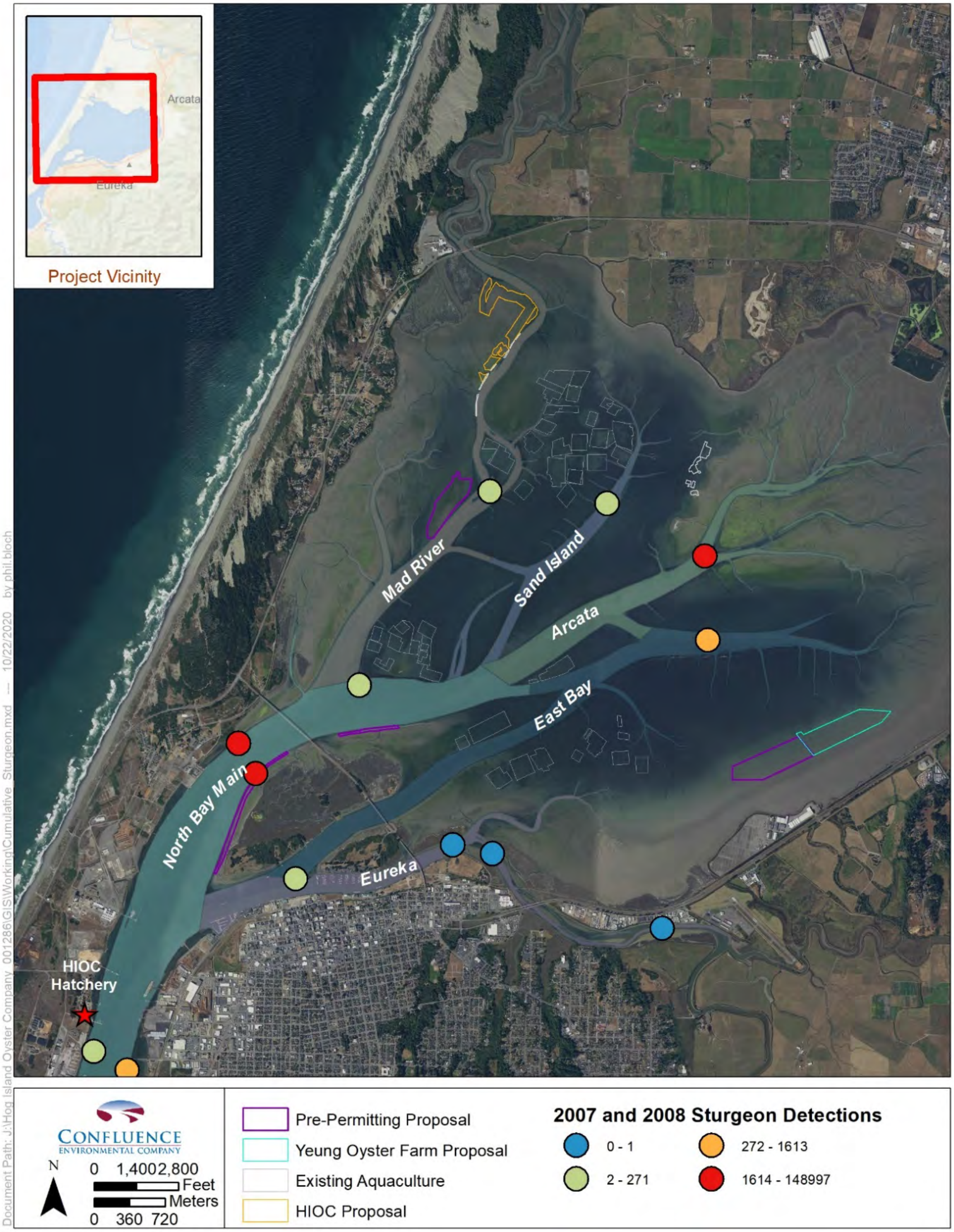

Figure D-4: Shellfish Aquaculture in Humboldt Bay in Relation to Sturgeon Movement
Source: USFWS unpublished data

While the HIOC Project and other proposed shellfish farms may increase vessel traffic within Arcata Bay and activity on cultivated mudflats, sturgeon would be easy to avoid. They occur primarily in the main channels, and would access near-channel habitat when it is inundated. The increase in vessel traffic is expected to be minimal within Humboldt Bay overall compared to existing use of the area by work vessels or other recreational boats. Proposed intertidal aquaculture structures would be inundated for an average of approximately 68% to 89% of the year (District 2020). Sturgeon forage primarily in mudflat habitat and on fish in the channels. Adding structure to mudflat habitat represents a change, but does not mean that sturgeon would be restricted from these areas.

Overall, spatial overlap of proposed culture does not represent a significant portion of the habitat that sturgeon are likely using, there would be a low frequency of activity within the majority of proposed culture areas, and aquaculture gear is not expected to represent a problem for migration and access. Therefore, cumulative impacts to sturgeon are expected to be less than significant.

D.5.6 Salmonids

Salmonids in Humboldt Bay primarily use either the main channels during their outmigration or the tidal portions of Humboldt Bay tributaries (Wallace 2006, Wallace and Allen 2007, Pinnix et al. 2013, Wallace and Allen 2015). This pattern is similar for other salmonids along the West Coast. Simenstad et al. (1982) indicated that most anadromous salmonids that rear for an extended time in freshwater (e.g., coho salmon, Chinook salmon, steelhead, cutthroat cutthroat) will be oriented toward deeper water when they are present in estuaries. However, the early migrant juveniles use the shallower margins of estuaries for a few weeks in the spring before moving into deeper water as they grow larger (Simenstad and Eggars 1981, Simenstad et al. 1982). Information developed by these researchers suggests that adult salmonids are not substantially using the locations where intertidal shellfish aquaculture is currently sited or being proposed, but there may be more overlap with early migrant juveniles. Most shellfish aquaculture operations are located in shallow intertidal habitat. For example, the cumulative amount of habitat overlap within main channels (i.e., subtidal areas) represents approximately 0.2% of subtidal habitat in Arcata and Central Bays that could be used by salmonids.

There is no indication from the existing data that salmonids will be significantly affected by this amount of shellfish aquaculture gear even if they encounter it during outmigration or rearing. Much of the research suggests that estuaries with aquaculture may enhance habitat for salmonids, or at least represent a neutral effect. For example, Magnusson and Hilborn (2003) assessed the survival of coho salmon and Chinook salmon released from West Coast hatcheries with respect to three characteristics: (1) size of the estuary, (2) percentage of the estuary that is in natural condition, and (3) presence of oyster culture in the estuary. While Humboldt Bay was not one of the estuaries assessed, the results suggested that oyster culture was not having an adverse impact on salmon survival in estuaries where there were substantial runs. Willapa Bay, which has a 150+ year history of extensive oyster culture, including areas in dense eelgrass beds, had the highest coho salmon survival. Grays Harbor, also an important oyster farming estuary, had the third highest coho survival of the twenty estuaries included in the study.

Dumbauld et al. (2015) analyzed whether intertidal oyster aquaculture in Willapa Bay effects the distribution and feeding ecology of juvenile salmonids. The study identified no significant differences in the density of juvenile salmonids caught in the four habitat types analyzed (undisturbed open mudflat, seagrass, channel habitats, and oyster aquaculture), and few significant associations with the prey items that the fish consumed. In other words, the majority of salmon that were found over low intertidal habitats were not dependent on structured habitat (e.g., eelgrass or oyster aquaculture) for prey items. Chum salmon, a typically smaller fish during estuarine residency, was the possible exception. This species doesn't occur in Humboldt Bay. The final conclusion by Dumbauld et al. (2015) was that:

> Permanent or 'press' disturbances like diking marshes, dredging and filling shallower estuarine habitats and even hardening shorelines would be expected to have significant impacts for other stocks and life history variants with smaller juveniles that utilize upper intertidal areas (Fresh 2006, Bottom et al. 2009), but our research suggests that short term 'pulse' disturbances like aquaculture which alter the benthic substrate in lower intertidal areas used primarily by larger juvenile salmon outmigrants may pose a less significant threat to maintaining resilience of these fish populations.

Based on the literature discussed above from estuaries that have a much higher amount of oyster aquaculture, and a variety of culture methods, throughout the estuaries, the amount of culture proposed in Humboldt Bay are expected to result in less than significant cumulative impacts to salmonids.

D.5.7 Pacific Herring

Forage fish (e.g., fish in the families Osmeridae and Clupeidae) are an important dietary resource for higher trophic-level fish and marine mammals. Four species of Osmeridae (or the smelt family) were collected by Pinnix et al. (2005) in both eelgrass habitat and oyster growing areas, including longfin smelt. Larval smelt was one of the dominant species in the otter trawl sampling in January 2003 to 2006 in a small eelgrass bed near the entrance to Humboldt Bay (Garwood et al. 2013). No eulachon were collected in either survey, and they are not common south of the Mad River, although they are considered infrequent visitors to Humboldt Bay (Gustafson et al. 2010). Pinnix et al. (2005) also collected three species of Clupeidae (or the herring family) from oyster growing areas and eelgrass, including Pacific herring. A recent study looking at the changes in fish communities inside and outside of shellfish aquaculture gear in Humboldt Bay also collected fish in the Osmeridae and Clupeidae families (Confluence et al. 2019).

Forage fish are common in the shallow intertidal habitat of Humboldt Bay, especially Pacific herring. There are approximately 166 acres of intertidal shellfish aquaculture proposed in Humboldt Bay and 287 acres of existing intertidal culture, which represents 6.2% of intertidal habitat (total of 7,354 acres) in Arcata Bay overall. This represents a small amount of the available habitat where forage fish may be found, and given the low intensity and frequency of access to individual areas, even areas occupied by aquaculture gear are unlikely to disturb forage fish populations. Similarly, potential impacts to prey resources are considered less than significant, based on the less than significant changes expected to benthic communities.

The only potentially significant overlap with forage fish habitat is Pacific herring spawning habitat. Rooper and Haldorson (2000) noted that desiccation potential and predation pressure are the main trade-offs for Pacific herring spawning locations. Experimental evidence along British Columbia's Central Coast suggests that the majority of herring eggs are being consumed on the seabed compared to the water column (Keeling 2013). Keeling (2013) concluded that increasing the available spawning habitat (i.e., surface area for egg deposition) may allow herring eggs to be deposited at lower densities and increase egg viability through enhanced water movement and respiratory exchange. In this way, the presence of shellfish aquaculture gear can be a potential benefit by providing more surface area to eggs that remain in the water column and away from benthic predators. The addition of alternate spawning substrate in the form of shellfish and aquaculture gear may provide additional "bet hedging tactics," as described by Lambert and Ware (1984), allowing increased survival from multiple waves of egg and larval cohorts to enhance the probability of good recruitment.

Studies have shown no significant difference in hatching success of herring eggs from artificial substrates, natural substrates, and a variety of macroalgae (Hourston et al. 1984, Palsson 1984, Shelton et al. 2014, Hessing-Lewis et al. 2016). The key to successful herring egg deposition is enough surface area to provide an even coverage of eggs to provide enough exchange of oxygen. Shellfish aquaculture gear may detain or promote colonization of aquatic vegetation. Aquatic vegetation at appropriate tidal elevations may improve the viability of deposited herring eggs.

Overall, the main protection for Pacific herring for shellfish aquaculture in Humboldt Bay is avoidance. The same mitigation measure (Mit-5) proposed for the HIOC Project would be expected for other shellfish companies.

Mit-5 Pacific Herring (*Clupea pallasii*) Avoidance: In any cultivation beds within or adjacent to eelgrass beds (in the event that eelgrass moves into the project site), HIOC will conduct visual surveys for Pacific herring spawn prior to conducting activities during the herring spawning season (October to April). If herring spawn is present, HIOC will suspend activities in the areas where spawning has occurred until the eggs have hatched and spawn is no longer present (typically 2 weeks).

The HIOC Project would add up to 30 acres over the next 5 years in areas that currently do not include eelgrass beds. Other proposed projects would add up to 136 acres. Herring spawn in Humboldt Bay primarily on eelgrass beds south of the HIOC Project (Mello and Ramsay 2004). Only a small portion of these areas proposed for shellfish farms are in areas that have documented spawning for Pacific herring, and there is a mitigation measure to avoid the spawn when it is observed. Therefore, cumulative impacts to forage fish are expected to be less than significant with mitigation.

D.5.8 Black Brant

The HIOC Project's potential impacts on black brant associated with reduction in foraging opportunity is assessed in the IS document. Other existing and proposed culture also has the potential to result in impacts to black brant, although the monitoring associated with the Pacific Project indicates that this potential impact is minor (HTH 2015, 2018). Please refer to the IS document for additional details.

The Pacific Project (formally Coast Seafoods Company) Humboldt Bay Shellfish Aquaculture Environmental Impact Report, which evaluated a project that proposed to cultivate shellfish in approximately 407 acres of continuous eelgrass, estimated that the bay-wide eelgrass biomass reduction (i.e., the impact to brant foraging) from the project would be approximately 3% (District 2016). The EIR evaluated 15 times as much shellfish cultivation in continuous eelgrass as compared to the cultivation evaluated in this analysis, and still concluded that the functional loss of eelgrass to black brant is not expected to result in a significant energetic constraint. The other proposed projects in Arcata Bay (e.g., the HIOC Project, Yeung Oyster Farm, and Pre-Permitting Project) either avoid eelgrass or are located in patchy eelgrass. Patchy eelgrass beds are not considered in the biomass estimates used by black brant (District 2016). Therefore, the additional proposed shellfish aquaculture is not estimated to put a strain on bay-wide resources important for black brant foraging.

Impacts on black brant associated with human disturbance as a result in increased boat traffic and human presence is estimated to be minor. Because the proposed HIOC Project, Yeung Oyster Farm, and Pre-Permitting Project will primarily avoid continuous eelgrass, there is less potential for brant to be disturbed by workers at these higher-elevation intertidal areas. However, all projects will result in an increase in boat traffic in the main channels of Humboldt Bay that could result in cumulative effects on black brant. The estimate of increased vessel use by HIOC Project above existing conditions is approximately 104 days per year (or up to 2 round trips weekly). Based on the frequency identified in District (2020), the other proposed farms in Arcata Bay would add a similar amount of vessel use per year, although that would depend on how many companies lease through the Pre-Permitting Project. The only potential gritting site that could be affected from shellfish aquaculture is the Pre-Permitting Project. As a result, black brant may show some short-term shifting of their distribution within Arcata Bay to avoid disturbance and some portion of individuals may respond by shifting to South Bay, where the majority of the brant distribution formerly occurred.

The ability for black brant and other waterbirds to acclimate to some level of disturbance should not be discounted. Based on an analysis performed by H.T. Harvey & Associates (HTH) for the Pacific Project (District 2016; SCH #2015082051), and incorporating data from Stillman et al. (2015), brant are distributed roughly equally between South Bay and Arcata Bay (and eelgrass biomass is also similar in the two basins), despite the current level of aquaculture and other recreational and commercial boating occurring in Arcata Bay. This suggests that black brant have adjusted their behavior (i.e., become acclimated to some levels of disturbance) to exploit areas of eelgrass abundance, and it is unlikely that brant would completely abandon most foraging sites, especially considering the amount of area available and the fact that activities do not occur at all shellfish beds during the foraging timing of brant. A shift in brant distribution could result in higher levels of grazing in less disturbed areas. However, the results of eelgrass biomass modelling efforts by HTH indicated the reduction in available biomass under cumulative conditions does not approach significance thresholds, and impacts were estimated at <3% to the available foraging habitat (District 2016). Because the HIOC Project, Pre-Permitting Project, and Yeung Project area all avoiding placement of shellfish aquaculture gear in eelgrass beds, this would avoid major black brant foraging areas.

Finally, the same BMPs proposed for the HIOC Project identified in the IS document would be expected for other shellfish companies. Note that this is a BMP that would be used by all boaters because there are federal laws (e.g., Endangered Species Act, Marine Mammals Protection Act, Migratory Bird Treaty Act) that protect fish and wildlife. While there is no potential impact from the HIOC Project that would need to be mitigated regarding potential interactions with black brant, it is still a common BMP that provides consistency with federal laws.

BMP-3 Fish and Wildlife: During vessel transit, harvest, maintenance, inspection, and planting operations, HIOC will avoid approaching, chasing, flushing, or directly disturbing shorebirds, waterfowl, seabirds, or marine mammals.

Based on the above analysis, it is unlikely that brant will experience a significant reduction in foraging opportunity bay-wide such that their ability to emigrate and breed is threatened. Therefore, cumulative impacts to black brant are expected to be less than significant.

D.5.9 Roosting Birds

Many birds roost on structures within Humboldt Bay, including double-crested cormorants, California brown pelicans, Caspian terns, Forster's terns, elegant terns, and several gull species. These birds roost on rafts or other structures, as well as on Sand Island. Noise and other sources of human disturbance can cause them to flush from the area. These disturbances have energetic costs associated with flight while birds search for alternative roost sites. The movement of boats and workers associated with all shellfish aquaculture projects may result in cumulative effects to roosting birds. However, activities that would disturb birds primarily occur in the main channels to access intertidal sites. Birds are unlikely to flush from roosts when boats move through the channels, as roosting birds would be acclimated to regular boat traffic in those areas. It is expected that roosting birds in the bay are generally habituated to human disturbance, given that birds often roost on sites that are near human activity (e.g., docks, piers, etc.), and that individuals that are not habituated to regular human disturbance will roost in more remote areas of the bay. Roost sites in the bay are not a limited resource, as there are numerous unoccupied roost sites in the bay year-round. Therefore, cumulative impacts to roosting birds are expected to be less than significant.

D.5.10 Nesting Birds

Sand Island occurs in the north-central portion of Arcata Bay. Double-crested cormorants and Caspian terns nest on Sand Island and human disturbance associated with all shellfish aquaculture operations in the vicinity of the island has the potential to flush nesting birds. Disturbances could result in the loss of eggs and/or chicks, and potentially nest or colony abandonment. The Pacific Project is reducing shellfish gear and culture operations in the vicinity of Sand Island by 14 acres. The HIOC Project is located approximately 1.5 miles from Sand Island. The Pre-Permitting Project has some proposed culture areas near the area, but are also located over a mile from nesting areas. Based on a literature review on human-caused disturbances that elicited a flushing response or nest failure, Borgmann (2010) recommended strategies for avoiding disturbance to nesting birds that included a 330-foot buffer from nesting activities.

Shellfish aquaculture operations are cyclical activities with short periods of work, rather than an ongoing daily operation. Noise-generating activities would occur at discrete points in time during the culture cycle. More importantly, the proposed farm sites provide a larger buffer from nesting activities of double-crested cormorants and Caspian terns than the 330-foot recommended buffer. Therefore, cumulative impacts to nesting birds are expected to be less than significant.

D.5.11 Waterfowl

Boat traffic and the presence of workers associated with the HIOC Project and other shellfish activities in Arcata Bay could disturb waterfowl, causing birds to flush from foraging areas and reducing temporal and/or spatial access to food. Human disturbance can result in increased energetic costs as well as a reduction in foraging opportunity (Borgmann 2010). The waterfowl species most likely affected is American wigeon, which occur in low densities on the bay in winter when they feed on both emergent and floating eelgrass. Similar to the discussion above for black brant, cumulative impacts are not expected to result in significant adverse effects to foraging opportunities or behavioral disturbances such that waterfowl are energetically constrained in regard to emigration or breeding. This is primarily because existing and proposed projects mostly avoid continuous eelgrass beds, overlapping with only 1.5% of the continuous eelgrass beds in Arcata Bay (refer to Table D-3). Impacts associated with the Pacific Project, which involved the greatest amount of overlap with continuous eelgrass beds, were appropriately mitigated (District 2016). Additionally, initial results of eelgrass monitoring by Merkel and Associates (2020) indicate that eelgrass cover is not reduced in existing culture areas. There may be some reduction of eelgrass density, although these results are confounded with natural changes due to elevation.

While there is potential for shellfish aquaculture operations to result in cumulative effects on waterfowl through increased disturbance, this impact is not expected to be significant given that waterfowl in the bay are already somewhat habituated to the current level of human disturbance from boat traffic and other activities. Moreover, the highest densities of American wigeon in Humboldt Bay coincide with winter waterfowl hunting, indicating that winter habitat use is not strongly influenced by human disturbance. Therefore, cumulative foraging and disturbance-related impacts to American wigeon and other waterfowl are expected to be less than significant.

D.5.12 Migratory Shorebirds

Humboldt Bay is an important estuary for migrating and wintering shorebirds in the Pacific Flyway (Pacific Flyway Council 2018). Impacts to shorebirds were discussed in the IS document, including the results of the Connolly and Colwell (2015) study and observations from the HTH (2015, 2018) studies. Although short-term cumulative impacts to shorebird foraging may occur, the effects are expected to be less than significant based on existing evidence of shorebird use of aquaculture sites. Specifically, intertidal culture areas generally do not support substantial shorebird use at lower elevations (i.e., the Pacific Project). Proposed projects that would be located at higher elevations (e.g., HIOC Project, Yeung Oyster Farm, and Pre-Permitting Project) have a greater potential to affect shorebirds since they occur in mudflat areas that are considered typical foraging habitat. However, foraging-related impacts to shorebirds are expected to be less than significant because shorebird foraging has been observed to occur irrespective of the presence of longlines or other near-bottom shellfish aquaculture gear (HTH 2015, 2018). Further, the variety of elevations for the various shellfish aquaculture operations and variety of cultivation schedules (i.e., planting and harvesting) for the projects will further reduce potential impacts.

Shorebirds are unlikely to be flushed by boats moving through channels to or from shellfish aquaculture sites based on common observations of shorebird presence on exposed flats throughout Humboldt Bay. For example, during reconnaissance site visits associated with black brant surveys by HTH (2015, 2018) using images recorded using trail cameras that recorded images at fixed intervals throughout tidal cycles, shorebirds were observed foraging under longlines in close proximity to the passing boat and did not typically flush or alter behavior as the boat passed by. As such, the greatest impact to shorebirds related to human disturbance likely occurs when workers directly access the plots. However, birds will generally experience infrequent levels of disturbance (i.e., once/month for inspections, other than harvest and planting). Shorebirds may exhibit short-term avoidance of these areas when workers are present, but they are unlikely to be regularly disturbed given the infrequent access to farmed plots. Therefore, cumulative foraging and disturbance-related impacts to migratory shorebirds are expected to be less than significant.

D.5.13 Marine Mammals

Marine mammals, especially harbor seals, are primarily located in the main channels and in haul-out areas. The closest haul-out area to shellfish aquaculture sites in Arcata Bay is towards the southern end of the Mad River channel (Ougzin 2013). Otherwise, haul-out sites are located in South Bay or along the coast (Archibald 2015). Some marine mammals produce and use sound for various biological functions, including social interactions, foraging, orientation, and predator detection. Interference with producing or receiving sounds could have adverse consequences to individuals or populations, including impaired foraging efficiency from masking, altered movement of prey, increased energetic expenditures, and temporary or permanent hearing threshold shifts due to chronic stress from noise (Southall et al. 2007). Boat trips associated with all current and proposed shellfish aquaculture in Arcata Bay is expected to be minimal, and increases in boat activity from the HIOC Project, Yeung Oyster Farm, and Pre-Permitting Project will be small compared to existing boat use of the available channels. Human disturbance is, therefore, considered similar to existing conditions and within the range that marine mammals are accustomed to in Humboldt Bay.

The primary impact mechanism identified by the Corps (85 FR 57332) of existing shellfish aquaculture activities or future like actions on marine mammals is entanglement. A recent review of entanglements within aquaculture gear (specifically gear for mussel culture on rafts in deeper coastal waters) found just 19 occurrences globally since 1982 (Price et al. 2016). It is notable that these examples were associated with off-shore shellfish aquaculture operations in deepwater habitat. By contrast, global annual entanglements and bycatch of marine mammals within fishery gear (e.g., gill nets, trawl nets) numbers in the hundreds of thousands (Reid et al. 2006). Gear for intertidal longline systems and rack and bag culture is not designed to capture organisms, like fishing gear, and there are no reports of entanglement concerns within Humboldt Bay from at least 25 years of using near-bottom culture methods. Therefore, this potential impact is considered negligible for intertidal culture methods to marine mammals found in Humboldt Bay.

The proposed HIOC Project, Yeung Oyster Farm, and Pre-Permitting Project all avoid established marine mammal haul-out areas. The haul-out location towards the southern end of the Mad River channel is close to an area where oyster aquaculture has occurred for over 60 years, and the amount of existing shellfish aquaculture is decreasing in that area by 14 acres. Based on the above analysis, under cumulative conditions, this impact is expected to be less than significant.

D.6 Cumulative Impacts: Cultural Resources

Existing and other proposed mariculture in the bay (including the Yeung Oyster Farm and Pre-Permitting Project) will have similar potential impacts to cultural resources as the HIOC Project. While there is very little soil disturbance from near-bottom culture methods, there is the potential that placement of gear could disturb cultural or archeological resources. In order to protect potential impacts, HIOC and other shellfish companies comply with the following mitigation measure:

> **Mit-6 Cultural Resources:** HIOC will comply with the Harbor District Protocol agreed upon between the Harbor District and the Blue Lake Rancheria, Bear River Band of Rohnerville Rancheria, and Wiyot Tribes regarding the inadvertent discovery of archaeological resources, cultural resources, or human remains or grave goods (Appendix B).

The measures detailed out in Appendix B, and provided recently in the Pre-Permitting Project and Yeung Oyster Farm (SCH #2017032068), include an inadvertent discovery plan. The protocols of this plan are laid out in the IS document. Given that all activities that could disturb sediments would include an inadvertent discovery plan, potential cumulative impacts to cultural resources are expected to be less than significant with mitigation incorporated.

D.7 Cumulative Impacts: Geology and Soils

There are numerous fault lines throughout Humboldt Bay, and there is also an intersection of three tectonic plates. As such, the area is highly susceptible to seismic activity. However, shellfish aquaculture operations do not add any fixed structures to the landscape that would be susceptible to seismic damage, nor would these operations put existing structures at greater risk. In addition, culture areas in the bay are level and lack structures that could become unstable and injure workers. The sediment could be subject to liquefaction, which would pose a minor risk to workers; however, the risk is considered very low, given that (1) liquefaction of the type that would be a risk to workers is uncommon, and there is no historical evidence of liquefaction in Humboldt Bay; (2) workers would be within culture areas only temporarily, and no people would inhabit the area; and (3) workers would be near vessels and safety equipment, including personal floatation devices. Therefore, cumulative impacts related to seismic risks are expected to be less than significant.

D.8 Cumulative Impacts: Greenhouse Gas Emissions

Existing and other proposed mariculture in the bay (including the Yeung Oyster Farm and Pre-Permitting Project) will have similar greenhouse gas (GHG) emission impacts as the HIOC Project. Even at a cumulative scale, the level of GHG emissions resulting from shellfish culture (i.e., boat use and storage, processing/cleaning, and transportation of shellfish) in Humboldt Bay is considered minor, particularly relative to the amount of food that will be produced and other activities in the region such as traffic on the surrounding roadways (the existing setting). Therefore, this cumulative impact is expected to be less than significant.

D.9 Cumulative Impacts: Hazards and Hazardous Materials

As described in the IS document, historic land uses around Humboldt Bay have contributed to legacy sediment contamination of both polychlorinated biphenyls (PCBs) and dioxins. These contaminants may bind to sediments and can be remobilized by ground disturbing activities; however, the methods used in Arcata Bay are near-bottom methods that do not significantly disturb bottom sediments.

Shellfish aquaculture operations are dependent on high water quality standards, which is influenced by sediment quality. Because oysters require high quality water to grow, farms avoid areas of Arcata Bay that are known to have water quality concerns, such as areas with high runoff from tributaries, known areas with high dioxin levels, etc. Additionally, shellfish companies are required to avoid areas that could be considered “prohibited” due to upland pollution sources, such as non-functioning septic fields or wastewater treatment plants (CADPH 2020). Maintenance of high water quality and reduction of contaminants due to the presence of commercial shellfish harvesting areas benefits public health and improves opportunities for recreation.

Even with shellfish aquaculture operations in close proximity to former lumber mill locations (e.g., the HIOC Project), there does not appear to be concern for resuspension of dioxins from shellfish aquaculture operations. Testing of tissue in 2003 confirmed that dioxin concentrations in shellfish next to the Mad River Slough were at or below levels found in background conditions associated with food resources throughout the U.S. (PSI 2007). Because existing shellfish aquaculture operations in the Mad River Slough area were transitioned to cultch-on-longline and SEAPA basket culture between 1997 to 2006, the sampling in 2003 would have captured conditions that would be consistent with the HIOC Project or other existing culture operations in Arcata Bay.

Existing and other proposed mariculture in the bay (including the Yeung Oyster Farm and Pre-Permitting Project) will have similar effects regarding hazards and hazardous materials as the HIOC Project. Other shellfish aquaculture operations are expected to take similar precautions to minimize the potential for oil or other spills in the bay, including BMP-1 and BMP-2, so as not to cause impacts related to hazards and hazardous materials.

BMP-1 Vessel Maintenance and Fueling: HIOC will maintain all vessels used in culture activities to limit the likelihood of release of fuels, lubricants, or other potentially toxic materials associated with vessels due to accident, upset, or other unplanned events.

HIOC will use marine grade fuel cans that are refilled on land, and HIOC carries oil spill absorption pads and seals wash decks or isolates fuel areas prior to fueling to prevent contaminants from entering the water.

BMP-2 Vessel Motors: HIOC will use highly efficient 4-stroke outboard motors. All motors will be muffled to reduce noise.

Given the reliance on high water quality standards, the presence of shellfish aquaculture operations provides an industry to the bay that results in consistent monitoring and actions to improve water quality. Therefore, this cumulative impact is expected to be less than significant.

D.10 Cumulative Impacts: Hydrology and Water Quality

Existing and other proposed mariculture in the bay (including the Yeung Oyster Farm and Pre-Permitting Project) will have similar effects on hydrology and water quality as the HIOC Project. Other projects are expected to take similar precautions (i.e., BMPs and mitigation measures) not to impact water quality. Additionally, the carrying capacity analysis (District and SHN 2015) on the abundance of suspended organic matter and potential competition for this food source between cultured shellfish and other filter feeders is a cumulative analysis and the impact is found to be less than significant.

Filter feeding shellfish may locally reduce turbidity and represent a net removal of nitrogen from Humboldt Bay, as well as transfer nutrients from the water column to the sediments. This is based on recent studies associated with shellfish aquaculture operations in the U.S. For example, the IS document discussed the Kellogg et al. (2018) study that looked at the quantification of ecological benefits and impacts of oyster aquaculture in Chesapeake Bay. Although culture densities were shown to have little impact or benefit on water quality, the removal of nitrogen from the system was identified as a quantifiable benefit. The study calculated a removal of 21 to 372 pounds (lbs) of nitrogen and 3 to 49 lbs of phosphorus per farm per year. The net removal of nitrogen compensates for anthropogenic additions of nitrogen (e.g., shoreline development and agricultural runoff), and shellfish filtration may become more valuable as nutrient input increases within coastal communities (Shumway et al. 2003, NRC 2010, Burkholder and Shumway 2011, Kellogg et al. 2013, 2018).

Oyster culture has the potential to increase contaminants in the water column associated with the use of work skiffs for accessing culture rafts, oyster beds and associated areas. All companies that would operate in Humboldt Bay would implement similar measures as BMP-1 and BMP-2 above to minimize the potential for spills and to reduce impacts from spills that do occur. For example, boats would be fueled at the local commercial fuel dock and boats would carry oil spill absorption pads. Overall, even with the increased number of operators proposed in Humboldt Bay, this impact is expected to be less than significant.

D.11 Cumulative Impacts: Noise

The primary noise effect caused by shellfish aquaculture operations include the use of small vessels with internal combustion engines. These vessels generate noise similar to that generated by other small vessels on the bay. The HIOC Project vessels would not be heard from sensitive receptors, especially with the implementation of the following BMP:

> **BMP-2 Vessel Motors.** HIOC will use highly efficient 4-stroke outboard motors. All motors are muffled to reduce noise.

This is a similar BMP used by other companies throughout Humboldt Bay. In general, shellfish aquaculture causes temporary noise effects during the installation of aquaculture gear and other regular operations related to culture activities, but the noise generated is similar to ambient noise conditions at shoreline locations (e.g., cars along the road along the shoreline or other boats on the water). In addition, one of the primary (and preferred uses) of the bay is shellfish aquaculture, which is part of the existing noise environment in Humboldt Bay. The HIOC Project and other proposed shellfish aquaculture projects would not contribute a significant amount of noise impacts to the bay. Overall, cumulative noise impacts are expected to be less than significant.

D.12 Cumulative Impacts: Transportation

Potential impacts to transportation, specifically potential hazards, were identified in the IS document as a potential significant effect that required mitigation to reduce the impacts to less than significant. The main concerns include the potential to disrupt in-water navigation and the potential to generate marine debris. The following mitigation measure and BMP would be used to avoid and minimize these impacts.

Mit-1 Marine Debris: HIOC will implement a marine debris management plan (Appendix A). At the time of harvest of each cultivation area, HIOC will carry out a thorough inspection to locate and remove any loose, abandoned or out of use equipment and tools. All floating bags and baskets will be marked or branded with the HIOC's name and phone number.

BMP-4 Bed Marking. HIOC culture beds will be marked with a long PVC pole to provide information to boaters of the location of shellfish aquaculture gear. HIOC will also inform the District of the location of the beds and they will be posted on the District's website.

The location of the HIOC Project is within 1,500 feet of a public access point and is surrounded by the Ma-le'l Dunes Park, Humboldt Bay National Wildlife Refuge area, and Mad River Slough Wildlife Areas (Figure D-5). Other farms are located in the same area, although they are further from these primary access points in the Mad River Slough area. An additional avoidance measure used by existing shellfish companies, and would also be used by HIOC, is using a different boat access point into Arcata Bay that is not used by the public. In addition, shellfish aquaculture gear is located in shallow, intertidal habitat that is not commonly used by recreational boaters. Boaters typically use the main channels or deeper sloughs. If boats access high intertidal areas, then shellfish beds are marked to help inform the location of gear.

As presented in the District Pre-Permitting Project Draft EIR (District 2020), shellfish gear is inundated for the majority of year (Table D-4). The HIOC Project is located at +1.6 feet to +4.6 feet MLLW, which is at a similar tidal elevation as the Pre-Permitting Project, and would be exposed approximately 30% of the year or less. During times when gear is inundated, kayakers can pass or maneuver over shellfish gear.

Table D-4. Percent of Time Shellfish Culture Gear is Exposed by Low Tides

Project	Percent of Year Out of Water	Percent of Year Inundated
Pre-Permitting Project	32%	68%
Coast Expansion	11%	89%
Coast Existing	16%	84%
Other Existing	26%	74%
Source: District 2020		

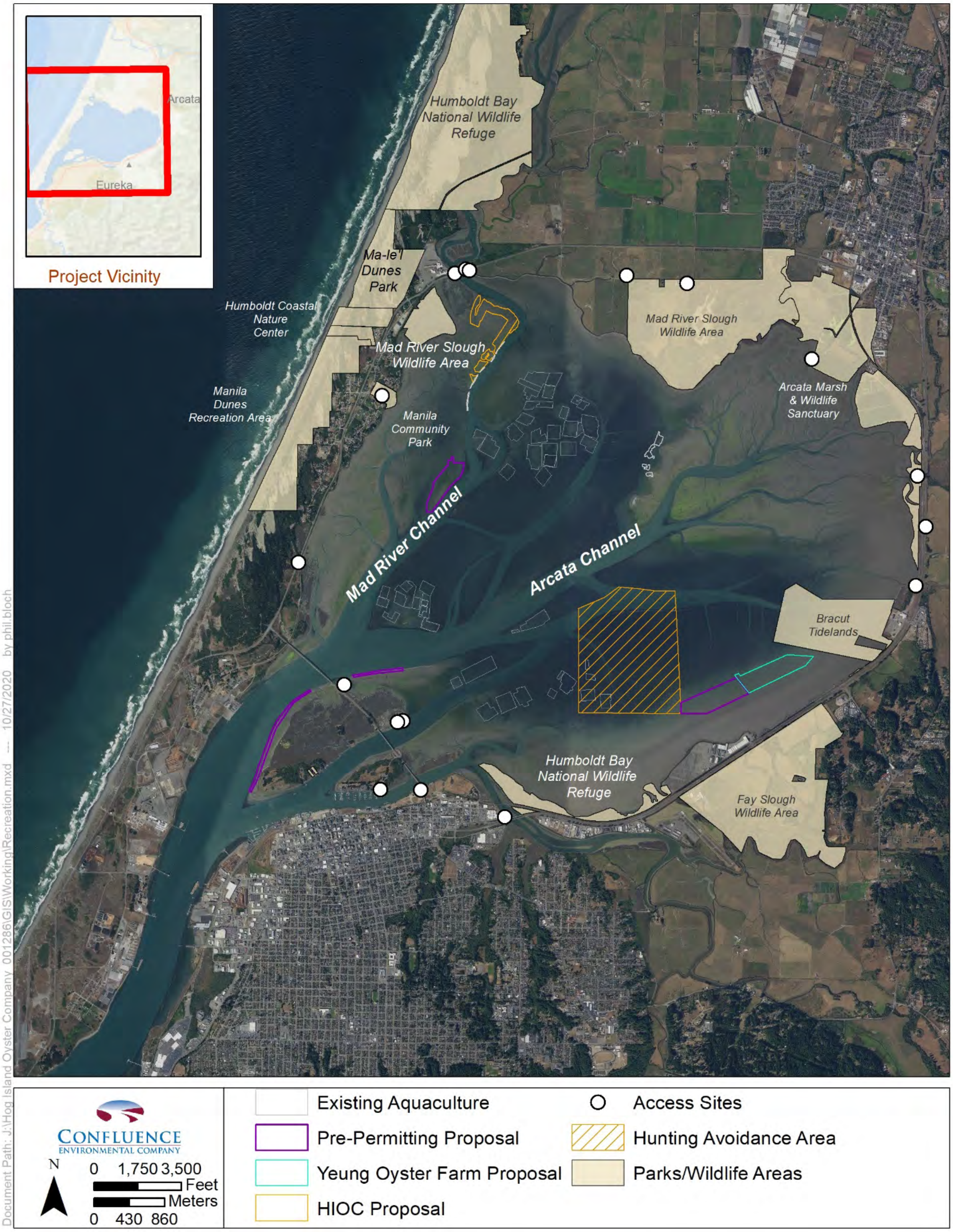

Figure D-5: Existing and Proposed Shellfish Aquaculture in Humboldt Bay in Relation to Recreational Access and Use Areas

While there may be some delays or restricted movement of vessels within specific intertidal areas, there are measures in place to avoid and minimize potential hazards for recreational boaters and kayakers. For example, the mitigation measure (Mit-1) to control escapement of shellfish aquaculture gear also avoid and minimize potential hazards for recreational boaters and kayakers that may encounter the gear. HIOC and other shellfish companies are expected to routinely inspect intertidal longline systems and rack and bag culture during monthly maintenance work and harvest activities. Any pipes or racks disturbed are re-secured or removed if damaged. Any identified loose pipes or other marine debris, even if it is not part of the shellfish operations, are removed from the culture area. It is relevant that shellfish aquaculture has been an industry that is part of Humboldt Bay's history. Shellfish aquaculture started around the 1950s (Barrett 1963). Therefore, shellfish gear and activities are part of the existing conditions that recreationalists have navigated for decades, and shellfish growers understand the importance of good farm maintenance.

Existing and other proposed shellfish aquaculture in Arcata Bay (including the Yeung Oyster Farm and Pre-Permitting Project) will have similar effects to potential transportation hazards in the bay as the HIOC Project. Potential impacts would only occur during certain tide heights and would be limited to areas outside of navigation channels. In addition, the HIOC Project employs mitigation measures to improve communication and the quality of the bay habitat by removing marine debris for both shellfish growers and recreationalists. Therefore, the cumulative impact on recreation is expected to be less than significant with mitigation.

D.13 Cumulative Impacts: Tribal Cultural Resources

Potential cumulative impacts to cultural resources are the same as the potential impacts to tribal cultural resources because the most likely cultural resources in Humboldt Bay are related to the tribes that used the area. The measures detailed out in the mitigation measure above (Mit-6), and the inadvertent discovery plan protocols provided recently in the Pre-Permitting Project and Yeung Oyster Farm (SCH #2017032068), would be used by any shellfish company operating in Humboldt Bay. Given that all activities that could disturb sediments would include an inadvertent discovery plan, potential cumulative impacts to tribal cultural resources are expected to be less than significant with mitigation incorporated.

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