APPENDIX A

Abridged List of Major Federal and State Laws, Regulations, and Policies Potentially Applicable to the RTI Infrastructure, Inc. Grover Beach Subsea Fiber Optic Cables Project

(Updated: April 2020)

Frequently Used Abbreviations

(see also List of Abbreviations and Acronyms in Table of Contents)

§	Section
AB	Assembly Bill
Cal. Code Regs.	California Code of Regulations
Caltrans	California Department of Transportation
CARB	California Air Resources Board
CCC	California Coastal Commission
CDFW	California Department of Fish and Wildlife
CEQA	California Environmental Quality Act
CFR	Code of Federal Regulations
CO_2; CO_2e	Carbon Dioxide; Carbon Dioxide Equivalent
CSLC	California State Lands Commission
EO	Executive Order
Fed. Reg.	Federal Register
GHG	Greenhouse Gas
MOU	Memorandum of Understanding
NMFS	National Marine Fisheries Service
NOx	Nitrogen Oxide
NPDES	National Pollutant Discharge Elimination System
P.L.	Public Law
Pub. Resources Code	Public Resources Code
RWQCB	Regional Water Quality Control Board
SB	Senate Bill
SWRCB	State Water Resources Control Board
U.S.C.	United States Code
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service

APPENDIX A

Appendix A identifies major federal and state laws, regulations and policies (local or regional are presented in each issue area chapter) potentially applicable to the RTI Infrastructure, Inc. Grover Beach Subsea Fiber Optic Cables Project.[1]

MULTIPLE ENVIRONMENTAL ISSUES

Multiple Environmental Issues (Federal)
Coastal Zone Management Act (42 U.S.C. § 4321 et seq.)
The Coastal Zone Management Act recognizes a national interest in coastal zone resources and in the importance of balancing competing uses of those resources, giving full consideration to aesthetic, cultural and historic, ecological, recreational, and other values as well as the needs for compatible economic development. Pursuant to the Act, coastal states develop and implement comprehensive coastal management programs, authorities and enforceable policies, and coastal zone boundaries, among other elements. The Act also gives state coastal management agencies regulatory control ("federal consistency" review authority) over federal activities and federally licensed, permitted or assisted activities, if the activity affects coastal resources; such activities include military projects at coastal locations and outer continental shelf oil and gas leasing, exploration and development. The California Coastal Commission (CCC) and San Francisco Bay Conservation and Development Commission (BCDC) coordinate California's federally approved coastal management programs and federal consistency reviews within their respective jurisdictions.

Multiple Environmental Issues (State)
California Environmental Quality Act (CEQA; Pub. Resources Code, § 21000 et seq.)
CEQA requires state and local agencies to identify significant environmental impacts of their actions and to avoid or mitigate those impacts, if feasible. A public agency must comply with CEQA when it undertakes an activity defined by CEQA as a "project" that must receive some discretionary approval (i.e., the agency has authority to deny the requested permit or approval) which may cause either a direct physical change, or a reasonably foreseeable indirect change, in the environment.

[1] Environmental issue areas are found in State California Environmental Quality Act Guidelines Appendix G (http://califaep.org/docs/2019-Appendix_G_Checklist.pdf).

Multiple Environmental Issues (State)
California State Lands Commission (CSLC) and the Common Law Public Trust
The CSLC has jurisdiction and management authority over all ungranted tidelands, submerged lands, and the beds of navigable lakes and waterways, as well as certain residual and review authority for tidelands and submerged lands legislatively granted in trust to local jurisdictions (Pub. Resources Code, §§ 6301, 6306). All tidelands and submerged lands, granted or ungranted, as well as navigable lakes and waterways, are subject to the protections of the Common Law Public Trust. As general background, the State of California acquired sovereign ownership of all tidelands and submerged lands and beds of navigable lakes and waterways upon its admission to the U.S. in 1850. The State holds these lands for the benefit of all people of the State for statewide Public Trust purposes, which include but are not limited to waterborne commerce, navigation, fisheries, water-related recreation, habitat preservation, and open space. On tidal waterways, the State's sovereign fee ownership extends landward to the mean high tide line, except for areas of fill or artificial accretion. The CSLC's jurisdiction also includes a section of tidal and submerged land 3 nautical miles wide adjacent to the coast and offshore islands, including bays, estuaries, and lagoons; the waters and underlying beds of more than 120 rivers, lakes, streams, and sloughs; and 1.3 million acres of "school lands" granted to the State by the Federal government to support public education. The CSLC also has leasing jurisdiction, subject to certain conditions, over mineral extraction from State property owned and managed by other State agencies (Pub. Resources Code, § 68910, subd. (b)), and is responsible for implementing a variety of State regulations for activities affecting these State Trust Lands, including implementation of CEQA.
California Coastal Act (Pub. Resources Code, § 30000 et seq.) and California Federal Consistency Program
Pursuant to the Coastal Act, the CCC, in partnership with coastal cities and counties, plans and regulates the use of land and water in the coastal zone. The Coastal Act includes specific policies (see Chapter 3) that address issues such as shoreline public access and recreation, lower cost visitor accommodations, terrestrial and marine habitat protection, visual resources, landform alteration, agricultural lands, commercial fisheries, industrial uses, water quality, oil and gas development, transportation, development design, power plants, ports, and public works. Development activities in the coastal zone generally require a coastal permit from either the CCC or the local government: (1) the CCC retains jurisdiction over the immediate shoreline areas below the mean high tide line and offshore areas to the 3 nautical mile State water limit; and (2) following certification of county- and municipality-developed Local Coastal Programs, the CCC has delegated permit authority to many local governments for the portions of their jurisdictions within the coastal zone. The CCC also implements the Coastal Zone Management Act as it applies to federal activities (e.g., development projects, permits, and licenses) in the coastal zone by reviewing specified federal actions for consistency with the enforceable policies of Chapter 3 of the Coastal Act.

AESTHETICS

There are no major federal laws, regulations, and policies potentially applicable to this project

Aesthetics (State)
California Scenic Highway Program (Sts. & Hy. Code, § 260 et seq.)
The purpose of California's Scenic Highway Program, which was created by the Legislature in 1963 and is managed by the California Department of Transportation (Caltrans), is to preserve and protect scenic highway corridors from change which would diminish the aesthetic value of lands adjacent to highways. State highways identified as scenic, or eligible for designation, are listed in Streets and Highways Code section 260 et seq. A highway's status changes from eligible to officially designated when a local governmental agency has implemented a corridor protection program for an eligible highway that meets the standards of an official scenic highway (Caltrans 2008).
Coastal Act Chapter 3 policies (see *Multiple Environmental Issues*)
The Coastal Act is concerned with protecting the public viewshed, including views from public areas, such as roads, beaches, coastal trails, and access ways. Section 30251 states: Permitted development shall be sited and designed to protect views to and along the ocean and scenic coastal areas, to minimize the alteration of natural landforms, to be visually compatible with the character of the surrounding area, and, where feasible, to restore and enhance visual quality in visually degraded areas. New development in highly scenic areas such as those designated in the California Coastline Preservation and Recreation Plan prepared by the Department of Parks and Recreation and by local government shall be subordinate to the character of its setting. Section 30253 states: New development shall, where appropriate, protect special communities and neighborhoods that, because of their unique characteristics, are popular visitor destination points for recreational uses.

AGRICULTURE AND FORESTRY RESOURCES

There are no major federal laws, regulations, and policies potentially applicable to this project

Agriculture and Forestry Resources (State)
Williamson Act (Gov. Code, §§ 51200-51207)
This Act enables local governments to enter into contracts with private landowners to restrict specific parcels of land to agricultural or related open space use, and provides landowners with lower property tax assessments in return. Local government planning departments are responsible for the enrollment of land into Williamson Act contracts and may also identify compatible uses permitted with a use permit. Generally, any commercial agricultural use would be permitted within any agricultural preserve.
Coastal Act Chapter 3 policies (see *Multiple Environmental Issues*)
The Coastal Act requires the protection of agricultural lands within the coastal zone by requiring that (1) the maximum amount of prime agricultural land be maintained in production to protect the agricultural economy and (2) conflicts between agricultural and urban uses be minimized through the application of development standards that ensure that new development will not diminish agricultural productivity. Development standards include establishing stable urban-rural boundaries, providing agricultural buffers, ensuring that non-agricultural development is directed first to lands not suitable for agriculture, restricting land divisions and controlling public service expansions. (See: Definitions [§§ 30100.2, 30113, 30106]; Agricultural related Policies [§§ 30222, 30241, 30241.5, 30242, 30243, 30250]; and other public access and resource protection policies that apply to projects on agricultural lands.)

AIR QUALITY

Air Quality (Federal)
Federal Clean Air Act (FCAA) (42 U.S.C. § 7401 et seq.)
The FCAA requires the U.S. Environmental Protection Agency (USEPA) to identify National Ambient Air Quality Standards (NAAQS) to protect public health and welfare. National standards are established for ozone, carbon monoxide, nitrogen dioxide, sulfur dioxide, particulate matter (PM10 and PM2.5), and lead. The FCAA mandates that states submit and implement a State Implementation Plan (SIP) for local areas not meeting those standards; plans must include pollution control measures that demonstrate how the standards would be met. Pursuant to the 1990 FCAA amendments, the USEPA also regulates hazardous air pollutants (HAPs), which are pollutants that result in harmful health effects, but are not specifically addressed through the establishment of NAAQS. HAPs require the use of the maximum or best available control technology to limit emissions. USEPA classifies air basins (or portions thereof) as in "attainment" or "nonattainment" for each criteria air pollutant by comparing monitoring data with State and Federal standards to determine if the NAAQS are achieved. Areas are classified for a pollutant as follows: • "Attainment" – the pollutant concentration is lower than the standard. • "Nonattainment" – the pollutant concentration exceeds the standard. • "Unclassified" – there are not enough data available for comparisons. In 2007, the U.S. Supreme Court ruled that carbon dioxide (CO_2) is an air pollutant as defined under the FCAA, and that the USEPA has authority to regulate greenhouse gas (GHG) emissions. The FCAA allows delegation of the enforcement of many of the federal air quality regulations to the states. In California, the California Air Resources Board (CARB) is responsible for enforcing air pollution regulations in concert with regional air pollution control districts.
Marine Diesel Engine Emission Standards.
In March 2008, the USEPA adopted more stringent emission standards for locomotives and marine compression-ignition engines (73 Fed.Reg. 37096 (USEPA 2008a)). To reduce emissions from Category 1 (at least 50 horsepower [hp] but less than 7 liters per cylinder displacement) and Category 2 (7 to 30 liters per cylinder displacement) marine diesel engines, the USEPA has established emission standards for new engines, referred to as Tier 2 marine engine standards. The Tier 2 standards were phased in from 2004 to 2007 (year of manufacture), depending on the engine size (USEPA 1999). The 2008 final rule includes the first-ever national emission standards for existing marine diesel engines, applying to engines larger than 600 kilowatts (kW) when they are remanufactured. The rule also sets Tier 3 emissions standards for newly built engines that began implementation phase-in in 2009. Finally, the rule establishes Tier 4 standards for newly built commercial marine diesel engines above 600 kW, based on the application of high-efficiency catalytic after-treatment technology that began implementation in 2014. The new diesel marine engine standards will reduce emissions of diesel particulate matter by 90 percent and emissions of NOx by 80 percent for engines meeting Tier 4 standards, in comparison with engines meeting the current Tier 2 standards. The USEPA's three-part program: (1) tightened standards for existing marine diesel engines when they are remanufactured, taking effect as certified remanufacture systems are available starting in 2008; (2) sets near-term emission standards, referred to as Tier 3 standards, for newly built locomotive and diesel marine engines, which reflect the application of currently available technologies to reduce engine-out PM and NOx emissions and phase-in starting in 2009; and (3) applies the final long-term Tier 4 emissions standards to marine diesel engines. These standards are based on the application of high-efficiency catalytic after-treatment technology and would be phased in beginning in 2014 for marine diesel engines. These marine Tier 4

Air Quality (Federal)
engine standards apply only to commercial marine diesel engines above 600 kW (800 hp) (USEPA 2008b).
Non-Road Diesel Engine Emission Standards. The USEPA has established a series of cleaner emission standards for new off-road diesel engines culminating in the Tier 4 Final Rule of June 2004 (USEPA 2004a). The Tier 1, Tier 2, Tier 3, and Tier 4 standards require compliance with progressively more stringent emission standards. Tier 1 standards were phased in from 1996 to 2000 (year of manufacture), depending on the engine horsepower category. Tier 2 standards were phased in from 2001 to 2006, and the Tier 3 standards were phased in from 2006 to 2008. The Tier 4 standards complement the latest 2007 and later on-road heavy-duty engine standards by requiring 90 percent reductions in diesel particulate matter and NOx when compared against current emission levels. The Tier 4 standards were phased in starting with smaller engines in 2008 until all but the very largest diesel engines were to meet NOx and particulate matter (PM) standards in 2015.
On-Road Trucks Emission Standards. To reduce emissions from on-road, heavy-duty diesel trucks, the USEPA established a series of cleaner emission standards for new engines, starting in 1988. These emission standards regulations have been revised over time. The latest effective regulation, the 2007 Heavy-Duty Highway Rule, provides for reductions in PM, NOx, and non-methane hydrocarbon emissions that were phased in during the model years 2007 through 2010 (USEPA 2000).

Air Quality (State)
California Clean Air Act of 1988 (CCAA) The CCAA requires all air districts in the State to endeavor, achieve and maintain State ambient air quality standards for ozone, carbon monoxide, sulfur dioxide, nitrogen dioxide, and particulate matter. CARB sets air quality standards for the State at levels to protect public health and welfare with an adequate margin of safety. The California Ambient Air Quality Standards (CAAQS) are generally stricter than national standards for the same pollutants; California also has standards for sulfates, hydrogen sulfide, vinyl chloride, and visibility-reducing particles. The CAAQS describe adverse conditions (i.e., pollution levels must be below these standards before a basin can attain the standard). Air quality is considered in “attainment” if pollutant levels are continuously below or equal to the standards and violate the standards no more than once each year. The 1992 CCAA Amendments divide ozone nonattainment areas into four categories of pollutant levels (moderate, serious, severe, and extreme) to which progressively more stringent requirements apply. CARB also regulates toxic air contaminants (pollutants that result in harmful health effects, but are not specifically addressed by air quality standards) using air toxic control measures.
California Air Resources Board Programs, Regulations, and Standards • **California Diesel Fuel Regulations** (Cal. Code Regs., tit. 13, §§ 2281-2285; Cal. Code Regs., tit. 17, § 93114). In 2004, the CARB set limits on the sulfur content of diesel fuel sold in California for use in on-road and off-road motor vehicles. Harbor craft and intrastate locomotives were later included by a 2004 rule amendment (CARB 2005a). Under this rule, diesel fuel used in motor vehicles except harbor craft and intrastate locomotives has been limited to 500 ppm sulfur since 1993. The sulfur limit was reduced to 15 ppm beginning on September 1, 2006. Diesel fuel used in harbor craft in the SCAB also was limited to 500 ppm sulfur starting January 1, 2006, and was lowered to 15 ppm sulfur on September 1, 2006. • **California Diesel Risk Reduction Plan.** CARB has adopted several regulations that are meant to reduce the health risk associated with on- and off-road and stationary diesel engine operation. This plan recommends many control measures with the goal of an 85 percent

Air Quality (State)

reduction in diesel particulate matter emissions by 2020. The regulations noted below, which may also serve to significantly reduce other pollutant emissions, are all part of this risk reduction plan.

- **Commercial Harbor Craft Regulation** requires upgrades to Tier 2 or Tier 3 standards to reduce diesel particulate matter and NOx emissions from diesel engines used on commercial harbor craft (e.g., tugboats, crew and supply vessels, work boats, barges, dredges) operated in California Regulated Waters (internal waters, estuarine waters, ports and coastal waters within 24 nautical miles of the coast)
- **Emission Standards for On-Road and Off-Road Diesel Engines.** Similar to the USEPA for on-road and off-road emissions described above, the CARB has established emission standards for new on-road and off-road diesel engines. These regulations have model year based emissions standards for NOx, hydrocarbons, CO, and PM.
- **Heavy Duty Diesel Truck Idling Rule – Heavy Duty Diesel Truck Idling Regulation.** This CARB rule became effective February 1, 2005, and prohibits heavy-duty diesel trucks from idling for longer than 5 minutes at a time, unless they are queuing and provided the queue is located beyond 100 feet from any homes or schools (CARB 2006).
- **In-Use Off-Road Vehicle Regulation** (Cal. Code Regs., tit. 13, § 2449). The State has also enacted a regulation to reduce diesel particulate matter and criteria pollutant emissions from in-use off-road diesel-fueled vehicles. This regulation provides target emission rates for PM and NOx emissions from owners of fleets of diesel-fueled off-road vehicles, and applies to off-road equipment fleets of three specific sizes, as follows:
  - Small Fleet – Fleet or municipality with equipment totaling less than or equal to 2,500 hp, or municipal fleet in lower population area, captive attainment fleet, or non-profit training center regardless of horsepower.
  - Medium Fleet – Fleet with equipment totaling 2,501 to 5,000 hp.
  - Large Fleet – Fleet with equipment totaling more than 5,000 hp, or all State and federal government fleets regardless of total hp.

  The target emission rates for these fleets are reduced over time. Specific regulation requirements:
  - Limit on idling, requiring a written idling policy, and disclosure when selling vehicles;
  - Require all vehicles to be reported to CARB (using the Diesel Off-Road Online Reporting System, DOORS) and labeled;
  - Restrict the adding of older vehicles into fleets starting on January 1, 2014; and
  - Require fleets to reduce their emissions by retiring, replacing, or repowering older engines, or installing Verified Diesel Emission Control Strategies (i.e., exhaust retrofits). (CARB 2014)
- **Ocean-Going Vessels Fuel Standards.** After January 1, 2014, ocean-going vessels within California Regulated Waters must use fuel with a maximum fuel sulfur content of 0.1 percent (using cleaner marine distillate fuels in larger ocean-going vessels reduces diesel particulate matter, NOx, and SOx emissions)
- **Off-Road Mobile Sources Emission Reduction Program.** The CCAA mandates that CARB achieve the maximum degree of emission reductions from all off-road mobile sources (e.g., construction equipment, marine vessels, and harbor craft) to attain state ambient air quality standards. Tier 2, Tier 3, and Tier 4 exhaust emissions standards apply to off-road equipment. In addition, CARB fleet requirements specify how equipment that is already in use can be retrofitted to achieve lower emissions using the CARB-verified retrofit technologies. U.S. Environmental Protection Agency (USEPA) standards for marine compression-ignition engines address NOx and diesel particulate matter emissions, depending on engine size and year of manufacture. Tier 2 standards for marine engines

Air Quality (State)
were phased in for model years 2004 to 2007, and Tier 3 standards were phased in for currently available technologies to reduce NOx and PM, starting in 2009. • **Statewide Portable Equipment Registration Program (PERP)**. The PERP establishes a uniform program to regulate portable engines and portable engine-driven equipment units (CARB 2005b). Once registered in the PERP, engines and equipment units may operate throughout California without the need to obtain individual permits from local air districts, if the equipment is located at a single location for no more than 12 months.
Health and Safety Code • **Sections 25531-25543** set forth changes in four areas: (1) provides guidelines to identify a more realistic health risk; (2) requires high-risk facilities to submit an air toxic emission reduction plan; (3) holds air pollution control districts accountable for ensuring that plans achieve objectives; and (4) requires high-risk facilities to achieve their planned emission reductions • **The Air Toxics Hot Spots Information and Assessment Act (§ 44300 et seq.)** provides for the regulation of over 200 toxic air contaminants. Under the act, local air districts may request that a facility account for its toxic air contaminant emissions. Local air districts then prioritize facilities based on emissions; high priority designated facilities must submit a health risk assessment.
Coastal Act Chapter 3 policies (see *Multiple Environmental Issues*) Section 30253, subdivision (c) requires that new development shall be consistent with requirements imposed by an air pollution control district or CARB as to each development.

BIOLOGICAL RESOURCES

Biological Resources (Federal)
Federal Endangered Species Act (FESA) (7 U.S.C. § 136, 16 U.S.C. § 1531 et seq.) The FESA, which is administered in California by the USFWS and National Marine Fisheries Service (NMFS), provides protection to species listed as threatened or endangered, or proposed for listing as threatened or endangered. When applicants propose projects with a federal nexus that “may affect” a federally listed or proposed species, the federal agency must (1) consult with the USFWS or NMFS, as appropriate, under Section 7, and (2) ensure that any actions authorized, funded, or carried out by the agency are not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of areas determined to be critical habitat. Section 9 prohibits the “take” of any member of a listed species. • **Take –** To harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct • **Harass –** An intentional or negligent act or omission that creates the likelihood of injury to a listed species by annoying it to such an extent as to significantly disrupt normal behavior patterns that include, but are not limited to, breeding, feeding, or sheltering • **Harm –** Significant habitat modification or degradation that results in death or injury to listed species by significantly impairing behavioral patterns such as breeding, feeding, or sheltering
Fish and Wildlife Coordination Act of 1958 This Act requires that whenever a body of water is proposed to be controlled or modified, the lead agency must consult with the state and federal agencies responsible for fish and wildlife management (e.g., USFWS, CDFW, and National Oceanic and Atmospheric Administration). The Act allows for recommendations addressing adverse impacts associated with a proposed project, and for mitigating or compensating for impacts on fish and wildlife.

Biological Resources (Federal)
Magnuson-Stevens Fishery Conservation and Management Act (MSA) (16 U.S.C. § 1801 et seq.)
The MSA governs marine fisheries management in Federal waters. The MSA was first enacted in 1976 and amended by the Sustainable Fisheries Act of 1996 and the Magnuson-Stevens Fishery Conservation and Management Reauthorization Act in 2007. Amendments require the identification of Essential Fish Habitat (EFH) for federally managed species and the implementation of measures to conserve and enhance this habitat. Any project requiring Federal authorization, such as a U.S. Army Corps of Engineers permit, is required to complete and submit an EFH Assessment with the application and either show that no significant impacts to the essential habitat of managed species are expected or identify mitigations to reduce those impacts. Under the MSA, Congress defined EFH as “those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity” (16 U.S.C. § 1802(10)). The EFH provisions of the MSA offer resource managers a means to heighten consideration of fish habitat in resource management. Federal agencies shall consult with the NMFS regarding any action they authorize, fund, or undertake that might adversely affect EFH (§ 305(b)(2)).
Marine Mammal Protection Act (MMPA) (16 U.S.C. § 1361 et seq.)
The MMPA is designed to protect and conserve marine mammals and their habitats. It prohibits takes of all marine mammals in the U.S. (including territorial seas) with few exceptions. The Act defines “take” as hunt, capture, or kill, or attempt to harass, hunt, capture, or kill any marine mammal.” “Harassment” is defined as any act of pursuit, torment, or annoyance that has the potential to injure a marine mammal or marine mammal stock in the wild; or has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering. The NMFS may issue a take permit under Section 104 if the activities are consistent with the purposes of the MMPA and applicable regulations at 50 CFR, Part 216. The NMFS must also find that the manner of taking is “humane” as defined in the MMPA. If lethal taking of a marine mammal is requested, the applicant must demonstrate that using a non-lethal method is not feasible. In 1994 a simplified process for obtaining “small take” exemptions was added for unintentional taking by incidental harassment only. Under this process, incidental take of small numbers of marine mammals by harassment can be authorized for periods of up to 1 year.
Migratory Bird Treaty Act (MBTA) (16 U.S.C. § 703-712)
The MBTA prohibits the take, possession, import, export, transport, selling, purchase, barter, or offering for sale, purchase, or barter, of any migratory bird, their eggs, parts, and nests, except as authorized under a valid permit (50 CFR 21.11). The USFWS issues permits for take of migratory birds for activities such as scientific research, education, and depredation control, but does not issue permits for incidental take of migratory birds.
National Invasive Species Act (NISA) (33 CFR, Part 151, Subpart D)
NISA was originally passed in 1990 as the Nonindigenous Aquatic Nuisance Prevention and Control Act [16 U.S.C. § 4701-4751] and reauthorized, renamed and expanded in 1996. Under its provisions, the U.S. Coast Guard requires ballast water management (i.e., exchange) for vessels entering U.S. waters from outside the 200-nautical-mile U.S. Exclusive Economic Zone. The original Act was established to: (1) prevent unintentional introduction and dispersal of nonindigenous species into Waters of the U.S. through ballast water management and other requirements; (2) coordinate and disseminate information on federally conducted, funded, or authorized research, on the prevention and control of the zebra mussel and other aquatic nuisance species; (3) develop and carry out control methods to prevent, monitor, and control unintentional introductions of nonindigenous species from pathways other than ballast water exchange; (4) understand and minimize economic and ecological impacts of established

Biological Resources (Federal)
nonindigenous aquatic nuisance species; and (5) establish a program of research and technology development and assistance to states in the management and removal of zebra mussels.
Executive Orders (EO) • **EO 11990** requires federal agencies to provide leadership and take action to minimize the destruction, loss or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands. Each agency, to the extent permitted by law, must (1) avoid undertaking or providing assistance for new construction located in wetlands unless the head of the agency finds there is no practical alternative to such construction or the proposed action includes all practical measures to minimize harm to wetlands that may result from such use; (2) take into account economic, environmental and other pertinent factors in making this finding; and (3) provide opportunity for early public review of any plans or proposals for new construction in wetlands. • **EO 13112** requires federal agencies to use authorities to prevent introduction of invasive species, respond to and control invasions, and provide for restoration of native species and habitat conditions in invaded ecosystems; also established the Invasive Species Council, which prepares a National Invasive Species Management Plan that details and recommends performance-oriented goals and objectives and measures of success for federal agencies • **EO 13158** requires federal agencies to (1) identify actions that affect natural or cultural resources that are within an MPA; and (2) in taking such actions, to avoid harm to the natural and cultural resources that are protected by a MPA. • **EO 13186** sets forth responsibilities of federal agencies to protect migratory birds.
Other Federal Acts • **Bald and Golden Eagle Protection Act** makes it illegal to import, export, take, sell, purchase or barter any bald eagle or golden eagle or parts thereof. • **Clean Water Act and Rivers and Harbors Act** (*see Hydrology and Water Quality section*) • **Coastal Zone Management Act** (see *Multiple Environmental Issues*) • **Estuary Protection Act (16 U.S.C. § 1221-1226)** authorizes federal agencies to assess the impacts of commercial and industrial developments on estuaries.

Biological Resources (State)
California Endangered Species Act (CESA) (Fish & G. Code, § 2050 et seq.)
The CESA provides for the protection of rare, threatened, and endangered plants and animals, as recognized by the CDFW, and prohibits the taking of such species without its authorization. Furthermore, the CESA provides protection for those species that are designated as candidates for threatened or endangered listings. Under the CESA, the CDFW has the responsibility for maintaining a list of threatened species and endangered species (Fish & G. Code, § 2070). The CDFW also maintains a list of candidate species, which are species that the CDFW has formally noticed as under review for addition to the threatened or endangered species lists. The CDFW also maintains lists of Species of Special Concern that serve as watch lists. Pursuant to CESA requirements, an agency reviewing a proposed project within its jurisdiction must determine whether any State-listed endangered or threatened species may be present in the project site and determine whether the proposed project will have a significant impact on such species. The CDFW encourages informal consultation on any proposed project that may affect a candidate species. The CESA also requires a permit to take a State-listed species through incidental or otherwise lawful activities (§ 2081, subd. (b))
Lake and Streambed Alteration Program (Fish & G. Code, §§ 1600-1616)
These regulations require that the CDFW: be notified of activities that would interfere with the natural flow of, or substantially alter, the channel, bed, or bank of a lake, river, or stream;

Biological Resources (State)
determines if the activity may substantially adversely affect an existing fish and wildlife resource; and issue a Streambed Alteration Agreement if applicable.
Marine Life Protection Act (MLPA) (Fish & G. Code, §§ 2850–2863) Pursuant to this Act, the CDFW established and manages a network of MPAs to, among other goals, protect marine life and habitats and preserve ecosystem integrity. For the purposes of MPA planning, California was divided into five distinct regions (four coastal and San Francisco Bay) each of which had its own MPA planning process. The coastal portion of California's MPA network is now in effect statewide; options for a planning process in San Francisco Bay have been developed for consideration at a future date. The MLPA establishes clear policy guidance and a scientifically sound planning process for the siting and design of MPAs such as: • State Marine Reserves (SMRs), which typically preclude all extractive activities (such as fishing or kelp harvesting) • State Marine Parks (SMPs), which do not allow any commercial extraction • State Marine Conservation Areas (SMCAs), which preclude some combination of commercial and/or recreational extraction
Other relevant California Fish and Game Code sections and Programs/Plans • **Section 1900 et seq.** (California Native Plant Protection Act) is intended to preserve, protect, and enhance endangered or rare native plants in California. Under section 1901, a species is endangered when its prospects for survival and reproduction are in immediate jeopardy from one or more causes. A species is rare when, although not threatened with immediate extinction, it is in such small numbers throughout its range that it may become endangered. The Act includes provisions that prohibit taking of listed rare or endangered plants from the wild and a salvage requirement for landowners. • **Sections 3503 & 3503.5** prohibit take and possession of native birds' nests and eggs from all forms of needless take and provide that it is unlawful to take, possess, or destroy any birds in the orders Falconiformes or Strigiformes (birds-of-prey) or to take, possess, or destroy the nests or eggs of any such bird except as otherwise provided by this Code or any regulation adopted pursuant thereto. • **Sections 3511** (birds), **4700** (mammals), **5050** (reptiles and amphibians), & **5515** (fish) designate certain species as "fully protected;" such species, or parts thereof, may not be taken or possessed at any time without permission by the CDFW. • **Section 3513** does not include statutory or regulatory mechanism for obtaining an incidental take permit for the loss of non-game, migratory birds. • **California Aquatic Invasive Species Management Plan** provides a framework for agency coordination and identifies actions to minimize harmful effects of aquatic invasive species.
Marine Invasive Species Act (MISA) (Pub. Resources Code, § 71200 et seq.) (AB 433; Stats. 2003, ch. 491) Originally passed in 2003 and amended several times, the purpose of MISA is to move towards eliminating the discharge of nonindigenous species into waters of the state or waters that may impact waters of the state, based on the best available technology economically achievable. MISA requires mid-ocean exchange or retention of all ballast water and associated sediments for all vessels 300 gross registered tons or more, U.S. and foreign, carrying ballast water into the waters of the state after operating outside state waters. For all vessels 300 gross register tons or more arriving at a California port or place carrying ballast water from another port or place within the Pacific Coast Region, the Act mandates near-coast exchange or retention of all ballast water. MISA also requires completion and submission of Ballast Water Reporting Form 24 hours in advance of each port of call in California, annual submittal of the Hull Husbandry Reporting Form, the keeping of a ballast management plan and logs, and the application of "Good Housekeeping" Practices designed to minimize the transfer and introduction of invasive

Biological Resources (State)
species. Compliance with MISA is the responsibility of vessel owners/operators. The California State Lands Commission has regulatory authority to manage and enforce MISA.
Coastal Act Chapter 3 policies* (see *Multiple Environmental Issues) • **Section 30230 –** Marine resources shall be maintained, enhanced, and where feasible, restored. Special protection shall be given to areas and species of special biological or economic significance. Uses of the marine environment shall be carried out in a manner that will sustain the biological productivity of coastal waters and that will maintain healthy populations of all species of marine organisms adequate for long-term commercial, recreational, scientific, and educational purposes. • **Section 30231 –** The biological productivity and the quality of coastal waters, streams, wetlands, estuaries, and lakes appropriate to maintain optimum populations of marine organisms and for the protection of human health shall be maintained and, where feasible, restored through, among other means, minimizing adverse effects of waste water discharges and entrainment, controlling runoff, preventing depletion of ground water supplies and substantial interference with surface water flow, encouraging waste water reclamation, maintaining natural vegetation buffer areas that protect riparian habitats, and minimizing alteration of natural streams. • **Section 30232 –** Protection against the spillage of crude oil, gas, petroleum products, or hazardous substances shall be provided in relation to any development or transportation of such materials. Effective containment and cleanup facilities and procedures shall be provided for accidental spills that do occur. • **Section 30233 –** applies in part to development activities within or affecting wetlands and other sensitive areas, identifies eight allowable uses, requires projects be the least environmentally damaging feasible alternative, and where applicable, requires feasible and appropriate mitigation. • **Section 30240 –** (a) Environmentally sensitive habitat areas shall be protected against any significant disruption of habitat values, and only uses dependent on those resources shall be allowed within those areas. (b) Development in areas adjacent to environmentally sensitive habitat areas and parks and recreation areas shall be sited and designed to prevent impacts which would significantly degrade those areas, and shall be compatible with the continuance of those habitat and recreation areas.
Other • California Department of Food and Agriculture's California Noxious and Invasive Weed Action Plan seeks to prevent and control noxious and invasive weeds. • **Wetlands Conservation Policy** – no net loss of wetland acreage; long-term gain in the quantity, quality, and permanence of California's wetlands.

CULTURAL RESOURCES

Cultural Resources (Federal)
Abandoned Shipwreck Act of 1987 (43 U.S.C. § 2101–2106) and **National Park Service (NPS) Abandoned Shipwreck Act Guidelines.** Asserts U.S. Government title to three categories of abandoned shipwrecks: those embedded in a state's submerged lands; those embedded in coralline formations protected by a state on its submerged lands, and those located on a state's lands that are included or determined eligible for inclusion in the National Register of Historic Places. The law then transfers title for a majority of those shipwrecks to the respective states, and provides that states develop policies for management of the wrecks so as to protect natural resources, permit reasonable public

Cultural Resources (Federal)
access, and allow for recovery of shipwrecks consistent with the protection of historical values and environmental integrity of wrecks and sites. The NPS has issued guidelines that are intended to: maximize the enhancement of shipwreck resources; foster a partnership among sport divers, fishermen, archeologists, sailors, and other interests to manage shipwreck resources of the states and the U.S.; facilitate access and utilization by recreational interests; and recognize the interests of individuals and groups engaged in shipwreck discovery and salvage.
Archaeological and Historic Preservation Act (AHPA) The AHPA provides for the preservation of historical and archaeological data that might be irreparably lost or destroyed as a result of (1) flooding, the building of access roads, the erection of workmen's communities, the relocation of railroads and highways, and other alterations of terrain caused by the construction of a dam by an agency of the U.S. or by any private person or corporation holding a license issued by any such agency; or (2) any alteration of the terrain caused as a result of a federal construction project or federally licensed project, activity, or program. This Act requires federal agencies to notify the Secretary of the Interior when they find that any federally permitted activity or program may cause irreparable loss or destruction of significant scientific, prehistoric, historical, or archaeological data. The AHPA built upon national policy, set out in the Historic Sites Act of 1935, "...to provide for the preservation of historic American sites, buildings, objects, and antiquities of national significance...."
Archaeological Resources Protection Act of 1979 (ARPA) (P.L. 96-95; 93 Stat. 712) The ARPA states that archaeological resources on public or Indian lands are an accessible and irreplaceable part of the nation's heritage and: • Establishes protection for archaeological resources to prevent loss and destruction due to uncontrolled excavations and pillaging; • Encourages increased cooperation and exchange of information between government authorities, the professional archaeological community, and private individuals having collections of archaeological resources prior to the enactment of this Act; • Establishes permit procedures to permit excavation or removal of archaeological resources (and associated activities) located on public or Indian land; and • Defines excavation, removal, damage, or other alteration or defacing of archaeological resources as a "prohibited act" and provides for criminal and monetary rewards to be paid to individuals furnishing information leading to the finding of a civil violation or conviction of a criminal violator. An anti-trafficking provision prohibits interstate or international sale, purchase, or transport of any archaeological resource excavated or removed in violation of a state or local law, ordinance, or regulation. ARPA's enforcement provision provides for criminal and civil penalties against violators of the Act. The ARPA's permitting component allows for recovery of certain artifacts consistent with NPS Federal Archeology Program standards and requirements.
National Historic Preservation Act of 1966 (NHPA) (16 U.S.C. § 470 et seq.) and implementing regulations (Protection of Historic Properties; 36 CFR 800) (applies only to federal undertakings) Archaeological resources are protected through the NHPA and its implementing regulation (Protection of Historic Properties; 36 CFR 800), the AHPA, and the ARPA. This Act presents a general policy of supporting and encouraging the preservation of prehistoric and historic resources for present and future generations by directing federal agencies to assume responsibility for considering the historic resources in their activities. The State implements the NHPA through its statewide comprehensive cultural resource surveys and preservation programs coordinated by the California Office of Historic Preservation (OHP) in the State

Cultural Resources (Federal)
Department of Parks and Recreation, which also advises federal agencies regarding potential effects on historic properties. The OHP also maintains the California Historic Resources Inventory. The State Historic Preservation Officer (SHPO) is an appointed official who implements historic preservation programs within the State's jurisdictions, including commenting on Federal undertakings. Under the NHPA, historic properties include "any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion in, the National Register of Historic Places" (16 U.S.C. § 470w [5]).
Executive Order (EO) 13158 EO 13158 requires federal agencies to (1) identify actions that affect natural or cultural resources that are within an MPA; and (2) in taking such actions, to avoid harm to the natural and cultural resources that are protected by a MPA.

Cultural Resources (State)
California Register of Historical Resources (CRHR) The CRHR is "an authoritative listing and guide to be used by state and local agencies, private groups, and citizens in identifying the existing historical resources of the State and to indicate which resources deserve to be protected, to the extent prudent and feasible, from substantial adverse change" (Pub. Resources Code, § 5024.1, subd. (a)). CRHR eligibility criteria are modeled after National Register of Historic Places (NRHP) criteria but focus on resources of statewide significance. Certain resources are determined by the statute to be automatically included in the CRHR, including California properties formally determined to be eligible for, or listed in, the NRHP. To be eligible for the CRHR, a prehistoric or historical period property must be significant at the local, state, or federal level under one or more of the following criteria (State CEQA Guidelines, § 15064.5, subd. (a)(3)): • Criterion 1: Is associated with events that have made a significant contribution to the broad patterns of California's history and cultural heritage • Criterion 2: Is associated with the lives of persons important in California's past • Criterion 3: Embodies the distinctive characteristics of a type, period, region, or method of construction, or represents the work of an important creative individual, or possesses high artistic values • Criterion 4: Has yielded, or may be likely to yield, information important in prehistory or history A resource eligible for the CRHR must meet one of the criteria of significance above, and retain enough of its historic character or appearance (integrity) to be recognizable as an historical resource and to convey the reason for its significance. An historic resource that may not retain sufficient integrity to meet the criteria for listing in the NRHP, may still be eligible for listing in the CRHR. Properties listed, or formally designated as eligible for listing, on the National Register are automatically listed on the CRHR, as are certain State Landmarks and Points of Interest. A lead agency is not precluded from determining that the resource may be an historical resource as defined in Public Resources Code sections 5020.1, subdivision (j), or 5024.1 (State CEQA Guidelines, § 15064.5, subd. (a)(4)).
CEQA (Pub. Resources Code, § 21000 et seq.) CEQA section 21084.1 provides that a project that may cause a substantial adverse change in the significance of an historical resource is a project that may have a significant effect on the environment. An "historical resource" includes: (1) a resource listed in, or eligible for listing in, the California Register of Historic Resources; (2) a resource included in a local register of historical or identified as significant in an historical resource surveys; and (3) any resource that a lead agency determines to be historically significant for the purposes of CEQA, when

Cultural Resources (State)
supported by substantial evidence in light of the whole record. Historical resources may include archaeological resources. Mitigation measures for significant impacts to historical resources must be identified and implemented if feasible.
Coastal Act Chapter 3 policies (see *Multiple Environmental Issues*)
Section 30244 states: Where development would adversely impact archaeological or paleontological resources as identified by the State Historic Preservation Officer, reasonable mitigation measures shall be required.

CULTURAL RESOURCES – TRIBAL

Tribal Cultural Resources (Federal)
Native American Graves Protection and Repatriation Act of 1990 (P.L. 101-601; 104 Stat. 3049)
Assigns ownership or control of Native American human remains, funerary objects, sacred objects, and objects of cultural patrimony that are excavated or discovered on federal lands or tribal lands after passage of the act to lineal descendants or affiliated Indian tribes or Native Hawaiian organizations; establishes criminal penalties for trafficking in human remains or cultural objects; requires federal agencies and museums that receive federal funding to inventory Native American human remains and associated funerary objects in their possession or control and identify their cultural and geographical affiliations within 5 years, and prepare summaries of information about Native American unassociated funerary objects, sacred objects, or objects of cultural patrimony. This is to provide for repatriation of such items when lineal descendants, Indian tribes, or Native Hawaiian organizations request it.
Executive Order (EO) 13007, Indian Sacred Sites
EO 13007 requires federal agencies with administrative or legal responsibility to manage federal lands to accommodate access to and ceremonial use of Indian sacred sites by Indian religious practitioners and avoid adversely affecting the physical integrity of such sites (to the extent practicable permitted by law and not clearly inconsistent with essential agency functions)

Tribal Cultural Resources (State)
CEQA (Pub. Resources Code, § 21073, 21074, 21080.3.1, 21080.3.2, 21082.3, 21083.09, 21084.2, and 21084.3) [AB 52 (Gatto, Stats. 2014, Ch. 532)]
The AB 52 (effective July 1, 2015) amendments to CEQA relate to consultation with California Native American tribes, consideration of tribal cultural resources, and confidentiality. The definition of tribal cultural resources considers tribal cultural values in addition to scientific and archaeological values when determining impacts and mitigation. AB 52 provides procedural and substantive requirements for lead agency consultation with California Native American tribes and consideration of effects on tribal cultural resources, as well as examples of mitigation measures to avoid or minimize impacts to tribal cultural resources. AB 52 establishes that if a project may cause a substantial adverse change in the significance of a tribal cultural resource, that project may have a significant effect on the environment. Lead agencies must avoid damaging effects to tribal cultural resources, when feasible, and shall keep information submitted by tribes confidential.
Health and Safety Code section 7050.5
This section provides for treatment of human remains exposed during construction; no further disturbance may occur until the County Coroner makes findings as to origin and disposition pursuant to Public Resources Code section 5097.98. The Coroner has 24 hours to notify the Native American Heritage Commission (NAHC) if the remains are determined to be of Native American descent. The NAHC contacts most likely descendants about how to proceed.

Tribal Cultural Resources (State)
Public Resources Code section 5097.98
This section provides (1) a protocol for notifying the most likely descendent from the deceased if human remains are determined to be Native American in origin and (2) mandated measures for appropriate treatment and disposition of exhumed remains.
Executive Order B-10-11
EO B-10-11 establishes as state policy that all agencies and departments shall encourage communication and consultation with California Indian Tribes and allow tribal governments to provide meaningful input into proposed decisions and policies that may affect tribal communities.

ENERGY

There are no major federal laws, regulations, and policies potentially applicable to this project.

Energy (State)
Legislative Requirements for Energy Efficieny Savings In response to the energy crisis of 2000-2001, the Energy Commission, the California Public Utilities Commission (CPUC), and the California Power Authority developed "the loading order" as a joint policy vision articulated in the Energy Action Plan. The state would invest in: 1.cost-effective energy efficiency and demand-side resources 2.renewable resources 3.clean conventional electricity supply The CPUC adopts energy efficiency goals, conducts various potential studies, and performs evaluation, measurement, and verification (EM&V) for investor owned utilities (IOUs). Publicly owned utilities (POUs) are not regulated by the CPUC and are not subject to the same energy efficiency mandates as the IOUs. California Code of Regulations Title 20 §1311 requires each POU to report to the Energy Commission its annual investments in energy efficiency and demand reduction programs. Public Utilities Code §9505(d) requires each POU to provide to its customers and the Energy Commission the results of evaluation that measures and verifies their claimed energy savings and demand reduction. Since the early 1990s, the Energy Policy Act requires POUs to file Integrated Resource Plans (IRP) every five years with annual progress reports to the Western Area Power Administration (WAPA). In the IRP, each POU is required to evaluate energy efficiency as an energy supply alternative. Senate Bill 1037 (Kehoe, Chapter 366, Statutes of 2005) requires the CPUC, in consultation with the Energy Commission, to identify all potentially achievable cost-effective electric and natural gas energy efficiency measures for the IOUs, set targets for achieving this potential, review the energy procurement plans of IOUs, and consider cost-effective supply alternatives such as energy efficiency. In addition to these IOU requirements, SB 1037 requires that all POUs, regardless of size, report investments in energy efficiency programs annually to their customers and to the Energy Commission. Assembly Bill 2021 (Levine, Chapter 734, Statutes of 2006) requires the Energy Commission to develop statewide energy efficiency potential estimates and savings targets. AB 2021 mandates the Energy Commission to report statewide energy efficiency potential estimates and savings targets as part of its Integrated Energy Policy Report (IEPR) proceeding. Senate Bill 488 (Pavley, Chapter 352, Statutes of 2009) requires the Energy Commission to evaluate the effectiveness of POU "comparative energy usage disclosure programs" and include POU energy savings potential in the triennial assessment of utility energy efficiency potential and targets. Assembly Bill 2227 (Bradford, Chapter 606, Statutes of 2012) consolidates reporting requirements into a single section of the Public Utilities Code, making compliance easier and more cost-effective for POUs, and amends the reporting timeline under AB 2021 to align more closely with the IEPR timeline. Rather than providing new 10-year targets every third year, POUs will provide updated targets every fourth year.
Clean Energy and Pollution Reduction Act (SB 350; Stats. 2015, ch. 547) This Act requires that the amount of electricity generated and sold to retail customers from renewable energy resources be increased to 50 percent by December 31, 2030, and that statewide energy efficiency savings in electricity and natural gas by retail customers be doubled by January 1, 2030.

GEOLOGY, SOILS, AND PALEONTOLOGICAL RESOURCES

Geology, Soils, and Paleontological Resources (Federal/International)
Building Codes
The design and construction of engineered facilities in California must comply with the requirements of the International Building Code (IBC) and the adoptions of that code by the State of California. The International Building Code sets design standards to accommodate a maximum considered earthquake (MCE), based on a project's regional location, site characteristics, and other factors.

Geology, Soils, and Paleontological Resources (State)
Alquist-Priolo Earthquake Fault Zoning Act (Pub. Resources Code, §§ 2621-2630)
This Act requires that "sufficiently active" and "well-defined" earthquake fault zones be delineated by the State Geologist and prohibits locating structures for human occupancy on active and potentially active surface faults. (Note that since only those potentially active faults that have a relatively high potential for ground rupture are identified as fault zones, not all potentially active faults are zoned under the Alquist-Priolo Earthquake Fault Zone, as designated by the State of California.)
California Building Code (Cal. Code Regs., tit. 23)
The California Building Code provides a minimum standard for building design, which is based on the UBC, but is modified for conditions unique to California. The Code, which is selectively adopted by local jurisdictions, based on local conditions, contains requirements pertaining to multiple activities, including: excavation, site demolition, foundations and retaining walls, grading activities including drainage and erosion control, and construction of pipelines alongside existing structures. For example, sections 3301.2 and 3301.3 contain provisions requiring protection of adjacent properties during excavations and require a 10-day written notice and access agreements with adjacent property owners. California's Marine Oil Terminal Engineering and Maintenance Standards (MOTEMS), which are implemented by the California State Lands Commission, are codified in Chapter 31F—Marine Oil Terminals (Cal. Code Regs., tit. 24, § 3101F et seq.).
Seismic Hazards Mapping Act & Mapping Regs (Pub. Resources Code, § 2690; Cal. Code Regs., tit. 14, div. 2, ch. 8, art. 10).
These regulations were promulgated to promote public safety by protecting against the effects of strong ground shaking, liquefaction, landslides, other ground failures, or other hazards caused by earthquakes. The Act requires that site-specific geotechnical investigations be conducted identifying the hazard and formulating mitigation measures prior to permitting most developments designed for human occupancy. California Division of Mines and Geology Special Publication 117, *Guidelines for Evaluating and Mitigating Seismic Hazards in California* (1997), constitutes the guidelines for evaluating seismic hazards other than surface fault-rupture, and for recommending mitigation measures as required by Public Resources Code section 2695, subdivision (a). The Act does not apply offshore as the California Geological Survey has not zoned offshore California under the Act.
Coastal Act Chapter 3 policies *(see Multiple Environmental Issues)*
With respect to geological resources, Section 30253 requires, in part, that: New development shall: (a) Minimize risks to life and property in areas of high geologic, flood, and fire hazard; and (b) Assure stability and structural integrity, and neither create nor contribute significantly to erosion, geologic instability, or destruction of the site or surrounding area or in any way require the construction of protective devices that would substantially alter natural landforms along bluffs and cliffs. Section 30243 also states in part that the long-term productivity of soils and timberlands shall be protected.
Public Resources Code division 6, parts 1 and 2 (see *Multiple Environmental Issues*)

Geology, Soils, and Paleontological Resources (State)
California Code of Regulations, title 2, division 3, chapter 1, article 3 (see *Multiple Environmental Issues*)
Coastal Development Permit
The Coastal Development Permit is the regulatory mechanism used to ensure that proposed developments in the coastal zone are in compliance with the policies of Chapter 3 of the Coastal Act. In San Luis Obispo County, a permit application is reviewed by the Coastal Permit Administrator to determine if it can be processed administratively or if it must be processed as a Coastal Development Standard Permit. Granting of the permit requires a public hearing by the Planning Commission or Coastal Permit Administrator.
Other
• **Public Resources Code section 5097.5** prohibits excavation or removal of any "vertebrate paleontological site or historical feature, situated on public lands, except with the express permission of the public agency having jurisdiction over such lands"

GREENHOUSE GAS EMISSIONS

Greenhouse Gas Emissions (Federal & International)
Federal Clean Air Act (FCAA) (42 U.S.C. § 7401 et seq.)
In 2007, the U.S. Supreme Court ruled that carbon dioxide (CO_2) is an air pollutant as defined under the Federal Clean Air Act (FCAA), and that the US Environmental Protection Agency (USEPA) has authority to regulate Greenhouse Gas (GHG) emissions.
Mandatory Greenhouse Gas Reporting (74 Fed. Reg. 56260)
On September 22, 2009, the USEPA issued the Mandatory Reporting of Greenhouse Gases Rule, which requires reporting of GHG data and other relevant information from large sources (industrial facilities and power plants that emit more than 25,000 metric tons of carbon dioxide–equivalent ($MTCO_2e$) emissions per year) in the U.S. The purpose of the Rule is to collect accurate and timely GHG data to inform future policy decisions. The Rule is referred to as 40 CFR Part 98 (Part 98). Gases covered by implementation of Part 98 (GHG Reporting Program) are: CO_2, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, sulfur hexafluoride, and other fluorinated gases including nitrogen trifluoride and hydrofluorinated ethers.
Kyoto Protocol and Paris Climate Agreement
On March 21, 1994, the Kyoto Protocol, the first international agreement to regulate GHG emissions, was signed. The Kyoto Protocol was a treaty made under the United Nations Framework Convention on Climate Change. If the commitments outlined in the Kyoto Protocol are met, global GHG emissions would be reduced by 5 percent from 1990 levels during the commitment period of 2008 to 2012. The U.S. was a signatory to the Kyoto Protocol; however, Congress has not ratified it and the U.S. is not bound by the Protocol's commitments. In December 2015, the Paris Climate Agreement was endorsed and adopted by 195 countries including the U.S. (which has since withdrawn from the Agreement). The overarching goal was to reduce pollution levels so that the rise in global temperatures is limited to no more than 2^{o} Celsius (3.6^{o} Fahrenheit). The Agreement included voluntary commitments to cut or limit the growth of their GHG emissions and provide regular and transparent reporting of every country's carbon reductions.

Greenhouse Gas Emissions (State)
California Global Warming Solutions Act of 2006 (AB 32, Stats. 2006, ch. 488)
Under Assembly Bill (AB) 32, the California Air Resources Board (CARB) is responsible for monitoring and reducing GHG emissions in the State and for establishing a statewide GHG emissions cap for 2020 based on 1990 emissions levels. CARB has adopted the AB 32

Greenhouse Gas Emissions (State)
Climate Change Scoping Plan (Scoping Plan), initially approved in 2008 and updated in 2014, which contains the main strategies for California to implement to reduce CO_2e emissions by 169 million metric tons (MMT) from the State's projected 2020 emissions level of 596 MMT CO_2e under a business-as-usual scenario. The Scoping Plan breaks down the amount of GHG emissions reductions CARB recommends for each emissions sector of the State's GHG inventory, but does not directly discuss GHG emissions generated by construction activities.
California Global Warming Solutions Act of 2006: emissions limit (SB 32, Stats. 2016, ch. 249) The update made by SB 32 requires a reduction in statewide GHG emissions to 40 percent below 1990 levels by 2030 to meet the target set in EO B-30-15. The 2017 Climate Change Scoping Plan provides a path to meet the SB 32 GHG emissions reduction goals and provides several GHG emissions reduction strategies to meet the 2030 interim GHG emissions reduction target including implementation of the Sustainable Freight Action Plan, Diesel Risk Reduction Plan, Renewable Portfolio Standard (50 percent by 2030), Advanced Clean Cars policy, and Low Carbon Fuel Standard.
SB 97 (Stats. 2007, ch. 185) Pursuant to SB 97, the State Office of Planning and Research prepared and the Natural Resources Agency adopted amendments to the State CEQA Guidelines for the feasible mitigation of GHG emissions or the effects of GHG emissions. Effective as of March 2010, the revisions to the CEQA Environmental Checklist Form (Appendix G) and the Energy Conservation Appendix (Appendix F) provide a framework to address global climate change impacts in the CEQA process; State CEQA Guidelines section 15064.4 was also added to provide an approach to assessing impacts from GHGs. As discussed in State CEQA Guidelines section 15064.4, the determination of the significance of GHG emissions calls for a careful judgment by the lead agency, consistent with the provisions in section 15064. Section 15064.4 further provides that a lead agency should make a good-faith effort, to the extent possible, on scientific and factual data, to describe, calculate, or estimate the amount of GHG emissions resulting from a project. A lead agency shall have discretion to determine, in the context of a particular project, whether to: • Use a model or methodology to quantify GHG emissions resulting from a project and determine which model or methodology to use. The lead agency has discretion to select the model or methodology it considers most appropriate provided it supports its decision with substantial evidence. The lead agency should explain the limitations of the particular model or methodology selected for use; and/or • Rely on a qualitative analysis or performance based standards. • Section 15064.4 also advises a lead agency to consider the following factors, among others, when assessing the significance of impacts from GHG emissions on the environment: the extent to which the project may increase or reduce GHG emissions as compared to the existing environmental setting; whether the project emissions exceed a threshold of significance that the lead agency determines applies to the project; and the extent to which the project complies with regulations or requirements adopted to implement a statewide, regional, or local plan for the reduction or mitigation of GHG emissions.
Other Legislation • **AB 1493** (Stats. 2002, ch. 200) required CARB to develop and implement regulations (stricter emissions standards) to reduce automobile and light truck GHG emissions beginning with model year 2009.

Greenhouse Gas Emissions (State)
• **AB 2800** (Stats. 2016, ch. 580) requires, in part, that state agencies, until 2020, take into account current and future climate change impacts when planning, designing, building, operating, maintaining, and investing in infrastructure. • **SB 375** (Stats. 2008, ch. 728; effective 2009) required CARB to develop regional GHG emission reduction targets in regions covered by California's 18 metropolitan planning organizations (MPOs) and required the 18 MPOs to develop regional land use and transportation plans and demonstrate an ability to attain the proposed reduction targets by 2020 and 2035. • **SB 1383** (Stats. 2016, ch. 395) requires CARB to approve and begin implementing its Short-Lived Climate Pollutant Reduction Strategy by January 1, 2018, to achieve a 40 percent reduction in methane, 40 percent reduction in hydrofluorocarbon gases, and 50 percent reduction in anthropogenic black carbon by 2030, relative to 2013 levels. • **SB 1425** (Stats. 2016, ch. 596) requires the California Environmental Protection Agency to oversee the development of a registry of GHG emissions resulting from the use of water, such as pumping, treatment, heating, and conveyance (the water-energy nexus), using the best available data.
Executive Orders (EOs) • **EO B-30-15** (Governor Brown, 2015) established a new interim statewide GHG emission reduction target to reduce GHG emissions to 40 percent below 1990 levels by 2030 to ensure California meets its target to reduce GHG emissions to 80 percent below 1990 levels by 2050. State agencies with jurisdiction over sources of GHG emissions to implement measures were also directed pursuant to statutory authority, to achieve GHG emissions reductions to meet the 2030 and 2050 targets. • **EO S-21-09** (Governor Schwarzenegger, 2009) directed CARB to adopt a regulation consistent with the goal of EO S-14-08. • **EO S-14-08** (Governor Schwarzenegger, 2008) required all retail suppliers of electricity in California to serve 33 percent of their load with renewable energy by 2020. • **EO S-13-08** (Governor Schwarzenegger, 2008) directed state agencies to take specified actions to assess and plan for impacts of global climate change, particularly sea-level rise. • **EO S-01-07** (Governor Schwarzenegger, 2007) set a low carbon fuel standard for California and directed the carbon intensity of California's transportations fuels to be reduced by at least 10 percent by 2020. • **EO S-3-05** (Governor Schwarzenegger, 2005) directed reductions in GHG emissions to 2000 levels by 2010, 1990 levels by 2020, and 80 percent below 1990 levels by 2050.

HAZARDS AND HAZARDOUS MATERIALS

Hazards and Hazardous Materials (Federal)
California Toxics Rule (40 CFR 131) In 2000, the US Environmental Protection Agency (USEPA) promulgated numeric water quality criteria for priority toxic pollutants and other water quality standards provisions to be applied to waters in California to protect human health and the environment. Under Clean Water Act section 303(c)(2)(B), the USEPA requires states to adopt numeric water quality criteria for priority toxic pollutants for which the USEPA has issued criteria guidance, and the presence or discharge of which could reasonably be expected to interfere with maintaining designated uses. These federal criteria are legally applicable in California for inland surface waters, enclosed bays, and estuaries.
Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (42 U.S.C., Ch. 103)

Hazards and Hazardous Materials (Federal)
CERCLA, commonly known as Superfund, provides broad federal authority to respond directly to releases or threatened releases of hazardous substances that may endanger public health or the environment. CERCLA establishes requirements concerning closed and abandoned hazardous waste sites, provides for liability of persons responsible for releases of hazardous waste at these sites, and establishes a trust fund to provide for cleanup when no responsible party could be identified. CERCLA was amended by the Superfund Amendments and Reauthorization Act on October 17, 1986.
Occupational Safety and Health Act of 1970
Congress created the California Division of Occupational Safety and Health Administration (Cal OSHA) to assure safe and healthful working conditions for working men and women by setting and enforcing standards and by providing training, outreach, education and assistance. Cal OSHA has entered into an agreement with California under which California regulations covers all private sector places of employment within the state with certain exceptions.
Resource Conservation and Recovery Act (RCRA) (42 U.S.C. § 6901 et seq.)
The RCRA authorizes the USEPA to control hazardous waste from “cradle-to-grave” (generation, transportation, treatment, storage, and disposal). RCRA Hazardous and Solid Waste Amendments from 1984 include waste minimization, phasing out land disposal of hazardous waste, and corrective action for releases. The Department of Toxic Substances Control is the lead state agency for corrective action associated with RCRA facility investigations and remediation.
Toxic Substances Control Act (TSCA) (15 U.S.C. § 2601–2692)
The TSCA authorizes the USEPA to require reporting, record-keeping, testing requirements, and restrictions related to chemical substances and/or mixtures. It also addresses production, importation, use, and disposal of specific chemicals, such as polychlorinated biphenyls (PCBs), asbestos-containing materials, lead-based paint, and petroleum.
Other Relevant Laws, Regulations, and Recognized National Codes and Standards
• **33 CFR, Navigation and Navigable Waters** regulates aids to navigation, vessel operations, anchorages, bridges, security of vessels, waterfront facilities, marine pollution financial responsibility and compensation, prevention and control of releases of materials (including oil spills) from vessels, ports and waterways safety, boating safety, and deep-water ports • **46 CFR parts 1 through 599 and Inspection and Regulation of Vessels (46 U.S.C. Subtitle II Part B)** provide that all commercial (e.g., passengers for hire, transport of cargoes, hazardous materials, and bulk solids) vessels operating offshore on specified routes (inland, near coastal, and oceans), including those under foreign registration, are subject to requirements applicable to vessel construction, condition, and operation. These regulations also allow for inspections to verify that vessels comply with applicable international conventions and U.S. laws and regulations. • **Act of 1980 to Prevent Pollution from Ships** requires ships in U.S. waters, and all U.S. ships to comply with International Convention for the Prevention of Pollution from Ships (MARPOL) • **Clean Water Act** (see *Hydrology and Water Quality*) • **Convention on the International Regulations for Preventing Collisions at Sea** establishes “rules of the road” such as rights-of-way, safe speed, actions to avoid collision, and procedures to observe in narrow channels and restricted visibility • **Hazardous Materials Transportation Act** (*see Transportation/Traffic*) • **Safety and Corrosion Prevention Requirements** — American Society of Mechanical Engineers, National Association of Corrosion Engineers (NACE), ANSI

Hazards and Hazardous Materials (State)
California Occupational Safety and Health Act of 1973 and California Code of Regulations, title 8 California employers have many different responsibilities under the Cal/OSHA Regulations. The following represents several requirements**:** • Establish, implement and maintain an Injury and Illness Prevention Program and update it periodically to keep employees safe. • Inspect workplace(s) to identify and correct unsafe and hazardous conditions. • Make sure employees have and use safe tools and equipment and properly maintain this equipment. • Provide and pay for personal protective equipment. • Use color codes, posters, labels or signs to warn employees of potential hazards.
Clean Coast Act of 2005 (SB 771; Stats. 2005, ch. 588) This Act (effective January 1, 2006) includes requirements to reduce pollution of California waters from large vessels, such as by: prohibiting and reporting of discharges of hazardous wastes, other wastes, or oily bilge water into California waters or a marine sanctuary; and prohibiting and reporting discharges of grey water and sewage into California waters from vessels with sufficient holding-tank capacity or vessels capable of discharging grey water or sewage to available shore-side reception facilities.
Coastal Act Chapter 3 policies (see *Multiple Environmental Issues*) Section 30232 of the Coastal Act addresses hazardous materials spills and states that "Protection against the spillage of crude oil, gas, petroleum products, or hazardous substances shall be provided in relation to any development or transportation of such materials. Effective containment and cleanup facilities and procedures shall be provided for accidental spills that do occur."
Lempert-Keene-Seastrand Oil Spill Prevention and Response Act (OSPRA) (Gov. Code, § 8670.1 et seq., Pub. Resources Code, § 8750 et seq., and Rev. & Tax. Code, § 46001 et seq.) The Office of Spill Prevention and Response (OSPRA) and its implementing regulations seek to protect state waters from oil pollution and to plan for the effective and immediate response, removal, abatement, and cleanup in the event of an oil spill. The Act requires applicable operators to prepare and implement marine oil spill contingency plans and to demonstrate financial responsibility, and requires immediate cleanup of spills, following the approved contingency plans, and fully mitigating impacts on wildlife. The Act assigns primary authority to the OSPR within the California Department of Fish and Wildlife (CDFW) to direct prevention, removal, abatement, response, containment, and cleanup efforts with regard to all aspects of any oil spill in the marine waters of the state; the California State Lands Commission is also provided with authority for oil spill prevention from and inspection of marine facilities and assists OSPR with spill investigations and response. Notification is required to the State Office of Emergency Services, which in turn notifies the response agencies, of all oil spills in the marine environment, regardless of size. The Act also created the Oil Spill Prevention and Administration Fund and the Oil Spill Response Trust Fund. Pipeline operators pay fees into the first of these funds for pipelines transporting oil into California across, under, or through marine waters.
Other • **Hazardous Waste Control Act (Health & Saf. Code, ch. 6.5 & Cal. Code Regs., tit. 22 and 26)** establishes criteria for defining hazardous waste and its safe handling, storage, treatment, and disposal (law is designed to provide cradle-to-grave management of hazardous wastes and reduce the occurrence and severity of hazardous materials releases).

Hazards and Hazardous Materials (State)

- **Hazardous Material Release Response Plans and Inventory Law** (Health & Saf. Code, ch. 6.95) is designed to reduce the occurrence and severity of hazardous materials releases. This State law requires businesses to develop a Release Response Plan for hazardous materials emergencies if they handle more than 500 pounds, 55 gallons, or 200 cubic feet of hazardous materials. In addition, the business must prepare a Hazardous Materials Inventory of all hazardous materials stored or handled at the facility over the above thresholds, and all hazardous materials must be stored in a safe manner.
- **California Code of Regulations, title 8, division 1** sets forth the Permissible Exposure Limit, the exposure, inhalation or dermal permissible exposure limit for numerous chemicals. Included are chemicals, mixture of chemicals, or pathogens for which there is statistically significant evidence, based on at least one study conducted in accordance with established scientific principles, that acute or chronic health effects may occur in exposed employees. Title 8 sections 5191 and 5194 require a Hazard Communication Plan to ensure both employers and employees understand how to identify potentially hazardous substances in the workplace, understand the associated health hazards, and follow safe work practices.
- **California Code of Regulations, title 19, division 2** establishes minimum statewide standards for Hazardous Materials Business Plans.
- **California Code of Regulations, title 22, division 4.5** regulates hazardous wastes and materials by implementation of a Unified Program to ensure consistency throughout the state in administration requirements, permits, inspections, and enforcement by Certified Unified Program Agencies (CUPAs)
- **California Code of Regulations, title 24, part 9 (Fire Code regulations) –** state hazardous materials should be used and storage in compliance with the state fire codes
- **Porter-Cologne Water Quality Control Act** (*see Hydrology and Water Quality)*
- **Seismic Hazards Mapping Act/Regulations** (*see Geology and Soils)*
- **California State Lands Commission Oil and Gas Provisions and Regulations** (see *Multiple Environmental Issues*)

HYDROLOGY AND WATER QUALITY

Hydrology and Water Quality (Federal)

Federal Clean Water Act (CWA) (33 U.S.C. § 1251 et seq.)

The CWA is comprehensive legislation (it generally includes the Federal Water Pollution Control Act of 1972, its supplementation by the CWA of 1977, and amendments in 1981, 1987, and 1993) that seeks to protect the nation's water from pollution by setting water quality standards for surface water and by limiting the discharge of effluents into waters of the U.S. These water quality standards are promulgated by the USEPA and enforced in California by the State Water Resources Control Board (SWRCB) and nine Regional Water Quality Control Boards (RWQCBs). CWA sections include:

- **Section 303(d) (33 U.S.C. § 1313)** requires states to list waters that are not attaining water quality standards, which is known as the 303(d) List of impaired waters. These requirements have lead to the development of total maximum daily load (TMDL) guidance at the state level through the SWRCB and various RWQCBs.
- **Section 305(b) (33 U.S.C. § 1315)** requires states to assess and report on the water quality status of waters within the states.
- **Section 401 (33 U.S.C. § 1341)** specifies that any applicant for a federal permit or license to conduct any activity which may result in any discharge into the navigable waters of the U.S. to obtain a certification or waiver thereof from the state in which the discharge originates that

Hydrology and Water Quality (Federal)
such a discharge will comply with established state effluent limitations and water quality standards. U.S. Army Corps of Engineers projects are required to obtain this certification. • **Section 402 (33 U.S.C. § 1342)** establishes conditions and permitting for discharges of pollutants under the National Pollutant Discharge Elimination System) (NPDES). Under the NPDES Program, states establish standards specific to water bodies and designate the types of pollutants to be regulated, including total suspended solids and oil; all point sources that discharge directly into waterways are required to obtain a permit regulating their discharge. NPDES permits fall under the jurisdiction of the SWRCB or RWQCBs when the discharge occurs within state waters (out to 3 nautical miles). • **Section 403 (33 U.S.C. § 1343)** provides permit issuance guidelines for ocean discharge. Section 403 provides that point source discharges to the territorial seas, contiguous zone, and oceans are subject to regulatory requirements in addition to the technology – or water quality-based requirements applicable to typical discharges. These requirements are intended to ensure that no unreasonable degradation of the marine environment will occur as a result of the discharge and to ensure that sensitive ecological communities are protected. • **Section 404 (33 U.S.C. § 1344)** authorizes the U.S. Army Corps of Engineers to issue permits for the discharge of dredged or fill material into waters of the U.S., including wetlands, streams, rivers, lakes, coastal waters or other water bodies or aquatic areas that qualify as waters of the U.S.
Marine Protection, Research, and Sanctuary Act (16 U.S.C. § 1431 et seq. and 33 U.S.C. § 1401 et seq.)
In 1972, this Act established the National Marine Sanctuary Program, administered by the National Oceanic and Atmospheric Administration, which has a primary goal to establish and maintain National Marine Sanctuaries and protect natural and cultural resources contained within their boundaries.
Rivers and Harbors Act (33 U.S.C. § 401)
This Act governs specified activities in “navigable waters” (waters subject to the ebb and flow of the tide or that are presently used, have been used in the past, or may be susceptible for use to transport interstate or foreign commerce). Section 10 provides that construction of any structure in or over any navigable water of the U.S., or the accomplishment of any other work affecting the course, location, condition, or physical capacity of such waters, is unlawful unless the U.S. Army Corps of Engineers approves the work and issues a Rivers and Harbors Act section 10 Permit (which may occur concurrently with Clean Water Act section 404 permits).
National Flood Insurance Program In response to the increasing cost of disaster relief, Congress passed the National Flood Insurance Program (NFIP) of 1968 and the Flood Disaster Protection Act of 1973. FEMA administers the NFIP to provide subsidized flood insurance to communities that comply with FEMA regulations to limit development in floodplains. A FIRM is an official FEMA-prepared map of a community. It is used to delineate both the SFHAs and the flood-risk premium zones that are applicable to the community.

Hydrology and Water Quality (Federal)

Other Relevant Laws and Regulations

- **Marine Plastic Pollution Research and Control Act** prohibits the discharge of plastic, garbage, and floating wood scraps within 3 nautical miles of land. Beyond 3 nautical miles, garbage must be ground to less than 1 inch, but discharge of plastic and floating wood scraps is still restricted. This Act requires manned offshore platforms, drilling rigs, and support vessels operating under a federal oil and gas lease to develop waste management plans.
- **Navigation and Navigable Waters (33 CFR) regulations** include requirements pertaining to prevention and control of releases of materials from vessels (e.g., oil spills), traffic control, and restricted areas, and general ports and waterways safety.
- **Oil Pollution Act (OPA)** (see *Hazards and Hazardous Materials*).

Hydrology and Water Quality (State)

Porter-Cologne Water Quality Control Act (Wat. Code, § 13000 et seq.) (Porter-Cologne)

Porter-Cologne is the principal law governing water quality in California. The Act established the SWRCB and nine RWQCBs, which have primary responsibility for protecting water quality and beneficial uses of state waters. Porter-Cologne also implements many provisions of the federal Clean Water Act, such as the NPDES permitting program. Pursuant to Clean Water Act section 401, applicants for a federal license or permit for activities that may result in any discharge to waters of the U.S. must seek a Water Quality Certification from the state in which the discharge originates; such Certification is based on a finding that the discharge will meet water quality standards and other appropriate requirements of state law. In California, RWQCBs issue or deny certification for discharges within their jurisdiction. The SWRCB has this responsibility where projects or activities affect waters in more than one RWQCB's jurisdiction. If the SWRCB or a RWQCB imposes a condition on its Certification, those conditions must be included in the federal permit or license. Plans that contain enforceable standards for the various waters they address include the following:

- Basin Plan. Porter-Cologne (see § 13240) requires each RWQCB to formulate and adopt a Basin Plan for all areas within the region. Each RWQCB must establish water quality objectives to ensure the reasonable protection of beneficial uses, and an implementation program for achieving water quality objectives within the basin plan. In California, the beneficial uses and water quality objectives are the state's water quality standards.
- California Ocean Plan (see § 13170.2) establishes water quality objectives for California's ocean waters and provides the basis for regulating wastes discharged into ocean and coastal waters. The plan applies to point and non-point sources. In addition, the Ocean Plan identifies applicable beneficial uses of marine waters and sets narrative and numerical water quality objectives to protect beneficial uses. The SWRCB first adopted this plan in 1972, and it reviews the plan at least every 3 years to ensure that current standards are adequate and are not allowing degradation to indigenous marine species or posing a threat to human health.

RWQCBs also oversee on-site treatment of "California Designated, Non-Hazardous Waste" and enforces water quality thresholds and standards set forth in the Basin Plan. Applicants may be required to obtain a General Construction Activities Storm Water Permit under the NPDES program, and develop and implement a Storm Water Pollution Prevention Plan (SWPPP) that includes best management practices to control erosion, siltation, turbidity, and other contaminants associated with construction activities. The SWPPP would include best management practices to control or prevent the release of non-storm water discharges, such as crude oil, in storm water runoff.

NPDES General Construction Stormwater Permit

Hydrology and Water Quality (State)
The General NPDES Permit for Stormwater Discharges Associated with Construction and Land Disturbance Activities (Order 2009-0009-DWQ, as amended by 2010-0014-DWQ and 2012-006-DWQ) (Construction General Permit) regulates stormwater discharges related to construction activities. Dischargers whose projects disturb 1 or more acres of soil, or whose projects disturb less than 1 acre but are part of a larger common plan of development that, in total, disturbs 1 or more acres, are required to obtain coverage under the Construction General Permit. The Construction General Permit requires development and implementation of a Stormwater Pollution Prevention Plan (SWPPP). The SWPPP must list best management practices (BMPs) that the discharger will use to reduce or eliminate pollutants associated with construction activities in stormwater runoff and document the placement and maintenance of those BMPs. Additionally, the SWPPP must contain a visual monitoring program; a chemical monitoring program for "nonvisible" pollutants, to be implemented in case of a BMP failure; and a monitoring plan for turbidity and pH for projects that meet defined risk criteria. The requirements of the SWPPP are based on the construction design specifications detailed in the final design plans of a project and the hydrology and geology of the site expected to be encountered during construction. The local or lead agency requires proof of coverage under the Construction General Permit prior to building permit issuance. The SWPPP is submitted to the State Water Board, and a copy is kept at the jobsite where it is updated during different phases of construction. The SWPPP must be available for inspection and review upon request.
State Water Board Phase II MS4 Permit San Luis Obispo County is considered to be traditional small MS4 permittees under the State Water Board's WDRs for stormwater discharges from small MS4s (NPDES Order No. 2013-001-DWQ; General Permit No. CAS000004). Stormwater infrastructure connected to the stormwater system is covered under the County's MS4 Permit. Traditional small MS4 permittees are required to comply with Section E of the Statewide Phase II MS4 Permit, which specifies requirements for site design measures, LID design standards, a post-construction stormwater management program, and operation and maintenance (O&M) of post-construction stormwater management measures as part of a Post-Construction Stormwater Management Program (Provision E.12). LID design standards are required to be implemented for all development (or redevelopment) projects that create and/or replace 5,000 square feet (sf) or more of impervious surface. Redevelopment is any land-disturbing activity that results in the creation, addition, or replacement of an exterior impervious surface area on a site where some past development has occurred. If a redevelopment project increases the impervious surface of an existing development by more than 50 percent, runoff from the entire project, including all existing, new, and/or replaced impervious surfaces, must be included to the extent feasible. If a redevelopment project increases the impervious surface of an existing development by less than 50 percent, only runoff from the new and/or replaced impervious surface of the project must be included. The Statewide Phase II MS4 Permit specifies criteria for site design measures and stormwater treatment measures.
Surface and Submerged Lands Lease Agreement The California State Lands Commission (CSLC) has exclusive jurisdiction over all of California's tidelands and submerged lands as well as the beds of naturally navigable rivers and lakes, sovereign lands, swamp and overflow lands, and state school lands (proprietary lands). CSLC has statutory authority (Division 6 of the California Resources Code) to approve appropriate uses for public property rights within these sovereign lands, such as water-borne commerce, navigation, fisheries, open space, recreation, or other recognized public trust purposes. CSLC management responsibilities include activities within submerged lands (from the mean high-tide line) as well as activities within an area 3 nautical miles offshore. These activities

Hydrology and Water Quality (State)
include oil and gas development, harbor development and management oversight, construction and operation of offshore pipelines or other facilities, dredging, reclamation, use of filled sovereign lands, topographical and geological studies, and other activities that occur on these lands. CSLC also surveys and maintains the title records of all state sovereign lands and settles issues regarding title and jurisdiction.
Coastal Act Chapter 3 policies (see *Multiple Environmental Issues*) Section 30231 states that the biological productivity and the quality of coastal waters, streams, wetlands, estuaries, and lakes appropriate to maintain optimum populations of marine organisms and for the protection of human health shall be maintained and, where feasible, restored through, among other means, minimizing adverse effects of waste water discharges and entrainment, controlling runoff, preventing depletion of ground water supplies and substantial interference with surface water flow, encouraging waste water reclamation, maintaining natural vegetation buffer areas that protect riparian habitats, and minimizing alteration of natural streams.
Harbors and Navigation Code sections 650-674 This code specifies a State policy to "promote safety for persons and property in and connected with the use and equipment of vessels," and includes laws concerning marine navigation that are implemented by local city and county governments. This Code also regulates discharges from vessels within territorial waters of the State of California to prevent adverse impacts on the marine environment. This code regulates oil discharges and imposes civil penalties and liability for cleanup costs when oil is intentionally or negligently discharged to the waters of the State of California.
Inland Surface Waters, Enclosed Bays, and Estuaries Plan On April 7, 2015, the State Water Board adopted an amendment to the Part 1 Trash Provisions of the Water Quality Control Plan for Inland Surface Waters, Enclosed Bays, and Estuaries of California. Referred to as the "Trash Amendment," this amendment prohibits the presence of trash in inland surface waters, enclosed bays, estuaries, and along shorelines in amounts that adversely affect beneficial uses or cause nuisance. Compliance with this prohibition is achieved through compliance with NPDES permit limitations, WDRs, and waivers. Discharges that are not subject to these regulatory requirements are also required to comply. MS4 permittees with authority over priority land uses that would be developed under the proposed project are required to comply with the discharge prohibitions. Compliance may be achieved using a full capture system for all storm drains (Track 1) or a combination of full capture systems, multi-benefit projects, other treatment controls, and institutional controls (Track 2). These Track 2 measures must achieve a level of control equivalent to full capture under Track 1. The amendment requires that MS4 permits are modified or reissued to address this amendment within 18 months of adoption of the amendment. The Trash Amendment also requires that trash is eliminated from all stormwater and nonstormwater discharges from construction activities regulated under the Construction General Stormwater Permit. If this is not economically feasible, dischargers must meet the requirements of Track 1 or Track 2, which are described above. Existing NPDES permits must be modified or reissued to include the requirements of the Trash Amendment within 18 months of adoption of the amendment. Permittees must submit an implementation plan within 3 months of adoption of the implementing permit. MS4 permittees must achieve full compliance with the requirements of the Trash Amendment within 10 years of the effective date of the first implementing permit and must achieve interim milestones during the first 10 years to show progress toward achieving full implementation.
Marine Life Management Act

Hydrology and Water Quality (State)
The Marine Life Management Act of 1999 is a plan for managing fisheries and other marine life in the State.
Marine Life Protection Act (MLPA) (Fish & G. Code, §§ 2850–2863)
Pursuant to this Act, the California Department of Fish and Wildlife (CDFW) established and manages a network of Marine Protected Areas (MPAs) to, among other goals, protect marine life and habitats and preserve ecosystem integrity.
Marine Managed Areas Improvement Act.
This Act established the California Marine Managed Areas System, extended State Parks' management jurisdiction into the marine environment, and gives priority to MPAs adjacent to protected terrestrial lands. For example, more than 25 percent of the California coastline is within the State Park System.
Other Relevant Law
• Lake and Streambed Alteration Program (Fish & G. Code, §§ 1600-1616) (see *Biological Resources*). • Water Code section 8710 requires that a reclamation board permit be obtained prior to the start of any work, including excavation and construction activities, if projects are located within floodways or levee sections. Structures for human habitation are not permitted within designated floodways. • Water Code section 13142.5 provides marine water quality policies stating that wastewater discharges shall be treated to protect present and future beneficial uses, and, where feasible, to restore past beneficial uses of the receiving waters. The highest priority is given to improving or eliminating discharges that adversely affect wetlands, estuaries, and other biologically sensitive sites; areas important for water contact sports; areas that produce shellfish for human consumption; and ocean areas subject to massive waste discharge.

LAND USE AND PLANNING

Land Use and Planning (Federal)
Coastal Zone Management Act (see *Multiple Environmental Issues*)

Land Use and Planning (State)
Submerged Lands Act
The State of California owns tide and submerged lands waterward of the ordinary high watermark. State law gives primary responsibility for determination of the precise boundary between these public tidelands and private lands, and administrative responsibility over state tidelands, to the CSLC. Access and use of state shoreline areas can be obtained through purchase or lease agreements.
Coastal Act Chapter 3 policies (see *Multiple Environmental Issues*)
• **Section 30220 –** Coastal areas suited for water-oriented recreational activities that cannot readily be provided at inland water areas shall be protected for such uses. • **Section 30221 –** Oceanfront land suitable for recreational use shall be protected for recreational use and development unless present and foreseeable future demand for public or commercial recreational activities that could be accommodated on the property is already adequately provided for in the area. • **Section 30222 –** The use of private lands suitable for visitor-serving commercial recreational facilities designed to enhance public opportunities for coastal recreation shall have priority over private residential, general industrial, or general commercial development, but not over agriculture or coastal-dependent industry.

Land Use and Planning (State)
• **Section 30223 –** Upland areas necessary to support coastal recreational uses shall be reserved for such uses, where feasible. • **Section 30224 –** Increased recreational boating use of coastal waters shall be encouraged, in accordance with this division, by developing dry storage areas, increasing public launching facilities, providing additional berthing space in existing harbors, limiting non-water-dependent land uses that congest access corridors and preclude boating support facilities, providing harbors of refuge, and by providing for new boating facilities in natural harbors, new protected water areas, and in areas dredged from dry land.

MINERAL RESOURCES

There are no major federal laws, regulations, and policies potentially applicable to this project.

Mineral Resources (State)
Surface Mining and Reclamation Act (SMARA) (Pub. Resources Code, §§ 2710-2796).
The California Department of Conservation is the primary agency with regard to mineral resource protection. The Department, which is charged with conserving earth resources (Pub. Resources Code, §§ 600-690), has five program divisions: California Geological Survey (CGS); Division of Oil, Gas, and Geothermal Resources; Division of Land Resource Protection; State Mining and Geology Board (SMGB); and Division of Mine Reclamation. SMGB develops policy direction regarding the development and conservation of mineral resources and reclamation of mined lands. In accordance with SMARA, CGS classifies the regional significance of mineral resources and assists in designating lands containing significant aggregate resources. Four Mineral Resource Zones (MRZs) are designated to indicate the significance of mineral deposits. • MRZ-1 – Areas where adequate information indicates that no significant mineral deposits are present or where it is judged that little likelihood exists for their presence • MRZ-2 – Areas where adequate information indicates significant mineral deposits are present, or where it is judged that a high likelihood exists for their presence • MRZ-3 – Areas containing mineral deposits the significance of which cannot be evaluated from available data • MRZ-4 – Areas where available information is inadequate for assignment to any other MRZ
The Warren-Alquist Act
This act was adopted in 1974 to encourage conservation of non-renewable energy resources.

NOISE

Noise (Federal)
Noise Control Act (42 U.S.C. § 4910) and NTIS 550\9-74-004, 1974
The Noise Control Act required the USEPA to establish noise emission criteria and noise testing methods (40 CFR Chapter 1, Subpart Q). These criteria generally apply to interstate rail carriers and to some types of construction and transportation equipment. In 1974, the USEPA provided guidance in NTIS 550\9-74-004 ("Information on Levels of Environmental Noise Requisite to Protect Health and Welfare with an Adequate Margin of Safety;" referenced as the "Levels Document") that established an L_{dn} of 55 dBA as the requisite level, with an adequate margin of safety, for areas of outdoor uses including residences and recreation areas. The recommendations do not consider technical or economic feasibility (i.e., the document identifies safe levels of environmental noise exposure without consideration for achieving these

Noise (Federal)
levels or other potentially relevant considerations), and therefore should not be construed as standards or regulations.

Noise (State)
Land Use Compatibility Guidelines from the now defunct California Office of Noise Control
State regulations for limiting population exposure to physically and/or psychologically significant noise levels include established guidelines and ordinances for roadway and aviation noise under the California Department of Transportation and the now defunct California Office of Noise Control. Office of Noise Control land use compatibility guidelines provided the following: • For residences, an exterior noise level of 60 to 65 dBA Community Noise Equivalent Level (CNEL) is considered "normally acceptable;" a noise level of greater than 75 dBA CNEL is considered "clearly unacceptable." • A noise level of 70 dBA CNEL is considered "conditionally acceptable" (i.e., the upper limit of "normally acceptable" for sensitive uses [schools, libraries, hospitals, nursing homes, churches, parks, offices, commercial/professional businesses]).
Other Relevant Regulations
• **California Code of Regulations, title 24** establishes CNEL 45 dBA as the maximum allowable indoor noise level resulting from exterior noise sources for multi-family residences.

POPULATION AND HOUSING

There are no major federal or state laws, regulations, and policies potentially applicable to this project

PUBLIC SERVICES

Public Services (Federal)
CFR Title 29
• **29 CFR 1910.38** requires an employer, when required by a California Division of Occupational Safety and Health Administration (Cal OSHA) standard, to have an Emergency Action Plan that must be in writing, kept in the workplace, and available to employees for review. • **29 CFR 1910.39** requires an employer to have a Fire Prevention Plan. • **29 CFR 1910.155, Subpart L, Fire Protection** requires employers to place and keep in proper working order fire safety equipment within facilities.

Public Services (State)
California Code of Regulations, title 19 (Public Safety)
California State Fire Marshal regulations establish minimum standards for the prevention of fire and for protection of life and property against fire, explosion, and panic.

RECREATION

There are no major federal laws, regulations, and policies potentially applicable to this project

Recreation (State)
Coastal Act Chapter 3 policies (see *Multiple Environmental Issues*)
• **Section 30210** – In carrying out the requirement of Section 4 of Article X of the California Constitution, maximum access, which shall be conspicuously posted, and recreational opportunities shall be provided for all the people consistent with public safety needs and the need to protect public rights, rights of private property owners, and natural resource areas from overuse • **Section 30220** – Coastal areas suited for water-oriented recreational activities that cannot readily be provided at inland water areas shall be protected for such uses • **Section 30221** – Oceanfront land suitable for recreational use shall be protected for recreational use and development unless present and foreseeable future demand for public or commercial recreational activities that could be accommodated on the property is already adequately provided for in the area • **Section 30222.5** – Oceanfront land that is suitable for coastal dependent aquaculture shall be protected for that use, and proposals for aquaculture facilities located on those sites shall be given priority, except over other coastal dependent developments or uses
Other Relevant Regulations
• **California Ocean Sport Fishing Regulations.** Each year, the Fish and Game Commission issues regulations on the recreational fishing within State marine waters. These regulations specify season, size and bag limits, gear restrictions, as well as licensing requirements. Following the development of the MPAs, a section on fishing restrictions within the MPAs was also included.

TRANSPORTATION / TRAFFIC

Transportation / Traffic (Federal)
Ports and Waterways Safety Act
This Act provides the authority for the U.S. Coast Guard to increase vessel safety and protect the marine environment in ports, harbors, waterfront areas, and navigable waters, including by authorizing the Vessel Traffic Service, controlling vessel movement, and establishing requirements for vessel operation.

Transportation / Traffic (State)
California Vehicle Code
Chapter 2, article 3 defines the powers and duties of the California Highway Patrol, which enforces vehicle operation and highway use in the State. The California Department of Transportation is responsible for the design, construction, maintenance, and operation of the California State Highway System and the portion of the Interstate Highway System within State boundaries. Caltrans has the discretionary authority to issue special permits for the use of California State highways for other than normal transportation purposes. Caltrans also reviews all requests from utility companies, developers, volunteers, nonprofit organizations, and others desiring to conduct various activities within the California Highway right of way. The Caltrans Highway Design Manual, prepared by the Office of Geometric Design Standards (Caltrans 2012), establishes uniform policies and procedures to carry out the highway design functions of Caltrans. Caltrans has also prepared a Guide for the Preparation of Traffic Impact Studies (Caltrans 2002). Objectives for the preparation of this guide include providing consistency and uniformity in the identification of traffic impacts generated by local land use proposals.
Harbors and Navigation Code sections 650-674

Transportation / Traffic (State)
This code specifies a policy to “promote safety for persons and property in and connected with the use and equipment of vessels,” and includes laws concerning marine navigation that are implemented by local city and county governments. This Code also regulates discharges from vessels within territorial waters of the State of California to prevent adverse impacts on the marine environment. This code regulates oil discharges and imposes civil penalties and liability for cleanup costs when oil is intentionally or negligently discharged to state waters.

UTILITIES AND SERVICE SYSTEMS

Utilities and Service Systems (Federal)
CFR Title 29 (see *Public Services*)

Utilities and Service Systems (State)
California Integrated Waste Management Act (AB 939; Stats. 1989, ch. 1095)
Assembly Bill (AB) 939 mandates management of non-hazardous solid waste throughout California. Its purpose includes: reduce, recycle, and reuse solid waste generated in the state to the maximum extent feasible; improve regulation of existing solid waste landfills; ensure that new solid waste landfills are environmentally sound; streamline permitting procedures for solid waste management facilities; and specify local government responsibilities to develop and implement integrated waste management programs. AB 939 policies preferred waste management practices include the following. The highest priority is to reduce the amount of waste generated at its source (source reduction). Second is to reuse, by extending the life of existing products and recycling those wastes that can be reused as components or feed stock for the manufacture of new products, and by composting organic materials. Source reduction, reuse, recycling and composting are jointly referred to as waste diversion methods because they divert waste from disposal. Third is disposal by environmentally safe transformation in a landfill. All local jurisdictions, cities, and counties must divert 50 percent of the total waste stream from landfill disposal by the year 2000 and each year thereafter (with 1990 as the base year).
California Code of Regulations, title 19 (Public Safety)
Title 19, sets standards for the prevention of fire and protection of property and life by the Seismic Safety Commission, Office of Emergency Services, and Office of the Fire Marshall. It also contains guidelines and standards for general fire, construction, explosives, emergency management, earthquakes, and fire.
Coastal Act Chapter 3 policies (see *Multiple Environmental Issues*)
• **Section 30254** – New or expanded public works facilities shall be designed and limited to accommodate needs generated by development or uses permitted consistent with the provisions of this division; provided, however, that it is the intent of the Legislature that State Highway Route 1 in rural areas of the coastal zone remain a scenic two-lane road. Special districts shall not be formed or expanded except where assessment for, and provision of, the service would not induce new development inconsistent with this division. Where existing or planned public works facilities can accommodate only a limited amount of new development, services to coastal-dependent land use, essential public services and basic industries vital to the economic health of the region, state, or nation, public recreation, commercial recreation, and visitor-serving land uses shall not be precluded by other development.

WILDFIRE

There are no major federal laws, regulations, and policies potentially applicable to this project

Wildfire (State)
State Responsibility Area (SRA) The California Public Resources Code (Section 4101 et seq.) includes fire safety requirements for which the Department of Forestry and Fire Protection (CAL FIRE) has adopted regulations (for example, Chapters 6 and 7 of Chapter 1.5 of 14 CCR) that apply to state responsibility areas (SRAs). As the name implies, SRAs are areas where CAL FIRE has primary responsibility for fire protection. During the fire hazard season, these regulations: (a) restrict the use of equipment that may produce a spark, flame, or fire; (b) require the use of spark arrestors on equipment that has an internal combustion engine; (c) specify requirements for the safe use of gasoline-powered tools in fire hazard areas; and (d) specify fire-suppression equipment that must be provided onsite for various types of work in fire-prone areas.
Very High Fire Hazard Severity Zones (AB337) As a result of the Oakland Hills Fire (Tunnel Fire) of 1991, the Bates Bill (337) was passed in 1992 requiring CAL FIRE to work with local governments to identify high fire hazard severity zones within local responsibility areas throughout each county in the state. Over the years CAL FIRE has updated the maps and provided new recommendations to local governments. Following the Bill, CAL FIRE periodically gathers new data and updates the mapping. This is a massive project requiring policy and procedure staff, prevention and planning staff, and the technical geographic information system (GIS) skills of CAL FIRE's Fire and Resource Assessment Program.

APPENDIX B

Air Quality Analysis Methodology and Results

APPENDIX B AIR QUALITY ANALYSIS METHODS AND RESULTS

This appendix discusses the approach and methods used to assess construction and operational emissions associated with the RTI Infrastructure, Inc. Grover Beach Subsea Fiber Optic Cables Project (Project). The analysis evaluates daily, quarterly, and yearly emissions generated by terrestrial equipment and vehicles and marine activities within 3 nautical miles (nm) of the shore. The equipment considered in this appendix is more conservative than the one listed in the MND to allow flexibility and to analyze all possible equipment scenarios that may be available to carry out the Project. The work schelude is estimated to start in Summer 2020. Even if the work schedule changes beyond Summer 2020, it would not change the number of working days (Tables B-1 and B-2), equipment (Tables B3, B-4, and B-6), or emissions (Tables B-7 to B-20). The modeling is conservative because it is based on 2020 emission factors. There will be no overlap of phases. Emissions analyzed include criteria pollutants of ozone precursors (reactive organic gases [ROG] and nitrogen oxides [NOx]), carbon monoxide (CO), particulate matter (PM10 and PM2.5), and sulfur dioxide (SO_2) and greenhouse gases (GHG) of carbon dioxide (CO_2), methane (CH_4), and nitrous oxides (N_2O).

As discussed in Section 3.3., *Air Quality* of the Initial Study/Mitigated Negative Declaration (IS/MND) for the Project, the criteria pollutant impact analysis is limited to emissions generated within 3 nautical miles (nm) from the U.S. coastline. This is consistent with the jurisdiction of the California State Lands Commission (CSLC) under the California Environmental Quality Act (CEQA).

As discussed in Section 3.8, *Greenhouse Gases* of the IS/MND the GHG impact analysis extends to 24 nm from the U.S. coastline. While this distance goes beyond the area typically analyzed in CEQA documents (3 nm), the CSLC has elected to analyze emissions conservatively to 24 nm for consistency with the State's GHG emissions inventory and reduction planning goals.

Data and assumptions for the two analyses (3 nm and 24 nm) are included in the following sections and labeled as such, where applicable. Criteria pollutant emissions within 24 nm from the U.S. coastline are included for informational purposes at the end of this appendix.

B.1 CONSTRUCTION

Construction of the proposed Project requires both terrestrial (i.e., on land) and marine activities. Terrestrial activities include landing pipe installation, underground conduit installation, cable pulling, and upgrading (all from the inside) the existing cable landing station (CLS) facility. These activities would generate criteria pollutant and GHG emissions from off-road equipment (e.g., backhoes) and vehicles used for employee commuting and hauling. Fugitive dust and ROG also would be generated by earthmoving (e.g., minor grading) and paving, respectively. Marine activities include laying and burying the cables. Vessels used to support these activities include main lay vessels, support vessels, workboats, patrol boats, and tugboats.

The following sections summarize the methods used to assess each of the terrestrial and marine emission sources. An overview of the construction schedule also is provided.

B.1.1 Schedule

Each of the cables would be installed in four separate phases. Construction on the first cable is expected to begin in Summer 2020. Even if the work schedule changes beyond Summer 2020, it would not change the number of working days (Tables B-1 and B-2). Updates to the existing CLS facility would occur during this first phase, extending the duration of Phase 1 to 165 working days. Installation of the remaining three cables would require no more than 34 working days per year. Table B-1 summarizes the construction schedule assumed in the emissions modeling for terrestrial and marine construction within 3 nm from the U.S. coastline. Table B-2 summarizes the construction schedule for marine activities between 3 and 24 nm from the U.S. coastline.

Table B-1. Schedule for Terrestrial and Marine Construction within 3 Nautical Miles from the U.S. Coastline

Phase and Description[a]		Start Date	End Date	Working Days
Phase 1				
1-1	Terrestrial lading pipe installation	5/1/2020	7/24/2020	84
1-2	Landing pipes – marine	4/1/2020	4/29/2020	28
1-3	Ocean ground bed and landing manhole	4/29/2020	5/13/2020	14
1-4	Terrestrial cable pulling	7/24/2020	7/29/2020	5
1-5	Cable landing station facility (construction and testing)	5/1/2020	8/29/2020	120
1-6	Pre-lay grapnel run	8/30/2020	8/31/2020	1
1-7	Marine cable landing	9/4/2020	9/5/2020	1
1-8	Marine cable lay	9/6/2020	9/7/2020	1
1-9	Marine cable burial (diver-assisted)	9/8/2020	9/10/2020	2
1-10	Marine cable burial (ROV-assisted)	9/11/2020	9/13/2020	2
1-11	Worker/delivery	4/1/2020	9/13/2020	165
Phase 2				
2-1	Ocean ground bed installation	8/1/2021	8/6/2021	5
2-2	Terrestrial cable pulling	8/7/2021	8/14/2021	7
2-3	Cable landing station facility (construction and testing)	8/15/2021	8/20/2021	5
2-4	Pre-lay grapnel run	8/21/2021	8/22/2021	1
2-5	Marine cable landing	8/26/2021	8/27/2021	1
2-6	Marine cable lay	8/28/2021	8/29/2021	1
2-7	Marine cable burial (diver-assisted)	8/30/2021	9/1/2021	2

Phase and Description[a]		Start Date	End Date	Working Days
2-8	Marine cable burial (ROV-assisted)	9/2/2021	9/4/2021	2
2-9	Worker/delivery	8/1/2021	9/4/2021	34
Phase 3				
3-1	Ocean ground bed installation	9/1/2023	9/6/2023	5
3-2	Terrestrial cable pulling	9/7/2023	9/14/2023	7
3-3	Cable landing station facility (construction and testing)	9/15/2023	9/20/2023	5
3-4	Pre-lay grapnel run	9/21/2023	9/22/2023	1
3-5	Marine cable landing	9/26/2023	9/27/2023	1
3-6	Marine cable lay	9/28/2023	9/29/2023	1
3-7	Marine cable burial (diver-assisted)	9/30/2023	10/2/2023	2
3-8	Marine cable burial (ROV-assisted)	10/3/2023	10/5/2023	2
3-9	Worker/delivery	9/1/2023	10/5/2023	34
Phase 4				
4-1	Ocean ground bed installation	10/1/2025	10/6/2025	5
4-2	Terrestrial cable pulling	10/7/2025	10/14/2025	7
4-3	Cable landing station facility (construction and testing)	10/15/2025	10/20/2025	5
4-4	Pre-lay grapnel run	10/21/2025	10/22/2025	1
4-5	Marine cable landing	10/26/2025	10/27/2025	1
4-6	Marine cable lay	10/28/2025	10/29/2025	1
4-7	Marine cable burial (diver-assisted)	10/30/2025	11/1/2025	2
4-8	Marine cable burial (ROV-assisted)	11/2/2025	11/4/2025	2
4-9	Worker/delivery	10/1/2025	11/4/2025	34

Source: Bergfalk pers. comm.
ROV = remotely operated vehicle.
[a] The numeric codes shown in the first column are used to identify the construction phases in later tables. The first digit corresponds to the phase and the second digit the subphase. For example, 1-1 refers to Phase 1, Subphase 1, terrestrial landing pipe installation.

Table B-2. Schedule for Marine Construction between 3 and 24 Nautical Miles from the U.S. Coastline

Phase and Description[a]		Start Date	End Date	Working Days
Phase 1				
1-6	Pre-lay grapnel run	9/1/2020	9/3/2020	2
1-8	Marine cable lay	9/8/2020	9/16/2020	6
1-10	Marine cable burial (ROV-assisted)	9/14/2020	9/19/2020	4
Phase 2				
2-4	Pre-lay grapnel run	8/23/2021	8/25/2021	2
2-6	Marine cable lay	8/30/2021	9/7/2021	6
2-8	Marine cable burial (ROV-assisted)	9/5/2021	9/10/2021	4

Phase and Description[a]		Start Date	End Date	Working Days
Phase 3				
3-4	Pre-lay grapnel run	9/23/2023	9/25/2023	2
3-6	Marine cable lay	9/30/2023	10/8/2023	6
3-8	Marine cable burial (ROV-assisted)	10/6/2023	10/11/2023	4
Phase 4				
4-4	Pre-lay grapnel run	10/23/2025	10/25/2025	2
4-6	Marine cable lay	10/30/2025	11/7/2025	6
4-8	Marine cable burial (ROV-assisted)	11/5/2025	11/10/2025	4

Source: Bergfalk pers. comm.

ROV = remotely operated vehicle

[a] The numeric codes shown in the first column are used to identify the construction phases in later tables. The first digit corresponds to the phase, and the second digit to the subphase. For example, 1-1 refers to Phase 1, Subphase 1, terrestrial landing pipe installation.

B.1.2 Models and Methods for Emissions Quantification

Criteria pollutant and GHG emissions generated by the proposed Project's construction were assessed using standard and accepted models and tools. Combustion exhaust, fugitive dust (PM10 and PM2.5), and fugitive off-gassing (ROG) were estimated using a combination of emission factors and methodologies from CalEEMod, Version 2016.3.2; the California Air Resources Board's (CARB) EMFAC2017 model and marine vessel guidance; and the United States Environmental Protection Agency's (EPA) *AP-42 Compilation of Air Pollutant Emission Factors* (AP-42) (EPA 2006) based on Project-specific construction data (e.g., schedule, equipment, and truck volumes). The following sections describe the quantification approach for each of the primary emission sources.

B.1.2.1 Off-Road Equipment

Emission factors for off-road construction equipment (e.g., loaders, graders, and bulldozers) were obtained from the CalEEMod (Version 2016.3.2) User's Guide appendix, which provides values per unit of activity (in grams per horsepower-hour) (Trinity Consultants 2017).[1] See Project-specific calculations, quantification method, and emission factors at the end of this appendix. Pollutants were estimated by multiplying the CalEEMod emission factors by the equipment inventory shown in Table B-3. Model defaults were assumed for equipment horsepower (hp) and load factors, except for drill rig used during terrestrial boring. This equipment was assumed to use a 600-hp engine. All off-road equipment would be used for terrestrial construction (i.e., on land).

[1] CalEEMod does not include emission factors for N_2O. Emissions of N_2O were determined by scaling CO_2 emissions by the ratio of N_2O/CO_2 (0.000025) emissions expected per gallon of diesel fuel according to the Climate Registry (2018).

Table B-3. Off-Road Equipment Inventory for Terrestrial Construction

Phase[a]	Equipment	#/Day	Hours/Day	Horsepower
1-1	Concrete/industrial saws	1	2	81
1-1	Tractors/loaders/backhoes	1	8	97
1-1	Rollers	1	2	80
1-1	Plate compactors	1	1	8
1-2	Bore/drill rigs	1	10	600
1-2	Excavators	1	2	158
1-2	Welders	1	8	46
1-2	Generator sets	1	10	84
1-3	Tractors/loaders/backhoes	1	8	97
1-3	Bore/drill rigs	1	4	221
1-3	Plate compactors	1	1	8
2-1	Tractors/loaders/backhoes	1	8	97
2-1	Bore/drill rigs	1	4	221
2-1	Plate compactors	1	1	8
3-1	Tractors/loaders/backhoes	1	8	97
3-1	Bore/drill rigs	1	4	221
3-1	Plate compactors	1	1	8
4-1	Tractors/loaders/backhoes	1	8	97
4-1	Bore/drill rigs	1	4	221
4-1	Plate compactors	1	1	8
1-7	Tractors/loaders/backhoes	1	4	97
1-7	Other general industrial equipment	1	8	88
1-7	Cranes	1	2	231
1-7	Generator sets	1	4	84
2-5	Tractors/loaders/backhoes	1	4	97
2-5	Other general industrial equipment	1	8	88
2-5	Cranes	1	2	231
2-5	Generator sets	1	4	84
3-5	Tractors/loaders/backhoes	1	4	97
3-5	Other general industrial equipment	1	8	88
3-5	Cranes	1	2	231
3-5	Generator sets	1	4	84
4-5	Tractors/loaders/backhoes	1	4	97
4-5	Other general industrial equipment	1	8	88
4-5	Cranes	1	2	231
4-5	Generator sets	1	4	84

Source: Bergfalk pers. comm.
[a] Refer to Table B-1 for phase descriptions.

B.1.2.2 On-Road Vehicles

On-road vehicles include vehicles used for material and equipment hauling, employee commuting, and onsite crew and material movement. Exhaust emissions from on-road vehicles were estimated using the EMFAC2017 emissions model. Emission factors for delivery and tractor trailer trucks are based on aggregated-speed emission rates for EMFAC's T7 Single and T7 Tractor vehicle categories, respectively. Emission factors for employee commute vehicles are based on a weighted average for all vehicle speeds for EMFAC's Lighty-Duty Automobile/Lighty Duty Truck vehicle categories. One-way employee commute trip lengths were conservatively assumed to be 50 miles. Offsite pick-up trucks required for crew movement and fuel delivery trucks were modeled using EMFAC's Light-Duty Truck and T6 Instate Heavy vehicle categories, respectively.

Emission factors for on-site trucks were based on 5 miles per hour (mph) emission rates. On-site dump trucks were modeled using EMFAC's T7 Single vehicle category, whereas on-site asphalt and equipment trucks were modeled using EMFAC's T6 Instate Heavy vehicle category. On-site cable pulling trucks were modeled using EMFAC's T6 Utility vehicle category.

Fugitive re-entrained road dust emissions for all vehicle types were estimated using EPA's AP-42, Sections 13.2.1 and 13.2.2 (EPA 2006, 2011).

Table B-4 summarizes the on-road vehicle inventory assumed in the emissions modeling. All on-road vehicles would be used for terrestrial construction (i.e., on land).

Table B-4. On-Road Vehicle Inventory for Terrestrial Construction

Phase[a]	Vehicle	Vehicles/Day	Trips/Day	Miles/Day
1-1	Pickup truck	1	2	10
1-1	Dump truck	1	2	20
1-1	Asphalt truck	1	2	10
1-2	Pickup truck	1	2	15
1-2	Tractor trailer	1	2	20
1-3	One ton truck	1	2	10
1-3	Pickup truck	1	2	15
1-3	Delivery truck	1	2	10
1-3	Dump truck	1	2	10
2-1	One ton truck	1	2	10
2-1	Pickup truck	1	2	15
2-1	Delivery truck	1	2	10
2-1	Dump truck	1	2	10
3-1	One ton truck	1	2	10
3-1	Pickup truck	1	2	15
3-1	Delivery truck	1	2	10

Phase[a]	Vehicle	Vehicles/Day	Trips/Day	Miles/Day
3-1	Dump truck	1	2	10
4-1	One ton truck	1	2	10
4-1	Pickup truck	1	2	15
4-1	Delivery truck	1	2	10
4-1	Dump truck	1	2	10
1-4	Cable-pulling truck	1	2	40
1-4	Pickup truck with reel	1	2	20
1-4	Equipment truck	1	2	15
2-2	Cable-pulling truck	1	2	40
2-2	Pickup truck with reel	1	2	20
2-2	Equipment truck	1	2	15
3-2	Cable-pulling truck	1	2	40
3-2	Pickup truck with reel	1	2	20
3-2	Equipment truck	1	2	15
4-2	Cable-pulling truck	1	2	40
4-2	Pickup truck with reel	1	2	20
4-2	Equipment truck	1	2	15
1-11	Tractor trailer	2	5	500
2-9	Tractor trailer	2	5	500
3-9	Tractor trailer	2	5	500
4-9	Tractor trailer	2	5	500
1-11	Fuel and misc delivery	1	1	100
2-9	Fuel and misc delivery	1	1	100
3-9	Fuel and misc delivery	1	1	100
4-9	Fuel and misc delivery	1	1	100
1-5	Equipment truck	1	2	15
1-7	Pickup truck	1	2	15
2-5	Pickup truck	1	2	15
3-5	Pickup truck	1	2	15
4-5	Pickup truck	1	2	15
1-11	Employee vehicle	10	10	1,000
2-9	Employee vehicle	10	10	1,000
3-9	Employee vehicle	10	10	1,000
4-9	Employee vehicle	10	10	1,000

Source: Bergfalk pers. comm.

[a] Refer to Table B-1 for phase descriptions.

B.1.2.3 Earthmoving and Paving

Fugitive dust emissions from earth movement (i.e., site grading, excavation, and truck loading) were quantified using emission factors from the CalEEMod User's Guide (Trinity

Consultants 2017). Grading acres and cut-and-fill quantities were provided by the Project applicant (Brungardt pers. comm.).

Fugitive ROG emissions associated with paving were calculated using activity data (e.g., square feet paved) provided by the Project applicant and the CalEEMod default emission factor of 2.62 pounds of ROG per acre paved (Brungardt pers. comm.; Trinity Consultants 2017).

Table B-5 summarizes the earthmoving and paving quantities assumed in the emissions modeling. All earthmoving and paving would occur during terrestrial construction (i.e., on land).

Table B-5. Earthmoving and Paving Quantities for Terrestrial Construction

Phase[a]	Grading (acres/day)	Cut/Fill (cubic yards/day)	Paving (square feet/day)
1-1	0.07	44	0.003
1-2	0.09	0	0
1-3	0	14	0
2-1	0	14	0
3-1	0	14	0
4-1	0	14	0

Source: Bergfalk pers. comm.
[a] Refer to Table B-1 for phase descriptions.

B.1.2.4 Marine Vessels

Marine vessels used during construction include main lay vessels, support vessels, workboats, patrol boats, and tugboats. Criteria pollutant emissions from marine vessels were quantified using CARB's (2010a) *Updates on the Emissions Inventory for Commercial Harbor Craft Operating in California* (Harbor Craft Methodology) and several other sources. Emissions per vessel were determined using the equation below.

$$E = P \times LF \times A \times EF$$

Where E = *Emissions (grams)*
P = *Maximum Continuous Rating Power (horsepower)*
LF = *Load Factor (percent of vessel's total power)*
A = *Activity (hours)*
EF = *Emission Factor (grams per horsepower-hour [g/hp-hr])*

Emissions were calculated separately for propulsion and auxiliary engines for each vessel. The following section describes the vessels, engine horsepower assumptions, load factors, and emission factors used in the calculations. Activity hours were provided by the Project applicant and are summarized in Table B-6 (Brungardt pers. comm.).

Table B-6. Marine Vessel Inventory

Phase[a]	Vessel[2]	Hours per Day
U.S. Coastline to 3 Nautical Miles (air quality impact analysis)		
1-2	Work boat	6
1-2	Tug boat	5
1-2	Patrol boat	6
1-6	Main lay vessel (laying)	24
1-7	Main lay vessel (transit)	10
1-8	Main lay vessel (laying)	24
1-9	Support vessel	24
1-10	Main lay vessel (laying)	24
2-4	Main lay vessel (laying)	24
2-5	Main lay vessel (transit)	10
2-6	Main lay vessel (laying)	24
2-7	Support vessel	24
2-8	Main lay vessel (laying)	24
3-4	Main lay vessel (laying)	24
3-5	Main lay vessel (transit)	10
3-6	Main lay vessel (laying)	24
3-7	Support vessel	24
3-8	Main lay vessel (laying)	24
4-4	Main lay vessel (laying)	24
4-5	Main lay vessel (transit)	10
4-6	Main lay vessel (laying)	24
4-7	Support vessel	24
4-8	Main lay vessel (laying)	24
3 to 24 Nautical Miles (greenhouse gas impact analysis)		
1-6	Main lay vessel (laying)	20
1-6	Main lay vessel (transit)	4
1-6	Support vessel	12
1-8	Main lay vessel (laying)	20
1-8	Main lay vessel (transit)	4
1-10	Main lay vessel (laying)	20
1-10	Main lay vessel (transit)	4
2-4	Main lay vessel (laying)	20
2-4	Main lay vessel (transit)	4
2-4	Support vessel	12
2-6	Main lay vessel (laying)	20

[2] A variety of vessels is used because it is unknown exactly what vessels will be used. In order to provide the most conservative air quality analysis, assumptions are made as to the type of support vessel(s) that may be needed. Using a mix of vessels provides a more realistic analysis.

Phase[a]	Vessel[2]	Hours per Day
2-6	Main lay vessel (transit)	4
2-8	Main lay vessel (laying)	20
2-8	Main lay vessel (transit)	4
3-4	Main lay vessel (laying)	20
3-4	Main lay vessel (transit)	4
3-4	Support vessel	12
3-6	Main lay vessel (laying)	20
3-6	Main lay vessel (transit)	4
3-8	Main lay vessel (laying)	20
3-8	Main lay vessel (transit)	4
4-4	Main lay vessel (laying)	20
4-4	Main lay vessel (transit)	4
4-4	Support vessel	12
4-6	Main lay vessel (laying)	20
4-6	Main lay vessel (transit)	4
4-8	Main lay vessel (laying)	20
4-8	Main lay vessel (transit)	4

Source: Bergfalk pers. comm.
[a] Refer to Table B-1 for phase descriptions.

Main Lay Vessel

The main lay vessel is modelled after the Ile de Batz (IMO # 9247041). It is a DPS-2 classed cable lay and multi-purpose offshore support vessel and used by Alcatel-Lucent for cable laying (CBS n.d.). This vessel will be laying the cable on the ocean. It will pull the cable plow that will be installing the cable to a depth of 3.3 feet (1 meter) below the ocean floor. It will come to the end of the landing pipe (about 3,600 feet offshore) and feed the marine cable into the landing pipe, then will continue offshore with the cable and across the ocean.

The main lay vessel is a diesel-electric vessel powered by four 5,873-hp Mak 9M32 Category 3 diesel engines (IHS Markit n.d.). All four engines are connected to generators. Propulsion is driven by two 5,368-hp electric motors. Under CARB harbor craft guidance, the main lay vessel is considered an ocean-going vessel (OGV) because it is longer than 400 feet. The vessel was built in 2001.

The main lay vessel will operate in two modes during construction. The first is “transit” back and forth to the construction site. Transit occurs at 12 knots. The second is during “cable laying” when the vessel is travelling at 8 knots and laying cable.

Propulsion load factors for the two modes were calculated using the propeller law equation below (Starcrest Consulting Group 2017). This load factor was applied to the two electric motors used for propulsion.

Propulsion Load Factor = (actual speed/maximum speed)^3

As the vessel has a maximum speed of 16.4 knots, the transit propulsion load factor is 0.39 and the cable laying propulsion load factor is 0.12. Auxiliary engine loads and auxiliary boiler loads for the two modes were obtained from the Port of Los Angeles 2016 emission inventory (Starcrest Consulting Group 2017). The calculations for the transit mode assumed an auxiliary load of 643 kilowatts (kW), while the cable laying mode assumed an auxiliary load of 597 kW. Boiler loads were assumed at 33 kW during transit and 65 kW during cable laying.

Emission factors for the main lay vessel were obtained from the Port of Los Angeles 2014 emission inventory (Starcrest Consulting Group 2015),[3] assuming that all engines were Category 3 medium-speed engines running on 0.1% sulfur marine gasoil/marine diesel oil (MGO/MDO), which has been required within California waters since 2014 and within the North American Emission Control Area (up to 200 nm from the U.S. coastline) since 2015 (CARB 2011a). The main lay emission factors are presented in Table B-7.

Table B-7. Main Lay Vessel Emission Factors (g/hp-hr)

Engine	ROG	NOx	CO	PM10	PM2.5	SO2	CO2	N2O	CH4
Propulsion/ Auxiliary	0.5	9.1	0.8	0.19	0.18	0.3	484	0.022	0.007
Boiler	0.1	1.5	0.1	0.10	0.10	0.5	688	0.056	0.001

Note:
The emission factors from the 2014 emissions inventory have been corrected for use of 0.1% sulfur distillate fuel. Accordingly, application of a fuel correction factor is not required. Because deterioration factors are not applied to ocean-going vessels, per California Air Resources Board guidance, the emission factors are held constant for all analysis years.

Support Vessel

The support vessel is modelled after the DSV Clean Ocean (Aqueos n.d.). It is a 155-foot-long anchor, offshore supply, dive, and remotely operated undersea vehicle support. The support vessel will be used for the prelay grapnel run (where it will pull a grapnel along the cable alignment to ensure that it is free of debris) and to support the main cable lay through control of remotely operated vehicles (ROVs). It also will be used during cable burial.

Under CARB's harbor craft regulations, the support vessel falls under the category of crew and supply boat. It was repowered in 2015 under the CARB (2011b) harbor craft rule. It is currently powered by two 750-hp Cummins QSK-19 Tier 3 engines and has two 133-hp auxiliary Tier 3 engines.

[3] Emission factors for OGV have not changed since the 2014 emissions inventory and therefore are not repeated in subsequent inventories, including the latest 2016 emissions inventory.

Load factors for this type of vessel were obtained from CARB's (2010a) Harbor Craft Methodology and were assumed to be 0.38 for the propulsion engines and 0.32 for the auxiliary engines. Uncorrected zero hour emission rates for NOx, PM10, ROG, and CO were derived from CARB's Harbor Craft Methodology. GHG and SO_2 emission factors were obtained from the Port of Los Angeles 2013 emission inventory (Starcrest Consulting Group 2014).[4] All harbor craft must use ultra-low sulfur diesel (ULSD) within California regulated waters (CARB 2005). Since these vessels are small and generally have only one fuel tank, it was assumed that they also would use ULSD out to 24 nm.

Uncorrected zero hour emission rates are shown in Table B-8. Fuel correction factors for ULSD are shown in Table B-9 (these also apply to the work boat described in the next section).

Table B-8. Support Vessel Uncorrected Zero Hour Emission Rates (g/hp-hr)

Engine	ROG	NOx	CO	PM10	PM2.5	SO_2	CO_2	N_2O	CH_4
Propulsion	0.68	5.10	3.73	0.15	0.15	0.13	486.2	0.023	0.013
Auxiliary	0.81	5.10	3.73	0.22	0.21	0.13	486.2	0.023	0.016

Table B-9. Fuel Correction Factors for the Support Vessel and Work Boat

Engine	ROG	NOx	CO	PM10	PM2.5	SO_2	CO_2	N_2O	CH_4
All	0.720	0.948	1.000	0.852	0.852	0.043	1.000	0.948	0.720

Deterioration factors were applied to compensate for engine wear. CARB's Harbor Craft Methodology recommends that a tug or barge at the end of its useful life could have NOx, PM, hydrocarbons (e.g., ROG), and CO emission factors that are 21%, 67%, 44% and 25%, respectively, higher than the zero-hour values. Since the Harbor Craft Methodology was released, CARB has revised its methodology to limit deterioration at 12,000 hours of operation. This is because CARB found, in discussions with stakeholders and the industry, that diesel engines are typically rebuilt after 12,000 hours of use (Dolney pers. comm.). Based on this new guidance, once an engine's cumulative hours equals 12,000 hours, the deteriorated emission factor is assumed to remain constant (CARB 2010b).

Annual hours of operation, useful life, and the deterioration factors for the propulsion and auxiliary engines are shown in Table B-10. Final emission factors are shown in Table B-11.

[4] Emission factors for crew and supply boats have not changed since the 2013 emissions inventory and therefore are not repeated in subsequent inventories, including the latest 2016 emissions inventory.

Table B-10. Hours of Operation, Useful Life and Deterioration Factors for Support Vessel

Engine	Annual Hours	Useful Life	Deterioration Factor			
Propulsion	1,796	28	0.21	0.67	0.44	0.25
Auxiliary	2,265	28	0.14	0.44	0.28	0.16

Table B-11 Support Vessel Emission Factors (g/hp-hr)

Year	Engine	ROG	NOx	CO	PM10	PM2.5	SO_2	CO_2	N_2O	CH_4
2019	Propulsion	0.52	4.98	3.86	0.14	0.14	0.01	486.2	0.022	0.010
	Auxiliary	0.61	4.93	3.82	0.20	0.19	0.01	486.2	0.022	0.012
2020	Propulsion	0.53	5.02	3.90	0.14	0.14	0.01	486.2	0.022	0.010
	Auxiliary	0.61	4.96	3.84	0.20	0.20	0.01	486.2	0.022	0.012
2021	Propulsion	0.54	5.05	3.93	0.15	0.14	0.01	486.2	0.022	0.010
	Auxiliary	0.61	4.96	3.84	0.20	0.20	0.01	486.2	0.022	0.012
2022+[a]	Propulsion	0.54	5.08	3.95	0.15	0.14	0.01	486.2	0.022	0.010
	Auxiliary	0.61	4.96	3.84	0.20	0.20	0.01	486.2	0.022	0.012

[a] The support vessel will reach the 12,000-hour deterioration cap in 2022. After this time, it was assumed that the engine will be rebuilt, per CARB guidance. However, this analysis conservatively holds the final deteriorated emission factor constant for all future analysis years.

Work Boat

The work boat is modelled after the *Danny C* vessel, which is a 77-foot utility boat used in dive support, ROV support, anchor support, and equipment transport. The work boat will be used during construction to perform the following activities.

- As a dive platform for divers to support the marine side of the landing pipes.
- As a dive platform for divers to support the cable landing where the main cable vessel feeds the marine cable into the landing pipe.
- As a dive platform for divers to jet bury the cable in the shallow water areas (out to a water depth of approximately 30 meters).
- As a taxi to take divers to and from the dive platform.

Under CARB harbor craft regulations, the *Danny C* falls under the category of work boat. It was repowered in 2015 under the CARB harbor craft rule. It is currently powered by two 405-hp Cummins QSM11 Tier 3 engines and has two 32-hp auxiliary Tier 3 engines.

Load factors,[5] zero hour emission rates, annual hours of operation, useful life assumptions, and deterioration factors were derived using the same methods and sources as described above for the support vessel. Uncorrected zero hour emission rates are shown in Table B-12. Annual hours of operation, useful life, and the deterioration factors for the propulsion and auxiliary engines are shown in Table B-13. Final emission factors are shown in Table B-14. Refer to Table B-9 above for the ULSD fuel correction factors.

Table B-12. Work Boat Uncorrected Zero Hour Emission Rates (g/hp-hr)

Engine	ROG	NOx	CO	PM10	PM2.5	SO_2	CO_2	N_2O	CH_4
Propulsion	0.68	5.10	3.73	0.15	0.15	0.13	486.2	0.023	0.013
Auxiliary	0.81	5.10	3.73	0.22	0.21	0.13	486.2	0.023	0.016

Table B-13. Hours of Operation, Useful Life and Deterioration Factors for Work Boat

Engine	Annual Hours	Useful Life	Deterioration Factor			
			NOx	PM	ROG	CO
Propulsion	675	17	0.21	0.67	0.44	0.25
Auxiliary	750	23	0.06	0.31	0.51	0.41

Table B-14. Work Boat Emission Factors (g/hp-hr)

Year	Engine	ROG	NOx	CO	PM10	PM2.5	SO_2	CO_2	N_2O	CH_4
2019	Propulsion	0.54	5.08	3.95	0.15	0.14	0.01	486.2	0.022	0.010
	Auxiliary	1.68	5.10	4.00	0.20	0.19	0.01	486.2	0.022	0.031
2020	Propulsion	0.55	5.13	4.00	0.15	0.15	0.01	486.2	0.022	0.010
	Auxiliary	1.71	5.11	4.06	0.20	0.19	0.01	486.2	0.022	0.031
2021	Propulsion	0.57	5.19	4.06	0.16	0.15	0.01	486.2	0.022	0.010
	Auxiliary	1.75	5.12	4.13	0.20	0.20	0.01	486.2	0.022	0.031
2022	Propulsion	0.58	5.25	4.11	0.16	0.16	0.01	486.2	0.022	0.010
	Auxiliary	1.78	5.14	4.20	0.21	0.20	0.01	486.2	0.022	0.031
2023	Propulsion	0.59	5.31	4.17	0.17	0.16	0.01	486.2	0.022	0.010
	Auxiliary	1.82	5.15	4.26	0.21	0.20	0.01	486.2	0.022	0.031
2024	Propulsion	0.60	5.37	4.22	0.17	0.17	0.01	486.2	0.022	0.010
	Auxiliary	1.85	5.16	4.33	0.21	0.20	0.01	486.2	0.022	0.031
2025	Propulsion	0.62	5.43	4.28	0.18	0.17	0.01	486.2	0.022	0.010
	Auxiliary	1.88	5.17	4.39	0.21	0.21	0.01	486.2	0.022	0.031
2026	Propulsion	0.63	5.49	4.33	0.18	0.18	0.01	486.2	0.022	0.010
	Auxiliary	1.92	5.19	4.46	0.22	0.21	0.01	486.2	0.022	0.031

[5] Load factors for the work boat were assumed to be 0.45 for the propulsion engines and 0.43 for the auxiliary engines.

Patrol Boat and Tug Boat

The patrol boat would be used to shuttle divers to and from the dive platform or to take observers (inspectors or monitors) to the site during the landing pipe activities or during the cable landing. The tug boat may be needed to anchor the main lay vessel. Tug boats rarely are required because the cable ships usually have dynamic thrusters so they can hold station. Tug boats have been added in the emission calculations in the event they are needed.

Under the CARB harbor craft rule, the patrol boat falls under the category of a crew and supply boat, and the tug boat falls under the category of a tow boat. Both ships are a “ship of opportunity,” meaning that any available crew and supply boat can be used. Average crew boat characteristics were obtained from the Port of Los Angeles 2016 emission inventory (Starcrest Consulting Group 2017) to define the characteristics of the patrol boat, and average towboat characteristics were used to define the characteristics of the tug boats for analysis purposes. The assumptions are listed in Table B-15.

Table B-15. Patrol Boat and Tug Boat Characteristics

Engine Type	Patrol Boat			Tug Boat		
	Model Year	Engines		Model Year	Engines	
		HP	Number		HP	Number
Propulsion	2009	572	2	2010	777	2
Auxiliary	2008	55	1	2009	64	2

Load factors,[6] zero hour emission rates, annual hours of operation, useful life assumptions, and deterioration factors were derived using the same methods and sources as described above for the support vessel. Uncorrected zero hour emission rates are shown in Table B-16. Annual hours of operation, useful life, and the deterioration factors for the propulsion and auxiliary engines are shown in Table B-17. Table B-18 summarizes the ULSD fuel correction factors, which are applicable to engines older than model year 2011. Final emission factors are shown in Table B-19.

Table B-16. Patrol Boat and Tug Boat Uncorrected Zero Hour Emission Rates (g/hp-hr)

Engine	ROG	NOx	CO	PM10	PM2.5	SO_2	CO_2	N_2O	CH_4
Patrol Boat									
Propulsion	0.68	5.10	3.73	0.15	0.15	0.13	486.2	0.023	0.013
Auxiliary	1.18	5.32	3.73	0.30	0.29	0.13	486.2	0.023	0.016

[6] Load factors for the patrol boat were assumed to be 0.38 for the propulsion engines and 0.32 for the auxiliary engines. Load factors for the tug boat were assumed to be 0.68 for the propulsion engines and 0.43 for the auxiliary engines.

Engine	ROG	NOx	CO	PM10	PM2.5	SO_2	CO_2	N_2O	CH_4
Tug Boat									
Propulsion	0.68	5.53	3.73	0.20	0.19	0.13	486.2	0.023	0.013
Auxiliary	1.18	5.32	3.73	0.22	0.21	0.13	486.2	0.023	0.024

Table B-17. Useful Life and Deterioration Factors for Patrol Boat and Tug Boat

Engine	Annual Hours	Useful Life	Deterioration Factor			
			NOx	PM	ROG	CO
Patrol Boat						
Propulsion	1,796	28	0.21	0.67	0.44	0.25
Auxiliary	2,265	28	0.14	0.44	0.28	0.16
Tug Boat						
Propulsion	1,993	26	0.21	0.67	0.44	0.25
Auxiliary	2,965	25	0.14	0.44	0.28	0.16

Table B-18. Fuel Correction Factors for the Patrol Boat and Tug Boat

Engine	ROG	NOx	CO	PM10	PM2.5	SO_2	CO_2	N_2O	CH_4
All	0.720	0.948	1.000	0.800	0.800	0.043	1.000	0.948	0.720

Table B-19. Patrol Boat and Tug Boat Emission Factors (g/hp-hr)

Engine	ROG	NOx	CO	PM10	PM2.5	SO_2	CO_2	N_2O	CH_4
Patrol Boat									
Propulsion	0.54	5.08	3.95	0.14	0.14	0.01	486.19	0.022	0.010
Auxiliary	0.89	5.18	3.84	0.26	0.25	0.01	486.19	0.022	0.012
Tug Boat									
Propulsion	0.54	5.50	3.95	0.18	0.18	0.01	486.2	0.022	0.010
Auxiliary	0.89	5.16	3.83	0.19	0.18	0.01	486.2	0.022	0.017

Note:
The patrol and tug boats will reach the 12,000 hour deterioration cap before 2019. After this time, it was assumed that the engines will be rebuilt, per California Air Resources Board guidance. However, this analysis conservatively holds the final deteriorated emission factor constant for all future analysis years.

B.2 OPERATION

The Project's normal operation consists of monthly inspections, requiring a vehicle trip. Electricity would be consumed at the CLS facilities. Emissions from employee commutes were quantified using the methods described above for on-road vehicles. The employee was assumed conservatively to travel 100 miles to the Project site. Indirect GHG emissions from electricity consumption were quantified using emission factors from Pacific Gas and Electric Company (2015) and EPA (2018). The Project was assumed to use 292 megawatt-hours of electricity each year. Emissions were quantified using 2026 emission rates, which is the first year of full operation.

B.3 INFORMATIONAL CRITERIA POLLUTANT ANALYSIS

Criteria pollutants generated by construction activities out to 24 nm are presented in Table B-20. As previously noted, these emissions are presented for informational purposes only.

Table B-20. Informational Criteria Pollutant Emissions Generated by Terrestrial and Marine Activities Out to 24 Nautical Miles (nm)

Phase	Source	Tons per Year					
		ROG	NOx	CO	PM10	PM2.5	SO_2
Phase 1	Terrestrial	<1	1	1	<1	<1	<1
	Marine (0 to 3 nm)	<1	4	2	<1	<1	<1
	Marine (3 to 24 nm)	<1	7	1	<1	<1	<1
	Total	1	13	3	1	<1	<1
Phase 2	Terrestrial	<1	<1	<1	<1	<1	<1
	Marine (0 to 3 nm)	<1	3	<1	<1	<1	<1
	Marine (3 to 24 nm)	<1	7	1	<1	<1	<1
	Total	1	10	1	<1	<1	1
Phase 3	Terrestrial	<1	<1	<1	<1	<1	<1
	Marine (0 to 3 nm)	<1	3	<1	<1	<1	<1
	Marine (3 to 24 nm)	<1	7	1	<1	<1	<1
	Total	1	10	1	<1	<1	<1
Phase 4	Terrestrial	<1	<1	<1	<1	<1	<1
	Marine (0 to 3 nm)	<1	3	<1	<1	<1	<1
	Marine (3 to 24 nm)	<1	7	1	<1	<1	<1
	Total	**1**	**10**	**1**	**<1**	**<1**	**<1**

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B.4.2 Personal Communications

Brian Bergfalk. RTI Solutions, Inc. San Francisco, CA. June 5, 2019—conversation with Laura Yoon of ICF.

Nicole Dolney. California Air Resource Board. Sacramento, CA. March 25, 2013—conversation with Lou Browning of ICF.

Construction (within 3 NM)

Schedule

Phase	Code	Start Date	End Date	Working Days
Phase 1				
Terrestrial conduit installation	1-1	5/1/2020	7/24/2020	84
Directional bores – marine	1-2	4/1/2020	4/29/2020	28
OGB and LMH	1-3	4/29/2020	5/13/2020	14
Terrestrial cable pulling	1-4	7/24/2020	7/29/2020	5
CLS facility (construction and testing)	1-5	5/1/2020	8/29/2020	120
Pre-lay grapnel run	1-6	8/30/2020	8/31/2020	1
Marine cable landing	1-7	9/4/2020	9/5/2020	1
Marine cable lay	1-8	9/6/2020	9/7/2020	1
Marine cable burial (diver-assisted)	1-9	9/8/2020	9/10/2020	2
Marine cable burial (ROV-assisted)	1-10	9/11/2020	9/13/2020	2
Worker/Delivery	1-11	4/1/2020	9/13/2020	165
Phase 2				
OGB installation	2-1	8/1/2021	8/6/2021	5
Terrestrial cable pulling	2-2	8/7/2021	8/14/2021	7
CLS facility (construction and testing)	2-3	8/15/2021	8/20/2021	5
Pre-lay grapnel run	2-4	8/21/2021	8/22/2021	1
Marine cable landing	2-5	8/26/2021	8/27/2021	1
Marine cable lay	2-6	8/28/2021	8/29/2021	1
Marine cable burial (diver-assisted)	2-7	8/30/2021	9/1/2021	2
Marine cable burial (ROV-assisted)	2-8	9/2/2021	9/4/2021	2
Worker/Delivery	2-9	8/1/2021	9/4/2021	34
Phase 3				
OGB installation	3-1	9/1/2023	9/6/2023	5
Terrestrial cable pulling	3-2	9/7/2023	9/14/2023	7
CLS facility (construction and testing)	3-3	9/15/2023	9/20/2023	5
Pre-lay grapnel run	3-4	9/21/2023	9/22/2023	1
Marine cable landing	3-5	9/26/2023	9/27/2023	1
Marine cable lay	3-6	9/28/2023	9/29/2023	1
Marine cable burial (diver-assisted)	3-7	9/30/2023	10/2/2023	2
Marine cable burial (ROV-assisted)	3-8	10/3/2023	10/5/2023	2
Worker/Delivery	3-9	9/1/2023	10/5/2023	34
Phase 4				
OGB installation	4-1	10/1/2025	10/6/2025	5
Terrestrial cable pulling	4-2	10/7/2025	10/14/2025	7
CLS facility (construction and testing)	4-3	10/15/2025	10/20/2025	5
Pre-lay grapnel run	4-4	10/21/2025	10/22/2025	1
Marine cable landing	4-5	10/26/2025	10/27/2025	1
Marine cable lay	4-6	10/28/2025	10/29/2025	1
Marine cable burial (diver-assisted)	4-7	10/30/2025	11/1/2025	2
Marine cable burial (ROV-assisted)	4-8	11/2/2025	11/4/2025	2
Worker/Delivery	4-9	10/1/2025	11/4/2025	34

Off-road Calculations

Code	Equip	#/day	hrs/day	HP	LF	Fuel	2020									
							Pounds per day						Metric tons per year			
							ROG	NOX	CO	PM10	PM2.5	SO2	CO2	CH4	N2O	CO2e
1-1	Concrete/Asphalt Saw	1	2	81	0.7	Diesel	0.1	0.8	0.9	0.0	0.0	0.0	5.6	0.0	0.0	5.7
1-1	Backhoe	1	8	97	0.4	Diesel	0.2	2.1	2.3	0.1	0.1	0.0	11.4	0.0	0.0	11.6
1-1	Pavement Roller	1	2	80	0.4	Diesel	0.1	0.5	0.5	0.0	0.0	0.0	2.4	0.0	0.0	2.4
1-1	Handheld Vibratory Compactor	1	1	8	0.4	Diesel	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.2
1-2	HDD Powerplant (AA DD625)	1	10	600	0.5	Diesel	0.7	8.2	6.5	0.3	0.3	0.0	40.0	0.0	0.0	40.6
1-2	Excavator	1	2	158	0.4	Diesel	0.1	0.6	0.8	0.0	0.0	0.0	1.6	0.0	0.0	1.6
1-2	Welder	1	8	46	0.5	Diesel	0.3	1.6	1.8	0.1	0.1	0.0	2.6	0.0	0.0	2.7
1-2	Generator	1	10	84	0.7	Diesel	0.5	4.3	4.6	0.2	0.2	0.0	9.9	0.0	0.0	10.0
1-3	Backhoe	1	8	97	0.4	Diesel	0.2	2.1	2.3	0.1	0.1	0.0	1.9	0.0	0.0	1.9
1-3	Well Drilling Machine	1	4	221	0.5	Diesel	0.1	1.8	1.0	0.1	0.0	0.0	2.9	0.0	0.0	2.9
1-3	Handheld Vibratory Compactor	1	1	8	0.4	Diesel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2-1	Backhoe	1	8	97	0.4	Diesel	0.2	2.1	2.3	0.1	0.1	0.0	0.0	0.0	0.0	0.0
2-1	Well Drilling Machine	1	4	221	0.5	Diesel	0.1	1.8	1.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0
2-1	Handheld Vibratory Compactor	1	1	8	0.4	Diesel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3-1	Backhoe	1	8	97	0.4	Diesel	0.2	2.1	2.3	0.1	0.1	0.0	0.0	0.0	0.0	0.0
3-1	Well Drilling Machine	1	4	221	0.5	Diesel	0.1	1.8	1.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0
3-1	Handheld Vibratory Compactor	1	1	8	0.4	Diesel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4-1	Backhoe	1	8	97	0.4	Diesel	0.2	2.1	2.3	0.1	0.1	0.0	0.0	0.0	0.0	0.0
4-1	Well Drilling Machine	1	4	221	0.5	Diesel	0.1	1.8	1.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0
4-1	Handheld Vibratory Compactor	1	1	8	0.4	Diesel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1-7	Backhoe	1	4	97	0.4	Diesel	0.1	1.0	1.1	0.1	0.1	0.0	0.1	0.0	0.0	0.1
1-7	Winch	1	8	88	0.3	Diesel	0.2	2.2	2.0	0.2	0.1	0.0	0.1	0.0	0.0	0.1
1-7	Crane	1	2	231	0.3	Diesel	0.1	1.3	0.5	0.1	0.1	0.0	0.1	0.0	0.0	0.1
1-7	Generator	1	4	84	0.7	Diesel	0.2	1.7	1.9	0.1	0.1	0.0	0.1	0.0	0.0	0.1
2-5	Backhoe	1	4	97	0.4	Diesel	0.1	1.0	1.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0
2-5	Winch	1	8	88	0.3	Diesel	0.2	2.2	2.0	0.2	0.1	0.0	0.0	0.0	0.0	0.0
2-5	Crane	1	2	231	0.3	Diesel	0.1	1.3	0.5	0.1	0.1	0.0	0.0	0.0	0.0	0.0
2-5	Generator	1	4	84	0.7	Diesel	0.2	1.7	1.9	0.1	0.1	0.0	0.0	0.0	0.0	0.0
3-5	Backhoe	1	4	97	0.4	Diesel	0.1	1.0	1.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0
3-5	Winch	1	8	88	0.3	Diesel	0.2	2.2	2.0	0.2	0.1	0.0	0.0	0.0	0.0	0.0
3-5	Crane	1	2	231	0.3	Diesel	0.1	1.3	0.5	0.1	0.1	0.0	0.0	0.0	0.0	0.0
3-5	Generator	1	4	84	0.7	Diesel	0.2	1.7	1.9	0.1	0.1	0.0	0.0	0.0	0.0	0.0
4-5	Backhoe	1	4	97	0.4	Diesel	0.1	1.0	1.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0
4-5	Winch	1	8	88	0.3	Diesel	0.2	2.2	2.0	0.2	0.1	0.0	0.0	0.0	0.0	0.0
4-5	Crane	1	2	231	0.3	Diesel	0.1	1.3	0.5	0.1	0.1	0.0	0.0	0.0	0.0	0.0
4-5	Generator	1	4	84	0.7	Diesel	0.2	1.7	1.9	0.1	0.1	0.0	0.0	0.0	0.0	0.0

							2021									
							Pounds per day						Metric tons per year			
Code	Equip	#/day	hrs/day	HP	LF	Fuel	ROG	NOX	CO	PM10	PM2.5	SO2	CO2	CH4	N2O	CO2e
1-1	Concrete/Asphalt Saw	1	2	81	0.7	Diesel	0.1	0.8	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1-1	Backhoe	1	8	97	0.4	Diesel	0.2	1.9	2.3	0.1	0.1	0.0	0.0	0.0	0.0	0.0
1-1	Pavement Roller	1	2	80	0.4	Diesel	0.0	0.5	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1-1	Handheld Vibratory Compactor	1	1	8	0.4	Diesel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1-2	HDD Powerplant (AA DD625)	1	10	600	0.5	Diesel	0.7	6.3	6.5	0.2	0.2	0.0	0.0	0.0	0.0	0.0
1-2	Excavator	1	2	158	0.4	Diesel	0.1	0.5	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1-2	Welder	1	8	46	0.5	Diesel	0.3	1.5	1.7	0.1	0.1	0.0	0.0	0.0	0.0	0.0
1-2	Generator	1	10	84	0.7	Diesel	0.4	4.0	4.6	0.2	0.2	0.0	0.0	0.0	0.0	0.0
1-3	Backhoe	1	8	97	0.4	Diesel	0.2	1.9	2.3	0.1	0.1	0.0	0.0	0.0	0.0	0.0
1-3	Well Drilling Machine	1	4	221	0.5	Diesel	0.1	1.5	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1-3	Handheld Vibratory Compactor	1	1	8	0.4	Diesel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2-1	Backhoe	1	8	97	0.4	Diesel	0.2	1.9	2.3	0.1	0.1	0.0	0.7	0.0	0.0	0.7
2-1	Well Drilling Machine	1	4	221	0.5	Diesel	0.1	1.5	1.0	0.0	0.0	0.0	1.0	0.0	0.0	1.1
2-1	Handheld Vibratory Compactor	1	1	8	0.4	Diesel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3-1	Backhoe	1	8	97	0.4	Diesel	0.2	1.9	2.3	0.1	0.1	0.0	0.0	0.0	0.0	0.0
3-1	Well Drilling Machine	1	4	221	0.5	Diesel	0.1	1.5	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3-1	Handheld Vibratory Compactor	1	1	8	0.4	Diesel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4-1	Backhoe	1	8	97	0.4	Diesel	0.2	1.9	2.3	0.1	0.1	0.0	0.0	0.0	0.0	0.0
4-1	Well Drilling Machine	1	4	221	0.5	Diesel	0.1	1.5	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4-1	Handheld Vibratory Compactor	1	1	8	0.4	Diesel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1-7	Backhoe	1	4	97	0.4	Diesel	0.1	0.9	1.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0
1-7	Winch	1	8	88	0.3	Diesel	0.2	2.0	2.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0
1-7	Crane	1	2	231	0.3	Diesel	0.1	1.2	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1-7	Generator	1	4	84	0.7	Diesel	0.2	1.6	1.8	0.1	0.1	0.0	0.0	0.0	0.0	0.0
2-5	Backhoe	1	4	97	0.4	Diesel	0.1	0.9	1.1	0.1	0.1	0.0	0.1	0.0	0.0	0.1
2-5	Winch	1	8	88	0.3	Diesel	0.2	2.0	2.0	0.1	0.1	0.0	0.1	0.0	0.0	0.1
2-5	Crane	1	2	231	0.3	Diesel	0.1	1.2	0.5	0.0	0.0	0.0	0.1	0.0	0.0	0.1
2-5	Generator	1	4	84	0.7	Diesel	0.2	1.6	1.8	0.1	0.1	0.0	0.1	0.0	0.0	0.1
3-5	Backhoe	1	4	97	0.4	Diesel	0.1	0.9	1.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0
3-5	Winch	1	8	88	0.3	Diesel	0.2	2.0	2.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0
3-5	Crane	1	2	231	0.3	Diesel	0.1	1.2	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3-5	Generator	1	4	84	0.7	Diesel	0.2	1.6	1.8	0.1	0.1	0.0	0.0	0.0	0.0	0.0
4-5	Backhoe	1	4	97	0.4	Diesel	0.1	0.9	1.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0
4-5	Winch	1	8	88	0.3	Diesel	0.2	2.0	2.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0
4-5	Crane	1	2	231	0.3	Diesel	0.1	1.2	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4-5	Generator	1	4	84	0.7	Diesel	0.2	1.6	1.8	0.1	0.1	0.0	0.0	0.0	0.0	0.0

Code	Equip	#/day	hrs/day	HP	LF	Fuel	2023									
							Pounds per day						Metric tons per year			
							ROG	NOX	CO	PM10	PM2.5	SO2	CO2	CH4	N2O	CO2e
1-1	Concrete/Asphalt Saw	1	2	81	0.7	Diesel	0.1	0.6	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1-1	Backhoe	1	8	97	0.4	Diesel	0.2	1.5	2.2	0.1	0.1	0.0	0.0	0.0	0.0	0.0
1-1	Pavement Roller	1	2	80	0.4	Diesel	0.0	0.4	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1-1	Handheld Vibratory Compactor	1	1	8	0.4	Diesel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1-2	HDD Powerplant (AA DD625)	1	10	600	0.5	Diesel	0.6	4.8	6.5	0.2	0.2	0.0	0.0	0.0	0.0	0.0
1-2	Excavator	1	2	158	0.4	Diesel	0.0	0.4	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1-2	Welder	1	8	46	0.5	Diesel	0.3	1.4	1.7	0.1	0.1	0.0	0.0	0.0	0.0	0.0
1-2	Generator	1	10	84	0.7	Diesel	0.4	3.4	4.6	0.2	0.2	0.0	0.0	0.0	0.0	0.0
1-3	Backhoe	1	8	97	0.4	Diesel	0.2	1.5	2.2	0.1	0.1	0.0	0.0	0.0	0.0	0.0
1-3	Well Drilling Machine	1	4	221	0.5	Diesel	0.1	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1-3	Handheld Vibratory Compactor	1	1	8	0.4	Diesel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2-1	Backhoe	1	8	97	0.4	Diesel	0.2	1.5	2.2	0.1	0.1	0.0	0.0	0.0	0.0	0.0
2-1	Well Drilling Machine	1	4	221	0.5	Diesel	0.1	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2-1	Handheld Vibratory Compactor	1	1	8	0.4	Diesel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3-1	Backhoe	1	8	97	0.4	Diesel	0.2	1.5	2.2	0.1	0.1	0.0	0.7	0.0	0.0	0.7
3-1	Well Drilling Machine	1	4	221	0.5	Diesel	0.1	1.0	1.0	0.0	0.0	0.0	1.0	0.0	0.0	1.1
3-1	Handheld Vibratory Compactor	1	1	8	0.4	Diesel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4-1	Backhoe	1	8	97	0.4	Diesel	0.2	1.5	2.2	0.1	0.1	0.0	0.0	0.0	0.0	0.0
4-1	Well Drilling Machine	1	4	221	0.5	Diesel	0.1	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4-1	Handheld Vibratory Compactor	1	1	8	0.4	Diesel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1-7	Backhoe	1	4	97	0.4	Diesel	0.1	0.8	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1-7	Winch	1	8	88	0.3	Diesel	0.2	1.6	1.9	0.1	0.1	0.0	0.0	0.0	0.0	0.0
1-7	Crane	1	2	231	0.3	Diesel	0.1	0.9	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1-7	Generator	1	4	84	0.7	Diesel	0.2	1.4	1.8	0.1	0.1	0.0	0.0	0.0	0.0	0.0
2-5	Backhoe	1	4	97	0.4	Diesel	0.1	0.8	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2-5	Winch	1	8	88	0.3	Diesel	0.2	1.6	1.9	0.1	0.1	0.0	0.0	0.0	0.0	0.0
2-5	Crane	1	2	231	0.3	Diesel	0.1	0.9	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2-5	Generator	1	4	84	0.7	Diesel	0.2	1.4	1.8	0.1	0.1	0.0	0.0	0.0	0.0	0.0
3-5	Backhoe	1	4	97	0.4	Diesel	0.1	0.8	1.1	0.0	0.0	0.0	0.1	0.0	0.0	0.1
3-5	Winch	1	8	88	0.3	Diesel	0.2	1.6	1.9	0.1	0.1	0.0	0.1	0.0	0.0	0.1
3-5	Crane	1	2	231	0.3	Diesel	0.1	0.9	0.5	0.0	0.0	0.0	0.1	0.0	0.0	0.1
3-5	Generator	1	4	84	0.7	Diesel	0.2	1.4	1.8	0.1	0.1	0.0	0.1	0.0	0.0	0.1
4-5	Backhoe	1	4	97	0.4	Diesel	0.1	0.8	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4-5	Winch	1	8	88	0.3	Diesel	0.2	1.6	1.9	0.1	0.1	0.0	0.0	0.0	0.0	0.0
4-5	Crane	1	2	231	0.3	Diesel	0.1	0.9	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4-5	Generator	1	4	84	0.7	Diesel	0.2	1.4	1.8	0.1	0.1	0.0	0.0	0.0	0.0	0.0

							2025									
							Pounds per day						Metric tons per year			
Code	Equip	#/day	hrs/day	HP	LF	Fuel	ROG	NOX	CO	PM10	PM2.5	SO2	CO2	CH4	N2O	CO2e
1-1	Concrete/Asphalt Saw	1	2	81	0.7	Diesel	0.1	0.6	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1-1	Backhoe	1	8	97	0.4	Diesel	0.1	1.3	2.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0
1-1	Pavement Roller	1	2	80	0.4	Diesel	0.0	0.4	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1-1	Handheld Vibratory Compactor	1	1	8	0.4	Diesel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1-2	HDD Powerplant (AA DD625)	1	10	600	0.5	Diesel	0.6	4.0	6.5	0.2	0.1	0.0	0.0	0.0	0.0	0.0
1-2	Excavator	1	2	158	0.4	Diesel	0.0	0.3	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1-2	Welder	1	8	46	0.5	Diesel	0.2	1.3	1.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1-2	Generator	1	10	84	0.7	Diesel	0.3	3.0	4.6	0.1	0.1	0.0	0.0	0.0	0.0	0.0
1-3	Backhoe	1	8	97	0.4	Diesel	0.1	1.3	2.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0
1-3	Well Drilling Machine	1	4	221	0.5	Diesel	0.1	0.9	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1-3	Handheld Vibratory Compactor	1	1	8	0.4	Diesel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2-1	Backhoe	1	8	97	0.4	Diesel	0.1	1.3	2.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0
2-1	Well Drilling Machine	1	4	221	0.5	Diesel	0.1	0.9	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2-1	Handheld Vibratory Compactor	1	1	8	0.4	Diesel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3-1	Backhoe	1	8	97	0.4	Diesel	0.1	1.3	2.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0
3-1	Well Drilling Machine	1	4	221	0.5	Diesel	0.1	0.9	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3-1	Handheld Vibratory Compactor	1	1	8	0.4	Diesel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4-1	Backhoe	1	8	97	0.4	Diesel	0.1	1.3	2.2	0.1	0.0	0.0	0.7	0.0	0.0	0.7
4-1	Well Drilling Machine	1	4	221	0.5	Diesel	0.1	0.9	1.0	0.0	0.0	0.0	1.0	0.0	0.0	1.1
4-1	Handheld Vibratory Compactor	1	1	8	0.4	Diesel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1-7	Backhoe	1	4	97	0.4	Diesel	0.1	0.7	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1-7	Winch	1	8	88	0.3	Diesel	0.1	1.3	1.9	0.1	0.1	0.0	0.0	0.0	0.0	0.0
1-7	Crane	1	2	231	0.3	Diesel	0.1	0.8	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1-7	Generator	1	4	84	0.7	Diesel	0.1	1.2	1.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2-5	Backhoe	1	4	97	0.4	Diesel	0.1	0.7	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2-5	Winch	1	8	88	0.3	Diesel	0.1	1.3	1.9	0.1	0.1	0.0	0.0	0.0	0.0	0.0
2-5	Crane	1	2	231	0.3	Diesel	0.1	0.8	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2-5	Generator	1	4	84	0.7	Diesel	0.1	1.2	1.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3-5	Backhoe	1	4	97	0.4	Diesel	0.1	0.7	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3-5	Winch	1	8	88	0.3	Diesel	0.1	1.3	1.9	0.1	0.1	0.0	0.0	0.0	0.0	0.0
3-5	Crane	1	2	231	0.3	Diesel	0.1	0.8	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3-5	Generator	1	4	84	0.7	Diesel	0.1	1.2	1.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4-5	Backhoe	1	4	97	0.4	Diesel	0.1	0.7	1.1	0.0	0.0	0.0	0.1	0.0	0.0	0.1
4-5	Winch	1	8	88	0.3	Diesel	0.1	1.3	1.9	0.1	0.1	0.0	0.1	0.0	0.0	0.1
4-5	Crane	1	2	231	0.3	Diesel	0.1	0.8	0.4	0.0	0.0	0.0	0.1	0.0	0.0	0.1
4-5	Generator	1	4	84	0.7	Diesel	0.1	1.2	1.8	0.0	0.0	0.0	0.1	0.0	0.0	0.1

Employee Calculations

Code	Round Trips/day	Miles/day	Vehicle Type	2020 Pounds per day								2020 Metric tons per year			
				ROG	NOX	CO	PM10	PM2.5	PM10 D	PM2.5 D	SO2	CO2	CH4	N2O	CO2e
1-11	10	1000	LDA-LDT	0.1	0.2	2.1	0.0	0.0	1.9	0.5	0.0	48.9	0.0	0.0	49.3
2-9	10	1000	LDA-LDT	0.1	0.2	2.1	0.0	0.0	1.9	0.5	0.0	0.0	0.0	0.0	0.0
3-9	10	1000	LDA-LDT	0.1	0.2	2.1	0.0	0.0	1.9	0.5	0.0	0.0	0.0	0.0	0.0
4-9	10	1000	LDA-LDT	0.1	0.2	2.1	0.0	0.0	1.9	0.5	0.0	0.0	0.0	0.0	0.0

Code	Round Trips/day	Miles/day	Vehicle Type	2021 Pounds per day								2021 Metric tons per year			
				ROG	NOX	CO	PM10	PM2.5	PM10 D	PM2.5 D	SO2	CO2	CH4	N2O	CO2e
1-11	10	1000	LDA-LDT	0.1	0.2	1.9	0.0	0.0	1.9	0.5	0.0	0.0	0.0	0.0	0.0
2-9	10	1000	LDA-LDT	0.1	0.2	1.9	0.0	0.0	1.9	0.5	0.0	9.8	0.0	0.0	9.8
3-9	10	1000	LDA-LDT	0.1	0.2	1.9	0.0	0.0	1.9	0.5	0.0	0.0	0.0	0.0	0.0
4-9	10	1000	LDA-LDT	0.1	0.2	1.9	0.0	0.0	1.9	0.5	0.0	0.0	0.0	0.0	0.0

Code	Round Trips/day	Miles/day	Vehicle Type	2023 Pounds per day								2023 Metric tons per year			
				ROG	NOX	CO	PM10	PM2.5	PM10 D	PM2.5 D	SO2	CO2	CH4	N2O	CO2e
1-11	10	1000	LDA-LDT	0.0	0.1	1.5	0.0	0.0	1.9	0.5	0.0	0.0	0.0	0.0	0.0
2-9	10	1000	LDA-LDT	0.0	0.1	1.5	0.0	0.0	1.9	0.5	0.0	0.0	0.0	0.0	0.0
3-9	10	1000	LDA-LDT	0.0	0.1	1.5	0.0	0.0	1.9	0.5	0.0	9.2	0.0	0.0	9.2
4-9	10	1000	LDA-LDT	0.0	0.1	1.5	0.0	0.0	1.9	0.5	0.0	0.0	0.0	0.0	0.0

Code	Round Trips/day	Miles/day	Vehicle Type	2025 Pounds per day								2025 Metric tons per year			
				ROG	NOX	CO	PM10	PM2.5	PM10 D	PM2.5 D	SO2	CO2	CH4	N2O	CO2e
1-11	10	1000	LDA-LDT	0.0	0.1	1.3	0.0	0.0	1.9	0.5	0.0	0.0	0.0	0.0	0.0
2-9	10	1000	LDA-LDT	0.0	0.1	1.3	0.0	0.0	1.9	0.5	0.0	0.0	0.0	0.0	0.0
3-9	10	1000	LDA-LDT	0.0	0.1	1.3	0.0	0.0	1.9	0.5	0.0	0.0	0.0	0.0	0.0
4-9	10	1000	LDA-LDT	0.0	0.1	1.3	0.0	0.0	1.9	0.5	0.0	8.5	0.0	0.0	8.6

Onroad Truck Calculations

Code	Trips/day	Miles/day	Vehicle	Vehicle Type	2020											
					Pounds per day								Metric tons per year			
					ROG	NOX	CO	PM10	PM2.5	PM10 D	PM2.5 D	SO2	CO2	CH4	N2O	CO2e
1-1	2	10	Pickup Truck	LDT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.3
1-1	2	20	Dump Truck	T7SingleOnsite	0.1	0.8	0.2	0.0	0.0	0.7	0.1	0.0	6.3	0.0	0.0	6.6
1-1	2	10	Asphalt Truck	T6InstateOnsite	0.0	0.3	0.1	0.0	0.0	0.3	0.0	0.0	2.1	0.0	0.0	2.2
1-2	2	15	Pickup Truck	LDT	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.2
1-2	2	20	Tractor Trailer	T7Tractor	0.0	0.4	0.1	0.0	0.0	0.0	0.0	0.0	1.1	0.0	0.0	1.2
1-3	2	10	One Ton Truck	T6InstateOnsite	0.0	0.3	0.1	0.0	0.0	0.3	0.0	0.0	0.3	0.0	0.0	0.4
1-3	2	15	Pickup Truck	LDT	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.1
1-3	2	10	Delivery Truck	T7Single	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.3
1-3	2	10	Dump Truck	T7SingleOnsite	0.0	0.4	0.1	0.0	0.0	0.3	0.0	0.0	0.5	0.0	0.0	0.6
2-1	2	10	One Ton Truck	T6InstateOnsite	0.0	0.3	0.1	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0
2-1	2	15	Pickup Truck	LDT	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2-1	2	10	Delivery Truck	T7Single	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2-1	2	10	Dump Truck	T7SingleOnsite	0.0	0.4	0.1	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0
3-1	2	10	One Ton Truck	T6InstateOnsite	0.0	0.3	0.1	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0
3-1	2	15	Pickup Truck	LDT	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3-1	2	10	Delivery Truck	T7Single	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3-1	2	10	Dump Truck	T7SingleOnsite	0.0	0.4	0.1	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0
4-1	2	10	One Ton Truck	T6InstateOnsite	0.0	0.3	0.1	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0
4-1	2	15	Pickup Truck	LDT	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4-1	2	10	Delivery Truck	T7Single	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4-1	2	10	Dump Truck	T7SingleOnsite	0.0	0.4	0.1	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0
1-4	2	40	Cable-Pulling Truck	T6UtilityOnsite	0.0	0.5	0.1	0.0	0.0	1.4	0.1	0.0	0.5	0.0	0.0	0.5
1-4	2	20	Pickup Truck with Reel	LDT	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1-4	2	15	Equipment Truck	T6InstateOnsite	0.1	0.5	0.1	0.0	0.0	0.5	0.1	0.0	0.2	0.0	0.0	0.2
2-2	2	40	Cable-Pulling Truck	T6UtilityOnsite	0.0	0.5	0.1	0.0	0.0	1.4	0.1	0.0	0.0	0.0	0.0	0.0
2-2	2	20	Pickup Truck with Reel	LDT	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2-2	2	15	Equipment Truck	T6InstateOnsite	0.1	0.5	0.1	0.0	0.0	0.5	0.1	0.0	0.0	0.0	0.0	0.0
3-2	2	40	Cable-Pulling Truck	T6UtilityOnsite	0.0	0.5	0.1	0.0	0.0	1.4	0.1	0.0	0.0	0.0	0.0	0.0
3-2	2	20	Pickup Truck with Reel	LDT	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3-2	2	15	Equipment Truck	T6InstateOnsite	0.1	0.5	0.1	0.0	0.0	0.5	0.1	0.0	0.0	0.0	0.0	0.0
4-2	2	40	Cable-Pulling Truck	T6UtilityOnsite	0.0	0.5	0.1	0.0	0.0	1.4	0.1	0.0	0.0	0.0	0.0	0.0
4-2	2	20	Pickup Truck with Reel	LDT	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4-2	2	15	Equipment Truck	T6InstateOnsite	0.1	0.5	0.1	0.0	0.0	0.5	0.1	0.0	0.0	0.0	0.0	0.0
1-11	5	500	Tractor Trailer	T7Tractor	0.6	8.5	1.7	0.1	0.1	1.0	0.3	0.0	157.3	0.0	0.0	164.7
2-9	5	500	Tractor Trailer	T7Tractor	0.6	8.5	1.7	0.1	0.1	1.0	0.3	0.0	0.0	0.0	0.0	0.0
3-9	5	500	Tractor Trailer	T7Tractor	0.6	8.5	1.7	0.1	0.1	1.0	0.3	0.0	0.0	0.0	0.0	0.0
4-9	5	500	Tractor Trailer	T7Tractor	0.6	8.5	1.7	0.1	0.1	1.0	0.3	0.0	0.0	0.0	0.0	0.0
1-11	1	100	Fuel and Misc Delivery	T6Instate	0.1	1.2	0.2	0.0	0.0	0.2	0.1	0.0	18.1	0.0	0.0	19.0
2-9	1	100	Fuel and Misc Delivery	T6Instate	0.1	1.2	0.2	0.0	0.0	0.2	0.1	0.0	0.0	0.0	0.0	0.0
3-9	1	100	Fuel and Misc Delivery	T6Instate	0.1	1.2	0.2	0.0	0.0	0.2	0.1	0.0	0.0	0.0	0.0	0.0
4-9	1	100	Fuel and Misc Delivery	T6Instate	0.1	1.2	0.2	0.0	0.0	0.2	0.1	0.0	0.0	0.0	0.0	0.0
1-5	2	15	Equipment Truck	T6InstateOnsite	0.1	0.5	0.1	0.0	0.0	0.5	0.1	0.0	4.4	0.0	0.0	4.6
1-7	2	15	Pickup Truck	LDT	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2-5	2	15	Pickup Truck	LDT	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3-5	2	15	Pickup Truck	LDT	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4-5	2	15	Pickup Truck	LDT	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Code	Trips/day	Miles/day	Vehicle	Vehicle Type	2021											
					Pounds per day								Metric tons per year			
					ROG	NOX	CO	PM10	PM2.5	PM10 D	PM2.5 D	SO2	CO2	CH4	N2O	CO2e
1-1	2	10	Pickup Truck	LDT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1-1	2	20	Dump Truck	T7SingleOnsite	0.1	0.7	0.2	0.0	0.0	0.7	0.1	0.0	0.0	0.0	0.0	0.0
1-1	2	10	Asphalt Truck	T6InstateOnsite	0.0	0.3	0.1	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0
1-2	2	15	Pickup Truck	LDT	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1-2	2	20	Tractor Trailer	T7Tractor	0.0	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1-3	2	10	One Ton Truck	T6InstateOnsite	0.0	0.3	0.1	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0
1-3	2	15	Pickup Truck	LDT	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1-3	2	10	Delivery Truck	T7Single	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1-3	2	10	Dump Truck	T7SingleOnsite	0.0	0.4	0.1	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0
2-1	2	10	One Ton Truck	T6InstateOnsite	0.0	0.3	0.1	0.0	0.0	0.3	0.0	0.0	0.1	0.0	0.0	0.1
2-1	2	15	Pickup Truck	LDT	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2-1	2	10	Delivery Truck	T7Single	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.1
2-1	2	10	Dump Truck	T7SingleOnsite	0.0	0.4	0.1	0.0	0.0	0.3	0.0	0.0	0.2	0.0	0.0	0.2
3-1	2	10	One Ton Truck	T6InstateOnsite	0.0	0.3	0.1	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0
3-1	2	15	Pickup Truck	LDT	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3-1	2	10	Delivery Truck	T7Single	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3-1	2	10	Dump Truck	T7SingleOnsite	0.0	0.4	0.1	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0
4-1	2	10	One Ton Truck	T6InstateOnsite	0.0	0.3	0.1	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0
4-1	2	15	Pickup Truck	LDT	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4-1	2	10	Delivery Truck	T7Single	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4-1	2	10	Dump Truck	T7SingleOnsite	0.0	0.4	0.1	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0
1-4	2	40	Cable-Pulling Truck	T6UtilityOnsite	0.0	0.4	0.1	0.0	0.0	1.4	0.1	0.0	0.0	0.0	0.0	0.0
1-4	2	20	Pickup Truck with Reel	LDT	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1-4	2	15	Equipment Truck	T6InstateOnsite	0.0	0.4	0.1	0.0	0.0	0.5	0.1	0.0	0.0	0.0	0.0	0.0
2-2	2	40	Cable-Pulling Truck	T6UtilityOnsite	0.0	0.4	0.1	0.0	0.0	1.4	0.1	0.0	0.7	0.0	0.0	0.7
2-2	2	20	Pickup Truck with Reel	LDT	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2-2	2	15	Equipment Truck	T6InstateOnsite	0.0	0.4	0.1	0.0	0.0	0.5	0.1	0.0	0.3	0.0	0.0	0.3
3-2	2	40	Cable-Pulling Truck	T6UtilityOnsite	0.0	0.4	0.1	0.0	0.0	1.4	0.1	0.0	0.0	0.0	0.0	0.0
3-2	2	20	Pickup Truck with Reel	LDT	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3-2	2	15	Equipment Truck	T6InstateOnsite	0.0	0.4	0.1	0.0	0.0	0.5	0.1	0.0	0.0	0.0	0.0	0.0
4-2	2	40	Cable-Pulling Truck	T6UtilityOnsite	0.0	0.4	0.1	0.0	0.0	1.4	0.1	0.0	0.0	0.0	0.0	0.0
4-2	2	20	Pickup Truck with Reel	LDT	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4-2	2	15	Equipment Truck	T6InstateOnsite	0.0	0.4	0.1	0.0	0.0	0.5	0.1	0.0	0.0	0.0	0.0	0.0
1-11	5	500	Tractor Trailer	T7Tractor	0.5	7.7	1.4	0.1	0.1	1.0	0.3	0.0	0.0	0.0	0.0	0.0
2-9	5	500	Tractor Trailer	T7Tractor	0.5	7.7	1.4	0.1	0.1	1.0	0.3	0.0	31.9	0.0	0.0	33.5
3-9	5	500	Tractor Trailer	T7Tractor	0.5	7.7	1.4	0.1	0.1	1.0	0.3	0.0	0.0	0.0	0.0	0.0
4-9	5	500	Tractor Trailer	T7Tractor	0.5	7.7	1.4	0.1	0.1	1.0	0.3	0.0	0.0	0.0	0.0	0.0
1-11	1	100	Fuel and Misc Delivery	T6Instate	0.0	1.0	0.1	0.0	0.0	0.2	0.1	0.0	0.0	0.0	0.0	0.0
2-9	1	100	Fuel and Misc Delivery	T6Instate	0.0	1.0	0.1	0.0	0.0	0.2	0.1	0.0	3.7	0.0	0.0	3.8
3-9	1	100	Fuel and Misc Delivery	T6Instate	0.0	1.0	0.1	0.0	0.0	0.2	0.1	0.0	0.0	0.0	0.0	0.0
4-9	1	100	Fuel and Misc Delivery	T6Instate	0.0	1.0	0.1	0.0	0.0	0.2	0.1	0.0	0.0	0.0	0.0	0.0
1-5	2	15	Equipment Truck	T6InstateOnsite	0.0	0.4	0.1	0.0	0.0	0.5	0.1	0.0	0.0	0.0	0.0	0.0
1-7	2	15	Pickup Truck	LDT	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2-5	2	15	Pickup Truck	LDT	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3-5	2	15	Pickup Truck	LDT	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4-5	2	15	Pickup Truck	LDT	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Code	Trips/day	Miles/day	Vehicle	Vehicle Type	2023											
					Pounds per day								Metric tons per year			
					ROG	NOX	CO	PM10	PM2.5	PM10 D	PM2.5 D	SO2	CO2	CH4	N2O	CO2e
1-1	2	10	Pickup Truck	LDT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1-1	2	20	Dump Truck	T7SingleOnsite	0.0	0.5	0.1	0.0	0.0	0.7	0.1	0.0	0.0	0.0	0.0	0.0
1-1	2	10	Asphalt Truck	T6InstateOnsite	0.0	0.2	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0
1-2	2	15	Pickup Truck	LDT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1-2	2	20	Tractor Trailer	T7Tractor	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1-3	2	10	One Ton Truck	T6InstateOnsite	0.0	0.2	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0
1-3	2	15	Pickup Truck	LDT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1-3	2	10	Delivery Truck	T7Single	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1-3	2	10	Dump Truck	T7SingleOnsite	0.0	0.3	0.1	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0
2-1	2	10	One Ton Truck	T6InstateOnsite	0.0	0.2	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0
2-1	2	15	Pickup Truck	LDT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2-1	2	10	Delivery Truck	T7Single	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2-1	2	10	Dump Truck	T7SingleOnsite	0.0	0.3	0.1	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0
3-1	2	10	One Ton Truck	T6InstateOnsite	0.0	0.2	0.0	0.0	0.0	0.3	0.0	0.0	0.1	0.0	0.0	0.1
3-1	2	15	Pickup Truck	LDT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3-1	2	10	Delivery Truck	T7Single	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.1
3-1	2	10	Dump Truck	T7SingleOnsite	0.0	0.3	0.1	0.0	0.0	0.3	0.0	0.0	0.2	0.0	0.0	0.2
4-1	2	10	One Ton Truck	T6InstateOnsite	0.0	0.2	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0
4-1	2	15	Pickup Truck	LDT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4-1	2	10	Delivery Truck	T7Single	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4-1	2	10	Dump Truck	T7SingleOnsite	0.0	0.3	0.1	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0
1-4	2	40	Cable-Pulling Truck	T6UtilityOnsite	0.0	0.4	0.1	0.0	0.0	1.4	0.1	0.0	0.0	0.0	0.0	0.0
1-4	2	20	Pickup Truck with Reel	LDT	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1-4	2	15	Equipment Truck	T6InstateOnsite	0.0	0.3	0.0	0.0	0.0	0.5	0.1	0.0	0.0	0.0	0.0	0.0
2-2	2	40	Cable-Pulling Truck	T6UtilityOnsite	0.0	0.4	0.1	0.0	0.0	1.4	0.1	0.0	0.0	0.0	0.0	0.0
2-2	2	20	Pickup Truck with Reel	LDT	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2-2	2	15	Equipment Truck	T6InstateOnsite	0.0	0.3	0.0	0.0	0.0	0.5	0.1	0.0	0.0	0.0	0.0	0.0
3-2	2	40	Cable-Pulling Truck	T6UtilityOnsite	0.0	0.4	0.1	0.0	0.0	1.4	0.1	0.0	0.7	0.0	0.0	0.7
3-2	2	20	Pickup Truck with Reel	LDT	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3-2	2	15	Equipment Truck	T6InstateOnsite	0.0	0.3	0.0	0.0	0.0	0.5	0.1	0.0	0.2	0.0	0.0	0.3
4-2	2	40	Cable-Pulling Truck	T6UtilityOnsite	0.0	0.4	0.1	0.0	0.0	1.4	0.1	0.0	0.0	0.0	0.0	0.0
4-2	2	20	Pickup Truck with Reel	LDT	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4-2	2	15	Equipment Truck	T6InstateOnsite	0.0	0.3	0.0	0.0	0.0	0.5	0.1	0.0	0.0	0.0	0.0	0.0
1-11	5	500	Tractor Trailer	T7Tractor	0.1	5.1	0.6	0.0	0.0	1.0	0.3	0.0	0.0	0.0	0.0	0.0
2-9	5	500	Tractor Trailer	T7Tractor	0.1	5.1	0.6	0.0	0.0	1.0	0.3	0.0	0.0	0.0	0.0	0.0
3-9	5	500	Tractor Trailer	T7Tractor	0.1	5.1	0.6	0.0	0.0	1.0	0.3	0.0	29.6	0.0	0.0	31.0
4-9	5	500	Tractor Trailer	T7Tractor	0.1	5.1	0.6	0.0	0.0	1.0	0.3	0.0	0.0	0.0	0.0	0.0
1-11	1	100	Fuel and Misc Delivery	T6Instate	0.0	0.6	0.0	0.0	0.0	0.2	0.1	0.0	0.0	0.0	0.0	0.0
2-9	1	100	Fuel and Misc Delivery	T6Instate	0.0	0.6	0.0	0.0	0.0	0.2	0.1	0.0	0.0	0.0	0.0	0.0
3-9	1	100	Fuel and Misc Delivery	T6Instate	0.0	0.6	0.0	0.0	0.0	0.2	0.1	0.0	3.4	0.0	0.0	3.6
4-9	1	100	Fuel and Misc Delivery	T6Instate	0.0	0.6	0.0	0.0	0.0	0.2	0.1	0.0	0.0	0.0	0.0	0.0
1-5	2	15	Equipment Truck	T6InstateOnsite	0.0	0.3	0.0	0.0	0.0	0.5	0.1	0.0	0.0	0.0	0.0	0.0
1-7	2	15	Pickup Truck	LDT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2-5	2	15	Pickup Truck	LDT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3-5	2	15	Pickup Truck	LDT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4-5	2	15	Pickup Truck	LDT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

					2025											
Code	Trips/day	Miles/day	Vehicle	Vehicle Type	Pounds per day								Metric tons per year			
					ROG	NOX	CO	PM10	PM2.5	PM10 D	PM2.5 D	SO2	CO2	CH4	N2O	CO2e
1-1	2	10	Pickup Truck	LDT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1-1	2	20	Dump Truck	T7SingleOnsite	0.0	0.5	0.1	0.0	0.0	0.7	0.1	0.0	0.0	0.0	0.0	0.0
1-1	2	10	Asphalt Truck	T6InstateOnsite	0.0	0.2	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0
1-2	2	15	Pickup Truck	LDT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1-2	2	20	Tractor Trailer	T7Tractor	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1-3	2	10	One Ton Truck	T6InstateOnsite	0.0	0.2	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0
1-3	2	15	Pickup Truck	LDT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1-3	2	10	Delivery Truck	T7Single	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1-3	2	10	Dump Truck	T7SingleOnsite	0.0	0.3	0.1	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0
2-1	2	10	One Ton Truck	T6InstateOnsite	0.0	0.2	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0
2-1	2	15	Pickup Truck	LDT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2-1	2	10	Delivery Truck	T7Single	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2-1	2	10	Dump Truck	T7SingleOnsite	0.0	0.3	0.1	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0
3-1	2	10	One Ton Truck	T6InstateOnsite	0.0	0.2	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0
3-1	2	15	Pickup Truck	LDT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3-1	2	10	Delivery Truck	T7Single	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3-1	2	10	Dump Truck	T7SingleOnsite	0.0	0.3	0.1	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0
4-1	2	10	One Ton Truck	T6InstateOnsite	0.0	0.2	0.0	0.0	0.0	0.3	0.0	0.0	0.1	0.0	0.0	0.1
4-1	2	15	Pickup Truck	LDT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4-1	2	10	Delivery Truck	T7Single	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.1
4-1	2	10	Dump Truck	T7SingleOnsite	0.0	0.3	0.1	0.0	0.0	0.3	0.0	0.0	0.2	0.0	0.0	0.2
1-4	2	40	Cable-Pulling Truck	T6UtilityOnsite	0.0	0.4	0.1	0.0	0.0	1.4	0.1	0.0	0.0	0.0	0.0	0.0
1-4	2	20	Pickup Truck with Reel	LDT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1-4	2	15	Equipment Truck	T6InstateOnsite	0.0	0.3	0.0	0.0	0.0	0.5	0.1	0.0	0.0	0.0	0.0	0.0
2-2	2	40	Cable-Pulling Truck	T6UtilityOnsite	0.0	0.4	0.1	0.0	0.0	1.4	0.1	0.0	0.0	0.0	0.0	0.0
2-2	2	20	Pickup Truck with Reel	LDT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2-2	2	15	Equipment Truck	T6InstateOnsite	0.0	0.3	0.0	0.0	0.0	0.5	0.1	0.0	0.0	0.0	0.0	0.0
3-2	2	40	Cable-Pulling Truck	T6UtilityOnsite	0.0	0.4	0.1	0.0	0.0	1.4	0.1	0.0	0.0	0.0	0.0	0.0
3-2	2	20	Pickup Truck with Reel	LDT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3-2	2	15	Equipment Truck	T6InstateOnsite	0.0	0.3	0.0	0.0	0.0	0.5	0.1	0.0	0.0	0.0	0.0	0.0
4-2	2	40	Cable-Pulling Truck	T6UtilityOnsite	0.0	0.4	0.1	0.0	0.0	1.4	0.1	0.0	0.6	0.0	0.0	0.7
4-2	2	20	Pickup Truck with Reel	LDT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4-2	2	15	Equipment Truck	T6InstateOnsite	0.0	0.3	0.0	0.0	0.0	0.5	0.1	0.0	0.2	0.0	0.0	0.3
1-11	5	500	Tractor Trailer	T7Tractor	0.1	5.1	0.6	0.0	0.0	1.0	0.3	0.0	0.0	0.0	0.0	0.0
2-9	5	500	Tractor Trailer	T7Tractor	0.1	5.1	0.6	0.0	0.0	1.0	0.3	0.0	0.0	0.0	0.0	0.0
3-9	5	500	Tractor Trailer	T7Tractor	0.1	5.1	0.6	0.0	0.0	1.0	0.3	0.0	0.0	0.0	0.0	0.0
4-9	5	500	Tractor Trailer	T7Tractor	0.1	5.1	0.6	0.0	0.0	1.0	0.3	0.0	29.0	0.0	0.0	30.3
1-11	1	100	Fuel and Misc Delivery	T6Instate	0.0	0.6	0.0	0.0	0.0	0.2	0.1	0.0	0.0	0.0	0.0	0.0
2-9	1	100	Fuel and Misc Delivery	T6Instate	0.0	0.6	0.0	0.0	0.0	0.2	0.1	0.0	0.0	0.0	0.0	0.0
3-9	1	100	Fuel and Misc Delivery	T6Instate	0.0	0.6	0.0	0.0	0.0	0.2	0.1	0.0	0.0	0.0	0.0	0.0
4-9	1	100	Fuel and Misc Delivery	T6Instate	0.0	0.6	0.0	0.0	0.0	0.2	0.1	0.0	3.3	0.0	0.0	3.5
1-5	2	15	Equipment Truck	T6InstateOnsite	0.0	0.3	0.0	0.0	0.0	0.5	0.1	0.0	0.0	0.0	0.0	0.0
1-7	2	15	Pickup Truck	LDT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2-5	2	15	Pickup Truck	LDT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3-5	2	15	Pickup Truck	LDT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4-5	2	15	Pickup Truck	LDT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Marine Calculations

Code	Boat	Hrs/day	2020									
			Pounds per day						Metric tons per year			
			ROG	NOX	CO	PM10	PM2.5	SO2	CO2	CH4	N2O	CO2e
1-2	Work Boat	6	3	27	21	1	1	0	32.0	0.0	0.0	32.5
1-2	Tug Boat	5	7	67	48	2	2	0	75.7	0.0	0.0	76.7
1-2	Patrol Boat	6	3	30	24	1	1	0	36.9	0.0	0.0	37.5
1-6	Main Lay Vessel (laying)	24	52	992	89	21	20	37	25.2	0.0	0.0	25.6
1-7	Main Lay Vessel (transit)	10	53	1,017	92	22	20	36	24.8	0.0	0.0	25.2
1-8	Main Lay Vessel (laying)	24	52	992	89	21	20	37	25.2	0.0	0.0	25.6
1-9	Support Vessel	24	19	174	135	5	5	0	15.3	0.0	0.0	15.5
1-10	Main Lay Vessel (laying)	24	52	992	89	21	20	37	50.4	0.0	0.0	51.1
2-4	Main Lay Vessel (laying)	24	52	992	89	21	20	37	0.0	0.0	0.0	0.0
2-5	Main Lay Vessel (transit)	10	53	1,017	92	22	20	36	0.0	0.0	0.0	0.0
2-6	Main Lay Vessel (laying)	24	52	992	89	21	20	37	0.0	0.0	0.0	0.0
2-7	Support Vessel	24	19	174	135	5	5	0	0.0	0.0	0.0	0.0
2-8	Main Lay Vessel (laying)	24	52	992	89	21	20	37	0.0	0.0	0.0	0.0
3-4	Main Lay Vessel (laying)	24	52	992	89	21	20	37	0.0	0.0	0.0	0.0
3-5	Main Lay Vessel (transit)	10	53	1,017	92	22	20	36	0.0	0.0	0.0	0.0
3-6	Main Lay Vessel (laying)	24	52	992	89	21	20	37	0.0	0.0	0.0	0.0
3-7	Support Vessel	24	19	174	135	5	5	0	0.0	0.0	0.0	0.0
3-8	Main Lay Vessel (laying)	24	52	992	89	21	20	37	0.0	0.0	0.0	0.0
4-4	Main Lay Vessel (laying)	24	52	992	89	21	20	37	0.0	0.0	0.0	0.0
4-5	Main Lay Vessel (transit)	10	53	1,017	92	22	20	36	0.0	0.0	0.0	0.0
4-6	Main Lay Vessel (laying)	24	52	992	89	21	20	37	0.0	0.0	0.0	0.0
4-7	Support Vessel	24	19	174	135	5	5	0	0.0	0.0	0.0	0.0
4-8	Main Lay Vessel (laying)	24	52	992	89	21	20	37	0.0	0.0	0.0	0.0

			2021									
Code	Boat	Hrs/day	Pounds per day						Metric tons per year			
			ROG	NOX	CO	PM10	PM2.5	SO2	CO2	CH4	N2O	CO2e
1-2	Work Boat	6	3	27	21	1	1	0	0.0	0.0	0.0	0.0
1-2	Tug Boat	5	7	67	48	2	2	0	0.0	0.0	0.0	0.0
1-2	Patrol Boat	6	3	30	24	1	1	0	0.0	0.0	0.0	0.0
1-6	Main Lay Vessel (laying)	24	52	992	89	21	20	37	0.0	0.0	0.0	0.0
1-7	Main Lay Vessel (transit)	10	53	1,017	92	22	20	36	0.0	0.0	0.0	0.0
1-8	Main Lay Vessel (laying)	24	52	992	89	21	20	37	0.0	0.0	0.0	0.0
1-9	Support Vessel	24	19	175	136	5	5	0	0.0	0.0	0.0	0.0
1-10	Main Lay Vessel (laying)	24	52	992	89	21	20	37	0.0	0.0	0.0	0.0
2-4	Main Lay Vessel (laying)	24	52	992	89	21	20	37	25.2	0.0	0.0	25.6
2-5	Main Lay Vessel (transit)	10	53	1,017	92	22	20	36	24.8	0.0	0.0	25.2
2-6	Main Lay Vessel (laying)	24	52	992	89	21	20	37	25.2	0.0	0.0	25.6
2-7	Support Vessel	24	19	175	136	5	5	0	15.3	0.0	0.0	15.5
2-8	Main Lay Vessel (laying)	24	52	992	89	21	20	37	50.4	0.0	0.0	51.1
3-4	Main Lay Vessel (laying)	24	52	992	89	21	20	37	0.0	0.0	0.0	0.0
3-5	Main Lay Vessel (transit)	10	53	1,017	92	22	20	36	0.0	0.0	0.0	0.0
3-6	Main Lay Vessel (laying)	24	52	992	89	21	20	37	0.0	0.0	0.0	0.0
3-7	Support Vessel	24	19	175	136	5	5	0	0.0	0.0	0.0	0.0
3-8	Main Lay Vessel (laying)	24	52	992	89	21	20	37	0.0	0.0	0.0	0.0
4-4	Main Lay Vessel (laying)	24	52	992	89	21	20	37	0.0	0.0	0.0	0.0
4-5	Main Lay Vessel (transit)	10	53	1,017	92	22	20	36	0.0	0.0	0.0	0.0
4-6	Main Lay Vessel (laying)	24	52	992	89	21	20	37	0.0	0.0	0.0	0.0
4-7	Support Vessel	24	19	175	136	5	5	0	0.0	0.0	0.0	0.0
4-8	Main Lay Vessel (laying)	24	52	992	89	21	20	37	0.0	0.0	0.0	0.0

Code	Boat	Hrs/day	2023									
			Pounds per day						Metric tons per year			
			ROG	NOX	CO	PM10	PM2.5	SO2	CO2	CH4	N2O	CO2e
1-2	Work Boat	6	4	27	22	1	1	0	0.0	0.0	0.0	0.0
1-2	Tug Boat	5	7	67	48	2	2	0	0.0	0.0	0.0	0.0
1-2	Patrol Boat	6	3	30	24	1	1	0	0.0	0.0	0.0	0.0
1-6	Main Lay Vessel (laying)	24	52	992	89	21	20	37	0.0	0.0	0.0	0.0
1-7	Main Lay Vessel (transit)	10	53	1,017	92	22	20	36	0.0	0.0	0.0	0.0
1-8	Main Lay Vessel (laying)	24	52	992	89	21	20	37	0.0	0.0	0.0	0.0
1-9	Support Vessel	24	19	176	137	5	5	0	0.0	0.0	0.0	0.0
1-10	Main Lay Vessel (laying)	24	52	992	89	21	20	37	0.0	0.0	0.0	0.0
2-4	Main Lay Vessel (laying)	24	52	992	89	21	20	37	0.0	0.0	0.0	0.0
2-5	Main Lay Vessel (transit)	10	53	1,017	92	22	20	36	0.0	0.0	0.0	0.0
2-6	Main Lay Vessel (laying)	24	52	992	89	21	20	37	0.0	0.0	0.0	0.0
2-7	Support Vessel	24	19	176	137	5	5	0	0.0	0.0	0.0	0.0
2-8	Main Lay Vessel (laying)	24	52	992	89	21	20	37	0.0	0.0	0.0	0.0
3-4	Main Lay Vessel (laying)	24	52	992	89	21	20	37	25.2	0.0	0.0	25.6
3-5	Main Lay Vessel (transit)	10	53	1,017	92	22	20	36	24.8	0.0	0.0	25.2
3-6	Main Lay Vessel (laying)	24	52	992	89	21	20	37	25.2	0.0	0.0	25.6
3-7	Support Vessel	24	19	176	137	5	5	0	15.3	0.0	0.0	15.5
3-8	Main Lay Vessel (laying)	24	52	992	89	21	20	37	50.4	0.0	0.0	51.1
4-4	Main Lay Vessel (laying)	24	52	992	89	21	20	37	0.0	0.0	0.0	0.0
4-5	Main Lay Vessel (transit)	10	53	1,017	92	22	20	36	0.0	0.0	0.0	0.0
4-6	Main Lay Vessel (laying)	24	52	992	89	21	20	37	0.0	0.0	0.0	0.0
4-7	Support Vessel	24	19	176	137	5	5	0	0.0	0.0	0.0	0.0
4-8	Main Lay Vessel (laying)	24	52	992	89	21	20	37	0.0	0.0	0.0	0.0

			2025									
Code	Boat	Hrs/day	Pounds per day						Metric tons per year			
			ROG	NOX	CO	PM10	PM2.5	SO2	CO2	CH4	N2O	CO2e
1-2	Work Boat	6	4	28	22	1	1	0	0.0	0.0	0.0	0.0
1-2	Tug Boat	5	7	67	48	2	2	0	0.0	0.0	0.0	0.0
1-2	Patrol Boat	6	3	30	24	1	1	0	0.0	0.0	0.0	0.0
1-6	Main Lay Vessel (laying)	24	52	992	89	21	20	37	0.0	0.0	0.0	0.0
1-7	Main Lay Vessel (transit)	10	53	1,017	92	22	20	36	0.0	0.0	0.0	0.0
1-8	Main Lay Vessel (laying)	24	52	992	89	21	20	37	0.0	0.0	0.0	0.0
1-9	Support Vessel	24	19	176	137	5	5	0	0.0	0.0	0.0	0.0
1-10	Main Lay Vessel (laying)	24	52	992	89	21	20	37	0.0	0.0	0.0	0.0
2-4	Main Lay Vessel (laying)	24	52	992	89	21	20	37	0.0	0.0	0.0	0.0
2-5	Main Lay Vessel (transit)	10	53	1,017	92	22	20	36	0.0	0.0	0.0	0.0
2-6	Main Lay Vessel (laying)	24	52	992	89	21	20	37	0.0	0.0	0.0	0.0
2-7	Support Vessel	24	19	176	137	5	5	0	0.0	0.0	0.0	0.0
2-8	Main Lay Vessel (laying)	24	52	992	89	21	20	37	0.0	0.0	0.0	0.0
3-4	Main Lay Vessel (laying)	24	52	992	89	21	20	37	0.0	0.0	0.0	0.0
3-5	Main Lay Vessel (transit)	10	53	1,017	92	22	20	36	0.0	0.0	0.0	0.0
3-6	Main Lay Vessel (laying)	24	52	992	89	21	20	37	0.0	0.0	0.0	0.0
3-7	Support Vessel	24	19	176	137	5	5	0	0.0	0.0	0.0	0.0
3-8	Main Lay Vessel (laying)	24	52	992	89	21	20	37	0.0	0.0	0.0	0.0
4-4	Main Lay Vessel (laying)	24	52	992	89	21	20	37	25.2	0.0	0.0	25.6
4-5	Main Lay Vessel (transit)	10	53	1,017	92	22	20	36	24.8	0.0	0.0	25.2
4-6	Main Lay Vessel (laying)	24	52	992	89	21	20	37	25.2	0.0	0.0	25.6
4-7	Support Vessel	24	19	176	137	5	5	0	15.3	0.0	0.0	15.5
4-8	Main Lay Vessel (laying)	24	52	992	89	21	20	37	50.4	0.0	0.0	51.1

Earthmoving/Paving Calculations

Code	Acres /day	Cut/Fill (cy/day)	Paving (sf/day)	2020 Pounds per day			2021 Pounds per day			2023 Pounds per day			2025 Pounds per day		
				ROG	PM10 D	PM2.5 D	ROG	PM10 D	PM2.5 D	ROG	PM10 D	PM2.5 D	ROG	PM10 D	PM2.5 D
1-1	0.069	44.444	0.003	0.0	0.1	0.0	0.0	0.1	0.0	0.0	0.1	0.0	0.0	0.1	0.0
1-2	0.092			0.0	0.1	0.0	0.0	0.1	0.0	0.0	0.1	0.0	0.0	0.1	0.0
1-3		13.704		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2-1		13.704		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3-1		13.704		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4-1		13.704		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Construction (3 to 24 NM)

Schedule

Phase	Code	Start Date	End Date	Working Days
Phase 1				
Pre-lay grapnel run	1-6	9/1/2020	9/3/2020	2
Marine cable lay	1-8	9/8/2020	9/16/2020	6
Marine cable burial (ROV-assisted)	1-10	9/14/2020	9/19/2020	4
Phase 2				
Pre-lay grapnel run	2-4	8/23/2021	8/25/2021	2
Marine cable lay	2-6	8/30/2021	9/7/2021	6
Marine cable burial (ROV-assisted)	2-8	9/5/2021	9/10/2021	4
Phase 3				
Pre-lay grapnel run	3-4	9/23/2023	9/25/2023	2
Marine cable lay	3-6	9/30/2023	10/8/2023	6
Marine cable burial (ROV-assisted)	3-8	10/6/2023	10/11/2023	4
Phase 4				
Pre-lay grapnel run	4-4	10/23/2025	10/25/2025	2
Marine cable lay	4-6	10/30/2025	11/7/2025	6
Marine cable burial (ROV-assisted)	4-8	11/5/2025	11/10/2025	4

Marine Calculations

Code	Boat	Hrs/day	2020									
			Pounds per day						Metric tons per year			
			ROG	NOX	CO	PM10	PM2.5	SO2	CO2	CH4	N2O	CO2e
1-6	Main Lay Vessel (laying)	20	43	826	75	18	17	31	42.0	0.0	0.0	42.6
1-6	Main Lay Vessel (transit)	4	21	407	37	9	8	14	19.9	0.0	0.0	20.1
1-6	Support Vessel	12	9	87	67	3	3	0	7.6	0.0	0.0	7.8
1-8	Main Lay Vessel (laying)	20	43	826	75	18	17	31	126.0	0.0	0.0	127.8
1-8	Main Lay Vessel (transit)	4	21	407	37	9	8	14	59.6	0.0	0.0	60.4
1-10	Main Lay Vessel (laying)	20	43	826	75	18	17	31	84.0	0.0	0.0	85.2
1-10	Main Lay Vessel (transit)	4	21	407	37	9	8	14	39.7	0.0	0.0	40.3
2-4	Main Lay Vessel (laying)	20	43	826	75	18	17	31	0.0	0.0	0.0	0.0
2-4	Main Lay Vessel (transit)	4	21	407	37	9	8	14	0.0	0.0	0.0	0.0
2-4	Support Vessel	12	9	87	67	3	3	0	0.0	0.0	0.0	0.0
2-6	Main Lay Vessel (laying)	20	43	826	75	18	17	31	0.0	0.0	0.0	0.0
2-6	Main Lay Vessel (transit)	4	21	407	37	9	8	14	0.0	0.0	0.0	0.0
2-8	Main Lay Vessel (laying)	20	43	826	75	18	17	31	0.0	0.0	0.0	0.0
2-8	Main Lay Vessel (transit)	4	21	407	37	9	8	14	0.0	0.0	0.0	0.0
3-4	Main Lay Vessel (laying)	20	43	826	75	18	17	31	0.0	0.0	0.0	0.0
3-4	Main Lay Vessel (transit)	4	21	407	37	9	8	14	0.0	0.0	0.0	0.0
3-4	Support Vessel	12	9	87	67	3	3	0	0.0	0.0	0.0	0.0
3-6	Main Lay Vessel (laying)	20	43	826	75	18	17	31	0.0	0.0	0.0	0.0
3-6	Main Lay Vessel (transit)	4	21	407	37	9	8	14	0.0	0.0	0.0	0.0
3-8	Main Lay Vessel (laying)	20	43	826	75	18	17	31	0.0	0.0	0.0	0.0
3-8	Main Lay Vessel (transit)	4	21	407	37	9	8	14	0.0	0.0	0.0	0.0
4-4	Main Lay Vessel (laying)	20	43	826	75	18	17	31	0.0	0.0	0.0	0.0
4-4	Main Lay Vessel (transit)	4	21	407	37	9	8	14	0.0	0.0	0.0	0.0
4-4	Support Vessel	12	9	87	67	3	3	0	0.0	0.0	0.0	0.0
4-6	Main Lay Vessel (laying)	20	43	826	75	18	17	31	0.0	0.0	0.0	0.0
4-6	Main Lay Vessel (transit)	4	21	407	37	9	8	14	0.0	0.0	0.0	0.0
4-8	Main Lay Vessel (laying)	20	43	826	75	18	17	31	0.0	0.0	0.0	0.0
4-8	Main Lay Vessel (transit)	4	21	407	37	9	8	14	0.0	0.0	0.0	0.0

Code	Boat	Hrs/day	2021									
			Pounds per day						Metric tons per year			
			ROG	NOX	CO	PM10	PM2.5	SO2	CO2	CH4	N2O	CO2e
1-6	Main Lay Vessel (laying)	20	43	826	75	18	17	31	0.0	0.0	0.0	0.0
1-6	Main Lay Vessel (transit)	4	21	407	37	9	8	14	0.0	0.0	0.0	0.0
1-6	Support Vessel	12	9	87	68	3	3	0	0.0	0.0	0.0	0.0
1-8	Main Lay Vessel (laying)	20	43	826	75	18	17	31	0.0	0.0	0.0	0.0
1-8	Main Lay Vessel (transit)	4	21	407	37	9	8	14	0.0	0.0	0.0	0.0
1-10	Main Lay Vessel (laying)	20	43	826	75	18	17	31	0.0	0.0	0.0	0.0
1-10	Main Lay Vessel (transit)	4	21	407	37	9	8	14	0.0	0.0	0.0	0.0
2-4	Main Lay Vessel (laying)	20	43	826	75	18	17	31	42.0	0.0	0.0	42.6
2-4	Main Lay Vessel (transit)	4	21	407	37	9	8	14	19.9	0.0	0.0	20.1
2-4	Support Vessel	12	9	87	68	3	3	0	7.6	0.0	0.0	7.8
2-6	Main Lay Vessel (laying)	20	43	826	75	18	17	31	126.0	0.0	0.0	127.8
2-6	Main Lay Vessel (transit)	4	21	407	37	9	8	14	59.6	0.0	0.0	60.4
2-8	Main Lay Vessel (laying)	20	43	826	75	18	17	31	84.0	0.0	0.0	85.2
2-8	Main Lay Vessel (transit)	4	21	407	37	9	8	14	39.7	0.0	0.0	40.3
3-4	Main Lay Vessel (laying)	20	43	826	75	18	17	31	0.0	0.0	0.0	0.0
3-4	Main Lay Vessel (transit)	4	21	407	37	9	8	14	0.0	0.0	0.0	0.0
3-4	Support Vessel	12	9	87	68	3	3	0	0.0	0.0	0.0	0.0
3-6	Main Lay Vessel (laying)	20	43	826	75	18	17	31	0.0	0.0	0.0	0.0
3-6	Main Lay Vessel (transit)	4	21	407	37	9	8	14	0.0	0.0	0.0	0.0
3-8	Main Lay Vessel (laying)	20	43	826	75	18	17	31	0.0	0.0	0.0	0.0
3-8	Main Lay Vessel (transit)	4	21	407	37	9	8	14	0.0	0.0	0.0	0.0
4-4	Main Lay Vessel (laying)	20	43	826	75	18	17	31	0.0	0.0	0.0	0.0
4-4	Main Lay Vessel (transit)	4	21	407	37	9	8	14	0.0	0.0	0.0	0.0
4-4	Support Vessel	12	9	87	68	3	3	0	0.0	0.0	0.0	0.0
4-6	Main Lay Vessel (laying)	20	43	826	75	18	17	31	0.0	0.0	0.0	0.0
4-6	Main Lay Vessel (transit)	4	21	407	37	9	8	14	0.0	0.0	0.0	0.0
4-8	Main Lay Vessel (laying)	20	43	826	75	18	17	31	0.0	0.0	0.0	0.0
4-8	Main Lay Vessel (transit)	4	21	407	37	9	8	14	0.0	0.0	0.0	0.0

Code	Boat	Hrs/day	2023									
			Pounds per day						Metric tons per year			
			ROG	NOX	CO	PM10	PM2.5	SO2	CO2	CH4	N2O	CO2e
1-6	Main Lay Vessel (laying)	20	43	826	75	18	17	31	0.0	0.0	0.0	0.0
1-6	Main Lay Vessel (transit)	4	21	407	37	9	8	14	0.0	0.0	0.0	0.0
1-6	Support Vessel	12	10	88	68	3	3	0	0.0	0.0	0.0	0.0
1-8	Main Lay Vessel (laying)	20	43	826	75	18	17	31	0.0	0.0	0.0	0.0
1-8	Main Lay Vessel (transit)	4	21	407	37	9	8	14	0.0	0.0	0.0	0.0
1-10	Main Lay Vessel (laying)	20	43	826	75	18	17	31	0.0	0.0	0.0	0.0
1-10	Main Lay Vessel (transit)	4	21	407	37	9	8	14	0.0	0.0	0.0	0.0
2-4	Main Lay Vessel (laying)	20	43	826	75	18	17	31	0.0	0.0	0.0	0.0
2-4	Main Lay Vessel (transit)	4	21	407	37	9	8	14	0.0	0.0	0.0	0.0
2-4	Support Vessel	12	10	88	68	3	3	0	0.0	0.0	0.0	0.0
2-6	Main Lay Vessel (laying)	20	43	826	75	18	17	31	0.0	0.0	0.0	0.0
2-6	Main Lay Vessel (transit)	4	21	407	37	9	8	14	0.0	0.0	0.0	0.0
2-8	Main Lay Vessel (laying)	20	43	826	75	18	17	31	0.0	0.0	0.0	0.0
2-8	Main Lay Vessel (transit)	4	21	407	37	9	8	14	0.0	0.0	0.0	0.0
3-4	Main Lay Vessel (laying)	20	43	826	75	18	17	31	42.0	0.0	0.0	42.6
3-4	Main Lay Vessel (transit)	4	21	407	37	9	8	14	19.9	0.0	0.0	20.1
3-4	Support Vessel	12	10	88	68	3	3	0	7.6	0.0	0.0	7.8
3-6	Main Lay Vessel (laying)	20	43	826	75	18	17	31	126.0	0.0	0.0	127.8
3-6	Main Lay Vessel (transit)	4	21	407	37	9	8	14	59.6	0.0	0.0	60.4
3-8	Main Lay Vessel (laying)	20	43	826	75	18	17	31	84.0	0.0	0.0	85.2
3-8	Main Lay Vessel (transit)	4	21	407	37	9	8	14	39.7	0.0	0.0	40.3
4-4	Main Lay Vessel (laying)	20	43	826	75	18	17	31	0.0	0.0	0.0	0.0
4-4	Main Lay Vessel (transit)	4	21	407	37	9	8	14	0.0	0.0	0.0	0.0
4-4	Support Vessel	12	10	88	68	3	3	0	0.0	0.0	0.0	0.0
4-6	Main Lay Vessel (laying)	20	43	826	75	18	17	31	0.0	0.0	0.0	0.0
4-6	Main Lay Vessel (transit)	4	21	407	37	9	8	14	0.0	0.0	0.0	0.0
4-8	Main Lay Vessel (laying)	20	43	826	75	18	17	31	0.0	0.0	0.0	0.0
4-8	Main Lay Vessel (transit)	4	21	407	37	9	8	14	0.0	0.0	0.0	0.0

Code	Boat	Hrs/day	2025									
			Pounds per day						Metric tons per year			
			ROG	NOX	CO	PM10	PM2.5	SO2	CO2	CH4	N2O	CO2e
1-6	Main Lay Vessel (laying)	20	43	826	75	18	17	31	0.0	0.0	0.0	0.0
1-6	Main Lay Vessel (transit)	4	21	407	37	9	8	14	0.0	0.0	0.0	0.0
1-6	Support Vessel	12	10	88	68	3	3	0	0.0	0.0	0.0	0.0
1-8	Main Lay Vessel (laying)	20	43	826	75	18	17	31	0.0	0.0	0.0	0.0
1-8	Main Lay Vessel (transit)	4	21	407	37	9	8	14	0.0	0.0	0.0	0.0
1-10	Main Lay Vessel (laying)	20	43	826	75	18	17	31	0.0	0.0	0.0	0.0
1-10	Main Lay Vessel (transit)	4	21	407	37	9	8	14	0.0	0.0	0.0	0.0
2-4	Main Lay Vessel (laying)	20	43	826	75	18	17	31	0.0	0.0	0.0	0.0
2-4	Main Lay Vessel (transit)	4	21	407	37	9	8	14	0.0	0.0	0.0	0.0
2-4	Support Vessel	12	10	88	68	3	3	0	0.0	0.0	0.0	0.0
2-6	Main Lay Vessel (laying)	20	43	826	75	18	17	31	0.0	0.0	0.0	0.0
2-6	Main Lay Vessel (transit)	4	21	407	37	9	8	14	0.0	0.0	0.0	0.0
2-8	Main Lay Vessel (laying)	20	43	826	75	18	17	31	0.0	0.0	0.0	0.0
2-8	Main Lay Vessel (transit)	4	21	407	37	9	8	14	0.0	0.0	0.0	0.0
3-4	Main Lay Vessel (laying)	20	43	826	75	18	17	31	0.0	0.0	0.0	0.0
3-4	Main Lay Vessel (transit)	4	21	407	37	9	8	14	0.0	0.0	0.0	0.0
3-4	Support Vessel	12	10	88	68	3	3	0	0.0	0.0	0.0	0.0
3-6	Main Lay Vessel (laying)	20	43	826	75	18	17	31	0.0	0.0	0.0	0.0
3-6	Main Lay Vessel (transit)	4	21	407	37	9	8	14	0.0	0.0	0.0	0.0
3-8	Main Lay Vessel (laying)	20	43	826	75	18	17	31	0.0	0.0	0.0	0.0
3-8	Main Lay Vessel (transit)	4	21	407	37	9	8	14	0.0	0.0	0.0	0.0
4-4	Main Lay Vessel (laying)	20	43	826	75	18	17	31	42.0	0.0	0.0	42.6
4-4	Main Lay Vessel (transit)	4	21	407	37	9	8	14	19.9	0.0	0.0	20.1
4-4	Support Vessel	12	10	88	68	3	3	0	7.6	0.0	0.0	7.8
4-6	Main Lay Vessel (laying)	20	43	826	75	18	17	31	126.0	0.0	0.0	127.8
4-6	Main Lay Vessel (transit)	4	21	407	37	9	8	14	59.6	0.0	0.0	60.4
4-8	Main Lay Vessel (laying)	20	43	826	75	18	17	31	84.0	0.0	0.0	85.2
4-8	Main Lay Vessel (transit)	4	21	407	37	9	8	14	39.7	0.0	0.0	40.3

Operational Emissions

Schedule

Phase	Code	Start Date	End Date	Days per Year
Power Feed Equipment Station	1-1	1/1/2026	12/31/202X	12
Employee Vehicle Trips	1-5	1/1/2026	12/31/202X	12
Electricity Consumption	1-6	1/1/2026	12/31/202X	-

Employee Calculations

Code	Round Trips/day	Miles/day	Vehicle Type	2026 +																			
				Pounds per day								Tons per year								Metric tons per year			
				ROG	NOX	CO	PM10	PM2.5	PM10 D	PM2.5 D	SO2	ROG	NOX	CO	PM10	PM2.5	PM10 D	PM2.5 D	SO2	CO2	CH4	N2O	CO2e
1-5	2	100	LDA-LDT	0.0	0.0	0.1	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.3

Emission Factors

Marine Emission Factors

Boat	Year	gram per hour (inclusive of hp and lf)								
		ROG	NOx	CO	PM10	PM2.5	SO2	CO2	CH4	N2O
Work Boat	2020	249	2,012	1,571	61	59	2	190,596	4	9
Tug Boat	2020	619	6,092	4,380	206	200	6	540,526	11	24
Patrol Boat	2020	251	2,299	1,786	65	63	2	219,913	4	10
Main Lay Vessel (laying)	2020	974	18,742	1,691	406	375	696	1,050,044	15	49
Main Lay Vessel (transit)	2020	2,396	46,146	4,161	987	911	1,644	2,481,714	38	112
Support Vessel	2020	353	3,282	2,548	99	96	4	318,513	7	14
Work Boat	2021	254	2,034	1,593	63	61	2	190,596	4	9
Tug Boat	2021	619	6,092	4,380	206	200	6	540,526	11	24
Patrol Boat	2021	251	2,299	1,786	65	63	2	219,913	4	10
Main Lay Vessel (laying)	2021	974	18,742	1,691	406	375	696	1,050,044	15	49
Main Lay Vessel (transit)	2021	2,396	46,146	4,161	987	911	1,644	2,481,714	38	112
Support Vessel	2021	358	3,303	2,567	101	98	4	318,513	7	14
Work Boat	2023	265	2,079	1,637	67	65	2	190,596	4	9
Tug Boat	2023	619	6,092	4,380	206	200	6	540,526	11	24
Patrol Boat	2023	251	2,299	1,786	65	63	2	219,913	4	10
Main Lay Vessel (laying)	2023	974	18,742	1,691	406	375	696	1,050,044	15	49
Main Lay Vessel (transit)	2023	2,396	46,146	4,161	987	911	1,644	2,481,714	38	112
Support Vessel	2023	361	3,317	2,580	102	99	4	318,513	7	14
Work Boat	2025	277	2,123	1,680	71	69	2	190,596	4	9
Tug Boat	2025	619	6,092	4,380	206	200	6	540,526	11	24
Patrol Boat	2025	251	2,299	1,786	65	63	2	219,913	4	10
Main Lay Vessel (laying)	2025	974	18,742	1,691	406	375	696	1,050,044	15	49
Main Lay Vessel (transit)	2025	2,396	46,146	4,161	987	911	1,644	2,481,714	38	112
Support Vessel	2025	361	3,317	2,580	102	99	4	318,513	7	14

Earthmoving Emission Factors

Source	Factor	Unit	Source
Paving ROG EF	2.6200	lbs/acre	CalEEMod (no mitigation)
Grading PM10 EF	1.0605	lbs/acre	CalEEMod (no mitigation)
Grading PM2.5 EF	0.1145	lbs/acre	CalEEMod (no mitigation)
Bulldozing PM10 EF	0.7528	lbs/hr	CalEEMod (no mitigation)
Bulldozing PM2.5 EF	0.4138	lbs/hr	CalEEMod (no mitigation)
Truck loading PM10 EF	0.000144	lb/ton	CalEEMod (no mitigation)
Truck loading PM2.5 EF	0.000022	lb/ton	CalEEMod (no mitigation)
Demo PM10 EF	0.0221	lb/ton	CalEEMod (no mitigation)
Demo PM2.5 EF	0.0033	lb/ton	CalEEMod (no mitigation)

On-Raod Emission Factors (EMFAC2017, AP-42)

		Running (RUNEX, PMTW, PMBW, RD) grams per mile											Process (IDLEX, STREX, TOTEX, DIURN, HTSK, RUNLS, RESTL) grams per trip										
Year	VehType	ROG	NOx	CO	PM10 Ex	PM10 D	PM2.5 Ex	PM2.5 D	SO2	CO2	CH4	N2O	ROG	NOx	CO	PM10 Ex	PM10 D	PM2.5 Ex	PM2.5 D	SO2	CO2	CH4	N2O
2020	T6InstateOnsite	1.8	14.3	2.7	0.3	15.5	0.3	1.6	0.0	2440	0.1	0.4	0.0	1.6	0.2	0.0	0.0	0.0	0.0	0.0	58.5	0.0	0.0
2021	T6InstateOnsite	1.4	12.6	2.3	0.2	15.5	0.2	1.6	0.0	2418	0.1	0.4	0.0	1.7	0.2	0.0	0.0	0.0	0.0	0.0	57.7	0.0	0.0
2023	T6InstateOnsite	0.2	9.2	0.9	0.0	15.5	0.0	1.6	0.0	2357	0.0	0.4	0.0	2.1	0.2	0.0	0.0	0.0	0.0	0.0	54.3	0.0	0.0
2025	T6InstateOnsite	0.2	9.1	0.9	0.0	15.5	0.0	1.6	0.0	2295	0.0	0.4	0.0	2.2	0.2	0.0	0.0	0.0	0.0	0.0	53.6	0.0	0.0
2020	T6UtilityOnsite	0.1	5.9	0.8	0.0	15.5	0.0	1.6	0.0	2445	0.0	0.4	0.0	2.6	0.4	0.0	0.0	0.0	0.0	0.0	155.0	0.0	0.0
2021	T6UtilityOnsite	0.0	4.3	0.6	0.0	15.5	0.0	1.6	0.0	2459	0.0	0.4	0.0	2.6	0.5	0.0	0.0	0.0	0.0	0.0	147.0	0.0	0.0
2023	T6UtilityOnsite	0.0	4.4	0.6	0.0	15.5	0.0	1.6	0.0	2379	0.0	0.4	0.0	2.6	0.5	0.0	0.0	0.0	0.0	0.0	143.3	0.0	0.0
2025	T6UtilityOnsite	0.0	4.5	0.6	0.0	15.5	0.0	1.6	0.0	2271	0.0	0.4	0.0	2.6	0.5	0.0	0.0	0.0	0.0	0.0	137.9	0.0	0.0
2020	T7SingleOnsite	2.1	17.7	4.1	0.3	15.4	0.3	1.6	0.0	3669	0.1	0.6	0.3	8.5	4.3	0.0	0.0	0.0	0.0	0.0	855.2	0.0	0.1
2021	T7SingleOnsite	1.7	15.7	3.7	0.2	15.4	0.2	1.6	0.0	3632	0.1	0.6	0.3	8.5	4.4	0.0	0.0	0.0	0.0	0.0	866.6	0.0	0.1
2023	T7SingleOnsite	0.2	10.7	1.8	0.0	15.4	0.0	1.6	0.0	3499	0.0	0.6	0.3	8.6	5.1	0.0	0.0	0.0	0.0	0.0	882.8	0.0	0.1
2025	T7SingleOnsite	0.1	10.8	1.8	0.0	15.4	0.0	1.6	0.0	3413	0.0	0.5	0.3	8.7	5.2	0.0	0.0	0.0	0.0	0.0	865.6	0.0	0.1
2020	T7TractorOnsite	2.2	18.2	4.9	0.2	15.4	0.2	1.6	0.0	3699	0.1	0.6	0.4	8.5	4.3	0.0	0.0	0.0	0.0	0.0	902.0	0.0	0.1
2021	T7TractorOnsite	1.7	17.0	4.4	0.2	15.4	0.2	1.6	0.0	3666	0.1	0.6	0.4	8.6	4.5	0.0	0.0	0.0	0.0	0.0	907.9	0.0	0.1
2023	T7TractorOnsite	0.2	14.1	2.2	0.0	15.4	0.0	1.6	0.0	3524	0.0	0.6	0.4	8.7	5.2	0.0	0.0	0.0	0.0	0.0	887.2	0.0	0.1
2025	T7TractorOnsite	0.2	14.5	2.3	0.0	15.4	0.0	1.6	0.0	3447	0.0	0.5	0.4	8.7	5.2	0.0	0.0	0.0	0.0	0.0	870.3	0.0	0.1
2020	LDA-LDT	0.0	0.1	0.9	0.0	0.9	0.0	0.2	0.0	296	0.0	0.0	1.1	0.3	2.8	0.0	0.0	0.0	0.0	0.0	64.4	0.1	0.0
2021	LDA-LDT	0.0	0.1	0.8	0.0	0.9	0.0	0.2	0.0	287	0.0	0.0	1.0	0.3	2.7	0.0	0.0	0.0	0.0	0.0	62.4	0.1	0.0
2023	LDA-LDT	0.0	0.1	0.7	0.0	0.9	0.0	0.2	0.0	269	0.0	0.0	0.9	0.2	2.5	0.0	0.0	0.0	0.0	0.0	58.6	0.1	0.0
2025	LDA-LDT	0.0	0.0	0.6	0.0	0.9	0.0	0.2	0.0	251	0.0	0.0	0.8	0.2	2.3	0.0	0.0	0.0	0.0	0.0	54.8	0.1	0.0
2020	LDT	0.0	0.1	1.2	0.0	0.9	0.0	0.2	0.0	349	0.0	0.0	1.6	0.4	3.3	0.0	0.0	0.0	0.0	0.0	77.0	0.1	0.0
2021	LDT	0.0	0.1	1.1	0.0	0.9	0.0	0.2	0.0	339	0.0	0.0	1.5	0.4	3.2	0.0	0.0	0.0	0.0	0.0	74.8	0.1	0.0
2023	LDT	0.0	0.1	0.9	0.0	0.9	0.0	0.2	0.0	318	0.0	0.0	1.4	0.3	2.9	0.0	0.0	0.0	0.0	0.0	70.3	0.1	0.0
2025	LDT	0.0	0.1	0.8	0.0	0.9	0.0	0.2	0.0	297	0.0	0.0	1.2	0.3	2.7	0.0	0.0	0.0	0.0	0.0	65.9	0.1	0.0
2020	T6Instate	0.2	5.4	0.7	0.1	1.0	0.1	0.3	0.0	1099	0.0	0.2	0.0	1.6	0.2	0.0	0.0	0.0	0.0	0.0	58.5	0.0	0.0
2021	T6Instate	0.2	4.6	0.6	0.1	1.0	0.1	0.3	0.0	1075	0.0	0.2	0.0	1.7	0.2	0.0	0.0	0.0	0.0	0.0	57.7	0.0	0.0
2023	T6Instate	0.0	2.8	0.2	0.0	1.0	0.0	0.3	0.0	1007	0.0	0.2	0.0	2.1	0.2	0.0	0.0	0.0	0.0	0.0	54.3	0.0	0.0
2025	T6Instate	0.0	2.7	0.2	0.0	1.0	0.0	0.3	0.0	980	0.0	0.2	0.0	2.2	0.2	0.0	0.0	0.0	0.0	0.0	53.6	0.0	0.0
2020	T6Utility	0.0	1.8	0.1	0.0	1.0	0.0	0.3	0.0	1071	0.0	0.2	0.0	2.6	0.4	0.0	0.0	0.0	0.0	0.0	155.0	0.0	0.0
2021	T6Utility	0.0	1.0	0.1	0.0	1.0	0.0	0.3	0.0	1030	0.0	0.2	0.0	2.6	0.5	0.0	0.0	0.0	0.0	0.0	147.0	0.0	0.0
2023	T6Utility	0.0	1.0	0.1	0.0	1.0	0.0	0.3	0.0	996	0.0	0.2	0.0	2.6	0.5	0.0	0.0	0.0	0.0	0.0	143.3	0.0	0.0
2025	T6Utility	0.0	1.0	0.1	0.0	1.0	0.0	0.3	0.0	951	0.0	0.1	0.0	2.6	0.5	0.0	0.0	0.0	0.0	0.0	137.9	0.0	0.0
2020	T7Single	0.5	7.6	1.3	0.1	0.9	0.1	0.2	0.0	1892	0.0	0.3	0.3	8.5	4.3	0.0	0.0	0.0	0.0	0.0	855.2	0.0	0.1
2021	T7Single	0.4	6.5	1.1	0.1	0.9	0.1	0.2	0.0	1860	0.0	0.3	0.3	8.5	4.4	0.0	0.0	0.0	0.0	0.0	866.6	0.0	0.1
2023	T7Single	0.0	3.6	0.4	0.0	0.9	0.0	0.2	0.0	1727	0.0	0.3	0.3	8.6	5.1	0.0	0.0	0.0	0.0	0.0	882.8	0.0	0.1
2025	T7Single	0.0	3.5	0.4	0.0	0.9	0.0	0.2	0.0	1682	0.0	0.3	0.3	8.7	5.2	0.0	0.0	0.0	0.0	0.0	865.6	0.0	0.1
2020	T7Tractor	0.6	7.6	1.5	0.1	0.9	0.1	0.2	0.0	1898	0.0	0.3	0.4	8.5	4.3	0.0	0.0	0.0	0.0	0.0	902.0	0.0	0.1
2021	T7Tractor	0.4	6.9	1.3	0.1	0.9	0.1	0.2	0.0	1870	0.0	0.3	0.4	8.6	4.5	0.0	0.0	0.0	0.0	0.0	907.9	0.0	0.1
2023	T7Tractor	0.0	4.5	0.5	0.0	0.9	0.0	0.2	0.0	1734	0.0	0.3	0.4	8.7	5.2	0.0	0.0	0.0	0.0	0.0	887.2	0.0	0.1
2025	T7Tractor	0.0	4.6	0.5	0.0	0.9	0.0	0.2	0.0	1696	0.0	0.3	0.4	8.7	5.2	0.0	0.0	0.0	0.0	0.0	870.3	0.0	0.1

On-Raod Emission Factors (EMFAC2017, AP-42)

		Running (RUNEX, PMTW, PMBW, RD) grams per mile											Process (IDLEX, STREX, TOTEX, DIURN, HTSK, RUNLS, RESTL) grams per trip										
Year	VehType	ROG	NOx	CO	PM10 Ex	PM10 D	PM2.5 Ex	PM2.5 D	SO2	CO2	CH4	N2O	ROG	NOx	CO	PM10 Ex	PM10 D	PM2.5 Ex	PM2.5 D	SO2	CO2	CH4	N2O
2026	LDA-LDT	0.0	0.0	0.5	0.0	0.9	0.0	0.2	0.0	243	0.0	0.0	0.7	0.2	2.2	0.0	0.0	0.0	0.0	0.0	53.1	0.0	0.0

APPENDIX C

Terrestrial and Marine Biological Resource Information

C.1 RESOURCE AGENCY COORDINATION

The ICF terrestrial biological team also coordinated with relevant resource agencies to discuss sensitive biological resources expected within the terrestrial BSA. A summary of agency communications and site visits is provided below:

California State Parks: July 25, 2019, met with the Environmental Scientist, Stephanie Little, to discuss Project design and potential biological concerns regarding the Project. Ms. Little expressed the importance of considering the western snowy plover. This species has been evaluated in the Biological Resources section and direct and indirect impacts are avoided.

Consultation Outcomes:

- Project was designed to use HDD construction technique to go under the beach with potential snowy plover habitat
- Pre-construction surveys associated with **MM BIO-7: Conduct Pre-Construction Nesting Bird Surveys and Implement Avoidance Measures** on the cable landing site would include surveys for western snowy plover

USFWS: November 19, 2019, site visit with South Coast Division's Biologist, Dou-Shuan Yang. Mr. Yang stated that USFWS would consider Meadow Creek to be habitat for California red-legged frog based on known occurrence information for Meadow Creek Lagoon downstream and occurrences upstream of Meadow Creek. Mr. Yang agreed that direct impacts could be avoided by HDD installation method by going under the creek and implementing avoidance and minimization measures in the vicinity of Meadow Creek. He suggested that the Applicant have a frac-out contingency plan in place. Mr. Yang agreed that Meadow Creek in the BSA does not provide suitable habitat for tidewater goby. Mr. Yang suggested that the Applicant contact State Parks to determine the current status of western snowy plovers and California least terns at Grover Beach. He stated that Oceano Dunes Recreation Area conducts annual surveys of the beach and could provide a current status of the species. He suggested that an appropriate buffer be maintained between proposed work and known nests and established wintering areas.

Consultation Outcomes:

- Consider Meadow Creek to be habitat for California red-legged frog
- Avoided direct impacts by using HDD installation method when going under the Meadow Creek and implementing avoidance and minimization measures in the vicinity of Meadow Creek

- Draft a Frac-Out Contingency Plan as a mitigation measure. A mitigation measure (**MM BIO-6: Prepare and Implement an Inadvertent Return Contingency Plan**) has been identified
- Not expect tidewater goby in Meadow Creek since there is no suitable habitat
- Contact California State Parks to their current data on western snowy plovers and California least terns being at the Grover Beach
- Contact Oceano Dunes Recreation Area for their annual surveys for western snowy plovers and California least terns in the Project area
- Include a mitigation measure to maintain an appropriate buffer between proposed work and known nests and established wintering areas. **MM BIO-7: Conduct Pre-Construction Nesting Bird Surveys and Implement Avoidance Measures** includes a requirement for establishing setback buffers.

CDFW: September 3, 2019, and November 21, 2019, telephone conversations with the Biologist, Brandon Sanderson, about potential resource concerns at Grover Beach. Mr. Sanderson stated that he had no major concerns about the work being proposed as it relates to state-listed species, in particular the California least tern (the only state-listed species potentially affected), because the nearest nesting records are considerably further south from Grover Beach. He said that CDFW would consider all sensitive wildlife species concerns when reviewing the CEQA document but, given coordination with State Parks for the bird species and no impacts on dune habitat, there should be no concerns for California least tern.

Mr. Sanderson recommended a notification for an LSAA to CDFW in the Fresno Office for boring activities under Meadow Creek. He stated that the notification should include a description of the bore, minimization measures to reduce the potential for a frac-out, and a frac-out contingency plan. CDFW does have concerns with tidewater goby because the goby is a sensitive wildlife species that occurs in streams and lagoons under CDFW's jurisdiction; these concerns could be addressed in the LSAA. ICF responded that a notification would be submitted to CDFW (Fresno Office) that would include a description of the bore, minimization measures to reduce the potential for a frac-out, and a frac-out plan. Mr. Sanderson agreed with that approach.

Consultation Outcomes:

- Survey for least-tern (only state-listed species potentially affected) in the Pre-Construction Surveys even CDFW staff expects them to be further south from Grover Beach
- Submit documents to the CDFW (Fresno Office) including a description of the bore, minimization measures to reduce the potential for a frac-out, and a frac-out plan
- Confirmed that CDFW was not expecting tidewater goby to be impacted by the Project because no streams and lagoons would be impacted since HDD construction techniques would be used. If needed these would be address in the CDFW's LSAA.

California Department of Parks and Recreation: January 14, 2020, telephone conversation with the Oceano Dunes District's Senior Environmental Scientist, Ronnie Glick about the Project happened. ICF biologist Angela Alcala asked Mr. Glick whether data were available for the 2019 breeding season on documented western snowy plover and California least tern nests in the vicinity of Grover Beach. Mr. Glick emailed Ms. Alcala a copy of the 2019 nesting report that included monitoring efforts on Grover Beach.

Consultation Outcomes:

- Incorporate the most recent 2019 breeding season data in the MND for western snowy plover and California least tern

Table C-1. Special-Status Wildlife Species with Potential to Occur in the Terrestrial Biological Study Area

Common Name Scientific Name	Status[a] Federal/State	Habitat Requirements	Potential for Occurrence in the Terrestrial Biological Study Area
Invertebrates			
Vernal pool fairy shrimp *Branchinecta lynchi*	FT/–	Occurs in the Central Valley, central and south Coast Ranges from Tehama County to Santa Barbara County. Inhabits vernal pools and is found in sandstone rock outcrop pools.	None—No suitable habitat is present in the BSA. Surrounding areas are developed.
Monarch butterfly *Danaus plexippus*	–/– Wintering sites protected	Coastal conifer forests or eucalyptus groves protected from wind, with water and nectar sources nearby for wintering sites. Breeds in milkweed.	None—No suitable wintering habitat is present in the BSA. Closest known wintering site is 0.35 mile north along Meadow Creek, adjacent to the North Beach Campground (CDFW 2019c).
Amphibians			
California red-legged frog *Rana draytonii*	FT/SSC	Found in still waters in ponds, marshes, and stream pools near woodlands, coastal scrub, and streams with dense vegetative cover. Most common in lowlands and foothills from sea level to 5,000 feet.	Moderate—Known to occur downstream in Meadow Creek Lagoon. Protocol surveys in 2005 within Meadow Creek through the BSA did not locate the species. The species is known to occur in Arroyo Grande Creek (CDFW 2019c) and in the lower portions of Meadow Creek Lagoon (Terra-Verde 2012). Suitable dispersal and foraging habitat is present within Meadow Creek in the BSA. The species is unlikely to breed in the BSA due to lack of sufficient ponding to support juvenile metamorphosis.
Reptiles			
Northern California legless lizard *Anniella pulchra*	–/SSC	Occurs along the Coast, Transverse, and Peninsular ranges from Contra Costa County to San Diego County with spotty occurrences in the San	High—Potential habitat is present in annual brome grassland and arroyo willow thicket near the cable landing site. Historical CNDDB occurrence for the

Table C-1. Continued

Common Name Scientific Name	Status[a] Federal/State	Habitat Requirements	Potential for Occurrence in the Terrestrial Biological Study Area
		Joaquin Valley. Found in habitats with loose soil for burrowing or thick duff or leaf litter; may be found on beaches, sandy washes, and in woodland, chaparral, and riparian areas.	species overlaps within the BSA (CDFW 2019c).
Western pond turtle *Emys marmorata*	–/SSC	Occurs throughout California west of the Sierra-Cascade crest. Occupies ponds, marshes, rivers, streams, and irrigation canals with muddy or rocky bottoms and with watercress, cattails, water lilies, or other aquatic vegetation in woodlands, grasslands, and open forests.	Moderate—Pond turtles are known to occupy Meadow Creek Lagoon downstream from the BSA (Terra-Verde 2012). The lack of permanent water within Meadow Creek in the BSA limits pond turtle use of the BSA.
Blainville's horned lizard *Phrynosoma blainvillii*	–/SSC	Occurs in the Sierra Nevada foothills and along central and southern California coasts. Uses a variety of habitats, from brushlands to coniferous forests, including annual grassland. Requires open areas of sandy soils and low vegetation for sunning. Harvester ants are the primary food source.	Moderate—Potential habitat is present in annual brome grassland and arroyo willow thicket near the cable landing site.
Two-striped garter snake *Thamnophis hammondii*	–/SSC	Highly aquatic species that is associated with permanent or semi-permanent water sources, often in rocky areas. Associated with a variety of vegetation types, including oak woodland, willow riparian, coastal sage scrub, scrub oak, chaparral, and brushland.	Moderate—Suitable habitat is present along Meadow Creek and within adjacent riparian and annual grassland habitat in the BSA. No CNDDB occurrences within 5 miles of the BSA (CDFW 2019c).

Table C-1. Continued

Common Name Scientific Name	Status[a] Federal/State	Habitat Requirements	Potential for Occurrence in the Terrestrial Biological Study Area
Birds			
Western burrowing owl *Athene cunicularia*	–/SSC	Lowlands throughout California, including the Central Valley, northeastern plateau, southeastern deserts, and coastal areas. Rare along south coast. Associated with level, open, dry, heavily grazed or low-stature grassland with available burrows.	None—Annual grassland in the BSA is patchy and surrounded by developed areas, and is not likely to support burrowing owl. No CNDDB occurrences within 5 miles of the BSA (CDFW 2019c).
Western snowy plover *Charadrius nivosus*	FT/SSC	Nests above high tide line on coastal beaches and dunes, near river mouths, and along edges of lagoons and estuaries.	None to Very Low—No suitable habitat within the BSA. Species is known to nest within beach habitat 1.7 miles south of the BSA in the vicinity of the Arroyo Grande Creek outfall (CDPR 2019). Surveys conducted at Grover Beach have not detected the species during breeding season (CDPR 2019).
Western yellow-billed cuckoo *Coccyzus americanus occidentalis*	FT/SE	Wide, dense riparian forests with a thick understory of willows for nesting; sites with a dominant cottonwood overstory are preferred for foraging; may avoid valley-oak riparian habitats where scrub-jays are abundant.	None—Arroyo willow thickets within the BSA are exposed and adjacent to a roadway and would not provide suitable nesting habitat for the cuckoo. The current range of the species does not include San Luis Obispo County.
White-tailed kite *Elanus leucurus*	–/SFP	Lowland areas west of Sierra Nevada from the head of the Sacramento Valley south, including coastal valleys and foothills to western San Diego County at the Mexico border. Nests in low foothills or valley areas with valley or live oaks, riparian areas, and marshes near open grasslands or agricultural fields for foraging.	Moderate—Arroyo willow thickets within and adjacent to the BSA provide suitable nesting substrate for kites. The species is known to nest in the vicinity of Meadow Creek Lagoon, approximately 1.4 miles south of the BSA (Terra-Verde 2012).

Table C-1. Continued

Common Name Scientific Name	Status[a] Federal/State	Habitat Requirements	Potential for Occurrence in the Terrestrial Biological Study Area
Peregrine falcon *Falco peregrinus*	–/SFP	Found in a variety of habitat types; typically nests on cliff ledges	None—Could forage in or near the BSA, but no suitable nesting habitat is present within 0.5 mile of the BSA.
California black rail *Laterallus jamaicensis coturniculus*	–/ST	Found in brackish and freshwater emergent marshes, typically in high wetland zone near the upper limit of flooding.	None—No suitable habitat is present within the BSA. Potential marsh habitat is present more than 400 feet south of the BSA. Closest CNDDB occurrence is 6.7 miles south of the BSA within freshwater marsh habitat at Oso Flaco Lake (CDFW 2019c).
California least tern *Sternula antillarum browni*	FE/SE	Beaches, mudflats, and sand dunes, usually near shallow estuaries and lagoons with access to the open ocean; nests typically established in barren to sparsely vegetated areas with sandy or gravelly substrates.	None to Very Low—No suitable habitat within the BSA. Species is known to nest within beach habitat 4.3 miles south of the BSA in a seasonally protected area (CDPR 2019). Surveys conducted at Grover Beach have not detected the species during the breeding season (CDPR 2019). There is potential for wintering birds to be present in dune habitat adjacent to the BSA.
Least Bell's vireo *Vireo bellii pusillus*	FE/SE	In coastal southern California, breeding occurs from Santa Barbara County south. Nests in willow riparian forest supporting a dense, shrubby understory.	None—No known nesting occurrences within 5 miles of the BSA (CDFW 2019c), and the species was not observed during 2012 surveys conducted in the nearby Meadow Creek Lagoon (Terra-Verde 2012). Riparian habitat in the BSA is located adjacent to an existing roadway and is not expected to provide suitable habitat for vireos.

Table C-1. Continued

Common Name Scientific Name	Status[a] Federal/State	Habitat Requirements	Potential for Occurrence in the Terrestrial Biological Study Area
		Mammals	
Townsend's big-eared bat *Corynorhinus townsendii*	–/SSC	Roosts in caves, tunnels, mines, crevices, hollow trees, and buildings; usually near water.	None—No suitable roost habitat or substrate is present in the BSA.
American badger *Taxidea taxus*	–/SSC	Woodland, shrub, and grassland habitat types with friable soils for burrowing; preys on small mammals, reptiles, insects, and birds; scavenges for carrion.	None—Grassland habitat in the BSA is patchy and surrounded by developed areas. No suitable denning habitat is present.
		Fish	
Tidewater goby *Eucyclogobius newberryi*	FE/SSC	Coastal lagoons, estuaries, and lower reaches of major stream drainages, often in brackish water.	None—No suitable lagoon or estuary habitat is present in the portion of Meadow Creek that crosses the BSA. However, species is known to occur in the Arroyo Grande Creek estuary 1.5 miles south and in the lower reaches of Pismo Creek 0.75 mile north of the BSA (CDFW 2019c). Tidewater goby was observed at the flap gates between Arroyo Grande estuary and Meadow Creek Lagoon during surveys conducted in 2012 (Terra-Verde 2012).
South-central California coast steelhead *Oncorhynchus mykiss*	FT/–	Requires cold, clean water and gravel for spawning and rearing, with cover for water velocity protection and predator refuge.	None—Meadow Creek in the BSA does not provide suitable habitat for steelhead. The closest known occurrences of steelhead are from Arroyo Grande Creek 1.6 miles south (CDFW 2019c).

Table C-1. Continued

Common Name Scientific Name	Status[a] Federal/State	Habitat Requirements	Potential for Occurrence in the Terrestrial Biological Study Area

Terms

BSA = terrestrial biological study area

CNDDB = California Natural Diversity Database

[a] Status:

C = candidate for listing under California Endangered Species Act (CESA)

FE = listed as endangered under Federal Endangered Species Act (FESA)

FT = listed as threatened under FESA

SE = listed as endangered under CESA

SFP = state fully protected

SSC = state species of special concern

ST = listed as threatened under CESA

Table C-2. Special-Status Plant Species with Potential to Occur in the Terrestrial Biological Study Area

Scientific Name/ Common Name	Legal Status[a] Federal/State/CRPR	General Habitat Description	Blooming Period	Potential to Occur in BSA[b, c]
Agrostis hooveri *Hoover's bent grass*	–/–/1B.2	Closed–cone coniferous forest, chaparral, cismontane woodland, valley and foothill grassland; usually within a sandy microhabitat; at 15–2,000 ft (6–610 m).	Apr–Jul	None—Not observed during appropriately-timed surveys. BSA supports low-quality habitat in annual brome grassland.
Arenaria paludicola *Marsh sandwort*	FE/CE/1B.1	Marshes and swamps (fresh or brackish water); within sandy openings; at 5–560 ft (3–170 m).	May–Aug	None—Not observed during appropriately-timed surveys. BSA supports low-quality habitat in hardstem bulrush marsh.
Calochortus obispoensis *San Luis mariposa lily*	–/–/1B.2	Chaparral, coastal scrub, grassland; often in serpentine grassland; at 160–2,395 ft (50–730 m).	May–Jul	None—Not observed during appropriately-timed surveys. BSA supports low-quality habitat in annual brome grassland.
Calochortus simulans *La Panza mariposa lily*	–/–/1B.3	Chaparral, cismontane woodland, lower montane coniferous forest, valley and foothill grassland; within a sandy microhabitat often consisting of granite soils and sometimes serpentinite soils; at 1,065–3,775 ft (325–1,150 m).	Apr–Jun	None—Not observed during appropriately-timed surveys. Annual brome grassland contains low-quality habitat.
Castilleja densiflora var. obispoensis *San Luis Obispo owl's–clover*	–/–/1B.2	Meadows and seeps, valley and foothill grassland; sometimes serpentinite soils; at 30–1,410 ft (10–430 m).	Mar–May	None—Not observed during appropriately-timed surveys. BSA supports low-quality habitat in annual brome grassland.

Table C-2. Continued

Scientific Name/ Common Name	Legal Status[a] Federal/State/CRPR	General Habitat Description	Blooming Period	Potential to Occur in BSA[b, c]
Centromadia parryi subsp. congdonii *Congdon's tarplant*	–/–/1B.1	Annual grassland, on lower slopes, flats, and swales; sometimes on alkaline or saline soils; at 0–755 ft (0–230 m).	May–Oct (Nov)	None—Not observed during appropriately-timed surveys. BSA supports low-quality habitat in annual brome grassland.
Cirsium fontinale var. obispoense *San Luis Obispo fountain thistle*	FE/CE/1B.2	Seeps and stream banks in chaparral, valley and foothill grassland, and oak woodlands; on serpentine substrates; at 110–1,265 ft (35–385 m).	Feb–Jul (Aug–Sep)	None—Not observed during appropriately-timed surveys. Banks of Meadow Creek in BSA provide low-quality habitat.
Cirsium scariosum var. loncholepis *La Graciosa thistle*	FE/CT/1B.1	Cismontane woodland, coastal dunes, coastal scrub, marshes and swamps (brackish), valley and foothill grassland; within a mesic, sandy microhabitat; at 10–720 ft (4–220 m).	May–Aug	None—Not observed during appropriately-timed surveys. BSA supports low-quality habitat in annual brome grassland and hardstem bulrush marsh.
Cladium californicum *California sawgrass*	–/–/2B.2	Meadows and seeps, marshes and swamps alkaline or freshwater; at 195–5,250 ft (60–1,600 m).	Jun–Sep	None—Not observed during appropriately-timed surveys. BSA supports low-quality habitat in hardstem bulrush marsh.
Dudleya blochmaniae subsp. blochmaniae *Blochman's dudleya*	–/–/1B.1	Coastal bluff scrub, chaparral, coastal scrub, valley and foothill grassland; within rocky, often clay or serpentinite soils; at 15–1,475 ft (5–450 m).	Apr–Jun	None—Not observed during appropriately-timed surveys. BSA supports low-quality habitat in annual brome grassland.

Table C-2. Continued

Scientific Name/ Common Name	Legal Status[a] Federal/State/CRPR	General Habitat Description	Blooming Period	Potential to Occur in BSA[b, c]
Layia jonesii *Jones' layia*	–/–/1B.2	Clay soils and serpentine outcrops in chaparral and grasslands; at 15–1,310 ft (5–400 m).	Mar–May	None—Not observed during appropriately-timed surveys. Annual brome grassland contains low-quality habitat.
Nasturtium gambelii *Gambel's water cress*	FE/CT/1B.1	Marshes and swamps (fresh or brackish water); at 15–1,085 ft (5–330 m).	Apr–Oct	None—Not observed during appropriately-timed surveys. BSA supports low-quality habitat in hardstem bulrush marsh.
Symphyotrichum defoliatum *San Bernardino aster*	–/–/1B.2	Cismontane woodland, coastal scrub, lower montane coniferous forest, meadows and seeps, marshes and swamps, valley and foothill grassland (vernally mesic); within wetland microhabitat, including ditches, streams, springs, seeps, and topographic depressions; at 5–6,695 ft (2–2,040 m).	Jul–Nov (Dec)	None—Not observed during appropriately-timed surveys. BSA supports low-quality habitat in hardstem bulrush marsh.
Trifolium hydrophilum *Saline clover*	–/–/1B.2	Marshes and swamps, valley and foothill grassland (mesic, alkaline), vernal pools; at 0–985 ft (0–300 m).	Apr–Jun	None—Not observed during appropriately-timed surveys. Hardstem bulrush marsh contains low-quality habitat.
Tropidocarpum capparideum *Caper–fruited tropidocarpum*	–/–/1B.1	Valley and foothill grassland (alkaline hills); at 0–1,495 ft (1–455 m).	Mar–Apr	None—Not observed during appropriately-timed surveys. Annual brome grassland contains low-quality habitat.

Table C-2. Continued

Scientific Name/ Common Name	Legal Status[a] Federal/State/CRPR	General Habitat Description	Blooming Period	Potential to Occur in BSA[b, c]

Terms:

ft = feet

m = meters

[a] Legal Status explanations

Federal

FE = listed as endangered under the federal Endangered Species Act (FESA)

FT = listed as threatened under FESA

– = no listing status

State

SE = listed as endangered under the California Endangered Species Act (CESA)

ST = listed as threatened under CESA

CR = listed as rare under the California Native Plant Protection Act. This category is no longer used for newly listed plants, but some plants previously listed as rare retain this designation

– = no listing status

California Rare Plant Rank (CRPR)

1A = presumed extirpated in California and either rare or extinct elsewhere

1B = rare, threatened, or endangered in California and elsewhere

2B = rare, threatened, or endangered in California but more common elsewhere

3 = more information is needed

4 = watch list: plant of limited distribution

.1 = seriously endangered in California (more than 80% of occurrences threatened / high degree and immediacy of threat)

.2 = moderately threatened in California (20–80% occurrences threatened/moderate degree and immediacy of threat)

.3 = not very threatened in California (less than 20% of occurrences threatened/low degree and immediacy of threat or no current threats known)

[b] Potential to Occur in BSA explanations:

None: Floristic surveys were appropriately timed to coincide with the blooming/identifiable period of the special-status plant species known to occur in the project region.

[c] Source

California Native Diversity Database (CDFW 2019b)

Table C-3. Plant Species Observed on the Grover Beach Subsea Cables Project

Scientific Name	Common Name
Achillea millefolium	Common yarrow
Acacia sp.	Acacia
Acmispon glaber	Deer weed
Albizia julibrissin	Persian silk tassel
Amsinckia menziesii	Common fiddleneck
Avena barbata	Common oats
Avena fatua	Slender wild oats
Baccharis pilularis	Coyote brush
Bromus diandrus	Ripgut brome
Bromus hordeaceus	Soft chess
Bromus madritensis	Foxtail chess
Capsella bursa-pastoris	Shepard's purse
Carduus pycnocephalus	Italian thistle
Carpobrotus chilensis	Sea fig
Carpobrotus edulis	Ice plant
Ceanothus thyrsiflorus var*. griseus*	Carmel ceanothus
Chenopodium album	Lamb's quarters
Cistanthe grandiflora	Rock purslane
Cortaderia jubata	Jubata grass
Crassula ovata	Pygmy weed
Cymbalaria muralis	Kenilworth Ivy
Cynodon dactylon	Bermuda grass
Dimorphotheca fruticose	Trailing African daisy
Ehrharta erecta	Panic veldt grass
Erigeron canadensis	Horse weed
Erodium botrys	Stork's bill
Erodium cicutarium	Coastal heron's bill
Eucalyptus globulus	Blue gum eucalyptus
Festuca bromoides	Brome fescue
Festuca myuros	Rattail sixweeks grass
Festuca perennis	Rye grass
Hedera helix	English Ivy
Helianthus annuus	Hairy-leaved sunflower
Helminthotheca echioides	Bristly ox-tongue
Heliotropium curassavicum	Seaside heliotrope
Hesperocyparis macrocarpa	Monterey cypress
Heteranthemis viscidihirta	Sand chrysanthemum
Heterotheca grandiflora	Telegraph weed
Hirschfeldia incana	Mustard
Hordeum marinum ssp. *gussoneanum*	Mediterranean barley

Table C-3. Continued

Scientific Name	Common Name
Hordeum murinum ssp. *leporinum*	Hare barley
Hypochaeris glabra	Smooth cat's-ear
Lactuca serriola	Prickly lettuce
Lagerstroemia indica	Crape myrtle
Lepidium nitidum	Shining pepper grass
Lotus corniculatus	Bird's foot trefoil
Lysimachia arvensis	Scarlet pimpernel
Malva parviflora	Cheeseweed
Matricaria discoidea	Pineapple weed
Medicago polymorpha	Bur clover
Melilotus indicus	Annual sweet clover
Myoporum laetum	Myoporum
Nandina domestica	Sacred bamboo
Oxalis pes-caprae	Bermuda buttercup
Phoenix dactylifera	Date palm
Plantago coronopus	Cut-leaf plantain
Plantago lanceolata	English plantain
Poa annua	Annual blue grass
Potentilla anserina ssp. *pacifica*	Pacific silverweed
Poa secunda var. *secunda*	One-sided blue grass
Polygonum aviculare	Prostrate knotweed
Pinus radiata	Monterey pine
Quercus agrifolia	Coast live oak
Raphanus sativus	Wild radish
Rubus armeniacus	Himalayan blackberry
Rubus ursinus	California blackberry
Salix lasiolepis	Arroyo willow
Salvia longistyla	Mexican sage
Schoenoplectus acutus var. *occidentalis*	Hardstem bulrush
Senecio vulgaris	Common groundsel
Sonchus asper	Sow thistle
Sonchus oleraceus	Common sow thistle
Tribulus terrestris	Puncture vine
Toxicodendron diversilobum	Poison oak
Urtica urens	Dwarf nettle
Washingtonia filifera	California fan palm
Vicia sativa ssp. *Savita*	Narrow-leaved vetch

Table C-4. Special-Status Marine Species and Their Potential to Occur in the Marine Biological Study Area

Common Name Scientific Name	Status[a]	Habitat	Potential to Occur in Marine Biological Study Area[b]
Marine Mammals			
Baird's beaked whale *Berardius bairdii*	P	Deep offshore waters in the north Pacific; common along steep underwater geologic structures (e.g., submarine canyons, seamounts, and continental slopes).	Not expected—Sightings in deeper waters than the MSA, mainly along the OCS edges or in deep submarine canyons where they forage. National Marine Fisheries Service records indicate that fewer than a dozen individuals have been washed up along the West Coast.
Blainville's beaked whale *Mesoplodon densirostris*	P	Mainly over the OCS and into open ocean waters; tropical to temperate waters worldwide; groups have been regularly observed off Oahu, Hawaii, and in the Bahamas in waters from 1,640 to 3,280 feet.	Not expected—Unlikely to occur in the MSA.
Blue whale *Balaenoptera musculus*	FE, FD, P	Worldwide, often near the edges of physical features where krill tend to concentrate. These whales begin to migrate south during November.	High—Relatively common farther offshore (56–230 miles from shore) but less common in the MSA.
Bottlenose dolphin *Tursiops truncatus*	P	Worldwide in temperate and tropical waters; both coastal and offshore populations; most common dolphins in the Southern California Bight.	Low-moderate— Bottlenose dolphins were observed offshore of Pismo Beach in recent years, which suggests that this species is becoming increasingly more common in central California as water temperatures warm.
Bryde's whale *Balaenoptera edeni*	P	Highly productive tropical, subtropical, and warm temperate waters worldwide; more common farther from shore.	Not expected—Unlikely to occur in the MSA.
California sea lion *Zalophus californianus*	P	Eastern north Pacific in coastal waters; commonly observed throughout the California coast.	High—Commonly observed.
Common dolphin–long-beaked *Delphinus capensis*	P	Shallow, warmer temperate waters relatively close to shore; most abundant cetacean from Baja California northward to central California; maximum northward extent is Point Arena.	Low—Numbers begin to decrease northward from the central California coast.

Table C-4. Continued

Common Name Scientific Name	Status[a]	Habitat	Potential to Occur in Marine Biological Study Area[b]
Common dolphin–short-beaked *Delphinus delphis*	P	More pelagic than the long-beaked common dolphin; can be found up to 300 nautical miles from shore; majority of populations are observed off California coast, especially in warm water months.	Moderate—Generally found offshore of the MSA.
Cuvier's beaked whale *Ziphius cavirostris*	P	Temperate, tropical, and subtropical waters; associated with deep pelagic waters (usually deeper than 3,280 feet) of the OCS and slope, and near underwater geologic features; seasonality and migration patterns unknown.	Not expected—Generally occur in the deeper waters west of the MSA.
Dall's porpoise *Phocoenoides dalli*	P	Throughout north Pacific, mainly in pelagic waters deeper than 590 feet but can be found both offshore and inshore.	Not expected-low—Most frequently observed offshore in deeper waters.
Dwarf sperm whale *Kogia simus*	P	Continental slope and open ocean; prefer warm tropical, subtropical, and temperate waters worldwide.	Not expected—Records are rare; it is unknown whether low numbers are a consequence of cryptic behavior or if they are not regular inhabitants of offshore California waters.
False killer whale *Pseudorca crassidens*	P	Continental slope and into open ocean waters of tropical and warm temperate waters worldwide.	Not expected—Prefer warmer and deeper waters than those within the MSA.
Fin whale *Balaenoptera physalus*	FE, FD, P	Deep, offshore waters of all major oceans; less common in the tropics.	Moderate—Relatively common in California waters from March to October but prefer deep water farther offshore.
Ginkgo-toothed whale *Mesoplodon ginkgodens*	P	Mainly over the OCS and into open ocean; warm waters of the Pacific and Indian Oceans.	Not expected—Not documented in the MSA.
Gray whale (Eastern Pacific DPS) *Eschrichtus robustus*	FD, P	Predominantly in nearshore coastal waters of the north Pacific from the Gulf of Alaska to Baja Peninsula; can be as close as a few hundred yards offshore but more common 3–12 miles offshore.	Moderate—Pass the MSA during late fall–winter in southward migration and during late winter–early summer in northward migration.

Table C-4. Continued

Common Name Scientific Name	Status[a]	Habitat	Potential to Occur in Marine Biological Study Area[b]
Guadalupe (southern) fur seal *Arctocephalus townsendi*	CT, FT, FD	Tropical waters of southern California and Mexico; breeds in rocky coastal habitats and caves mainly along the eastern coast of Guadalupe Island, approximately 124 miles west of Baja California; small population on San Miguel Island in the Channel Islands.	Not expected—Unlikely to occur north of Point Conception and the Southern California Bight.
Harbor porpoise *Phocoena phocoena*	P	Continental slope to oceanic waters, mainly in northern temperate, subarctic coastal, and offshore waters; common in bays, estuaries, harbors, and fjords less than 656 feet deep.	Low— Can occur in the MSA between 0 and 200 meters depth, but no observations reported in the MSA.
Harbor seal *Phoca vitulina*	P	From British Columbia to Baja California, most commonly observed pinniped along California coastline; favors nearshore coastal waters for foraging and beaches, offshore rocks on sand and mudflats in estuaries and bays for resting.	High—Common along the California coast. Harbor seals favor nearshore coastal waters.
Hubb's beaked whale *Mesoplodon carlhubbsi*	P	Endemic to north Pacific; species is not well known but is assumed to occur mainly over the OCS and into open ocean waters.	Not expected—May occur in waters off central and northern California, but species is very rare.
Humpback whale *Megaptera novaeangeliae*	FE, FD, P	All major oceans; central California population migrates from winter calving and mating areas off Mexico to summer and fall feeding areas off coastal California. Humpback whales occur from late April to early December.	Moderate—Frequently observed migrating along California coast April–November, typically 12–55 miles offshore; more common inshore near the submarine Monterey canyon.
Killer whale *Orcinus orca*	FE, FD, P	All oceans; most abundant in colder waters but also occur in temperate water; presence and occurrence common but unpredictable in coastal California.	Low—Most common in April, May, and June as they feed on northbound migrating gray whales; generally observed in deeper waters offshore of the MSA.
Long-snouted spinner dolphin *Stenella longirostris*	FD, P	Found in all tropical and subtropical oceans; OCS to open ocean waters, but most commonly in the deep ocean where they track prey.	Not expected—Unlikely to be present because species prefers warmer waters.

Table C-4. Continued

Common Name Scientific Name	Status[a]	Habitat	Potential to Occur in Marine Biological Study Area[b]
Minke whale *Balaenoptera acutorostrata*	P	Distributed worldwide and can be in coastal/inshore and over the OCS in temperate (preferred), boreal, or polar waters.	Low—Minke whale observed throughout California coast, but sightings are rare.
North Pacific right whale *Eubalaena japonica*	FE, FD, P	North Pacific Ocean; seasonally migratory; colder waters for feeding, migrating to warmer waters for breeding and calving; may move far out to sea during feeding seasons but give birth in coastal areas.	Not expected—Unlikely to be present in the MSA because they are very rare.
Northern elephant seal *Mirounga angustirostris*	P	Alaska to Mexico; sighted regularly over OCS, shelf-break, and slope habitats; also present in deep ocean habitats seaward of the 6,561-foot isobath; rookeries located north of the MSA.	Low-moderate—Widely distributed along North America's west coast but spend about 9 months at sea.
Northern fur seal *Callorhinus ursinus*	FD, P	Spend 300 or more days per year foraging in open ocean of north Pacific; use rocky beaches for reproduction; usually ashore in California only when debilitated; however, a few individuals observed on Año Nuevo Island.	Low—Usually 11–17 miles from shore in California; however, have been observed within 3 miles of Point Pinos north of the MSA.
Northern right whale dolphin *Lissodelphis borealis*	P	Endemic to deep, cold temperate waters in north Pacific; occur over the OCS and slope where waters are less than 66°F (18°C).	Not expected—Very rare in California waters.
Pacific white-sided dolphin *Lagenorhynchus obliquidens*	P	Temperate waters of north Pacific from the OCS to deep ocean.	Low—Likely to occur throughout California but typically do not occur nearshore.
Perrin's beaked whale *Mesoplodon perrini*	P	Believed to occupy continental shelves and open ocean waters but not well documented.	Not expected—Known from fewer than half a dozen strandings between San Diego and Monterey, but species' complete distribution is unknown.

Table C-4. Continued

Common Name Scientific Name	Status[a]	Habitat	Potential to Occur in Marine Biological Study Area[b]
Pygmy sperm whale *Kogia breviceps*	P	Continental slope and open ocean in tropical, subtropical, and temperate Pacific waters, mostly offshore of Peru; strandings have been documented off Mexico and once each in New Zealand and Monterey Bay.	Not expected—Overall, the species is rare and would occur south of the MSA.
Risso's dolphin *Grampus griseus*	P	All major oceans, generally in waters deeper than 3,280 feet and seaward of the OCS and slopes.	Low—Generally occur in deeper waters offshore of the MSA.
Rough-toothed dolphin *Steno bredanensis*	P	All tropical and subtropical oceans; OCS to open ocean waters; prefer depths of tropical and warmer temperate waters.	Not expected—Unlikely to occur in the relatively cold waters of the MSA.
Sei whale *Balaenoptera borealis*	FE, FD, P	Worldwide cosmopolitan distribution in subtropical, temperate, and subpolar waters; usually observed in deeper waters of oceanic areas far from coastline.	Not expected—Uncommon in California waters, especially in the Project vicinity, because they primarily occupy the open ocean.
Short-finned pilot whale *Globicephala macrorhynchus*	P	Warmer tropical and temperate waters, commonly along the coast close to the OCS; forage in areas with high densities of squid.	Not expected—Generally found in deeper, warmer waters than those in the MSA.
Southern sea otter *Enhydra lutris nereis*	FT, P	Top carnivore and keystone species in nearshore waters of California from San Mateo County south to Santa Barbara County; frequent inhabitant in kelp forests.	Moderate— Southern sea otters occupy the nearshore waters of California from San Mateo County south to Santa Barbara County. The primary populations reside between Monterey Bay and Cayucas in San Luis Obispo County. The waters offshore of Grover Beach are within the southern end of their range, and sea otters are frequently observed.
Sperm whale *Physeter macrocephalus*	FE, FD, P	Open ocean far from land and uncommon in waters less than 984 feet deep; live at surface of the ocean but dive deep to catch giant squid.	Low—Present in offshore California year-round, peaking in abundance in late spring and late summer; but rarely seen because they occupy deep water far offshore.

Table C-4. Continued

Common Name Scientific Name	Status[a]	Habitat	Potential to Occur in Marine Biological Study Area[b]
Spotted dolphin *Stenella attenuata*	FD, P	Typically, far away from coast in tropical and subtropical waters worldwide but can occupy waters over the OCS; spend majority of day in waters 295–984 feet deep, diving to depth at night to search for prey.	Not expected—Eastern Pacific population typically is observed far from the coast and is depleted in numbers.
Stejneger's beaked whale *Mesoplodon stejnegeri*	P	Found in cold temperate and subarctic waters of the north Pacific, occupying deep, offshore waters	Not expected—Generally found in deep, offshore waters on or beyond the OCS.
Steller (northern) sea lion *Eumetopias jubatus*	FE, FD, P	Distributed around the coasts along the north Pacific rim; common in coastal waters and onshore for resting; critical habitat extends approximately 1,000 meters seaward and landward of any Steller sea lion rookery in Washington, Oregon, and California. Any aquatic foraging habitat within the species geographic range.	Moderate—Documented as relatively common in the coastal waters of central California.
Striped dolphin *Stenella coeruleoalba*	P	Continental shelf to open ocean waters worldwide, often in areas of upwelling and around convergence zones; prefer highly productive tropical to warm temperate waters.	Not expected—Unlikely to occur in cold waters of the MSA. Observations typically are far offshore.
Marine Turtles			
Green sea turtle *Chelonia mydas*	FE, P	Distributed globally; oceanic beaches (for nesting), convergence zones in the open ocean and benthic feeding grounds in coastal areas.	Not expected—In eastern Pacific, sightings from Baja California to southern Alaska, but most commonly from San Diego south.
Leatherback sea turtle *Dermochelys coriacea*	FE, P	Distributed globally; regularly seen off West Coast in pelagic waters, with greatest densities found in central California. Critical habitat encompassing the MSA extends from the shore to a depth of 9,845 feet (3,000 meters) from Point Arena to Point Arguello.	Low—Most commonly seen between July and October, when surface water temperature warms to 59–61°F (15–16 °C) and large jellyfish, their primary prey, are seasonally abundant.

Table C-4. Continued

Common Name Scientific Name	Status[a]	Habitat	Potential to Occur in Marine Biological Study Area[b]
Loggerhead sea turtle *Caretta caretta*	FT, P	Temperate and tropical regions of Atlantic, Pacific, and Indian Oceans; use the terrestrial zone, the oceanic zone, and the neritic or nearshore coastal area.	Low—Most recorded U.S. sightings are of juveniles off the California coast, but occasional sightings have been reported along the Washington and Oregon coasts.
Olive ridley sea turtle *Lepidochelys olivacea*	FT	Mainly pelagic in tropical/temperate regions of Pacific, South Atlantic, and Indian Oceans but has been known to inhabit coastal areas, including bays and estuaries.	Not expected—In the eastern Pacific, their range extends from southern California to northern Chile.
Sharks and Fish			
Basking shark *Cetorhinus maximus*	CSC, P	Movements and migrations poorly understood; usually sighted from British Columbia to Baja California in winter and spring.	Not expected—Populations severely depleted by commercial fisheries of the 1950s, and they have never fully recovered due to slow growth and low fecundity.
Green sturgeon (southern DPS) *Acipenser medirostris*	FT, CSC	Marine and estuarine environments, Sacramento River; San Francisco Bay-Delta, Humboldt Bay, offshore waters to 360 feet from Monterey Bay to the U.S.-Canada border.	Low—Species may forage in or near the MSA, but species distribution in ocean waters is essentially unknown.
Steelhead (South-Central California Coast Steelhead DPS) *Oncorhynchus mykiss*	FT, CSC, P	Occur along entire Pacific Coast. Anadromous individuals can spend up to 7 years in fresh water prior to smoltification and then spend up to 3 years in salt water to first spawning. Individuals that spend entire life in fresh water are called rainbow trout. Critical habitat includes essentially all major rivers and all coastal stretches of all rivers and creeks throughout California. Near the BSA, this includes Pismo Creek (approximately 0.7 mile north) and Arroyo Grande Creek (approximately 1.5 miles north).	Moderate—Spawning locations include coastal rivers flowing into the ocean between Point San Luis and Mussel Point. Adults may occur in coastal waters near confluences with freshwater streams and rivers.
White shark *Carcharodon carcharias*	CSC, P	Coastal and offshore waters along the OCS and islands. Important habitat in vicinity of Monterey Bay and Greater Farallones National Marine Sanctuaries.	Moderate-high—Present in coastal waters throughout California. Occurrences in waters offshore of Grover Beach have been increasing in recent years.

Table C-4. Continued

Common Name Scientific Name	Status[a]	Habitat	Potential to Occur in Marine Biological Study Area[b]
Gastropods			
Black abalone *Haliotis cracherodii*	FE, P	Coastal and offshore island intertidal habitats on exposed rocky shores where bedrock provides deep, protective crevices for shelter. Range extends from Point Arena, California to Bahia Tortugas and Isla Guadalupe, Mexico. Critical habitat occurs in MSA.	Low—Point Arena is northernmost point of distribution along the California coast; rare north of San Francisco; populations in south-central California have been in decline in recent years.
Green abalone *Haliotis fulgens*	FSC, P	Coastal and offshore island intertidal habitats on exposed rocky shores where bedrock provides deep, protective crevices for shelter.	Not expected—Mainly distributed from Point Conception to Bahia Magdalena in Baja California.
Pink abalone *Haliotis corrugate*	FSC, P	Coastal and offshore island intertidal habitats on exposed rocky shores where bedrock provides deep, protective crevices for shelter.	Not expected—Mainly distributed from Point Conception to Bahia Magdalena in Baja California.
White abalone *Haliotis sorenseni*	FE, P	Coastal and offshore island intertidal habitats on exposed rocky shores where bedrock provides deep, protective crevices for shelter.	Not expected—Mainly distributed from Point Conception to Bahia Magdalena in Baja California.

Terms:
BSA = terrestrial biological study area
DPS = distinct population segment
MSA = marine biological study area
OCS = Outer Continental Shelf

[a] Status Codes:

Federal: U.S. Fish and Wildlife Service, National Marine Fisheries Service

FC = candidate to become a proposed species
FDL = delisted
FE = listed as "endangered" (in danger of extinction) under the federal Endangered Species Act (FESA)
FSC = former federal species of concern. U.S. Fish and Wildlife Service no longer lists species of concern but recommends that species considered to be at potential risk by a number of organizations and agencies be addressed during project environmental review. National Marine Fisheries Service still lists species of concern.
FT = listed as threatened (likely to become endangered within the foreseeable future) under FESA

State: California Department of Fish and Wildlife

CE = listed as endangered under the California Endangered Species Act (CESA)
CSC = species of special concern

Table C-4. Continued

Common Name Scientific Name	Status[a]	Habitat	Potential to Occur in Marine Biological Study Area[b]

CT = listed as threatened under CESA

RC = species of regional concern; CDFW regulates harvest levels within reserves

National Oceanographic and Atmospheric Administration; Marine Mammal Protection Act

FD = depleted population

P = federally protected

[b] Potential for Occurrence Rankings:

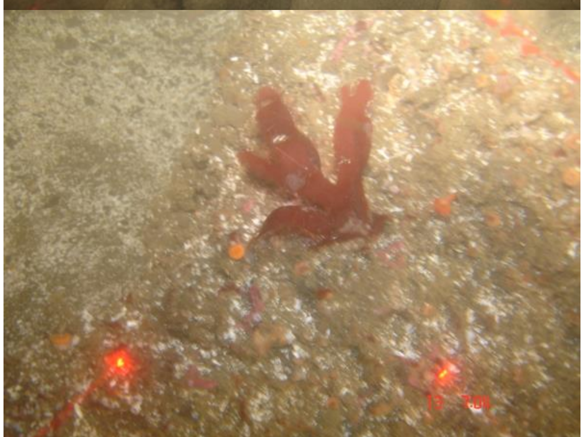
Not expected: Suitable foraging or spawning habitat is not known to be present or is rare, and species has not been or is rarely documented.

Low: Suitable foraging or spawning habitat is present, but species has not been documented to be present or, if present, is uncommon and infrequent.

Moderate: Suitable foraging or spawning habitat is present and species is somewhat common or common for part of the year.

High: Suitable foraging or spawning habitat is present, and species is common throughout the year or in substantial numbers.

Source: AMS 2019



Marine Aquatic Habitats and Biological Resources Offshore Grover Beach, California

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Table of Contents

1 Introduction

The purpose of this scientific review is to 1) present a broad overview of the marine intertidal and subtidal habitats and associated biota observed offshore of coastal Central California based on scientific literature and past field surveys, and 2) to characterize the seafloor habitats and associated macrobenthic communities that are expected to be present along the Bay to Bay Express (BtoBE) cable route, located offshore of Grover Beach, California, based on the geophysical hyrdroacoustic survey data and interpreted seafloor habitats along the proposed cable route. For the purposes of this review, the analysis of seafloor habitats and associated marine taxa covers the water depth range of 0 – 184 m (0 – 600 ft). For fish and marine mammals, the analysis extends out to 1,800 m (5,904 feet) water depth.

Figure 1 provides an illustration of the study area around Grover Beach, California, a graphical presentation of coastal bathymetry and topography, as well as nearby Marine Protected Areas.

2 Previous Scientific Surveys of Subtidal Habitats in Central and Southern California

Beginning in 1999, numerous visual and photographic surveys of fiber optic cable routes in Southern and Central California coastal waters have been conducted using remotely operated vehicles (ROVs). These include:

- Tyco Global West fiber optic cable project, San Diego, Manhattan Beach, Santa Barbara, and Morro Bay (SAIC 2000);
- Tycom fiber optic cable project, Hermosa Beach (MBC 2001);
- SEA-US 1 fiber optic cable project, Hermosa Beach (AMS 2016);
- MCI/WorldCom fiber optic cable project, Montana del Oro/Morro Bay (SAIC-SLO 1999);
- AT&T US/China fiber optic cable project, Morro Bay and Point Arena (SAIC 1999);
- AT&T AAG S-5 fiber optic cable project, Montana del Oro/Morro Bay (AMS 2008);
- Monterey Bay Aquarium Research Institute (MBARI) MARS fiber optic cable project, Monterey Bay (MBARI 2004).

In addition to the above listed surveys that primarily employed ROVs, others employed scientific SCUBA divers to assess the shallower water segments of cable route and landfall locations, marine terminal subsea infrastructure and subsea pipelines, and marine areas of special concern. These include:

- Pacific Crossing and Pan American Crossing fiber optic cable landing, Grover Beach (AMS 1999b);
- The Chevron Pipeline Company Estero Bay Marine Terminal infrastructure prior to abandonment (AMS 1999a; Chambers 1998);
- Tycom fiber optic cable project, Hermosa Beach (MBC 2001); and
- Diver surveys of nearshore rocky reefs in Santa Monica Bay (Occidental 2008).

Finally, the effects of physical disturbance to subtidal hard substrate habitats and associated marine biota, and the recovery of those marine communities following the disturbance, have been extensively studied in conjunction with offshore oil and gas exploration and production operations in the Pacific Outer Continental Shelf. The results of these scientific investigations have been summarized in:

- A Survey of Prominent Anchor Scars and the Level of Disturbance to Hard-Substrate Communities in the Point Arguello Region (Hardin *et al.* 1993);
- Recolonization of Deep-Water Hard Substrate Communities: Potential Impacts from Oil and Gas Development (Lissner *et al.* 199, Brewer et. al 1991).

These studies collectively provide insight into the types of subtidal habitat observed along the California coast in water depths ranging from 0 to 100 fathoms (180 meters).

3 Pelagic Open Water Habitat and Associated Biological Communities

The pelagic zone supports a number of planktonic organisms (phytoplankton, zooplankton, and ichthyoplankton) that float with the currents, as well as nektonic organisms, such as fishes, sharks, and marine mammals that move freely against local and oceanic currents.

3.1 Plankton

Phytoplankton, the primary producers at the base of the marine pelagic food web, are consumed by many species of zooplankton. In turn, zooplankton support a variety of species including small schooling fish (e.g., sardines, herring) and baleen whales (Mysticeti). In the marine environment, phytoplankton tend to be nutrient limited, explaining why they are found at higher densities near coastlines where nutrient inputs from terrestrial point and non-point sources help promote their growth (Fischer 2014). The abundance and composition of phytoplankton along the west coast of California is influenced by the upwelling system and tends to be dominated by diatoms year-round (Du *et al.* 2016). Winds blowing from the north create a current running north to south along the shore that promotes upwelling as well as mixing of plankton over large spatial scales. Relaxation of upwelling and stratification of the water column promotes the growth of phytoplankton that may be considered harmful, such as dinoflagellates and various species of the *Pseudonitzschia* genus (Du *et al.* 2016).

Organisms that complete their entire life cycle as planktonic forms are called holoplankton and include phytoplankton such as diatoms and zooplankton such as *Acartia tonsa*. Holoplankton have short generation times (hours to weeks), have the capability to reproduce continually (i.e. are not dependent on a certain season), and are not restricted to specific geographic zones. Plankton that only spend part of their life cycle as planktonic forms, including as eggs or larvae, are called meroplankton. Meroplankton make up a small fraction of the total number of planktonic organisms in seawater, have shorter spawning seasons, are restricted to a narrow region of the coast, and have a much greater likelihood of impacts on their populations from mortality due to entrainment. As a result, studies in California typically assess effects on meroplanktonic species as proposed by the U.S. EPA (EPA 1977). Important meroplankton include fish larvae and eggs (ichthyoplankton) as well as invertebrate larvae of lobsters, crabs, octopus and squid.

3.2 Fish

Pelagic fish communities tend to be similar throughout the coastal waters of Central California, characterized by small schooling species such as Pacific sardine (*Sardinops sagax*) and Northern anchovy (*Engraulis mordax*), schooling predators such as Bluefin tuna (*Thunnus thynnus*) and thresher shark (*Alopias vulpinus*), swordfish (*Xiphias gladius*), and large solitary predators such as Mako (*Isurus* *oxyrinchu*) and Leopard (*Triakis semifasciata*) sharks (CDFW 2018). Other common fish species that inhabit the open water environment include Chinook salmon (*Oncorhynchus tshawytscha)*, market squid (*Doryteuthis opalescens*), smelt (*Spirinchus stark*), Jack and Pacific mackerel (*Trachurus symmetricus and T. symmetricus*), Opah (*Lampris spp.)*, and assorted perches *(Embiotocidae)* More information on fish species inhabiting the open waters of Central California is provided in Section 5 (Fish Communities) below.

3.3 Marine Mammals & Sea Turtles

3.3.1 Marine Mammals

More than 12 species of marine mammals are reported as regular or periodic inhabitants of the coastal waters of California and anticipated to occupy the waters offshore Grover Beach. These include eight species of cetaceans (whales, dolphins, and porpoises) and three species of pinnipeds (seals and sea lions), and the Southern sea otter, a member of the weasel family (Table 5-1) (Carretta *et al.* 2013; Leatherwood and Reeves 1983; Reeves *et al.* 1992). Marine mammals commonly observed in the waters offshore Grover Beach, in less then 200 meters of water depth, include California sea lions (*Zalophus californianus*), Stellar sea lions (*Eumetopias jubatus*), Pacific harbor seals (*Phoca vitulina*), gray whales (*Eschrichtius robustus*), humpback whales (*Megaptera novaeangliae*), blue whales (*Balaenoptera musculus*, fin whales (*Balaenoptera physalus*), and occasionally, killer whales (*Orcinus orca*) (NOAA 2018a). In addition, Pacific white sided dolphins (*Lagenorhynchus obliquidens)*, common dolphins *(Delphinus delphis)*, and bottlenose dolphins *(Tursiops truncates*). Finally, the Southern sea otter *(Enhydra lutris nereis)* is increasing in numbers in the nearshore waters offshore Grover Beach, which is at the southern end of its current range in Central California.

All of these animals are protected under the Marine Mammal Protection Act (MMPA). Three of the species of cetaceans are federally listed as endangered, while one species of pinnipeds is listed as threatened under the Federal Endangered Species Act (FESA).

3.3.2 Sea Turtles

Physical and oceanographic forces drive patterns of primary and secondary productivity in the coastal waters off California (Wingfeld *et al.* 2011). Five species of marine sea turtles are known to inhabit these waters, or seasonally migrate to the area to forage during times of high productivity. These include Loggerhead (*Caretta caretta*), Green (*Chelonia mydas*), Leatherback (*Dermochelys coriacea*), Pacific Hawksbill (*Eretmochelys imbricata*), and Olive Ridley (*Lepidochelys olivacea*) sea turtles (California Herps 2018). The Loggerhead, Pacific Hawskbill and Olive Ridley sea turtles are only known to occur in Southern California south of Point Conception, although one sighting of an Olive Ridley near Tomales Bay was reported in 2002 (California Herps 2018).

Of these five species, only the Green and Leatherback sea turtles have been reported occurring in the waters of north Central and southern Northern California (California Herps 2018). Leatherback turtles observed in this region are found to nest in the western Pacific and migrate to the California coast in the summer and early fall to forage on abundant jellyfish that bloom as a result of coastal upwelling (Benson *et al.* 2006). East Pacific green sea turtles originate from nesting beaches in Mexico, and many are long-term residents of San Diego Bay (NOAA SWFSC 2014). They feed on eelgrass and associated biota including algae and invertebrates. While most commonly found in warmer waters off Mexico and southern California, green sea turtles are occasionally observed along Central and northern California during anomalously warm years, with far rarer observations as far north as Canada’s Vancouver Island (California Herps 2018).

Given the lack of eelgrass habitat in the nearshore coastal waters adjacent to Grover Beach (Sherman & DeBruyckere 2018), the potential for occurrence of Green sea turtles in this area is low. Leatherback sea turtles typically forage farther offshore than the area of focus, and no nesting of this species occurs north of Mexico (Benson *et al* 2006). Therefore, the potential for occurrence of Leatherback sea turtles in the nearshore coastal waters adjacent to Grover Beach is also low.

The Leatherback, Green, and Pacific Hawksbill sea turtles are Federally listed as endangered throughout their ranges and the Olive Ridley and Loggerhead sea turtles are Federally listed as Threatened. Critical habitat for the Leatherback sea turtle has been established from Point Arena in Northern California south to Point Arguello, in Southern California (NOAA 2018b).

4 Subtidal Habitats and Associated Macrobenthic Biological Communities

Subtidal habitats are typically characterized as either soft or hard substrate. Depending on water depth, currents, wave energy, and other physical conditions, the soft substrate can range from coarse sands, (typically observed in high energy and/or shallow water environments) to fine muds (low energy/deeper water environments). Hard substrate can be divided into natural (rocky outcrop) or artificial (concrete, pilings, steel, etc.) substrate, and further characterized by elevation or rise above the seafloor. While some reports characterize elevation rise only as "low" or "high", the typical descriptors used for categorizing elevation of hard substrate above the seafloor are:

- Mixed-bottom – a combination of coarse sand, gravel, cobble, and small boulders;
- Low-relief – exposed bedrock and rocky outcropping rising approximately < 0.3 m (<1 ft.) from the seafloor;
- Moderate-relief – exposed rocky outcroppings that typically rise approximately 0.3-1.0 m (1-3 ft.) from the seafloor;
- High-relief – exposed rocky outcropping that typically rise >1.0 m (>3 ft.) from the seafloor.

Many of the deep-water, hard substrate biological assessments featured in this report have documented an increase in species diversity and abundance with increasing elevation above the seafloor. These studies have demonstrated that water depth, current speed, rate of sedimentation, and elevation off the seafloor are all key factors in determining the composition of biota inhabiting a specific hard substrate habitat (Battelle 1991; Hardin 1994; Lissner & Shoakes 1986).

Additionally, with increasing water depth and the reduction of wave energy at the seafloor, the sediment composition shifts from coarse sands with low organic content near the beach to fine muds with increasing organic content as you transit farther offshore into deeper water depths. This shift in sediment composition and energy also results in changes to the marine biota inhabiting the soft substrate habitat.

Contained within the Appendices of this report are four tables providing taxonomic listings of invertebrate and fish species observed during the above listed fiber optic cable route reconnaissance surveys employing ROVs, and shallower water depth surveys employing SCUBA, in Southern and Central California with particular emphasis on studies conducted near Grover Beach, CA. Appendix A-1 is a master taxonomic list of invertebrate organisms that identifies each taxon's association with either hard or soft substrate habitat. Appendix A-2 provides a breakout of invertebrate taxa by water depth range. Appendix A-3 is a master taxonomic list of all fish and shark species observed in these surveys by habitat and Appendix A-4 is a breakout of the fish species by water depth range. When reviewing the data within the appendeces, it should be noted that hard bottom habitat was not always present within specific depth ranges along some of the proposed fiber optic cable routes. As a result, no associated species were reported as occurring within those water depth ranges for hard bottom habitat. This merely indicates that there was no suitable habitat present at that water depth range to be characterized and does not indicate that certain species would not occur in that location, if suitable habitat were present.

4.1 Habitats and Associated Biota Observed in the 0-30.5 Meter (0-100 ft.) Water Depth Range.

Most fiber optic cables begin their offshore routing at the point at which the cable exits an existing pipeline/outfall or horizontal bore hole. This typically occurs in 12-25 m (39-82 ft.) water depth and preferably in soft substrate such as sand or sandy silt. Although hard substrate does occur at these shallower water depths, cable routes are routinely selected to avoid them, especially at the very shallowest water depths. As a result, most of the fiber optic cable route reconnaissance surveys reviewed for this paper begin at water depths greater than 25 meters (82 ft.). Survey work on shallow water reefs in Southern and Central California have been conducted by Occidental College, Chambers, and AMS, which can be used to inform our understanding of species presence at water depths less than 30 meters (98 ft.) (Occidental 2008, Chambers 1998, AMS 1999a, SAIC 2010). Because scientists conducted these surveys using SCUBA equipment, the taxonomic lists generated are more extensive than typically generated from ROV surveys. Appendices A-1 through A-4 include a more detailed listing of marine invertebrate and fish taxa observed on shallow water reefs observed during these SCUBA conducted surveys in the Southern and Central California. The following discussion of deep-water biota focuses primarily on observations made during the cable route surveys in Central California. The shallow water data provided by the Occidental (2008), Chambers (1998), and AMS (1999a) reports has been included to provide reference information on hard and soft substrate communities in water depths shallower than fiber optic cable route characterizations typically assess.

4.1.1 Soft Substrate

Soft substrate habitat types commonly observed between 0-30 m (0-98 ft.) water depth include coarse sands in the surf zone shifting to finer sands and muds (silts and clays) at deeper water depths (Figures 2 and 3).

The most common invertebrate taxa observed include the ornate tube worm (*Diopatra ornata*), cancer crabs *(Cancer sp.),* slender crabs *(Cancer gracilis),* masking crab *(Loxorhynchus crispatus),* octopus *(Octopus rubescens and O. bimaculatus/bimaculoides)*), white sea pens (*Stylatula elongata*), sea cucumbers (*Parastichopus californicus*), sunflower stars (*Pycnopodia helianthoides*), occasional polychaete tube worms, *Pachycerianthus* anemones, spiny sand stars (*Astropecten armatus*), short-spined seastars (*Pisaster brevispinus*), sand stars (*Luidia foliolata*), sea pansy (*Renilla kollikeri*), swimming crabs (*Portunus xantusii*), an occasional hermit crab, Kellet’s whelk (*Kelletia kellettii*), Nassa mud snails (*Nassarius sp*.), and sand dollars (*Dendraster excentricus*).

The bat star (*Asterina miniata*) and red sea star (*Mediaster aequalis*) are occasionally observed in soft substrate when the soft substrate habitat is in close proximity to exposed hard substrate. In the coarser sand habitats, the invertebrate community is typically dominated by ornate tubeworms (*D. ornata*) and sand dollars (*D. excentricus*), when they are present in colonies occupying fairly narrow bands. In deeper waters, where the sediments shift to finer muds, brittle stars (*Ophiura spp*.) start to occur in larger numbers.

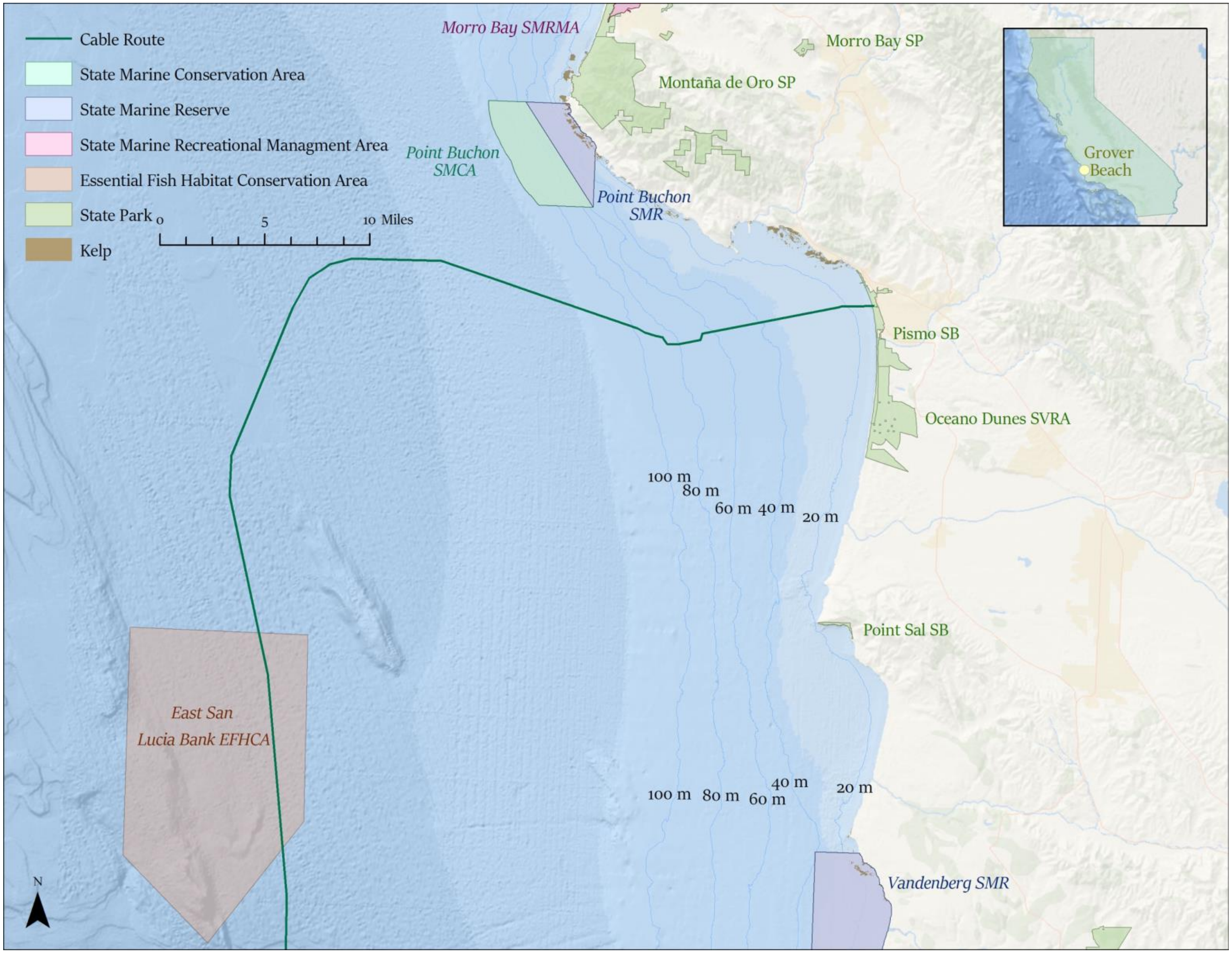

Figure 1: Marine Study Area Offshore Grover Beach California.

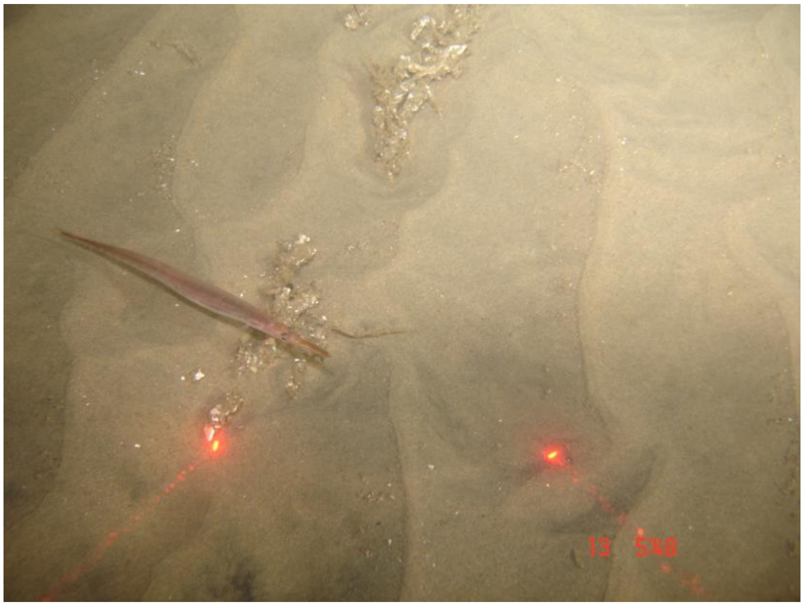

Figure 2: Coarser soft sand substrate in <30 m of water depth offshore Central California. Ornate tube worms (*D. ornata*) and a tubesnout (*Aulorhynchus flavidus*) along the AAG-S5 cable route.

Figure 3: Coarse sand substrate in <30 m water depth offshore Sothern California. Drift kelp, ornate tube worms (*D. ornata*) along the SEA-US cable route.

When hard substrate is nearby to the surveyed location, various species of drift algae are also commonly observed along the seafloor in soft bottom habitat. Observed species include giant kelp (*Macrocystis pyrifera*), feather boa kelp (*Egregia meanzinii*), acid kelp (*Desmarestia ligulata*), and surf grass (*Phyllospadix spp.)*. Populations of very small red and brown algae have also been reported to occur attached to worm tubes (MBC 2001, AMS 2016).

4.1.2 Hard Substrate

Hard substrate habitat types typically observed between 0-30.5 m (0-100 ft.) water depths include mixed-bottom (a combination of coarse sand, cobble, and small rocks < 0.3 m (1 ft.) in height above the seafloor), low-relief, substrate consisting primarily of exposed bedrock and small boulders, and occasionally high-relief substrate with rocks greater than 1 meter (3.3 ft.) above the seafloor (Figure 4).

The biological community inhabiting these hard substrate habitats is typically dominated by a dense mat of turf species (turf) including a mixture of small hydroids, bryozoans, tunicates, and sponges, multiple species of red and brown algae, the white-plumed anemone (*Metridium farcimen =giganteum*) and the strawberry anemone (*Corynactis californica*). Other species that may also be present at some locations include surf grass (*Phyllospadix sp.)* in the very shallow water depths of this zone, sea anemones (*Actinaria unident.*), swimming anemones (*Stomphia coccinea*), squid (*Loligo sp*.), crab (*Cancer sp*.), masking crab (*L. crispatus*), bat stars (*Asterina miniata*), red sea stars (*M. aequalis),* giant-spined sea stars (*Pisaster giganteus*), other *Pisaster* sea stars, brittle stars (*Ophiura spp*.) and occasionally sea hares (*Aplysia californica*). The presence and occurrence of red and brown algae, as well as the density of solitary corals such as orange cup coral (*Balanophyllia elegans*) and brown cup corals (*Paracyathus stearnsi*), appears to be highly influenced by the level of natural turbidity and periodic burial of exposed hard substrate (AMS 1999a, 1999b, Chambers 1998).

4.2 Habitats and Associated Biota Observed in the 30.5-100 Meter (100-329 ft.) Water Depth Range.

4.2.1 Soft Substrate

Soft substrate habitats in the 30.5-100 m (100-329 ft.) water depth range, where bottom currents or wave energy continue to wash the seafloor, include scattered mixed-bottom, coarse sand, and fine muds. The coarser sand substrates are normally only seen at the shallower water depths of this water depth range. The finer mud substrate is frequently pockmarked with burrow holes (Figures 5 and 6).

The soft substrate macrofauna is typically dominated by several species of sea pens (*Ptilosarcus gurneyi, Stylatula elongata, Acanthoptilum spp., Subselliflorae spp., Virgularia spp.)*, sea slugs (*Pleurobranchea californica*), and sand stars (*L. foliolata*). Also, frequently observed are crabs (*Cancer sp*.), red sea stars (*M. aequalis*), multi-armed sea stars (*Rathbunaster californica*), *Cerianthidae* anemones, swimming anemones (*Stomphia coccinea*), and ornate tubeworms *(D. ornata*). In coarser sediments, brittle stars (*Ophiuroids*) and sunflower stars (*Pycnopodia helianthoides*) predominate. One notable difference between surveys conducted in Central California and Southern California is the presence of the sea cucumber *P. californicus*. It is observed more frequently in Southern California than farther north, at all water depths.

4.2.1 Hard Substrate

Hard substrate habitat types observed in the 30.5-100 m (100-328 ft.) water depth range include mixed-bottom at shallower depths as well as low, moderate, and high-relief bottom towards the deeper end of this water depth range.

The hard substrate community appears to be dominated by turf, encrusting and foliose bryozoans, assorted encrusting sponges, and the white-plumed anemone *M. farcimen* (=*giganteum*) (Figure 6). Also, commonly occurring are brown cup corals (*P. stearnsii*), assorted crabs (*Cancer spp*.), shrimps, red sea stars (*M. aequalis*), swimming anemones (*S. coccinea*), and brittle stars (*Ophiuroids*). Additionally, soft gorgonian corals including *Lophogorgia chiliensis* and *Eugorgia rubens* are occasionally observed.

Figure 4: Mixed bottom, low relief, hard substrate habitat in <30 m of water depth offshore Central California along the SEA-US cable route.

4.3 Habitats and Associated Biota Observed in the 91-200 Meter (300-656 ft.) Water Depth Range.

4.3.1 Soft Substrate

The soft substrate observed in the 91-200 m (300-656 ft.) water depth range is exclusively comprised of fine mud (Figures 7 and 8). The macrobenthic community in this water depth range is characterized by sea pens (*S. elongata, Virgularia spp*.), sand stars (*L. foliolata*), crabs (*Cancer spp*.), and assorted shrimp. Other commonly or frequently occurring taxa include several species of sea anemones (e.g. *Urticina* spp.), multi-armed sea star (*R. californica*), the red sea star (*M. aequalis*), brittle stars (*Amphiodia sp*. and Ophiuroidea), pink sea urchin (*Allocentrotus fragilis*), free-living polychaetes (*Chloeia pinnata*), sea cucumber (*P. californicus*), and sea slugs (*P. californica*).

4.3.2 Hard Substrate

Hard substrate habitat types observed in the 91-200 m (328-656 ft.) water depth range are the same as those present in the 30.5-91 meter (100-300 feet) water depth range. The macrobenthic taxa are similar with turf, cup corals, and the white-plumed anemone being the most often observed. Also, commonly observed are giant basket stars (*Gorgonocephalus eucnemis*), brittle stars (Ophiuroidea), various species of crabs (*Cancer spp*.) and the red sea stars (*M. aequalis*). At some locations, crinoids (e.g. *F. serratissima*) are also commonly observed.

Figure 5: Soft substrate habitat in 30.5-100 m (100-328 ft.) water depth offshore Southern California along the SEA-US Cable Route. Left Photo-shell hash and drift algae. Right photo-*Acanthoptilum spp*. sea pens.

Figure 6: Natural and artificail hard substrate habitat in 30.5-100 m (100-328 ft.) water depth offshore Southern (Left photo) and Central California (right photo). Left photo-debris with attached turf species, *Metridium farcmens* anemone, crab, and rockfish along the SEA-US Cable Route. Right photo- low shelf with turf, cup corals (*Balanophyllia elegans*), sponges, and bryozoans along the AAG-S5 Cable Route.

Figure7: Fine silt and clay soft substrate in100-185 m water depth offshore Southern California. Pink urchins (*Strongylocentrotus fragilis*) along the SEA-US Cable Route.

Figure 8: Fine silt and clay soft substrate in 100-183 m water depth offshore Central California. Spiny sand star (*Astropecten spp*.) and brittle stars along the AAG-S5 Cable Route.

It is at these water depths that deep-water corals have occasionally been reported along fiber optic cable routes. Based on whether current speeds, sedimentation rates, and the occurrence of hig-relief features are favorable, branching hard and soft corals have been reported including the branching white coral *Lophelia sp*. and the California hydrocoral *Stylaster californicus* (= *Allopora californica)*. Note that Cairns (1983) synonymized *A. californica* to *S. californicus*. Because of widespread and historic use and immediate name recognition of "*Allopora*" by most marine scientists, this discussion uses the original name (*Allopora*) to avoid confusion. *Allopora* can also occur in shallower water depths when conditions are favorable, although frequently in a very small, stunted form (Occidental 2008).

5 Fish Communities

The distribution of fish species offshore California is influenced by various combinations of water depth, substrate type, temperature, and ocean currents (Love and Yoklavich 2006). Fish communities along the Central California coast have not been extensively researched and most data are based on commercial and recreational landing data. This data, combined with data from ROV reconnaissance surveys along fiber optic cable routes is the primary basis for describing fish communities in this paper. Although many marine resources, including fishes, are typically distributed by water depth and habitat type, the following description of fish communities is divided by substrate type. A master list of fish species observed during several fiber optic cable and scientific diver surveys near Grover Beach, CA is presented in Appendix A-3. Appendix A-4 presents fish species observed during these surveys by water depth range.

5.1 Hard Substrate

Similar to macroinvertebrate communities discussed above, fish communities in Central California are also highly variable depending on both abiotic and biotic parameters including the presence of reef structure (Pondella *et al.* 2011). Common fish species observed inhabiting or associating with hard substrate habitat, including both mixed bottom, low relief, and high-relief, include Sculpins (Cottidae), Bull sculpin (*Enophrys taurina*), coraline sculpin (*Artedius corallines*), black eyed goby (*Coryphopterus nicholsi*), giant kelpfish (*Heterostichus rostratus*), Rainbow seaperch (*Hypsurus caryi*), White seaperch (*Platchthys stellatus*), Pile perch (*Rhacochilus vacca*), Pink surfperch (*Zalembius rosaceus*), Kelp bass *(Paralabrax clathratus),* Painted greenling *(Oxylebius pictus),* Lingcod *(Ophiodon elongates),* and Senorita (*Oxyjulis california*) (AMS 2008, AMS 1999b, Chambers 1998, SAIC-SLO 1999, SAIC 1999, 2000).

The most common fish assemblages observed occurring on deeper water hard substrate outcroppings are assorted juvenile and adult rockfish including Brown (*Sebastes auriculatus*), Gopher (*S. carnatus*), Copper (*S. caurinus*), Green striped (*S. elongates),* Quillback (*S. maliger),* Rosy (*S. rosaceus),* Half banded (S. *semicinctus*), Olive (*S. serrinoides),* and Tree fish (*S. serriceps)* rockfish (AMS 2008, AMS 1998, Chambers 1998, SAIC-SLO 1999, SAIC 1999, 2000). Fish species typically observed associated with hard substrate do not appear to be restricted by water depth, at least to 200 m (656 ft.), as illustrated in Appendix A-4. If any water depth delineation occurs in Southern or Central California waters it appears to occur between water depths <30.5 m (100 ft.) and >30.5 m (100 ft.)(Appendix A-4)

Other schooling fish species that have been observed or collected close to hard bottom substrate areas include Poachers (Agonidae), Blue rockfish (*S. mystinus*), schooling baitfish (Atherindae), and speckled sanddabs (*Citharichthys stigmaeus*) (AMS 2008, AMS 1999b, Chambers 1998, SAIC-SLO 1999, SAIC 1999, 2000). These same species are expected to occur in the vicinity of hard bottom features along the Grover Beach Fiber Optic Cable Project's offshore cable routes. For additional species that have been documented over hard substrates in south Central California see Appendix A-3.

5.2 Soft Substrate

Soft bottom habitat is the most widespread benthic habitat on the California shelf (Dugan *et al*. 2015, Allen 2006; Allen *et al.* 2011). Demersal fishes occupying this habitat are relatively sedentary compared to pelagic fish species and respond more readily to changes in the benthic environment. Fishes found in soft-bottom habitats in south Central California are typified by flatfishes, such as Sanddabs, including speckled (*Citharichthys stigmaeus*) and Pacific (*C. sordidus*), Dover sole (*Microstomus pacificus*), English sole (*Pleuronectes vetulas*), assorted soles (Pleuronectidae), California halibut (*Paralichthys californicus*), Poachers (Agonidae), Tubesnout (*Aulorhynchus flavidus*), spotted cuskeels (*Chilara taylori*), Longspine combfish (*Zaniolepsis latispinnus*), black eyed gobys (*C. nicholsi*), Pacific hagfish (*Eptatretus stouti*), Spotted ratfish (*Hydrolagus colliei*), California tonguefish (*Symphurus atricauda*), Pacific electric ray (*Torpedo californica*), Banded guitarfish (*Zapteryx exasperate*) and Eelpouts (*Lycodes* spp) (AMS 2008, AMS 1999b, Chambers 1998, SAIC-SLO 1999, SAIC 1999, 2000). Larger predators include Big skate (*Raja binoculata*), Longnose skate (R. *shina*), Pacific angel shark (*Squatina californica*), Swell shark (*Cephaloscyllium ventriosum*) and Great white shark (*Carcharodon carcharias)*. As discussed above for fish species associated with hard substrate habitat, water depths <200 m (656 ft.) does not appear to be a big delineator for soft substrate associating fish (Appendix A-4).

Pelagic species that are common in waters offshore Grover Beach include Northern anchovy (*Engraulis mordax*), White croaker (*Genyonfemus lineatus*), and both juvenile and adult rockfish including Olive rockfish (*S. serrinoides/flavidus*) (AMS 2008, AMS 1999b, Chambers 1998, SAIC-SLO 1999, SAIC 1999, 2000) (Appendix A-3 and A-4).

5.3 Magnuson-Stevens Act Managed Fish Species

In accordance with the 1996 amendments to the Magnuson-Stevens Fishery Management and Conservation Act (MSA), Essential Fish Habitat (EFH) is defined as "those waters and substrates necessary to fish for spawning, breeding, feeding, or growth to maturity." Central California coincides with areas designated as EFH in all four Fishery Management Plans (FMPs): the Pacific Coast Groundfish FMP (PFMC 2016b), the Coastal Pelagic Species FMP (PFMC 2018a), Pacific Coast Salmon FMP (PFMC 2016a), and the Highly Migratory Species FMP (PFMC 2018b).

Most of the 85-groundfish species managed under the Pacific Groundfish FMP are found at various stages in their life histories in diverse habitats throughout the Central California. Some species are broadly dispersed during specific life stages, especially those with pelagic eggs and larvae, while other species may have limited distributions (i.e. adult rockfishes in nearshore habitats) with strong affinities to a particular location or substrate type. Estuaries, sea grass beds, canopy kelp, rocky reefs, and other "areas of interest" such as seamounts, offshore banks, canyons are designated Habitat Areas of Particular Concern (HAPC) for groundfish managed species. Figure 9 illustrates the locations of NMFS designated HAPCs along the California coast and specifically those occurring along the proposed BtoBE fiber optic cable route.

Fish species managed under the Pacific Groundfish FMP, known to inhabit the coastal waters of Central California, that have been observed during reviewed seafloor habitat and biological community surveys offshore Grover Beach, Montana Del Orro, and Estero Bay, include four flatfishes, 33 rockfishes (*Sebastes* spp.), the California scorpionfish, two different Thornyheads (*Sebastolobus* spp.), and five different roundfishes (Cabezon, Kelp greenling, Lingcod, Pacific cod, and Sablefish). There are also four different elasmobranchs (Big skate, Leopard shark, Longnose skate, and Spiny dogfish) managed under this plan that are known or expected to occur offshore Grover Beach (Table 4-1, Appendix A-3 and A-4).

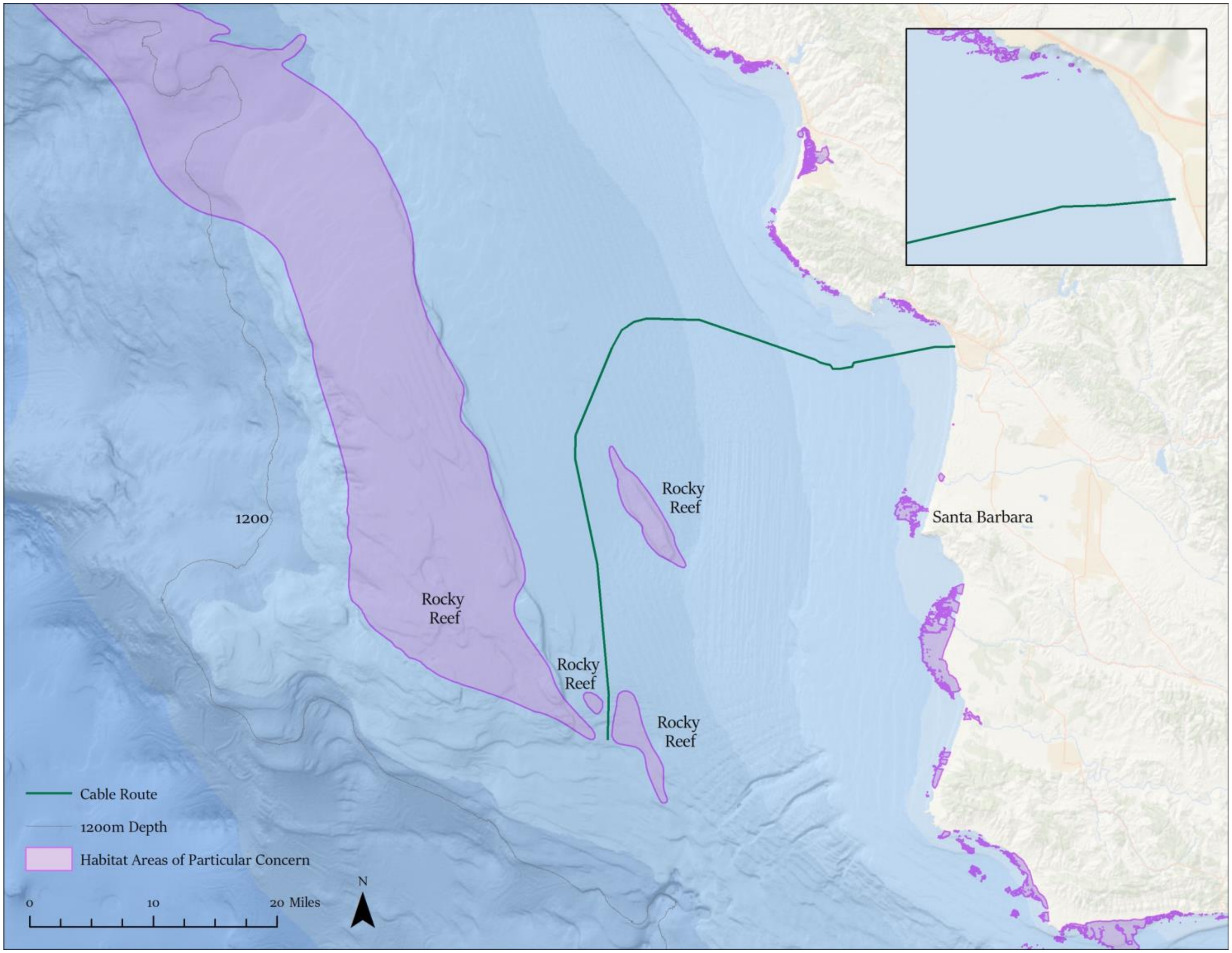

Figure 9: Habitat Areas of Special Concern (HAPC) Offshore Grover Beach in Central California.

Coastal Pelagic fish species live in the water column, not near the sea floor, and are usually found from the surface to >1,000 m (3,281 ft.) water depth (PFMC 2018a). There are 6 stocks of coastal pelagic fish species managed under the CPS FMP, including Jack mackerel (*Traxchurus symmetricus*), Pacific chub mackerel (*Scomber japonicas*), Pacific sardine (*Sardinops sagax*), market squid (*Doryteuthis opalescens*), Northern anchovy (*E. mordax)* and krill or euphausiids (*Euphausia* spp., *Thysanoessa* spp., *Nyctiphanes simplex, and Nematocelis difficilis*). Additionally, Jacksmelt (*Atherinopsis californiensis*) and Pacific herring (*Clupea pallasii*) are considered ecosystem components of the fishery and are also monitored. All of these species, with the exception of Pacific herring and Northern anchovy, are commonly observed and harvested in the coastal waters offshore Grover Beach (Table 4-1 and 4-2).

The Pacific Coast Salmon FMP (2016a) outlines spatially explicit EFH for chinook (*Oncorhynchus tshawytscha*), Coho (*Oncorhynchus kisutch*), and Puget Sound pink (*Oncorhynchus* gorbuscha) salmon. While inland spawning habitat is considered to be the most essential to these species (all areas designated as HAPC for salmon are inland), all three are still present in marine coastal waters. The marine EFH for all three species extends from the inland extreme high tide line out to the 200-mile Exclusive Economic Zone offshore of the states of Washington, Oregon, and California north of Point Conception. Grover Beach is therefore located near the southern boundary of this EFH. Chinook are more commonly found off the coast of California, but Coho and Puget Sound pink, while uncommon, can also be present (Table 4-1 and 4-2).

EFH for Highly Migratory Species includes all marine waters from the shoreline to 200 nautical miles (370 km) offshore. There are three species of shark managed under the Highly Migratory Species FMP; Blue shark (*Prionace glauca*), Common thresher shark (*Alopias vulpinus*), and Shortfin mako shark (*Isurus oxyrinchus*). In addition, there are five species of tunas managed under this plan including Bigeye tuna (*T. obesus*), North Pacific albacore (*Thunnus alalunga*), Pacific bluefin tuna (*T. orientalis*), Yellowfin tuna (*T. albacares*), and Skipjack tuna (*Katsuwonus pelamis*) (Table 4-1 and 4-2). Striped marlin (*Kajikia audax*) is the only species of billfish managed under the Highly Migratory Species management plan. Broadbill swordfish (*Xiphias gladius*) is the only species of swordfish and dorado/mahi mahi (*Coryphaena hippurus*) is the only species of dolphin fish managed under this plan. All of these species are known to occur in the nearshore and offshore waters adjacent to Grover Beach. The common thresher shark, North Pacific albacore, and Swordfish are also known to be present (Table 4-1 and 4-2).

5.4 Commercial and Recreational Fishing

The coastal waters of Central California are extensively used for both commercial and recreational fishing. Although more than 80 fish species or groups were commercially landed at Morro Bay and Port San Luis between 2013 and 2017, 15 of them accounted for 94% of the landings based on tonnage (Table 4-2). Those taxa that account individually for more than 0.7% of the total landings between 2013 and 2017 include Market squid (*Doryteuthis opalescens)*, Dungeness Crab (*Metacarcinus magister)*, Sablefish (*Anoplopoma fimbria)*, Hagfish (Myxini), Ocean pink shrimp (*Pandalus jordani*), Dover sole (*M. pacificus)*, Shortspine thornyhead (*Sebastolobus alascanus)*, *Longspine thornyhead (S. altivelis)*, Petrale sole (*E. jordani)*, Lingcod (*O. elongates)*, assorted Rockfish including Bank (*S. rufus)*, Brown (*S. auriculatus*), Gopher (*S. carnatus)*, and Chinook salmon (*Onchorynchus tshawytscha*). Commercial fishing methods employed include trolling, trawling, and trapping.

Recreational fishing, conducted from rocky shores, sandy beaches, docks, private boats, and commercial party boats, landed approximately 100 fish taxa between 2013 and 2017 (Table 4-3). However, 19 of these taxa accounted for more than 91% of the landings in tonnage or in individual numbers of fish landed. The dominant fish taxa caught by recreational fisherman include Lingcod (*O. elongates*), assorted species of rockfish including Blue, Vermillion, Yellowtail, Gopher, Copper, Brown, Black, Olive, Boccacio, Kelp, and Canary (*S. mystinus*, *S. miniatus*, *S. flavidus*, *S. caratus*, *S. caurinus*, *S. auriculatus*, *S. malanops*, *S. serranoides*, *S. paucispinis*, *S. astrovirens*, *S. pinniger*, respectively)), Cabezon (*Scorpaenichthys marmoratus*), Barred surfperch (*Amphistichus argenteus*), Dungeness crab (M. magister), California Halibut (*P. californicus)*, Jacksmelt (*A. californiensis*), Pacific chub mackerel (*Trachurus symmetricus*), and Pacific sanddab (*C. sordidus*), (Table 4-3).

6 Species of Special Concern

Inhabiting California's coastal subtidal region are several species of special concern, which includes species protected under the Federal Endangered Species Act (FESA); the California Endangered Species Act (CESA); the Marine Mammal Protection Act (MMPA); the California Fish and Game Code; the National Oceanic and Atmospheric Administration (NOAA) species of concern lists; the U.S. Fish and Wildlife Service; the California Department of Fish and Wildlife (CDFW); or State or Federal agencies, such as the California Coastal Commission (CCC) that designate species as having a scientific, recreational, ecological, or commercial importance. Table 5-1 provides a listing of all species of special concern that have any potential to be present offshore Grover Beach. Under FESA, CESA, and the MMPA, the marine mammals and sea turtles discussed in Section 6 (Marine Mammals & Sea Turtles) are all considered species of special concern. There are FESA/CESA protected and MSA managed fish species that are considered species of special concern and are similarly discussed in Section 5 (Fish Communities) above. Finally, there are marine birds that are FESA, CESA, or protected under the Federal Migratory Bird Act, that are not part of this study which is focused on marine aquatic resources.

TABLE 4-1
MAGNUSON-STEVENS ACT MANAGED FISH AND INVERTEBRATE SPECIES

Fisheries Management Plan	Species, Common Name	Species, Scientific Name	Life Stage[1]	Occurrence in Proximity to Grover Beach Site[2]
Coastal Pelagic	Jack mackerel	*Trachurus symmetricus*	E, L, J, A	Common
	Jacksmelt	*Atherinopsis californiensis*	E, L, J, A	Present
	Krill or Euphausiids	*Euphausia pacifica, Thysanoessa spinifera, Nyctiphanes simplex, Nematocelis difficilis, T. gregaria, E. recurva, E. gibboides, E. eximia*	E, L, J, A	Present
	Market squid	*Doryteuthis opalescens*	E, L, J, A	Common
	Northern anchovy	*Engraulis mordax*	E, L, J, A	Present
	Pacific herring	*Clupea pallasii pallasii*	E, L, J, A	Uncommon
	Pacific (chub) mackerel	*Scomber japonicus*	E, L, J, A	Common
	Pacific sardine	*Sardinops sagax*	E, L, J, A	Present
Pacific Groundfish	Cabezon	*Scorpaenichthys marmoratus*	E, L, J, A	Common
(Dashed lines separate Roundfish, Rockfish, Elasmobranchs, and Flatfish, respectively)	Kelp greenling	*Hexagrammos decagrammus*	E, L, J, A	Present
	Lingcod	*Ophiodon elongatus*	E, L, J, A	Common
	Pacific Cod	*Gadus macrocephalus*	E, L, J, A	Present
	Pacific Whiting (Hake)	*Merluccius productus*	E, L, J, A	Uncommon
	Sablefish	*Anoplopoma fimbria*	E, L, J, A	Common
	Aurora rockfish	*Sebastes aurora*	E, L, J, A	Uncommon
	Bank rockfish	*Sebastes rufus*	E, L, J, A	Present
	Black rockfish	*Sebastes melanops*	E, L, J, A	Common
	Black-and-yellow rockfish	*Sebastes chrysomelas*	E, L, J, A	Present
	Blackgill rockfish	*Sebastes melanostomus*	E, L, J, A	Present
	Blue rockfish	*Sebastes melanostomus*	E, L, J, A	Common
	Bocaccio rockfish	*Sebastes paucispinis*	E, L, J, A	Common
	Bronze spotted rockfish	*Sebastes gilli*	E, L, J, A	Uncommon

Fisheries Management Plan	Species, Common Name	Species, Scientific Name	Life Stage[1]	Occurrence in Proximity to Grover Beach Site[2]
	Brown rockfish	*Sebastes auriculatus*	E, L, J, A	Common
	Calico rockfish	*Sebastes dalli*	E, L, J, A	Uncommon
	California scorpionfish	*Scorpaena gutatta*	E, L, J, A	Present
	Canary rockfish	*Sebastes pinniger*	E, I, J, A	Present
	Chameleon rockfish	*Sebastes phillipsi*	E, L, J, A	Present
	Chillipepper rockfish	*Sebastes goodei*	E, L, J, A	Present
	China rockfish	*Sebastes nebulosus*	E, L, J, A	Present
	Copper rockfish	*Sebastes caurinus*	E, L, J, A	Common
	Cowcod	*Sebastes levis*	E, L, J, A	Uncommon
	Darkblotched rockfish	*Sebastes crameri*	E, L, J, A	Uncommon
	Deacon rockfish	*Sebastes diaconus*		Absent
	Dusky rockfish	*Sebastes ciliatus*		Absent
	Dwarf-red rockfish	*Sebastes rufinanus*		Absent
	Flag rockfish	*Sebastes rubrivinctus*	E, L, J, A	Uncommon
	Freckled rockfish	*Sebastes lentiginosus*	E, L, J, A	Absent
	Gopher rockfish	*Sebastes carnatus*	E, L, J, A	Common
	Grass rockfish	*Sebastes rastrelliger*	E, L, J, A	Present
	Greenblotched rockfish	*Sebastes rosenblatti*	E, L, J, A	Uncommon
	Greenspotted rockfish	*Sebastes chlorostictus*	E, L, J, A	Present
	Greenstriped rockfish	*Sebastes elongatus*	E, L, J, A	Uncommon
	Harlequin rockfish	*Sebastes variegatus*		Absent
	Halfbanded rockfish	*Sebastes semicinctus*	E, L, J, A	Uncommon
	Honeycomb rockfish	*Sebastes umbrosus*	E, L, J, A	Present
	Kelp rockfish	*Sebastes atrovirens*	E, L, J, A	Common
	Longspine thornyhead	*Sebastolobus altivelis*	E, L, J, A	Common
	Mexican rockfish	*Sebastes macdonaldi*	E, L, J, A	Uncommon
	Olive rockfish	*Sebastes serranoides*	E, L, J, A	Common
	Pacific ocean perch	*Sebastes alutus*	E, L, J, A	Uncommon
	Pink rockfish	*Sebastes eos*	E, L, J, A	Uncommon
	Pinkrose rockfish	*Sebastes simulator*		Absent
	Quillback rockfish	*Sebastes maliger*	E, L, J, A	Uncommon
	Redbanded rockfish	*Sebastes babcocki*	E, L, J, A	Uncommon
	Redstripe rockfish	*Sebastes proriger*		Absent
	Rosethorn rockfish	*Sebastes helvomaculatus*	E, L, J, A	Uncommon
	Rosy rockfish	*Sebastes rosaceus*	E, L, J, A	Present
	Rougheye rockfish	*Sebastes aleutianus*	E, L, J, A	Uncommon
	Sharpchin rockfish	*Sebastes zacentrus*	E, L, J, A	Uncommon
	Shortbelly rockfish	*Sebastes jordani*	E, L, J, A	Uncommon
	Shortraker rockfish	*Sebastes borealis*	E, L, J, A	Uncommon
	Shortspine thornyhead	*Sebastolobus alascanus*	E, L, J, A	Common
	Silvergray rockfish	*Sebastes brevispinis*	E, L, J, A	Uncommon
	Speckled rockfish	*Sebastes ovalis*	E, L, J, A	Present
	Splitnose rockfish	*Sebastes diploproa*	E, L, J, A	Uncommon
	Squarespot rockfish	*Sebastes hopkinsi*	E, L, J, A	Uncommon
	Sunset rockfish	*Sebastes crocotulus*	E, L, J, A	Common
	Starry rockfish	*Sebastes constellatus*	E, L, J, A	Present
	Stripetail rockfish	*Sebastes saxicola*	E, L, J, A	Uncommon
	Swordspine rockfish	*Sebastes ensifer*	E, L, J, A	Uncommon
	Tiger rockfish	*Sebastes nigrocinctus*	E, L, J, A	Uncommon
	Treefish rockfish	*Sebastes serriceps*	E, L, J, A	Present
	Vermillion rockfish	*Sebastes miniatus*	E, L, J, A	Common
	Widow rockfish	*Sebastes entomelas*	E, L, J, A	Present
	Yelloweye rockfish	*Sebastes ruberrimus*	E, L, J, A	Uncommon
	Yellowmouth rockfish	*Sebastes reedi*		Absent
	Yellowtail rockfish	*Sebastes flavidus*	E, L, J, A	Common
	Big skate	*Raja binoculata*	E, L, J, A	Uncommon
	Leopard shark	*Triakis semifasciata*	E, L, J, A	Present
	Longnose skate	*Raja rhina*	E, L, J, A	Present
	Spiny dogfish	*Squalus suckleyi*	E, L, J, A	Present
	Arrowtooth flounder (turbot)	*Atheresthes stomias*	E, L, J, A	Uncommon
	Butter sole	*Isopsetta isolepis*	E, L, J, A	Uncommon
	Curlfin sole	*Pleuronichthys decurrens*	E, L, J, A	Uncommon
	Dover sole	*Microstomus pacificus*	E, L, J, A	Present
	English sole	*Parophrys vetulus*	E, L, J, A	Uncommon

Fisheries Management Plan	Species, Common Name	Species, Scientific Name	Life Stage[1]	Occurrence in Proximity to Grover Beach Site[2]
	Flathead sole	*Hippoglossoides elassodon*		Absent
	Pacific sanddab	*Citharichthys sordidus*	E, L, J, A	Common
	Petrale sole	*Eopsetta jordani*	E, L, J, A	Present
	Rex sole	*Glyptocephalus zachirus*	E, L, J, A	Uncommon
	Rock sole	*Lepidopsetta bilineata*	E, L, J, A	Uncommon
	Sand sole	*Psettichthys melanostictus*	E, L, J, A	Present
	Starry flounder	*Platichthys stellatus*	E, L, J, A	Present
Salmon	Chinook Salmon	*Oncorhynchus tshawytscha*	A	Present
	Coho Salmon	*Oncorhynchus kisutch*	A	Uncommon
	Pink Salmon	*Oncorhynchus gorbuscha*	A	Uncommon
Highly Migratory	Bigeye tuna	*Thunnus obesus*	A	Uncommon
	Blue Shark	*Prionace glauca*	A	Uncommon
	Common thresher shark	*Alopias vulpinus*	A	Present
	Dorado (mahi mahi, dolphinfish)	*Coryphaena hippurus*	A	Uncommon
	North Pacific Albacore	*Thunnus alalunga*	A	Present
	Pacific bluefin tuna	*Thunnis orientalis*	A	Uncommon
	Shortfin mako (bonito) shark	*Isurus oxyrinchus*	A	Uncommon
	Skipjack tuna	*Katsuwonus pelamis*	A	Uncommon
	Swordfish	*Xiphias gladius*	A	Present
	Striped marlin	*Tetrapturus audax*	A	Uncommon
	Yellowfin tuna	*Thunnus albacares*	A	Uncommon
All FMPs	Mesopelagic fishes	Families: *Myctophidae, Bathyalgidae, Paralepididae, and Gonostomatidae*		Absent
	Pacific sand lance	*Ammodytes hexapterus*	E, L, J, A	Uncommon
	Pacific saury	*Cololabis saira*	A	Uncommon
	Pelagic squids	Families: *Cranchiidae, Gonatidae, Histioteuthidae, Octopoteuhidae, Ommastrephidae* except Humboldt squid (*Dosidicus gigas*), *Onychoteuthidae, and Thysanoteuthidae*	E, L, J, A	Present
	Round Herring	*Etrumeus teres*		Absent
	Silversides	*Atherinopsidae*	E, L, J, A	Uncommon
	Smelts	*Osmeridae*	E, L, J, A	Present
	Thread herring	*Opisthonema libertate, Opisthonema medirastre*		Absent

[1]**E** = Egg, **L** = Larvae, **J** = Juvenile, **A** = Adult

[2]**Common** = Species that comprise the top 90% of commercial and/or recreational landings in thousands of pounds between 2013-2018.

Present = Species that comprise 9% of commercial and/or recreational landings in thousands of pounds between 2013-2018
Uncommon = Species that comprise the bottom 1% of commercial and/or recreational landings in thousands of pounds between 2013-2018

Absent = Not found within project area

Notes: Species not listed in landings data were assigned categories based on the factors of distribution, range, and life history.

Sources: CDFW Final California Commercial Landings Table 14MB, 2013 – 2018; PSMFC RecFIN Recreational Landings for Santa Cruz, Monterey, and San Luis Obispo Counties (Central California Region), 2013 – 2018; www.fishbase.org

Table 4-2: Morro Bay, CA Annual Commercial Landings in Thousand Pounds: CDFW 2013 – 2017

Common Name	Genus Species	2017	2016	2015	2014	2013	Mean	% Total Catch
Squid, market	*Doryteuthis opalescens*	2,297.0	1,413	1,260	4,322	4,266	2,2	47.58%
Crab, Dungeness	*Metacarcinus magister*	687.5	870.8	672.9	735.1	534.2	700.1	12.29%
Sablefish	*Anoplopoma fimbria*	361.5	551.0	519.7	726.4	722.1	576.1	10.11%
Hagfishes	*Myxini*	663.9	635.1	500.6	440.9	517.1	551.5	9.68%
Shrimp, ocean (pink)	*Pandalus jordani*	195.8	718.1	0.0	0.0	0.0	456.9	3.21%
Sole, Dover	*Microstomus pacificus*	11.5	92.8	143.2	159.0	240.9	129.5	2.27%
Thornyhead, shortspine	*Sebastolobus alascanus*	54.5	90.5	123.0	115.0	174.4	111.5	1.96%
Sole, petrale	*Eopsetta jordani*	53.6	108.4	78.3	91.3	81.8	82.7	1.45%
Lingcod	*Ophiodon elongatus*	43.4	46.1	61.8	62.4	36.6	50.1	0.88%
Thornyhead, longspine	*Sebastolobus altivelis*	8.4	24.7	24.2	43.5	108.6	41.9	0.74%
Rockfish, gopher	*Sebastes carnatus*	42.9	39.5	46.0	40.9	40.3	41.9	0.74%
Crab, rock unspecified	*NA*	18.7	32.0	74.4	13.5	70.6	41.8	0.73%
Rockfish, bank	*Sebastes rufus*	12.9	29.3	32.4	58.4	65.4	39.7	0.70%
Rockfish, brown	*Sebastes auriculatus*	27.6	33.8	42.3	43.1	48.9	39.1	0.69%
Salmon, Chinook	*Oncorhynchus tshawytscha*	27.7	29.0	36.2	18.7	68.6	36.1	0.63%
Cabezon	*Scorpaenichthys marmoratus*	24.8	36.8	39.6	34.5	31.8	33.5	0.59%
Crab, red rock	*Cancer productus*	37.7	37.4	22.8	28.5	7.1	26.7	0.47%
Rockfish, chillipepper	*Sebastes goodei*	3.1	58.6	36.2	22.0	11.6	26.3	0.46%
Grenadier	*Macrouridae*	7.3	20.0	15.9	31.3	51.3	25.2	0.44%
Swordfish	*Xiphias gladius*	45.9	27.2	16.3	8.7	12.7	22.2	0.39%
Prawn, spot	*Pandalus platyceros*	18.9	21.2	22.7	15.4	21.4	19.9	0.35%
Rockfish, vermilion	*Sebastes miniatus*	16.9	16.1	20.2	18.2	18.0	17.9	0.31%
Rockfish, blackgill	*Sebastes melanostomus*	12.5	12.5	5.6	13.6	42.1	17.2	0.30%
Rockfish, black and yellow	*Sebastes chrysomelas*	18.6	15.5	17.5	15.6	15.9	16.6	0.29%
Halibut, California	*Paralichthys californicus*	21.0	18.5	14.2	7.3	12.1	14.6	0.26%
Crab, brown rock	*Cancer pagurus*	17.7	42.5	1.2	1.1	0.0	15.6	0.22%
Rockfish, grass	*Sebastes rastrelliger*	9.9	7.9	15.1	9.9	11.7	10.9	0.19%
Surfperch, barred	*Amphistichus argenteus*	5.8	13.2	22.7	7.3	5.5	10.9	0.19%
Skate, longnose	*Raja rhina*	0.3	0.4	2.9	2.9	34.9	8.3	0.15%
Rockfish, bocaccio	*Sebastes paucispinis*	4.5	19.0	8.6	3.2	2.3	7.5	0.13%
Seabass, white	*Atractoscion nobilis*	7.1	4.4	4.9	11.3	1.8	5.9	0.10%
Opah	*Lampris*	16.2	4.9	2.5	2.3	3.4	5.8	0.10%
Shark, thresher	*Alopias vulpinus*	6.7	2.9	13.0	2.1	1.5	5.3	0.09%
Tuna, albacore	*Thunnus alalunga*	3.5	2.3	3.0	4.9	11.2	5.0	0.09%
Sole, sand	*Psettichthys melanostictus*	0.4	0.3	9.3	5.2	7.0	4.4	0.08%
Greenling, kelp	*Hexagrammos decagrammus*	2.8	3.7	5.3	4.9	4.9	4.3	0.08%

Data source: CDFW Final California Commercial Landings, Table 14MB: 2013 - 2017. Species shown account for 99% of mean annual commercial landings in pounds in the Morro Bay area. Fished species comprising the remaining 1% include: Rockfish, treefish; Rockfish, blue; Sardine, Pacific; Crab, yellow rock; Rockfish, copper; Shark, shortfin mako; Tuna, bluefin; Rockfish, splitnose; Whiting, Pacific; Sole, English; Rockfish, black; Anchovy, northern; Surfperch, unspecified; Rockfish, aurora; Whelk, Kellet's; Prawn, ridgeback; Sanddab, Pacific; Mackerel, Pacific; Sheephead, California; Flounder, starry; Sea urchin, red; Bonito, Pacific; Rockfish, kelp; Rockfish, yellowtail; Sea cucumber, warty; Shark, Pacific angel; Shark, unspecified; Shark, sevengill; Shark, soupfin; Surfperch, calico; Barracuda, California; Sole, rex; Sole, unspecified; Skate, unspecified; Rockfish, widow; Louvar; Rockfish, group shelf; Crab, spider; Tuna, skipjack; Sea cucumber, giant red; Lobster, California spiny; Skate, big; Rockfish, China; Rockfish, group red; Rockfish, olive; Rockfish, canary; Rockfish, darkblotched; Yellowtail; Rockfish, cowcod; Rockfish, redbanded; Lizardfish, California; Jacksmelt, Octopus unspecified; Turbot; Sole, fantail; Rockfish, group slope; Rockfish, starry; Tuna, yellowfin; Whitefish, ocean; Ray, bat; Sole, rock; Rockfish, unspecified; Shark, spiny dogfish; Shark, leopard; Crab, tanner; Smelt, night; Prickleback, monkeyface (eel); Croaker, white; Shark, swell; Flounder, unspecified; Splittail; Snail, sea; Squid, jumbo; Sole, curlfin; Rockfish, Mexican; Surfperch, shiner; Rockfish, bronzespotted; Scorpionfish, California; Mackerel, unspecified; Halfmoon; Ray, unspecified; Surfperch, pile; Skate, California; Guitarfish, shovelnose; Rockfish, speckled; Surfperch, redtail; Smelt, surf; Rockfish, yelloweye; Rockfish, quillback; Stingray; Pomfret, Pacific; Shark, blue; Shad, American; Rockfish, rosy; Shrimp, bay; Surfperch, rubberlip; Rockfish, greenspotted; Butterfish (Pacific pompano); Seabass, striped; Mackerel, jack; Turbot, curlfin; Ray, Pacific electric; Rockfish, flag; Rockfish, Pacific ocean perch; Rockfish, group bolina; Thornyheads; Shark, brown smoothhound; Ratfish, spotted; Rockfish, greenstriped; Crab, box; Rockfish, shortbelly; Shark, sixgill; Sunfish, ocean; Sanddab; Skate, thornback; Fish, unspecified; Flounder, arrowtooth; Rockfish, greenblotched; Kelpfishes; Rockfish, rougheye; Surfperch, silver; Rockfish, stripetail; Surfperch, black; Crab, spider/sheep claws; Rockfish, pink; Rockfish, shortraker; Sole, slender.

Table 4-3: Central California Annual Recreational Fish & Invertebrate Landings: RecFin 2013 - 2018

Fish Species		Recreational Landings (metric tons)							
Common Name	**Genus Species**	**2018**	**2017**	**2016**	**2015**	**2014**	**2013**	**Mean**	**% Total Catch**
Lingcod	*Ophiodon elongatus*	41.0	164.0	184.6	216.2	215.2	150.1	161.9	23.57%
Rockfish, vermilion	*Sebastes miniatus*	63.7	121.2	79.2	79.6	55.9	41.1	73.5	10.70%
Surfperch, barred	*Amphistichus argenteus*	0.4	83.8	103.4	128.4	64.0	47.5	71.2	10.37%
Rockfish, blue	*Sebastes mystinus*	26.5	81.9	83.1	91.0	74.5	48.6	67.6	9.84%
Rockfish, yellowtail	*Sebastes flavidus*	15.0	26.4	18.0	49.7	35.7	36.1	30.2	4.39%
Rockfish, gopher	*Sebastes carnatus*	8.2	27.0	41.4	34.9	36.2	22.5	28.4	4.13%
Rockfish, copper	*Sebastes caurinus*	17.0	54.5	30.2	24.1	18.6	12.9	26.2	3.82%
Rockfish, brown	*Sebastes auriculatus*	9.9	23.7	18.8	21.5	41.5	33.1	24.7	3.60%
Rockfish, black	*Sebastes melanops*	1.9	4.2	16.0	18.5	24.4	54.7	20.0	2.90%
Rockfish Genus	*Sebastes*	0.0	0.0	0.0	6.1	13.7	76.6	16.1	2.34%
Sanddab, Pacific	*Citharichthys sordidus*	4.3	9.8	11.1	12.0	36.5	7.5	13.5	1.97%
Rockfish, olive	*Sebastes serranoides*	6.7	14.1	21.1	21.9	10.8	3.5	13.0	1.89%
Cabezon	*Scorpaenichthys marmoratus*	1.6	9.4	16.4	18.2	18.0	11.9	12.6	1.83%
Rockfish, bocaccio	*Sebastes paucispinis*	10.6	39.9	8.6	6.8	5.1	4.3	12.6	1.83%
Mackerel, Pacific (Chub)	*Trachurus symmetricus*	0.3	1.6	7.6	47.9	8.5	2.4	11.4	1.66%
Halibut, California	*Paralichthys californicus*	7.6	6.7	6.4	6.7	23.1	16.9	11.2	1.63%
Smelt, Jacksmelt	*Atherinopsis californiensis*	1.6	11.8	6.8	17.0	9.1	11.8	9.7	1.41%
Crab, dungeness	*Metacarcinus magister*						39.9	39.9	0.97%
Rockfish, kelp	*Sebastes atrovirens*	1.1	7.3	6.6	6.6	8.0	8.7	6.4	0.93%
Rockfish, canary	*Sebastes pinniger*	8.5	26.6	0.5	0.4	0.7	0.5	6.2	0.90%
Seaperch, striped	*Embiotoca lateralis*	0.0	8.0	4.6	6.1	5.2	5.8	5.0	0.72%
Rockfish, black and yellow	*Sebastes chrysomelas*	1.1	8.2	3.5	6.8	5.5	3.9	4.8	0.70%
Bass, striped	*Morone saxatilis*	0.2	3.3	8.4	12.5	0.0	2.3	4.4	0.65%
Rockfish, starry	*Sebastes constellatus*	3.8	7.7	3.0	3.5	2.3	2.8	3.9	0.56%
Rockfish, grass	*Sebastes rastrelliger*	0.3	3.5	2.7	4.4	5.3	4.7	3.5	0.51%
Bonito, Pacific	*Sarda lineolata*		0.2	1.3	18.1	0.5		5.0	0.49%
Greenling, kelp	*Hexagrammos decagrammus*	0.2	4.7	2.1	5.0	3.2	2.8	3.0	0.44%
Surfperch, calico	*Amphistichus koelzi*	0.1	1.8	3.4	5.3	2.5	4.6	3.0	0.43%
Mackerel, Jack	*Trachurus symmetricus*	0.2	8.9	1.1	5.0	2.1	0.3	2.9	0.43%
Seabass, white	*Atractoscion nobilis*	0.6	2.0	0.8	1.7	9.1	0.2	2.4	0.35%
Croaker, white	*Genyonemus lineatus*	0.6	2.5	0.8	1.9	3.5	3.3	2.1	0.31%
Surfperch, walleye	*Hyperprosopon argenteum*	0.3	2.1	1.3	1.2	2.1	3.0	1.7	0.24%
Rockfish, China	*Sebastes nebulosus*	0.6	1.6	2.1	2.2	1.9	1.2	1.6	0.23%
Rockfish, widow	*Sebastes entomelas*	2.6	1.9	0.4	1.3	2.1	1.1	1.6	0.23%
Surfperch, silver	*Hyperprosopon ellipticum*	0.0	1.9	2.2	3.3	0.7	1.2	1.5	0.23%

Fish Species		Recreational Landings (metric tons)							
Common Name	**Genus Species**	**2018**	**2017**	**2016**	**2015**	**2014**	**2013**	**Mean**	**% Total Catch**
Squid Class	*Cephalopoda*					0.0	8.0	4.0	0.19%
Common Name	**Genus Species**	**2018**	**2017**	**2016**	**2015**	**2014**	**2013**	**Mean**	**% Total Catch**
Surfperch, black	*Embiotoca jacksoni*	0.0	2.2	1.5	1.6	1.3	0.4	1.2	0.17%
Rockfish, treefish	*Sebastes serriceps*	0.5	1.5	1.2	1.7	1.5	0.6	1.2	0.17%
Rockfish, greenspotted	*Sebastes chlorostictus*	1.8	4.2	0.1	0.1	0.2	0.6	1.2	0.17%
Skate, big	*Beringraja binoculata*			0.0	0.0	0.0	6.4	1.6	0.16%
Anchovy, northern	*Engraulis mordax*	0.7	2.1	0.0	0.4	1.9	0.3	0.9	0.13%
Rockfish, rosy	*Sebastes rosaceus*	1.3	1.7	0.7	0.6	0.6	0.5	0.9	0.13%
Eel, monkeyface prickleback	*Cebidichthys violaceus*	0.0	0.8	0.6	1.3	1.0	1.3	0.8	0.12%
Perch, pile	*Rhacochilus vacca*	0.3	1.6	0.5	0.5	1.2	0.5	0.8	0.11%
Sardine, Pacific	*Citharichthys sordidus*	0.1	0.1	0.4	0.6	2.3	0.9	0.7	0.11%
Ray, bat	*Myliobatis californica*	0.0	1.2	1.4	0.4	1.2	0.1	0.7	0.11%
Shark, spiny dogfish	*Squalus acanthias*	1.5	1.3	0.0	0.3	0.5	0.3	0.7	0.10%
Surfperch Family	*Embiotocidae*	0.0	0.0	0.0	0.1	1.6	2.3	0.7	0.09%

Data Source: PSMFC RecFIN, Central California (San Luis Obispo, Monterey, and Santa Cruz Counties) 2013 – 2018. Species shown account for 99% of mean annual recreational landings in metric tons in the Santa Cruz – San Luis Obispo region. Fished species comprising the remaining 1% include: Unidentified Fish; Flounder, starry; Crab, red rock; Lizardfish, California; California Sheephead; Shark, unidentified; Rockfish, flag; Guitarfish, shovelnose; Perch, shiner; Skate And Ray Order; Sole, rock; Shark, leopard; Seaperch, rubberlip; Eel, wolf; Whitefish, ocean; Seaperch, white; Seaperch, rainbow; Greenling, rock; Rockfish, speckled; Sole, sand; Halfmoon; Sole, petrale; Sculpin, Pacific staghorn; Opaleye; Sablefish; Rockfish, yelloweye; Blacksmith; Rockfish, quillback; Barracuda, Pacific; Surfperch, redtail; Smelt, Topsmelt; Seaperch, sharpnose; Rockfish, squarespot; Sculpin Family; Shark, soupfin; Rockfish, greenstriped; Rockfish, chilipepper; Bass, kelp; Rockfish, calico; Lizardfish, California; Herring, Pacific; Thornback; Cowcod; Flatfish Order; Silverside Family; Rockfish, tiger; Rockfish, stripetail; Kelpfish, giant; Shark, gray smoothhound; Shark, brown smoothhound; Triggerfish, finescale; Surfperch, spotfin; Eulachon; Pompano, Pacific (Butterfish); Rockfish, bank; Sanddab Genus; Sanddab, speckled; Greenling, painted; Rockfish, greenblotched; Senorita; Sanddab, longfin; Skate, Longnose; Turbot, diamond; Sole, curlfin.

The following discussion is primarily focused on marine invertebrates and algae that inhabit the coastal subtidal waters of south central and northern Southern California out to approximately 1,200 m (3,937 ft.) water depth. The sub-sections below discuss specific species of concern inhabiting subtidal soft and hard substrate habitats offshore Grover Beach that may be at greater risk to fiber optic cable installations than other marine biota.

6.2 FESA/CESA Protected Invertebrate Species

6.2.1 Soft Substrate Species

Sand dollars (*D. excentricus*) are considered by some California agencies as a species of special concern. They form dense beds in the shallow subtidal zone of open sandy beaches in water depths between 4 (13 ft.) and 12 m (39 ft.), typically just offshore of the wave zone (Merrill & Hobson 1970). As would be expected, they move locations frequently and are easily subject to physical disturbance. Most cable landings go beneath the seafloor at water depths ranging between 10 (33 ft.) and 25 m (82 ft.) water depth, connecting with the horizontal bore hole or pipeline of the onshore segment of the cable. As such, it is unlikely that sand dollar beds would be affected by fiber-optic cable installations.

6.2.2 Hard Substrate (Sessile) Invertebrate Species

In general, hard substrate habitat occurrence offshore California, when compared to the extent of soft substrate habitat, is relatively limited. As indicated in the discussion above, the occurrence of high-relief hard substrate typically results in the presence of species that may be considered more susceptible to impacts from mechanical disturbance, such as cable installation. The most susceptible species to these types of impacts are usually large (e.g., more than 0.3 m (1 ft.) in height), slow growing (a few to several centimeters per year), and relatively delicate/brittle or soft/friable in body form (e.g. branching corals and erect sponges, respectively). (Lissner *et al*. 1991; Hardin *et al*. 1994). For example, large erect sponges (*Demospongiae*) in a variety of colors are slow growing, and similar to the California hydrocoral, *Stylaster californica*, require several years to achieve sizes of 30 cm (11.8 in.) or more (e.g., Lissner *et al.* 1991; Hardin *et al.* 1994, SAIC-SLO 1999). These species are of special concern due to their natural history characteristics. Following natural or human-related disturbance, recolonization and recovery can take years due to their limited dispersal abilities and slow growth.

6.2.3 White Abalone *(Haliotis sorenseni);* Green Abalone (*Haliotis fulgens*); Pink Abalone (*Haliotis corrugate)*

Abalones are large marine herbivorous gastropods that live in rocky ocean waters. White abalone typically occurs at depths of 24-30 m (80-100 ft) in low and high-relief rock or boulder habitats interspersed with sand channels (NOAA 2015b). White Abalone is listed as endangered under FESA and occurs only in coastal waters south of Point Conception. Green abalone is listed as a species of concern. This species resides in shallow water on open, exposed coastal areas in the low intertidal to at least 9 m (30 ft) water depth and in some locations as deep as 18 m (60 ft). Like the white abalone, green abalone only occurs south of Point Conception. Pink abalone is also listed as a species of concern. This species occupies sheltered waters at depths between 6 - 36 m (20 - 118 ft). Pink abalone also only occurs south of Point Conception.

6.2.4 Black Abalone (*Haliotis cracherodii*)

The black abalone is found inhabiting rocky intertidal and very shallow subtidal habitats. It is listed as endangered under FESA. Black abalone reaches maturity at about 3 years old and Southern California populations primarily eat giant kelp and feather boa kelp (NOAA 2015a). During low tides, these marine gastropods can typically be found wedged into crevices of intertidal and shallow subtidal rocks. Black abalone ranges from Point Arena, California to Bahia Tortugas and Isla Guadalupe, Mexico (NOAA 2015a). However, black abalone populations have experienced significant declines in abundance and have gone locally extinct in most locations south of San Simeon, California, along the Central California coast (Bell 2013). Prior to these declines, scientists estimated the abundance of black abalone at >3 million (NOAA 2015a). The primary factors leading to the declines are overfishing and withering syndrome, which struck black abalone at the northern Channel Islands in 1985 (NOAA 2015a). The disease appears to be more prevalent in locations where water temperatures are relatively warmer. Populations observed at Santa Cruz, California and northward along the California coast appear to be doing better than those areas in south Central and southern California (Bell 2013). Die-offs also seem to occur in habitats where water temperatures are elevated by thermal discharge from power plants. As population densities decrease, the increasing distance among potentially spawning males and females has also led to reproductive failure.

6.2.5 Red Abalone (*Haliotis rufescens*)

Most commonly found in Northern California, red abalone (*Haliotis rufescens*) inhabit intertidal and shallow subtidal rocky substrate between Bahia Tartugas, Baja California to Oregon. While red abalone predominantly inhabits rocky hard substrate, it is known to move across sand or gravel regions between isolated rocky substrate features. Red abalone inhabits water depths ranging between the intertidal zone to approximately 180 m (590 ft), but are most common between 6 and 40 m (20 and 131 ft) water depth (CDFG 2001).

Red abalone is a broadcast spawner that aggregates in clusters for reproduction. Young abalone, including post larva and juveniles, forage on bacteria, diatoms and single celled algae. Adult abalone forage on brown algae, and when food is scarce, feed on benthic diatom films.

Mortality of red abalone is typically due to predators, anthropogenic impacts, environmental conditions and disease (CDFG 2005). Although neither currently protected under Federal or State endangered species regulations, nor identified as a species of special concern, red abalone is a major recreational fishery in Northern California and recent declines in abundance and the recent closure of the fishery elevates this species to a status of special concern by the State of California.

All species of abalone were part of a commercial and recreational fishery offshore California until 1997 when the CDFW closed the commercial fishery due to crashing abalone populations. A red abalone recreational fishery was left open north of San Francisco, however this was reduced in size with an indefinite closure of the Fort Ross area after a high mortality event as a result of a harmful algal bloom (The Press Democrat 2014). The CDFW closed the red abalone recreational fishery at the end of 2017. The CDFW cite low stock abundances, starving abalone, and high mortalities as reason for the closure and is developing the Red Abalone Fisheries Management Plan that will identify what conditions need to be met for reopening the fishery (CDFW 2018).

6.3 Deep-Sea Corals

Deep-sea or cold-water corals are a diverse group of organisms with thousands of species found worldwide. Many of these corals provide habitats for a myriad of marine species. Deep-sea corals occur primarily on hard bottom substrate on the continental shelf and slope, offshore canyons, and on oceanic island slopes and seamounts. Deep-sea corals are HAPC for groundfish and other managed fish species under the MSA.

Deep-sea coral ecosystems are typically long lived, slow growing, and fragile, which makes them especially vulnerable to physical disturbances and damage. Along the west coast of North America, 101 species of corals have been identified, consisting of 18 species of stony corals, 7 species of black corals, 36 species of gorgonian or soft corals, 8 species of true soft corals, 27 species of pannatulaceans or sea pens, and 5 species of stylastid corals (Lumsden *et al.* 2007). Many of these species and taxa are designated as “structure-forming,” meaning they are known to provide vertical structure above the seafloor that can be utilized by other invertebrates or fish (NOAA 2010; Whitmire & Clarke 2007).

The most common stony corals observed offshore California are the solitary cup corals (e.g., *Balanophyllia elegans*, *Paracyathus stearsii*) and branching corals (e.g., *Lophelia pertusa, Oculina profunda, Madrepora oculata*, *Dendrophyllia oldroydae, Astrangia haimei*, *Labyrinthocyathus quaylei* and *Coenocyathus bowersi*). Black corals, which are represented by only seven species, are considered vary abundant along the Pacific coast, with *Antipathes sp*. and *Bathypathes sp*. exhibiting coast wide distributions, while the other five species appear to be limited to seamounts (Whitmire & Clarke 2007). Gorgonians are the most populous group of corals off the Pacific coast. *Eugorgia rubens* (purple gorgonian) and *Adelogorgia phyllostera* (orange gorgonian) are commonly observed in the nearshore coastal waters, whereas *Paragorgia arborea* (bubblegum coral), although found in high abundance region-wide, inhabits water depths greater than 200 meters. Gorgonian and black corals have branching tree-like forms and can occur singly or form thickets. These three-dimensional features and vertical structures provide habitat for numerous fish and invertebrate species and enhance the biological diversity of many deep-sea ecosystems.

Included with deep-sea corals are sea pens (order Pennatulacea), which occur over soft-bottom substrates and are the most abundant coral taxon in the region. Some sea pens are quite mobile and can move from one location to another. *Stylatula sp*., *Anthoptilum grandiflorum* and *Umbellula sp*. are the most common taxa, all of which are found coast wide. Although groves of pennatulaceans have been shown to support higher densities of some fish species over adjacent areas, they are not considered to be structure forming (Brodeur 2001).

Lace corals or stylasterid corals have been observed colonizing moderate to high-relief rocky habitats from the intertidal zone down to shelf water depths. Only five species from three genera are known to occur along the Pacific west coast with *A. californica* being the only species known to occur in California.

A. californicus has a calcareous skeleton and forms upright pink to dark blue branching colonies. This species is characterized by very slow growth (e.g. 5 to 10 years to reach sexual maturity, possibly more than 20 years to grow to a height of 30 cm) (Thompson, *et al*. 1993; Gotshall 1994). *Allopora* has no planktonic larval stage and fertilization between adult colonies more than 10 meters apart is rare.

In recent years, NOAA has developed an increased interest in these ecosystems and especially the potential for impacts from bottom contact fishing activities (NOAA 2014a). Deep-sea coral are being evaluated for designation as EFH within the Pacific Coast Groundfish FMP, and likely will be designated once the 5-year review is complete.

Unfortunately, there is limited information concerning known occurrences of deep-sea coral offshore Southern California. This is in part due to the difficulty and expense of locating and surveying deep-sea hard substrate habitat. Much of what the scientific community knows about their presence is as a direct result of manned submersible and ROV surveys of fiber optic cable routes or oil and gas exploration sites.

Christmas tree coral (*Antipathes dendrochristos*), a species of black coral that occurs in the Southern California Bight, has been documented around Piggy Bank and on Hidden Reef north of Santa Catalina Island; there are also a few documented occurrences around San Nicolas Island (Huff *et al.* 2013). Huff *et al.* (2013) mapped ocean currents, primary productivity (chlorophyll), and temperature against known locations of Christmas tree coral to develop a predictive model for the SCB. These environmental correlates predict bands of low occurrence, interspersed with isolated pockets of high occurrence, in the project area. Specific locations of coral within these bands and pockets depend on the availability of hard bottom substrate. Guinotte & Davies (2014) developed a habitat suitability model for multiple species of deep-sea coral for the U.S. West Coast. They reported bands of suitable habitat associated with specific bathometric features in the project area. Both studies show suitable deep-sea coral habitat in places that would be crossed by the proposed cable routes. Specific locations where the proposed cable routes may encounter deep-sea coral are the following:

- Bottom slopes south of the Channel Islands and around Piggy Bank;
- High-relief bottom between Santa Barbara Island and the Channel Islands;
- High-relief bottom between San Nicolas Island and the Channel Islands.

6.4 Kelp and Sea Grasses (Submerged Aquatic Vegetation)

The giant brown kelp (*Macrocystis pyrifera*) forms large dense forests in the nearshore waters of Southern California and some locations in Central California, as well as throughout the Channel Islands where clear water allows them to grow in depths exceeding 30 m (100 ft.). The more dominant “forest” forming algae in Central California is bull kelp (*Nereocystis luetkeana*). Bull kelp is an annual that releases spores in the spring that grow throughout the year and then die (Springer *et. al* 2007). Kelp forests are home to many marine animals and act as spawning and nursery grounds for many invertebrates and fish. *Macrocystis* and *Nereocystis* anchor themselves to the seafloor by attaching their holdfasts to small boulder-sized rocks or rocky outcroppings. Both *Macrocystis* and *Nereocystis* beds occur throughout Central California and are known to be present offshore Grover Beach. Extensive bull kelp beds occur north of Grover Beach, north of the Pismo Beach Pier. Some isolated bull kelp plants may be present in sporadic gravel/cobble beds offshore Grover Beach.

Surfgrass (*Phylospadix*) is a flowering marine plant in the family *Zosteraceae* and can be found throughout coastal California where suitable habitat occurs. It is most commonly observed attached to rocks in middle to low intertidal zones, but where conditions are favorable, it can occur to depths of 15 m. The closest known occurrence of surfgrass is at Shell Beach, 3 miles north of Grover Beach, where extensive intertidal and shallow subtidal rock shelf outcropping occur.

7 Potential Effects of Fiber Optic Cable Installation and Operation on Intertidal and Subtidal Marine Communities

The installation, maintenance, and ultimate abandonment/removal of a subsea fiber optic cable located in the coastal waters of California can be expected to result in disturbances to the communities that the cable traverses. These impacts would likely vary, not only with respect to the route and substrate type, but also according to installation methods which will depend on water depth and substrate type. In shallow water soft-sediment areas, divers or ROVs are typically used to bury the cable using a water jet to create a channel into which the cable is laid. Typically, the cable channel is allowed to self-bury. In deeper soft-bottom areas, a cable installation plow is employed to dig a 1 m (3.3 ft) deep trench in the seafloor, place the cable into the trench, and then refill the trench with the excavated sediment.

In the event a proposed cable route contains hard substrate features, the final routing of the cable will avoid, to the maximum extent feasible, moderate- and high-relief outcrops, especially in high energy environments in water depths less than 33 m (100 ft). If placement along mixed bottom or low- to moderate-relief habitat is unavoidable, the cable is typically laid onto the seafloor and either a ROV or divers are used to properly position the cable around isolated exposed outcrops or high relief features and to locate the cable so that minimum contact with more sensitive hard bottom habitat occurs.

In addition to direct physical disturbance of marine habitats by cable placement or burial during installation, other potential effects include:

- Short term and isolated, increased water turbidity during cable burial in soft seafloor sediments with a cable plow or by ROV or diver trenching activities,
- Potential release of drilling fluids during the boring of the fiber optic cable landfall conduits,
- Underwater noise from marine construction work vessels and cable laying activities, and
- Accidental release of hydrocarbon containing fuel oils and lubricants by work vessels engaged in cable installation and landfall conduit horizontal directional drilling (HDD) activities.

Numerous fiber optic cables have been installed in the coastal waters of California, Oregon and Washington over the past several decades (SAIC-SLO 1999, SAIC 1999, AMS 1999b, SAIC 2000, MBC 2001, MBARI 2004, AMS 2008, AMS 2016). Within California, landfalls have occurred in Southern California (San Diego, Hermosa Beach, Manhattan Beach, Los Angeles, and Santa Barbara), Central California (Montana de Oro, Grover Beach, Estero Bay, and Moss Landing), and Northern California (Manchester Beach). CEQA and NEPA documents prepared for these projects discuss in detail the potential impacts to marine biota from the installation, operation and removal/abandonment of fiber optic cables. Mitigation measures outlined in these documents can be assessed for their efficacy in preventing or minimizing the potential effects to marine resources. Additionally, pre- and post-cable lay ROV surveys have been performed that provide information on the longevity and severity of potential effects to marine habitats and biota. Finally, the effects of cable installation and operation on marine soft and hard substrate habitats and associated biological communities have been assessed in a number of diverse locations including the Olympic Coast National Marine Sanctuary, Washington (NOAA 2018b), Monterey Bay, California (Kogan *et. al* 2006, Kunz *et. al* 2015), coastal waters in Australia (Sherwood *et. al* 2016), and multiple other locations worldwide (Kraus and Carter 2018).

Potential effects will undoubtedly vary between each project depending on project specifics, route, location along the coast, and technical approach for installation. The following discussion provides a brief synopsis of potential marine effects to marine biological resources from fiber optic cable installation and operation, and outlines operational actions that can be employed to prevent significant impact to marine ecosystems.

7.1 Soft-bottom Habitat & Associate Biota

Effects to soft-sediment biota during cable installation, operation, or abandonment can be expected to be short-term and therefore temporary (Kraus and Carter 2018, Antrim *et al*. 2018, Kunhz *et. al* 2015, Kogan *et. al* 2006). The use of a cable plow to create a furrow along the seafloor into which the fiber optic cable is placed and buried can be expected to result in a temporary disturbance of benthic infauna (animals living in the sediments of the seafloor) and epifauna (animals living on the surface of the seafloor). It is estimated that the actual area of disturbance is less than 8 meters (26 ft.) wide with the most severe effects being limited to the 1 m (3.3 ft) wide trench made by the plow (Kraus and Carter 2018). Many motile epifaunal invertebrates and fish can be expected to avoid the plow and return to the area shortly after the plow has left and the trench has been refilled. Any benthic infauna inhabiting the upper sediment layers disturbed by the plow are assumed to be smothered and killed. This loss, however, will occur in a small area of the seafloor relative to the surrounding area. The infaunal community inhabiting the adjacent, undisturbed sediments will be expected to rapidly start recolonizing the affected area. Recolonization will occur both by migration from adjoining, undisturbed seafloor areas and by natural recruitment (Kunhz *et. al* 2015, Kraus and Carter 2018, Antrim 2018, Kogan *et. al* 2006).

Studies of the ATOC/Pioneer seamount cable (Kogan *et. al* 2006), the PAC fiber optic cable in the Olympic Coast National Marine Sanctuary (Antrim *et. al* 2018), the MARS fiber optic cable in the Monterey Bay National Marine Sanctuary (Kunhz *et. al*. 2015), and other submarine cables worldwide (Kraus and Carter 2018) found that recolonization of soft sediment communities was fairly rapid, beginning within weeks of the disturbance, but full recovery of the community could take up to a couple of years. Key factors in the recovery of seafloor sediments was water depth, sediment composition, level of energy present, and whether the location was depositional or erosional in nature. Studies that specifically investigated benthic infaunal and epifaunal communities along the cable routes found no significant differences in community composition between studied sites adjacent to the installed cables and comparison sites several 100 meters distant from the cables (Kogan *et. al* 2006, Kunhz *et. al*. 2015, Antrim *et. al* 2018). A similar study on a high voltage direct current power cable installation offshore Australia concluded that the ecological effects of the cable installation on soft substrate epibiota were transient and minor (Sherwood *et. al* 2016).

These findings are similar to findings from studies of offshore sand mining operations in the Gulf of Mexico and in the Atlantic Ocean where large areas of sand are removed for shoreline restoration. These studies have shown that recovery of the benthic infaunal and epifaunal community to comparable pre-disturbance conditions typically occurs within a couple years following the disturbance (Hammer *et al.* 1993; Van Dolah *et al*. 1992). The key factors influencing the speed of recovery in these studies were (1) when the impact occurred relative to seasonal periods of spawning and recruitment, and (2) the proximity of undisturbed sediment to the disturbed/impacted area.

Because the disturbance to benthic infauna during the proposed cable installation offshore Eureka, CA does not involve permanent sediment removal, and the distance between disturbed and undisturbed sediment will typically be less than 0.5 meters, recovery to pre-disturbance conditions is expected to be relatively rapid, requiring a couple of years or less for full recovery.

Disturbances resulting from laying cable in shallow water areas with coarse sand can be similar to disturbances in deeper areas covered with fine sediments, despite the existence of different types of sediments. Similar levels of disturbance may also result even if different methods of cable burial are employed, such as ROVs or cable plows. In the very nearshore areas, in water depths less than 30.5 m (100 ft), the seafloor and associated biota experience frequent and regular disturbances from wave action. As a result of this high energy, constantly changing environment, the associated biological community has adapted to frequent exposure and burial. The infaunal community is typically limited in species diversity and consists primarily of filter feeders (e.g. tube worms, sand dollars, sand anemones) and detrital feeders (e.g. shrimp and crabs). These taxa also tend to be highly motile and as a result, any effects to the habitat and associated biota can be expected to be undetectable within a few days or months of cable installation.

During cable plowing and trenching activities, temporary spikes in near-seafloor turbidity may occur. Increased turbidity is typically restricted to the water immediately above and adjacent to the seafloor where the plowing or trenching occurs. Depending on water depth, natural wave and current energy, turbidity plumes (i.e. resuspended sediments) generated from the trenching can be expected to resettle to the seafloor quickly. During ROV surveys of cable routes, seafloor sediments are frequently disturbed by the ROV thrusters and generate turbidity plumes similar to those generated by cable plows (AMS 2008, AMS 2016). These turbidity plumes also quickly dissipate within minutes following the disturbance.

Similar to increases in turbidity from cable trenching and plowing activities, HDD boring of conduits can result in turbidity increases through the accidental release of bentonite drilling fluid to the seafloor and nearshore subtidal habitats. Bentonite is a marine clay that is used for lubricating the borehead cutting tool and transporting borehole cuttings back to shore. The HDD boring process typically terminates the landfall conduit installation at water depths between 12-17 m (40 and 55 ft). In general, the offshore termination point along the cable route is selected to occur in soft sediment habitat. Throughout most of California, the seafloor sediments occurring at these water depths are composed of sand with some minor silt and clay components. Coastal seafloor sediments at these water depths are also typically exposed to wind and wave surge, as well as regular resuspension of seafloor sediments, resulting in naturally occurring increased turbidity near the seafloor.

The accidental release of small volumes of bentonite drilling fluid into this environment is not expected to result in any detectable effects on marine biota above that which may be naturally occurring in the area of release, or result in any permanent changes to soft substrate habitat. Any released bentonite clay would be expected to be quickly resuspended by wind- and wave-generated surge present at these shallow water depths and transported with similar sized sediment particles to natural depositional areas along the coast. Any potential increased turbidity resulting from the accidental release of bentonite drilling fluid would be expected to be either non-detectable against existing background turbidity conditions at the release site or to be quickly dissipate similar to any increased turbidity caused by cable trenching or ploughing.

The greatest potential for substantive effects to marine habitats and associated marine biota from the accidental release of bentonite drilling fluids during HDD boring activities is if a large volume of fluid is released. Such a large release could result in the short-term smothering and burial of benthic epifauna and infauna, as well as clogging of fish gills (Robertson-Bryan 2006). It could also cause longer-term increased turbidity in the area of the release. Early detection of any accidental release of bentonite drilling fluid, and the immediate cessation of HDD drilling activities until operational steps can be taken to stop the release of drilling fluid, are key to limiting the potential effects on marine habitats and biological resources. Preparation and implementation of an HDD monitoring plan that details procedures for preventing the accidental release of drilling fluid during HDD work, as well as operational and release response procedures in case of a drilling fluid release, can prevent the inadvertent discharge of large volumes of bentonite drilling fluid to the marine environment. A key and critical component of an HDD monitoring plan is the inclusion of rhodamine dye into the drilling fluid, paired with continuous monitoring, to detect its presence in the ocean water above the HDD borehole route during active HDD boring activities. Since 2000, bentonite drilling fluid has been detected very infrequently among a total of 28 fiber optic cable landing projects using HDD boring technology that implemented monitoring programs. In two cases where drilling fluid was detected, the boreholes were going through highly fractured sedimentary rock close to the seafloor surface, and were about to exit the seafloor. The early detection of rhodamine dye placed in the drilling fluid as part of the monitoring program, the immediate cessation of HDD boring activities, and in both cases the conversion to fresh water for lubrication, as outlined in the HDD monitoring and response plan, resulted in no continued detectable presence of bentonite on the seafloor or deleterious effects to marine taxa.

The use and operation of marine construction equipment and vessels always poses some risk of an accidental release of hydrocarbon-based products such as fuel oil, diesel fuel, lubricants, hydraulic fluids, etc. Depending on the quantity released, the accidental release of these products into the marine environment has the potential to impact marine habitats and taxa. These impacts could come from oiling, destruction or degradation of habitat, food sources, nursery grounds, or through chronic toxicity.

Vessels operate under strict State and Federal regulatory requirements that include measures to prevent and respond to an unforeseen accidental release of hydrocarbon-based products. These vessel-specific spill prevention and response plans include procedures to prevent, contain, report, recover, and remove any accidentally released hydrocarbon materials onboard the vessel or from the vessel into the ocean. Additionally, project-specific spill prevention and response plans include specific requirements that prevent hydrocarbon products present at work sites and onboard work vessels from reaching coastal waters. Such spill plans will typically prevent stockpiling of hydrocarbon-based products onboard, include onsite recovery and clean-up procedures for equipment and materials, and include training requirements for project personnel. These types of requirements routinely prevent the occurrence of accidental releases as well as minimize the potential exposure to marine ecosystems.

7.2 Hard-substrate Habitat

Impacts from cable installation can potentially be most severe in hard substrate habitat that occur within the cable route. The biota associated with hard substrate habitat is predominantly sessile, slow growing, and susceptible to crushing, dislodgement, and other physical disturbances. High-relief hard substrate areas (> 1 m (3.3 ft) are generally considered to be more sensitive to impacts than low-relief hard bottom habitat (< 1 m) (Lissner *et al*. 1991, Brewer et. al 1991). This is because of their higher species diversity, species abundances, and the potential presence of organisms that are sensitive to physical disturbances such as erect turf species, hard and soft hydrocorals, as well as branching and erect sponges (Lissner *et al*. 1991, Brewer et. al 1991). Mixed-bottom and low-relief hard bottom habitats generally have lower species diversity and abundances due to frequent cycles of burial by sand and higher turbidity near the seafloor. These harsher physical conditions typically result in a more ephemeral biological community that is often dominated by organisms that are more tolerant of high turbidity, sand scouring, or able to grow fast enough to avoid complete burial. Typical taxa observed in recent ROV habitat and macrobenthic taxa surveys for fiber optic cable routes in California include cup corals, gorgonian corals, brittle stars, sea stars, puffball and other similar encrusting sponges, and some species of anemones such as *Stomphia* and *Urticina*.

The predominant species inhabiting moderate- to high-relief hard substrate in water depths <200 m (650 ft) include turf communities (mixtures of small hydroids, bryozoans, tunicates, and sponges), cup corals (*Paracyathus* and *Balanophyllia*), sea stars (*Asterina* and *Henricia*), brittle stars (*Amphipholis*), red algae (at depths to about 30 m), rockfishes (*Sebastes spp.),* lingcod (*O. elongatus*), and painted greenling (*O. pictus*). Additionally, on hard bottom moderate- to high-relief features in water depths >100 meters (300 ft) the feather star or crinoid, *Florometra serratissima,* and the large plumose anemone *Metridium* are frequently observed. All of these taxa are capable of withstanding periodic physical impacts. Other species, such as California hydrocoral (*S. californica*), branching coral (*Lophelia*), colonial anemone (*C. californica*), and large erect sponges are typically more sensitive to physical impact/burial and may require longer time periods to recover. *Metridium* and *Corynactis* are common species on moderate and high-relief substrate, whereas *Stylaster and Lophelia* are only infrequently reported being observed in past cable route surveys.

The potential for post-lay disturbance effects is highly dependent on where the cable is located within a hard substrate area, the type of hard substrate present (i.e. Mixed, low, moderate or high relief) and how securely the cable is installed on the seafloor. Suspensions often result in continued movement of the cable in response to currents and wave action in shallow depths (< 30.5 m [100 ft]), causing abrasion of hard substrate (Kogan *et. al* 2006, Kuhnz *et. al* 2015). Based on observations made during past cable route and post-lay surveys in California coastal waters, the impacts to associated biota from post-lay movement appear to be minimal with careful placement of the cable. During a survey of the AT&T Asia-America Gateway (AAG) S-5 cable near Morro Bay, CA, AMS (2008) reported that they could not detect any noticeable impacts associated with previously laid cables in the area. Several studies have reported the presence of large erect sponges, *M. farcimen* anemones, and other sessile organisms growing on or over exposed cables (SAIC 1999, Kogan *et. al* 2006, Kuhnz *et. al* 2015). An ROV survey of the MCI-ATT fiber optic cable route offshore Montana De Oro reported small-localized movements of a previously installed trans-pacific telephone cable, up to 10 cm (4 in) in width, occurring when the cable was laid over hard substrate habitat in a high wave energy, shallow water depth, location (SAIC-SLO 1999). Similarly, sections of the surface installed ATOC/Pioneer Seamount cable running through soft silt/sandstone offshore Pigeon Point, CA reported deep groves cut into exposed rock from cable strumming in very high energy, shallow water depth (<11 m [35 ft]) (Kogan *et. al* 2006). The installation of a power transmission cable through a glass reef located offshore British Columbia resulted in 100% mortality of glass sponges immediately under the cable and up to 15% within 1.5 meters (4.5 ft) of the cable, because of the method of installation (Dunham *et. al* 2015). No evidence of cable movement was observed, however, once the cable was installed.

Recovery of disturbed hard substrate areas by immigration, asexual propagation or larval recruitment should begin occurring within months of the disturbance. However, some areas take longer to recover fully than others. A study performed in the Pt. Arguello area suggested that the small areas of hard bottom habitat that might be disturbed by cable laying operations could take years to recover fully to pre-disturbance conditions (Hardin et al. 1993). These authors reported estimated mean time for recovery to background densities of 23 years for *Paracyathus stearnsi* and 19 years for *Lophogorgia chilensis* in areas disturbed by dragging anchors during pipe laying operations. Sherwood *et. al* (2016) reported in his assessment of the ecological effects of a power cable installation offshore Australia, that the armored cable running over hard substrate provided a colonizable surface for reef species comparable to species found in surrounding coral reefs within 3.5 years of installation. Dunham *et. al* (2015), reported that the glass sponge reef offshore British Columbia had recovered to approximately 85% natural reef growth and cover when compared to control sites within 2-years of the cable's installation. Finally, during the assessment of the ATOC/Pioneer cable, the surface-laid cable through soft sediment areas of the cable route was noted to provide artificial hard substrate habitat which was quickly colonized by *M. farcimen* and *Urticina spp.* anemones, occasional sponges, and other low relief colonizing taxa (Kogan et. al 2006). In this latter case, species diversity and abundance associated with the cable were actually higher than that of adjacent sediment habitats (Kogan *et. al* 2006). These authors further noted that the presence of the attached epifaunal community established a microcosm that attracted fish and crab taxa (Kogan *et. al* 2006).

Increased turbidity from cable trenching or ploughing activities, or the accidental release of bentonite drilling fluid, can be expected to pose a greater negative effect on hard bottom habitats compared with soft bottom habitats. As discussed above, marine taxa, such as colonial and branching corals, large erect sponges, anemones, hydrocorals, and in shallower waters, brown, red and green algae, are generally more sensitive to increased turbidity and sediment deposition than solitary cup corals and turf species. Project induced turbidity, sedimentation, and bentonite drilling fluid releases can result in increased burial of low, moderate, and high-relief hard substrate and attached taxa, clogging of fish gills and feeding surfaces, and temporary loss of foraging habitat. These impacts can be expected to be greater for moderate- to high-relief habitat and associated biota because of their greater sensitivity to sedimentation and the greater time it takes to recover from impacts (Hardin *et. al.* 1993). Terminating cable trenching and HDD borehole cable conduits in areas of soft sediment that are away from hard bottom habitat and associated biota, as well as the development and implementation of an HDD Monitoring Plan, can be expected to prevent and minimize potential exposure of hard substrate habitat and biota to accidental bentonite drilling fluid releases and increased turbidity from cable trenching and burial.

Potential exposure of hard substrate habitat and associated marine communities, including fish, marine mammals, and sea turtles to hydrocarbon materials is typically worse than that posed for soft substrate communities because of the time it takes these communities to establish themselves. As for soft substrate communities, the implementation of spill prevention, training, and response procedures can be expected to prevent the occurrence of accidental hydrocarbon releases or limit the volume of released material.

7.3 Fishes

Most of the environmental assessments prepared for underwater fiber optic cables (e.g., CSLC 2000a; CSLC 2000b; CSLC 2005) indicate that temporary displacement of some fishes from the immediate vicinity (e.g. tens of feet) of the cable route would occur during passage of cable installation equipment. The impacts described in these assessments are considered temporary (i.e., hours) and localized (occurring over a very discrete area), and therefore less than significant. Extensive alteration or destruction of habitat or communities lasting more than 1 year is unlikely due to the small size of the cable, the very localized corridor represented by the route, and burial of the cable along most of the inshore route to a depth of 100 fathoms (185 m/600 ft) of the route. Any disturbances to the bottom from installation methods are expected to return to pre-installation conditions in a relatively short amount of time (less than a year) and are typically verified during a post-installation survey.

Fish could be exposed to temporary and isolated increased underwater noise from cable laying activities and from work vessels involved in HDD boring and cable installation activities. Studies in the North Sea assessing cable trenching and ploughing projects for offshore wind farms reported peak underwater noise levels of 178 db re 1 μp at a distance of 1 m (Nedwell et al 2003). Similarly, peak underwater noise levels for cable laying ships has been reported to range between 170-180 db re 1 μp at a distance of 1 m (Hale 2018) and 160-180 db at a distance of 1 m for small work boats (CalTrans 2015), depending on the vessel size and design. Peak nearshore background underwater noise levels have been reported averaging between 128-138 db re 1 μp at a distance of 1 m (Fabre and Wilson 1997). Therefore, the generation of underwater noise by fiber optic cable installation are most likely below established 206 dB acute peak underwater noise levels for fish as well as the SEL cumulative noise levels of 183 dB and 187 dB for fish less than and greater than 2 grams in mass, respectively, and only slightly higher than the 150 dB (rms) level established for behavioral disturbance (CalTrans 2015). Additionally, it can be anticipated that project generated underwater noise levels would degrade below behavioral effect levels for fish in approximately 32-64 m (95-210 ft), and below background underwater noise levels in 128-160 m (420-840 ft) from the source, based on an assumed drop of 5-6 db per doubling of distance from the noise source (McKenna et.al 2012). Given the low magnitude of underwater noise generated by most cable laying activities relative to established thresholds for acute effects to fish, and the short duration and small distance underwater noise generated by cable laying activities will exceed background conditions, no substantive effects to fish are anticipated.

As discussed above for invertebrate taxa, the accidental release of hydrocarbon-based products has the potential to impact any fish that happen to be present in the area effected by the release. The preparation and implementation of a spill prevention, training, and response procedures plan can be expected to prevent the occurrence of accidental hydrocarbon releases from cable installation and maintenance activities, as well as limit the volume of any released material and therein the potential effects on fish taxa, should it occur.

7.4 Marine Mammals & Sea Turtles

No significant effects to marine mammals are anticipated from cable installation at the landing sites or along the offshore route. Many of the potential impacts such as disruption of migration routes or increased noise during installation are considered temporary, lasting only hours (along the sea route installation) to a few days (at the cable landfall location) in any one location, and are not expected to cause disruptions substantially different from normal ship traffic (e.g., noise) through the area (SAIC 2000).

Ship strikes of whales have become of growing concern for several species, with ship strikes to the highly endangered North Atlantic right whale receiving the most attention off the U.S. east coast (Calambokidis 2011). In 2007, four blue whales off the coast of California were found dead with direct or indirect indications of having been struck by ships. These four were all found in the vicinity of the Santa Barbara Channel and Los Angeles-Long Beach Harbors. Ship strikes during cable installation is highly unlikely since the speed of the ship during cable laying activities is slower (~0.5 to 1.5 knots while plowing) than migrating whales or fast swimming sea lions. The potential for ship strikes to sea turtles is greater than for marine mammals, especially when they surface to breathe. Although some avoidance of a cable lay ship can be anticipated as a result of disturbance and the low level underwater noise generated by cable installation operations, some potential for collision remains. Active avoidance of potential collisions with both marine mammals and sea turtles remains the best approach to preventing negative interactions between cable lay vessels and marine mammals and sea turtles. This can be accomplished through the preparation and implementation of a marine mammal monitoring and avoidance plan during all cable laying operations. These plans typically require that marine mammal observers be present on the cable installation ship, in addition to outlining procedures for ceasing all operations if a marine mammal or sea turtle comes within a prescribed “safety zone” distance of the vessel, in order to halt movement by the vessel and equipment and thereby minimize the risk of a collision.

The long-term presence of the fiber optic cable along the seafloor also would not significantly impede whale migrations since it would be 1) buried along most of the nearshore route, and 2) represent a very low profile (e.g., 1 to several inches) in hard bottom areas as a result of careful installation and post-lay inspection/adjustment. Also, as discussed in CSLC (2000a), cable slack would be stabilized at a level within the range of 2 to 3 percent in areas where the cable cannot be buried to ensure that the cable conforms to the slopes and peaks of the seabed so that it is not suspended substantially (e.g., more than 1 foot) above the bottom. This would prevent the creation of any spans that could potentially entangle marine mammals (e.g. whales). Of the approximately 2 dozen known commercial fiber optic cable landings in coastal California waters installed since 2000, no known or reported entanglements between whales and fiber optic cables have occurred.

As discussed above for fish, exposure to non-impulsve underwater noise from cable installation activities and work vessels poses some potential for acute and/or sublethal effects to marine mammals and sea turtles. Underwater operations can generate underwater noise levels ranging between 160-180 db. NOAA (2016) established combined peak and cumulative (SEL) underwater sound exposure levels for marine mammals. These cumulative SEL levels from non-impuslive sound sources are199 dB for baleen whales, 198 dB for dolphins and toothed whales201 dB for true seals, , 155 dB for porpoises, and 219 dB for sealions, fur seals, and otters. With the exception of the sound exposure limits for porpoises, all other NOAA established underwater sound thresholds for non-impulsive sound sources are greater than the underwater noise generated by cable installation equipment and vessels. As discussed above for underwear noise effects on fish, assuming a 5-6 dB decrease in noise level for every doubling of the distance from the noise source, underwater noise associated with cable installation should decrease to levels <155 dB in approximately 16-32 m (52-105 ft) from the source.

As presented in Table 8, the only porpoise species expected to occur in the coastal waters offshore Grover Beach is Dahl’s porpoise. If present during cable installation activities, the porpoises would need to be closer than 32 m (105 ft) to the cable lay ship or work vessel to be impacted by the underwater noise. Although they can be expected to avoid the immediate area where the underwater noise is generated during cable lay activities, the implementation of a marine mammal monitoring program and the presence of a marine mammal observer onboard the cable installation vessel, can be expected to prevent any exposure of porpoises and other marine mammals and sea turtles to underwater noise levels of sufficient magnitude to result in any deleterious effects.

As discussed above for fish and invertebrate taxa, the accidental release of any hydrocarbon-based product has the potential to impact marine mammals and sea turtles that are present in the area affected by the accidental release. The preparation and implementation of a spill prevention, training, and response procedures plan can be expected to prevent the occurrence of accidental hydrocarbon releases from cable installation and maintenance activities, as well as limit the volume of any released material and therein the potential effects on marine taxa, should it occur.

Little scientific information is known about the effects of anthropogenic underwater noise on marine turtles or at what potential threshold levels acute or behavioral responses may occur (Williams et. al 2015). What apparent information is available concerns impulsive sound sources, such as seismic mapping equipment (ie. air guns) and from dynamite explosions. These studies indicated that marine turtles maybe somewhat resistant to successive dynamite blasts (Erbe 2012) and can detect and exhibit avoidance behavior to 175 dB RMS generating impulsive air gun sounds when several kilometers distant from the source (Weilgart 2012). Consequently, any marine turtles approaching active cable installation activities are expected to avoid project work vessels and if avoidance does not occur and they approach project work vessels, as indicated above, the Marine Wildlife Monitoring and Contingency Program applies to marine turtles and onboard observers will observe them and cease cable installation activities until the marine turtle has transited a safe distance past operations.

TABLE 5-1
SPECIAL-STATUS MARINE SPECIES AND THEIR POTENTIAL TO OCCUR WITHIN THE STUDY AREA

Common Name	Scientific Name	Listing Status	General Habitat, *Critical Habitat (if established)*	Regional Occurrence	Potential to Occur in Study Area
Marine Mammals					
Baird's Beaked Whale	*Berardius bairdii*	P	Inhabit deep offshore waters in the North Pacific and are common along steep underwater geologic structures, like submarine canyons, seamounts, and continental slopes.	Seasonal-sightings from late spring to early fall Very Rare	Not Expected. Sightings occur in deeper waters than the study area, mainly along continental shelf edges or in deep submarine canyons where they forage. National Marine Fisheries records indicate less than a dozen individuals have been washed up along the west coast of the US.
Blainville's Beaked Whale	*Mesoplodon densirostris*	P	Found mainly over the continental shelf and into open ocean waters. Occupy tropical to temperate waters worldwide. Groups have been regularly observed off Oahu, Hawaii and in the Bahamas in 500-1000 m waters.	Rare	Not Expected. Unlikely to be observed in the study area.
Blue Whale	*Balaenoptera musculus*	FE, FD, P	Blue whales are found worldwide but often occur near the edges of physical features where krill tend to concentrate. These whales begin to migrate south during November.	Seasonal from June through November Common	High. Relatively common offshore the CA coast, in waters 90- 370 km from the shore.
Bottlenose Dolphin	*Tursiops truncatus*	P	Found in temperate and tropical waters around the world. These are the most common dolphins in Southern and Central CA, including offshore. Have both coastal and offshore populations.	Year-round Uncommon-Occasional	Low-moderate. Bottlenoe dophins have been sited offshore Pismo Beach in recent years suggesting that this species is becoming increasingly more common in Central California as water temperatures warm.
Bryde's Whale	*Balaenoptera edeni*	P	Found in highly productive tropical, subtropical, and warm temperate waters worldwide. More commonly found further from shore.	Rare	Not Expected. Unlikely to be observed in the study area.
California Sea Lion	*Zalophus californianus*	P	Reside in the Eastern North Pacific Ocean in coastal waters. Commonly observed along the west coast of North America from southeast Alaska to the central coast of Mexico	Seasonal Common	High. Commonly observed.
Common Dolphin – Long-beaked	*Delphinus capensis*	P	Found from Baja California northward to central California. Found in shallow, warmer temperate waters typically within 15 nautical miles of the coast and on the continental shelf.	Year-round Uncommon-Occasional	Low. The common dolphin is the most abundant cetacean found in the coastal waters of California, but numbers begin to decrease northward from the central coast, and the maximum northward extent is Point Arena.

TABLE 5-1 (CONTINUED)
SPECIAL-STATUS MARINE SPECIES AND THEIR POTENTIAL TO OCCUR WITHIN THE STUDY AREA

Common Name	Scientific Name	Listing Status	Habitat	Regional Occurrence	Potential to Occur in Study Area
Marine mammals (continued)					
Common Dolphin – Short-beaked	*Delphinus delphis*	P	A more pelagic species than the long-beaked common dolphin; can be found up to 300 nm from shore and commonly found near underwater geologic features where upwelling occurs. Majority of populations are observed off California coast, especially in the warm water months.	Year-round Common	Moderate. Generally found offshore of the study area.
Cuvier's Beaked Whale	*Ziphius cavirostris*	P	Found in temperate, tropical, and subtropical waters. Associated with deep pelagic waters (usually greater than 1,000 m deep) of the continental shelf and slope, and near underwater geologic features. Seasonality and migration patterns are unknown.	Sightings in fall and winter Rare	Not Expected. Generally occur in the deeper waters west of the study area.
Dall's Porpoise	*Phocoenoides dalli*	P	Distributed throughout the North Pacific Ocean and along the west coast of the US from the border with Mexico to the Bering Sea. Mainly found in pelagic waters deeper than 180 m, but can be found both offshore and inshore.	Winter and early spring Rare	Not Expected-Low. Most frequently observed offshore in deeper waters.
Dwarf Sperm Whale	*Kogia simus*	P	Dwarf sperm whales live in tropical and temperate waters worldwide and occur over the continental slope and open ocean. Found in the Pacific northwest and California, but more common near Hawaii and the Gulf of Mexico.	Rare	Not Expected. Not likely to be observed within the study area. Records of dwarf sperm whales are rare and it is unknown whether low numbers are a consequence of their cryptic behavior or if they are not regular in habitants of offshore CA waters.
False Killer Whale	*Pseudorca crassidens*	P	Occur over the continental slope and into open ocean waters with depths over 1,000 m of tropical and warm temperate waters worldwide.	Sightings in summer and early fall Rare	Not Expected. Not likely to occur in the study area because they prefer warmer and deeper waters than within the study area.
Fin Whale	*Balaenoptera physalus*	FE, FD, P	Fin Whales occupy the deep, offshore waters of all major oceans, but are less common in the tropics.	Seasonal Common	Moderate. Relatively common in CA waters between March and October, but due to their occurrence farther offshore in deep water, it is not likely they would be seen in the study area.
Ginkgo-toothed Whale	*Mesoplodon ginkgodens*	P	Found mainly over the continental shelf and into open ocean warm waters of the Pacific and Indian Oceans.	Rare	Not Expected. No documented sightings in the study area.

TABLE 5-1 (CONTINUED)
SPECIAL-STATUS MARINE SPECIES AND THEIR POTENTIAL TO OCCUR WITHIN THE STUDY AREA

Common Name	Scientific Name	Listing Status	Habitat	Regional Occurrence	Potential to Occur in Study Area
Marine mammals (continued)					
Gray Whale (Eastern Pacific)	*Eschrichtus robustus*	FD, P	Predominantly occur within the nearshore coastal waters of the North Pacific Ocean, from the Gulf of Alaska to the Baja Peninsula.	Seasonal December through May Common	Moderate. Occur in coastal waters during late fall-winter southward migration and again late winter to early summer during their northward migration. Can be as close as a few hundred yards of shore, but more common 3-12 miles offshore.
Guadalupe (Southern) Fur Seal	*Arctocephalus townsendi*	CT, FT, FD	Reside in tropical waters off Southern California and Mexico. Breed in rocky coastal habitats and caves mainly along the eastern coast of Guadalupe Island, approximately 200 Kilometers west of Baja California. There is a small population on San Miguel Island in the Channel Islands.	Very Rare	Not Expected. Unlikely to occur north of Point Conception and the Southern Californian Bight.
Harbor Porpoise	*Phocoena phocoena*	P	Commonly found in bays, estuaries, harbors, and fjords less than 200 m deep in northern temperate and subarctic coastal waters. In California, most common north of Point Conception.	Year-round Uncommon	Low. Can occur in the study area between 0-200 m depth, but no obervations reported in study area.
Harbor Seal	*Phoca vitulina*	P	Found as far north as British Columbia, Canada and as far south as Baja California, Mexico. Most commonly observed pinniped along CA coastline. Use the offshore waters for foraging and beaches for resting. Occur on offshore rocks, on sand and mudflats in estuaries and bays, and on some isolated beaches.	Year-round Common	High. Common throughout the California coast. Harbor seals favor near shore coastal waters.
Hubb's Beaked Whale	*Mesoplodon carlhubbsi*	P	Endemic to the North Pacific Ocean. Species is not well known but assumed to occur mainly over the continental shelf and into open ocean waters.	Very Rare	Not Expected. May occur in waters offshore of central and north California but the species is very rare.
Humpback Whale	*Megaptera novaeangeliae*	FE, FD, P	Found in all major oceans. Central California population of humpback whales migrates from their winter calving and mating areas off Mexico to their summer and fall feeding areas off coastal California. Humpback whales occur from late April to early December.	Seasonal- May through November Common	Moderate. Frequently observed migrating along the CA coast between April and November, up to 90 km offshore.

TABLE 5-1 (CONTINUED)
SPECIAL-STATUS MARINE SPECIES AND THEIR POTENTIAL TO OCCUR WITHIN THE STUDY AREA

Common Name	Scientific Name	Listing Status	Habitat	Regional Occurrence	Potential to Occur in Study Area
Marine mammals (continued)					
Killer Whale	*Orcinus orca*	FE, FD, P	Found throughout all oceans. Most abundant in colder waters but can be somewhat abundant in temperate water. Presence and occurrence can be common but unpredictable in coastal California.	Seasonal Uncommon	Low. Most common during April, May, and June as they feed on northbound migrating gray whales. Generally observed in the deeper waters offshore of the study area.
Long-snouted Spinner Dolphin	*Stenella longirostris*	FD, P	Found in all tropical and subtropical oceans. Continental shelf to open ocean waters, but most commonly in the deep ocean where they track prey.	Sightings in summer and early fall Rare	Not expected to occur in the study area because they prefer warmer waters.
Minke Whale	*Balaenoptera acutorostrata*	P	Distributed worldwide and can be in coastal/inshore and over the continental shelf in temperature (preferred), boreal, or polar waters.	Year-round Uncommon	Low. Minke whale sightings have occurred throughout the California coast. While rare, they may be observed within the study area.
North Pacific Right Whale	*Eubalaena japonica*	FE, FD, P	Found in the North Pacific Ocean. Seasonally migratory; inhabit colder waters for feeding, and then migrate to warmer waters for breeding and calving. Although they may move far out to sea during their feeding seasons, right whales give birth in coastal areas.	Very Rare	Not Expected. Unlikely to be present in the study area because fewer than 50 individuals are believed to occupy US waters.
Northern Elephant Seal	*Mirounga angustirostris*	P	Found from Alaska to Mexico. They are sighted regularly over shelf, shelf-break, and slope habitats and they are also present in deep ocean habitats seaward of the 2000 m isobaths. Rookeries are located in the Channel Islands and Ano Nuevo State Park.	Year-round Uncommon	Low-Moderate. Northern elephant seals are widely distributed along the west coast of North America and spend about nine months of the year at sea.
Northern Fur Seal	*Callorhinus ursinus*	FD, P	Spend 300 or more days per year foraging in the open ocean of the North Pacific. Use rocky beaches for reproduction. Usually come ashore in California only when debilitated, however, few individuals observed on Ano Nuevo Island.	Year-round Very Rare	Low. Usually 18-28 km from shore in California, however, they have been observed within 5 km of Point Pinos to the north of the study area.
Northern Right Whale Dolphin	*Lissodelphis borealis*	P	Endemic to deep, cold temperate of the North Pacific Ocean. Also occur over the continental shelf and slope where waters are less than 66°F.	Year-round Rare	Not Expected. Considered very rare within CA waters. Not likely to occur near in the study area.
Pacific White-sided Dolphin	*Lagenorhynchus obliquidens*	P	Occupy temperate waters of the North Pacific. Found from the continental shelf to the deep ocean.	Year-round Common	Low. Likely to occur throughout the California coastline but typically do not occur nearshore.

TABLE 5-1 (CONTINUED)
SPECIAL-STATUS MARINE SPECIES AND THEIR POTENTIAL TO OCCUR WITHIN THE STUDY AREA

Common Name	Scientific Name	Listing Status	Habitat	Regional Occurrence	Potential to Occur in Study Area
Marine mammals (continued)					
Perrin's Beaked Whale	*Mesoplodon perrini*	P	Believed to occupy continental shelves and open ocean waters of the Pacific, but not well documented.	Very Rare	Not Expected. This whale is known from less than half a dozen strandings between San Diego and Monterey. It is highly unlikely that it will be observed within the study area, but the species' complete distribution is unknown.
Pygmy Sperm Whale	*Kogia breviceps*	P	Prefer tropical, subtropical, and temperate waters of the Pacific Ocean and occur over the continental slope and open ocean. They are mostly found offshore of Peru but also occur in the waters near Hawaii and the Pacific Northwest.	Rare	Not Expected. Unlikely to occur in the study area. Strandings have been documented off Mexico, and once in New Zealand and Monterey Bay. Overall the species is rare and would occur south of the study area.
Risso's Dolphin	*Grampus griseus*	P	Distributed throughout all major oceans. Generally found in waters greater than 1,000 m in depth and seaward of the continental shelf and slopes.	Year-round Rare	Low. They generally occur in deeper waters offshore of the study area.
Rough-toothed Dolphin	*Steno bredanensis*	P	Found in all tropical and subtropical oceans. Continental shelf to open ocean waters. Prefer deeper depths of tropical and warmer temperate waters.	Sighting in summer and early fall Rare	Not Expected. Unlikely to occur in the relatively cold waters surrounding the study area.
Sei Whale	*Balaenoptera borealis*	FE, FD, P	Wide distribution in subtropical, temperature, and subpolar waters around the world. Usually observed in deeper waters of oceanic areas far from the coastline.	Seasonal-spring and summer Very Rare	Not Expected. Sei whales are uncommon in CA waters, especially within the project area because they primarily occupy the open ocean.
Short-finned Pilot Whale	*Globicephala macrorhynchus*	P	Found in warmer tropical and temperate waters. Commonly seen along the coast close to the continental shelf. Forage in areas with high densities of squid.	Year-round Very Rare	Not Expected. Generally found in deeper water than that in the study area and in warmer waters.
Sperm Whale	*Physeter macrocephalus*	FE, FD, P	Occur globally in the open ocean far from land and are uncommon in waters less than 300 m deep. Live at the surface of the ocean but dive deeply to catch giant squid.	Most probable late spring and late fall Rare	Not Expected. Sperm whales are present offshore CA year- round, peak in abundance late spring and late summer, but are rarely seen because they occupy deep water far offshore.

TABLE 5-1 (CONTINUED)
SPECIAL-STATUS MARINE SPECIES AND THEIR POTENTIAL TO OCCUR WITHIN THE STUDY AREA

Common Name	Scientific Name	Listing Status	Habitat	Regional Occurrence	Potential to Occur in Study Area
Marine mammals (continued)					
Southern Sea Otter	*Enhydra lutris nereis*	FT, P, P	A top carnivore in its coastal range and a keystone species of the nearshore coastal zone. Frequent inhabitor in kelp forests.	Year-round Uncommon	Low-Moderate. Southern sea otters occupy the nearshore waters of California from San Mateo County south to Santa Barbara County. The primary populatons reside in between Monterey Bay and Cayucas in San Luis Obispos County. The waters offshore Grover Beach are within the southern end of their range and Sea otters are frequently observed.
Spotted Dolphin	*Stenella attenuata*	FD, P	Typically found far away from the coast in tropical and subtropical waters worldwide but can also occupy waters over the continental shelf. Spend majority of day in waters 90-300 m deep then dive to depth at night to search for prey.	Sightings in summer and early fall Rare	Not Expected. The eastern Pacific Ocean population is typically observed far from the coast and depleted in numbers of individuals.
Stejneger's Beaked Whale	*Mesoplodon stejnegeri*	P	Found in cold temperate and subarctic waters of the North Pacific Ocean, occupying deep, offshore waters.	Rare	Not Expected. Typically found in deep, offshore waters on or beyond the continental shelf.
Steller (Northern) Sea Lion	*Eumetopias jubatus*	FE, FD, P	Distributed around the coasts along the North Pacific Ocean rim. Common in coastal waters and onshore for resting. A small population breeds on Año Nuevo Island, north of Monterey Bay. *Critical Habitat; A zone that extends approximately 1000m seaward and landward of any Steller sea lion rookery in WA, OR, and CA. Any aquatic foraging habitat within the species geographic range.*	Seasonal Occasional-Common	Moderate. Documented as relatively common in the coastal waters of Central California.
Striped Dolphin	*Stenella coeruleoalba*	P	Distributed along continental shelf to open ocean waters worldwide, often found in areas of upwelling and around convergence zones. Prefer highly productive tropical to warm temperate waters that are oceanic and deep.	Sightings in summer and early fall Rare	Not Expected. Unlikely to occur near the study area. Observations are typically farther offshore.

TABLE XXX (CONTINUED)
SPECIAL-STATUS MARINE SPECIES AND THEIR POTENTIAL TO OCCUR WITHIN THE STUDY AREA

Common Name	Scientific Name	Listing Status	Habitat	Regional Occurrence	Potential to Occur in Study Area
Marine Turtles					
Green Sea Turtle	*Chelonia mydas*	FE, P	Distributed globally. Primarily use three types of habitat: oceanic beaches (for nesting), convergence zones in the open ocean, and benthic feeding grounds in coastal areas. *Critical Habitat; waters surrounding Puerto Rico.*	Seasonal Rare	Not Expected. In the eastern Pacific, green turtles have been sighted from Baja California to southern Alaska but most commonly occur from San Diego south.
Leatherback Sea Turtle	*Dermochelys coriacea*	FE, P	Distributed globally. Regularly seen off the western coast of the US in the pelagic with the greatest densities found off central CA. *Critical Habitat; U.S. Virgin Islands and offshore California, Oregon and Washington. In California all coastal waters between the shore and 200 m water depth between Point Arena and Point Sur and out to 3,000 m between Point Arena and Point Arguelo.*	Seasonal Occasional	Low. Leatherback sea turtles are most commonly seen between July and October, when the surface water temperature warms to 15-16° C and large jellyfish, the primary prey of the turtles, are abundant offshore.
Olive Ridley Sea Turtle	*Lepidochelys olivacea*	FT, P	Mainly a "pelagic" sea turtle in tropical/temperate regions of the Pacific, South Atlantic, and Indian Oceans but has been known to inhabit coastal areas, including bays and estuaries.	Seasonal Very Rare	Not Expected. In the eastern Pacific, the range of the Olive Ridley turtle extends from southern California to northern Chile.
Loggerhead Sea Turtle	*Caretta caretta*	FE, P	Distributed throughout the temperate and tropical regions of the Atlantic, Pacific, and Indian Oceans. Occupy three different ecosystems during their lives: the terrestrial zone, the oceanic zone, and the neritic or nearshore coastal area. *Critical Habitat; The Northwest Atlantic DPS critical habitat includes waters throughout the Gulf of Mexico around the Florida panhandle and up the eastern seaboard of the US.*	Seasonal Very Rare	Low. In the U.S., most recorded sightings are of juveniles off the coast of California but occasional sightings are reported along the coasts of Washington and Oregon.

TABLE XXX (CONTINUED)
SPECIAL-STATUS MARINE SPECIES AND THEIR POTENTIAL TO OCCUR WITHIN THE STUDY AREA

Common Name	Scientific Name	Listing Status	Habitat	Regional Occurrence	Potential to Occur in Study Area
Sharks and Fish					
Basking Shark	*Cetorhinus maximus*	CSC, P	Usually sighted from British Columbia to Baja California in the winter and spring months. Movements and migrations of species once it leaves coastal areas is poorly understood and largely unknown.	Seasonal Very Rare	Not Expected. Basking shark populations were severely depleted by commercial fisheries of the 1950s, and they have never fully recovered due to slow growth and low fecundity.
Eulachon	*Thaleichthys pacificus*	FT	Found between northern CA and southwest Alaska. Spawning and rearing occurs in estuarine river habitats, then individuals migrate to saltwater where they spend three year before returning to river spawning locations. *Critical Habitat; From Eureka, CA to the boarder with OR coastal stretches of the Mad River, Redwood Creek, and Klamath River that reach the ocean are designated as critical habitat.*	Rare	Not Expeted. Monterey Bay is at the southern limit of this species' distribution, and the population is in decline.
Coho Salmon (Southern OR and Northern CA coasts ESU)	*Oncorhynchus kisutch*	FT, CT, P	Spawn in small streams with gravel substrates, and spend first half of life cycle in streams and small freshwater tributaries. The later half of life cycle is spent foraging in estuarine and marine waters.	Seasonal, Very Rare	Not Expected. -Low. No known suitable spawning rivers in San Luis Obispo County. Salmon swimming ocean waters could occasionally be present.
Longfin smelt	*Spirinchus thaleichthys*	CT	Found along the Pacific coast from Alaska into California. This species uses nearshore waters, estuaries, and freshwater streams throughout its life cycle.	Very Rare	Not Expected. A single longfin smelt collected from the Monterey Bay area was reported by Eschmeyer et al. (1983) but the San Francisco Bay Delta population is considered the southernmost population for this species (Moyle 2002)

TABLE XXX (CONTINUED)
SPECIAL-STATUS MARINE SPECIES AND THEIR POTENTIAL TO OCCUR WITHIN THE STUDY AREA

Common Name	Scientific Name	Listing Status	Habitat	Regional Occurrence	Potential to Occur in Study Area
Sharks and fish (continued)					
North American Green sturgeon (Southern Distinct Population Segment, DPS)	*Acipenser medirostris*	FT	Within the marine environment, the Southern DPS occupies coastal bays and estuaries from Monterey Bay to Puget Sound in Washington. Individuals occasionally enter coastal estuaries to forage. *Critical Habitat; All of Monterey Bay, CA and ocean water out to 60 Fathoms depth from Monterey Bay northward to the boarder with Canada.*	Rare	Low. There a very few data on green sturgeon presence in coastal waters. This species may forage in or near the project area but its distribution in ocean waters is essentially unknown.
Steelhead Trout, South-Central California Coast Steelhead DPS	*Onchorhynchus mykiss*	FT, CSC, P	Can be found along the entire Pacific Coast. Anadromous individuals can spend up to 7 years in fresh water prior to smoltification, and then spend up to 3 years in salt water prior to first spawning. Individuals that spend their entire life in fresh water are called rainbow trout. *Critical Habitat; Essentially all major rivers and coastal stretches of all rivers and creeks throughout CA.*	Seasonal Rare to Common	Moderate. Spawn in streams and rivers throughout northern and central CA including coastal rivers flowing into the ocean between Point San Luis and Mussel Point. Adults may occur in coastal waters near streams and rivers.
Tidewater Goby	*Eucycloglobius newberryi*	FE, P	This goby inhabits lagoons formed by streams running into the sea. The lagoons are blocked from the Pacific Ocean by sandbars, admitting salt water only during particular seasons, and so their water is brackish and cool. The tidewater goby prefers salinities of less than 10 parts per thousand (ppt) and is thus more often found in the upper parts of the lagoons, near their inflow.	Seasonal Rare	Not Expected to occur in coastal waters. It is very rare and suitable habitat only occurs in coastal lagoons. Present in several of the coastal lagoons in Central California near Grover Beach.
White sharks	*Carcharodon carcharias*	CSC, P	Coastal and offshore waters along the continental shelf and islands. In California, important white shark habitat is present around Monterey Bay and Greater Farallones national marine sanctuaries. White shark populations are impacted by purposeful and incidental capture by fisheries, marine pollution, and coastal habitat degradation	Year-round Occassional to Common	Moderate to High. Present in coastal waters throughout the State. Occurrence in the waters offshore Grover Beach have been increasing in recent years.

TABLE XXX (CONTINUED)
SPECIAL-STATUS MARINE SPECIES AND THEIR POTENTIAL TO OCCUR WITHIN THE STUDY AREA

Common Name	Scientific Name	Listing Status	Habitat	Regional Occurrence	Potential to Occur in Study Area
Gastropods					
Black Abalone	*Haliotis cracherodii*	FE, P	Occurs in coastal and offshore island intertidal habitats on exposed rocky shores where bedrock provides deep, protective crevices for shelter. Range from Point Arena, CA to Bahia Tortugas and Isla Guadalupe, Mexico. *Critical Habitat; Essentially all CA coast line from Del Mar Landing Ecological Reserve to South of Government Point and again from the Palos Verded/Torrance boarder through the LA harbor. Also all nearshore waters around the Farallon and Ano Nuevo Islands and the San Miguel, Santa Cruz, Anacapa, Santa Barbara, and Santa Catalina Islands.*	Year-round Very Rare	Low. Point Arena is the northern most point of black abalone distribution along the entire California coast; the populations in south Central California have been declining in recent years due to a variety of ecological factors.
Green Abalone	*Haliotis fulgens*	FSC, P	Occurs in coastal and offshore island intertidal habitats on exposed rocky shores where bedrock provides deep, protective crevices for shelter. Green abalone habitat ranges from Point Conception, CA to Bahia Magdalena, Baja Calfironia Sur, Mexico.	Year-round Very Rare	Not Expected. Green abalone are not known to occur north of Point Conception, CA.
Pink Abalone	*Haliotis corrugate*	FSC, P	Occurs in coastal and offshore island intertidal habitats on exposed rocky shores where bedrock provides deep, protective crevices for shelter. Distributed from Point Conception to Bahia de Santa Maria in Baja California, Mexico.	Year-round Very Rare	Not Expected. Pink abalones are unlikely to be found north of Point Conception.
White Abalone	*Haliotis sorenseni*	FE, P	Occurs in coastal and offshore island intertidal habitats on exposed rocky shores where bedrock provides deep, protective crevices for shelter. Range from Point Conception, CA to Punta Abreojos, Baja California, Mexico.	Year-round Very Rare	Not Expected. White abalone numbers are extremely low throughout southern CA. It is highly unlikely given their historic range and depleted numbers that they occur north of the Point Conception.

NOTES:

FESA = Federal Endangered Species Act

MMPA = Marine Mammal Protection Act

CESA = California Endangered Species Act

STATUS CODES:

Federal: National Oceanographic and Atmospheric Administration (NOAA); MMPA

FD = Depleted Population

P = Federally Protected

Federal: U.S. Fish and Wildlife Service (USFWS), NOAA National Marine Fisheries Service (NMFS); FESA

FDL = Delisted

FE = Listed as “endangered” (in danger of extinction) under FESA

FT = Listed as “threatened” (likely to become Endangered within the foreseeable future) under FESA

FC = Candidate to become a proposed species

FSC = Former “federal species of concern”. The USFWS no longer lists Species of Concern but recommends that species considered to be at potential risk by a number of organizations and agencies be addressed during project environmental review. *NMFS still lists “Species of Concern”.

State: California Department of Fish and Game (CDFG); CESA

CE = Listed as “endangered” under the CESA

CT = Listed as “threatened” under the CESA

CSC = CDFW designated “species of special concern”

Potential for Species Occurrence Rankings:

Not Expected - Suitable foraging or spawning habitat is not known to be present or rare, and the species has not been or is rarely documented to occur

Low - Suitable foraging or spawning habitat is present, but the species has either not been documented to be present or if present, the presence is uncommon and infrequent

Moderate - Suitable foraging or spawning habitat is present and the species is somewhat common or common for part of the year

High - Suitable foraging or spawning habitat is present and the species is common throughout the year and/or in substantial numbers

Sources: Allen et al 2010, Allen 2014, Applied Marine Sciences (2015), California Department of Fish and Wildlife (CDFW), Natural Diversity Database. 2018., Dick et. al 2007, Driscoll 2014. Love and Yoklavich 2008, Marine Mammal Commission Marine Mammal Species of Special Concern 2018, Mercury News 2016, Miller and Shanks 2004, NOAA 2011b, NOAA 2014b, NOAA 2017, NOAA 2018a NOAA 2018b, OCS 2015, UC Davis 2017, Whaleopedia 2018,

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9 Appendices

Appendix A: Macrobenthic Invertebrate, Algae, and Fish Taxonomic Lists

Appendix A-1: Master Macrobenthic Invertebrate and Alga Taxonomic List for Fiber Optic Cable Route Surveys Conducted in Coastal Southern and South Central California Waters.

Appendix A-2: Macrobenthic Invertebrates and Alga Taxonomic List for Fiber Optic Cable Route Surveys Conducted in Coastal Southern and South Central California Waters by Depth.

Appendix A-3: Master Fish Taxonomic List for Fiber Optic Cable Route Surveys Conducted in Coastal Southern and South Central California Waters.

Appendix A-4: Fish Taxonomic List for Fiber Optic Cable Route Surveys Conducted in Coastal Southern and South Central California Waters by Depth.

Appendix A-1: Master Macrobenthic Invertebrate and Alga Taxonomic List for Fiber Optic Cable Route Surveys Conducted in Coastal Southern and Central California Waters.

Phylum	Scientific Name	Common Name	Hermosa Beach (MBC 2001, AMS 2016)			Global West (SAIC 2000)			S. Cal. Bight (Occidental 2008)	Grover Beach (AMS 1998)	Morro Bay (SAIC 1999; AMS 2008; SAIC-SLO 1999)			Estero Bay (AMS 1998, Chambers 1998)			Monterey Bay (MBARI 2004)	
			Hard Substrate	Mixed-Bottom	Soft Substrate	Hard Substrate-high-relief	Hard Substrate-low-relief	Soft Substrate	Hard Substrate	Soft Substrate	Hard Substrate	Mixed-Bottom	Soft Substrate	Hard Substrate	Mixed-Bottom	Soft Substrate	Hard Substrate	Soft Substrate
Angiosperm	**Flowering Plant**																	
	Phyllospadix sp.	Surf grass									X							
	Phyllospadix sp.	Drift surf grass			X													
Chlorophyta	**Green Algae**																	
	Ulva spp. drift	Sea lettuce, drift									X							
Phaeophyta	**Brown Algae**																	
	Egregia meanzinii drift	Feather boa kelp drift							X		X	X	X					
	Macrocystis pyrifera drift	Giant kelp, drift	X		X				X		X	X	X					
	Nereocystis californica drift	Bull kelp, drift									X	X	X					
	Phaeophyta, unident.	Unidentified brown algae																
Rhodophyta	**Red Algae**																	
	Callophyllus sp.	Beautiful leaf algae			X						X			X	X			
	Corallina officinalis														X			
	Corallincea Unident., drift	Coralline algae, drift		X	X						X	X	X	X				
	Cumathamnion decipiens													X				
Rhodophyta	*Cryptopleura violacea*														X			
	Gelidium coulteri													X				
	Gracilaria														X			
	Halymena californica													X	X			
	Halymena coccinea													X	X			
	Halymena hollenbergii														X			
	Gymnogongrus														X			

Phylum	Scientific Name	Common Name	Hermosa Beach (MBC 2001, AMS 2016)			Global West (SAIC 2000)			S. Cal. Bight (Occidental 2008)	Grover Beach (AMS 1998)	Morro Bay (SAIC 1999; AMS 2008; SAIC-SLO 1999)			Estero Bay (AMS 1998, Chambers 1998)			Monterey Bay (MBARI 2004)	
			Hard Substrate	Mixed-Bottom	Soft Substrate	Hard Substrate-high-relief	Hard Substrate-low-relief	Soft Substrate	Hard Substrate	Soft Substrate	Hard Substrate	Mixed-Bottom	Soft Substrate	Hard Substrate	Mixed-Bottom	Soft Substrate	Hard Substrate	Soft Substrate
	platyphyllus																	
	Mazzaella cordata													X	X			
	Mastocarpus papillatus	Turkish towel		X	X				X									
	Opuntiella californica													X				
	Phycodrys setchellii													X	X			
	Polyneura latissima													X				
	Rhodoglossum owensiae													X				
	Rhodymenia sp.	Red membrane algae									X			X	X			
	Rhodophyta, unident.	Red algae unidentified		X	X													
	Cystoseira osmundacea	Chain-bladder kelp							X									
Ochrophyta	*Desmarestia ligulata*	Acid kelp			X				X					X	X			
	Desmarestia ligulata	Acid kelp, drift	X	X	X													
	Eisenia arborea	Southern sea palm							X									
	Laminaria dentigera														X			
	Laminaria farlowii	oarweed							X									
Ochrophyta	*Laminaria setchellii*	Southern stiff striped kelp							X									
	Pterygopgora californica	Pom pom kelp							X									
	Sargassum sp.	wireweed							X									
	Undaria pinnatifida	Wakame							X									
	Sponges																**X**	
	Acarnus erithacus	Red volcano sponge													X			
	Craniella arb	Gray puffball sponge				X	X		X						X			
	Haliclona sp.														X			
Porifera	*Halichondria panicea*	Breadcrumb sponge												X				
	Leucetta losangelensis													X	X			
	Polymastia pachymastia	Aggravated vase sponge									X							
	Rhabdocalyptus sp.	Vase sponge		X														

Phylum	Scientific Name	Common Name	Hermosa Beach (MBC 2001, AMS 2016)			Global West (SAIC 2000)			S. Cal. Bight (Occidental 2008)	Grover Beach (AMS 1998)	Morro Bay (SAIC 1999; AMS 2008; SAIC-SLO 1999)			Estero Bay (AMS 1998, Chambers 1998)			Monterey Bay (MBARI 2004)	
			Hard Substrate	Mixed-Bottom	Soft Substrate	Hard Substrate-high-relief	Hard Substrate-low-relief	Soft Substrate	Hard Substrate	Soft Substrate	Hard Substrate	Mixed-Bottom	Soft Substrate	Hard Substrate	Mixed-Bottom	Soft Substrate	Hard Substrate	Soft Substrate
	Spheciospongia confoederata	Grey moon sponge									X							
		Sponge, foliose white									X	X						
		Sponge, large white									X							
Porifera		Sponge, white									X	X						
		Sponge, white encrusting									X	X						
		Sponge, white/gray saucer									X	X						
		Sponge, grey									X	X						
		Sponge, orange	X								X							
		Sponge, salmon encrusting									X	X						
		Sponge, tan bulbous									X							
		Sponge, tan globose									X							
		Sponge, unidentified	X											X				
		Sponge, yellow	X								X	X						
	Tethya aurantia	Orange puff ball sponge							X		X	X						
	Toxadocia spp.	White finger sponge							X		X							
Cnidaria	**Hydroids, Sea Anemones, Sea Pens, Corals**																	
	Acanthoptilum sp.	Sea Pen		X	X	X	X					X	X					X
	Actinaria unident.	Sea anemone				X											X	
	Actinostola	Anemone				X												
	Adelogorgia phyllostera	Orange gorgonian		X							X		X					
	Amphianthus	Sea anemone				X												
	Anthopleura artemsia?	Moonglow anemone											X		X			

Phylum	Scientific Name	Common Name	Hermosa Beach (MBC 2001, AMS 2016)			Global West (SAIC 2000)			S. Cal. Bight (Occidental 2008)	Grover Beach (AMS 1998)	Morro Bay (SAIC 1999; AMS 2008; SAIC-SLO 1999)			Estero Bay (AMS 1998, Chambers 1998)			Monterey Bay (MBARI 2004)	
			Hard Substrate	Mixed-Bottom	Soft Substrate	Hard Substrate-high-relief	Hard Substrate-low-relief	Soft Substrate	Hard Substrate	Soft Substrate	Hard Substrate	Mixed-Bottom	Soft Substrate	Hard Substrate	Mixed-Bottom	Soft Substrate	Hard Substrate	Soft Substrate
Cnidaria	Anthopleura elegantissima	Aggregating anemone							X						X			
	Anthopleura sola	Solitary anemone							X									
	Anthopleura xanthogrammica	Giant green anemone							X									
	Anthozoa unident.	Anthozoan anemone, unidentified			X													
	Aurellia sp.	Moon jelly																
	Balanophyllia elegans	Orange cup coral					X				X			X	X			
	Bossiella													X				
	Caryophillia sp.?	White cup coral				X	X				X							
	Cerianthidae, unident.	Cerianthid anemone										X	X					X
	Corallimorphus sp. 1	Colonial anthizoan																X
	Corynactis californica	Strawberry or club-tipped anemone				X					X			X	X		X	
	Cup coral	Brown or orange cup corals							X									
	Cyathoceras foxi	Cup corals		X														
	Desmophyllum	Cup corals				X												
	Eugorgia rubens	Purple gorgonian		X					X									
Cnidaria	*Eugorgia spp.*	Gorgonian coral, unidentified	X															
	Gorgonocephalus eucnemis	Giant basket star		X		X	X										X	
	Hydrozoa	Corals							X									
	Lophelia sp.	Branching white coral				X					X							
	Lophogorgia chiliensis	Red gorgonian (sea whip)		X		X	X		X		X							
	Metridium farcimen (giganteum)	White-plumed anemone	X	X	X	X	X				X	X	X	X	X		X	

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			Hard Substrate	Mixed-Bottom	Soft Substrate	Hard Substrate-high-relief	Hard Substrate-low-relief	Soft Substrate	Hard Substrate	Soft Substrate	Hard Substrate	Mixed-Bottom	Soft Substrate	Hard Substrate	Mixed-Bottom	Soft Substrate	Hard Substrate	Soft Substrate
	Muricea californica	Golden gorgonian							X									
	Muricea fruticoas	Brown gorgonian							X									
	Paracyathus stearnsi	Brown cup coral	X			X	X				X	X		X	X		X	
	Parazoanthus sp.	Parasitic aggregating		X														
	Pachycerianthus sp.	Tube anemone									X	X		X	X			
	Pachycerianthus fimbratus	Tube-dwelling anemone							X									
	Pennatulacea sp.	Sea pen																X
	Plumularia sp.															X		
	Polyorchis pencillatus	Bell medusa							X									
	Ptilosarcus gurneyi	Orange or fleshy sea pen		X	X								X					X
	Scytalium sp.	Sea pen			X							X	X					
	Stomphia coccinea	Swimming anemone				X					X		X					
	Stompia spp.	Swimming anemone																X
	Stylaster californicus (formerly Allopora californica)	California hydrocoral				X			X		X							
	Stylatula elongata	White sea pen		X	X							X	X	X		X		X
Cnidaria	*Stylatula sp.*	Sea pen			X			X				X	X					
	Urticina piscivora	Rose anemone									X	X						
	Urticina sp.	Anemone, unident.											X					
	Virgularia californica	Sea pen											X					
	Virgularia sp	Sea pen			X							X	X					
	Virgularidae unident.	Sea pen										X	X					
	Urticina columbiana	Sand-rose anemone									X	X						
	Urticina lofotensis	White-spotted rose anemone							X						X			
	Urticina mcpeaki	McPeak's urticina							X									

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			Hard Substrate	Mixed-Bottom	Soft Substrate	Hard Substrate-high-relief	Hard Substrate-low-relief	Soft Substrate	Hard Substrate	Soft Substrate	Hard Substrate	Mixed-Bottom	Soft Substrate	Hard Substrate	Mixed-Bottom	Soft Substrate	Hard Substrate	Soft Substrate
Cnidaria	*Urticina piscivora*	White-spotted rose anemone Fish-eating anemone									X			X	X			
	Urticina sp.	Sand dwelling anemone											X					
		Plumed hydroid, unident.									X		X					
		Branched hydroid, unident.									X							
Annelida	**Segmented Worms**																	
	Arcidae unident.							X										
	Amphinomidae	Polychaete worm											X					
	Chaetopterus variopedatus	Parchment worm			X									X		X		
	Chloeia pinnata?	Free living polycahete						X					X					
	Cossura	Polychaete						X										
	Dodecaceria fewkesi													X	X			
	Diopatra ornata	Ornate tube worm								X			X	X	X	X		X
		Serpulid worm casing									X							
		Tube Worm, unident.											X					
	Diopatra splendidissima	Splendid diopatra			X													
	Laonice spp.													X				
Annelida	*Lumbrineris*	polychaete						X										
	Maldanidae	polychaete mound worms		X	X			X										
	Mediomastus	Polychaete worm						X										
	Nephtys	Catworm						X										
	Paraprionospio	polychaete						X										
	Pectenaria	Fanworm						X										
	Phyllochaetopterus	Parchment worms		X														
	Pista pacifica															X		

Phylum	Scientific Name	Common Name	Hermosa Beach (MBC 2001, AMS 2016)			Global West (SAIC 2000)			S. Cal. Bight (Occidental 2008)	Grover Beach (AMS 1998)	Morro Bay (SAIC 1999; AMS 2008; SAIC-SLO 1999)			Estero Bay (AMS 1998, Chambers 1998)			Monterey Bay (MBARI 2004)	
			Hard Substrate	Mixed-Bottom	Soft Substrate	Hard Substrate-high-relief	Hard Substrate-low-relief	Soft Substrate	Hard Substrate	Soft Substrate	Hard Substrate	Mixed-Bottom	Soft Substrate	Hard Substrate	Mixed-Bottom	Soft Substrate	Hard Substrate	Soft Substrate
	Prionospio							X										
	Protula superba	Serpulid tube worm			X													
	Sabellidae unident.	Feather duster worms			X													X
	Serpulidae unident.	Sand tube worm			X													
	Spiophanes							X										
	Tharyx							X										
Mollusca	**Bivalves, Snails, Octopus, Squid, Sea Hares, Nudibranchs**																	
	Anisodoris sp.	Yellow nudibranch									X							
	Aplysia californica	California sea hare							X									
Mollusca	*Astrea gibberosa*	Red turban snail									X							
	Axinopsida							X										
	Bivalve Mollusk	Clam like bivalve																
	Bivalve siphon																	X
	Cadlina leuteomarginata	Yellow-edged cadlina							X									
	Calliostoma annulatum	Purple-ring top snail									X			X				
	Calliostoma tricolor	Three colored top shell													X			
	Calliostoma ligatum	Blue top snail												X	X			
	Cancellaria cooperii	Cooper's nutmeg														X		
	Ceratostoma foliatum	Leafy hornmouth							X					X				
	Chaceia ovoidea	Wart-necked piddock							X									
Mollusca	*Chromadorid sp.*	Chromid sea slug									X							
	Crassedoma giganteum	Rock scallop							X									
	Crossata ventricosa	California frog shell			X													
	Cyclocardia							X										
	Cypraea spadicea	Chestnut cowry							X									
	Cryptochiton stelleri	Gumboot chiton or giant western fiery chiton												X				

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			Hard Substrate	Mixed-Bottom	Soft Substrate	Hard Substrate-high-relief	Hard Substrate-low-relief	Soft Substrate	Hard Substrate	Soft Substrate	Hard Substrate	Mixed-Bottom	Soft Substrate	Hard Substrate	Mixed-Bottom	Soft Substrate	Hard Substrate	Soft Substrate
	Dendrodoris sp.	Dendrodorid nudibranch							X									
Mollusca	*Diaulula sandiegensis*	San Diego dorid							X					X				
	Diodora aspera	Rough keyhole limpet													X			
	Dirona albolineata	White-lined dirona							X									
	Doriopsilla albopunctata	White spotted sea goddess												X	X			
	Doris montereyensis	Monterey dorid							X									
	Flabellinopsis iodinea	Spanish shawl nudibranch							X		X			X	X			
	Gastropoda	Marine snail								X								X
	Haliotis corrugata	Pink abalone							X									
	Haliotis fulgens	Green abalone							X									
	Haliotisrufescens	Red abalone							X									
	Kelletia kellettii	Kellet's whelk			X				X					X	X			
	Leopecten diegensis	San Diego scallop		X	X													
	Lithopoma undosum	Turban snail							X									
	Loligo sp. (In water column)	squid									X	X	X					
	Megathura carpenteriana	Carpenter's turid			X													
	Megathura crenulata	Giant keyhole limpet							X									
Mollusca	*Mexichromis porterae*	Porter's chromodorid							X									
	Mitra idae	Ida's miter												X				
	Mitrella	Sea snail						X										
	Nassarius fossatus															X		
	Nassarius sp.	Nassa mud snails								X				X		X		
	Norrisia norrisi	Norris's topsnail							X									
	Nudibranch, dorid white	Sea slug									X							X
	Octopoda	Octopus			X			X						X	X			X

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			Hard Substrate	Mixed-Bottom	Soft Substrate	Hard Substrate-high-relief	Hard Substrate-low-relief	Soft Substrate	Hard Substrate	Soft Substrate	Hard Substrate	Mixed-Bottom	Soft Substrate	Hard Substrate	Mixed-Bottom	Soft Substrate	Hard Substrate	Soft Substrate
	Octopus bimaculoides	Two-spot octopus			X				X									
	Octopus californicus	Deep water octopus		X	X													
	Octopus rubescens	Octopus			X								X					
	Olivella biplicata	Purple dwarf olive														X		
	Opistobranchia, *unident.*	Unidentifed opistobranch			X													
	Parapholas californica	Scaleside piddock							X					X	X			
	Parvilucina							X										
	Peltodoris nobilis	Sea lemon							X									
	Polinices altus															X		
	Polinices draconis															X		
Mollusca	*Pleurobranchea californica*	Sea slug	X	X	X			X					X					X
	Rictaxis punctulatus													X				
	Tonicella lineata	Lined chiton												X				
	Tritonia diomedea	Large triton slug		X														
	Trivia calforinicana	Coffee bean trivia												X				
Arthropoda		**Shrimp, Crabs, Isopods**																
	Amphipods							X										
	Barnacle	Unidentified barnacle							X									
	Brachyura, unident.	Unidentified crab	X		X													
	Cancer antennarius	Brown rock crab							X									
	Cancer anthonyi	Yellow crab	X		X													
	Cancer gracilis	Slender crab										X	X					
	Cancer spp.	Crab	X		X			X	X		X	X	X					X
	Cancer productus	Red rock crab		X	X													
	Euphilomedes							X										
	Farfantepenaeus	Brown shrimp			X													

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			Hard Substrate	Mixed-Bottom	Soft Substrate	Hard Substrate-high-relief	Hard Substrate-low-relief	Soft Substrate	Hard Substrate	Soft Substrate	Hard Substrate	Mixed-Bottom	Soft Substrate	Hard Substrate	Mixed-Bottom	Soft Substrate	Hard Substrate	Soft Substrate
	californiensis																	
Arthropoda	*Galatheidae*	Squat lobster				X	X											
	Heterocrypta occidentalis	Sandflat elbow crab								X						X		
	Hemisquilla ensigera	Manta shrimp		X	X													
	Hinnites giganteus	Rock scallop									X							
	Isocheles pilosus															X		
	Loxorhynchus crispatus	Masking crab				X	X		X		X					X		
	Loxorhynchus grandis	Sheep crab												X	X			
	Majidae	Masking spider crab	X	X	X													
	Munida quadrispina	Squat lobster									X							
	Paguristes sp.	Hermit crab	X	X						X		X	X	X		X		
	Pandalus danae	Coon stripe shrimp									X							
	Pandalus gurneyi	Coon striped shrimp							X									
	Panulirus interruptus	California spiny lobster							X									
	Pandalus platyceros	California spot prawn																X
	Pandalis jordani ?	Pacific ocean shrimp									X	X	X					
	Pandalid shrimp	Shrimp									X	X	X					
	Paralithodes californiensis	California king crab		X														
	Photis	Amphipod	X	X	X			X										
	Phyllolithodes papillosus	Heart crab												X				
Arthropoda	*Playtymera guadichandii*	Armed box crab																
	Pugettia producta	Northern kelp crap							X							X		
	Pugettia richii	Cryptic kelp crab							X									
	Sicyonia	Prawn						X										

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			Hard Substrate	Mixed-Bottom	Soft Substrate	Hard Substrate-high-relief	Hard Substrate-low-relief	Soft Substrate	Hard Substrate	Soft Substrate	Hard Substrate	Mixed-Bottom	Soft Substrate	Hard Substrate	Mixed-Bottom	Soft Substrate	Hard Substrate	Soft Substrate
	Bryozoans																	
		Bryozoa, pink encrusting									X							
		Bryozoa, tan encrusting									X							
		Bryozoa, tan									X				X			
		Bryozoa, white branching		X							X							
Ectoprocta		Bryozoa, orange encrusting		X							X							
		Bryozoa, orange branching			X						X							
		Bryozoans, Unident				X	X				X							
	Membranipora sp.	White encrusting bryozoan on drift kelp										X						
		White ectoproct?																
	Cellaria sp	Stick-figure bryozoan									X							
	Sea Stars, Brittle Stars																	
Echinodermata	*Allocentrotus fragilis*	Pink sea urchin		X	X			X										
	Amphiodia sp.	Brittle star						X					X					
	Amphipholis sp.	Brittle star				X		X					X					
	Asterina miniata	Bat star			X	X	X		X	X			X	X	X	X		
	Astometis sertulifera	Fragile rainbow star							X									
	Asteroidea unident.	Sea star			X													X
	Astropecten verrilli and/or A. *armatus*	Spiny sand star		X	X			X	X				X					
Echinodermata	*Brisaster*	Sea urchin						X										
	Brisingidae	Sea star						X										X
	Brissopsis	Sea urchin																
	Centrostephanus coronatus	Black sea urchin							X									
	Ceramaster patagonicus	Cookie cutter sea star							X		X							
	Crinoidea	Orange crinoid	X															

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			Hard Substrate	Mixed-Bottom	Soft Substrate	Hard Substrate-high-relief	Hard Substrate-low-relief	Soft Substrate	Hard Substrate	Soft Substrate	Hard Substrate	Mixed-Bottom	Soft Substrate	Hard Substrate	Mixed-Bottom	Soft Substrate	Hard Substrate	Soft Substrate
	Cucumaria piperata	Salt-and-pepper sea cucumber							X									
	Dendraster excentricus	Sand dollar										X				X		
	Dermasterias imbricata	Leather star							X		X							
	Echinoderm, juvenile unident.	Juvenile sea star									X							
	Echinoderm, unident.	Unidentified sea star			X													
	Florometra serratissima	Crinoid					X				X							
	Henricia spp.	Sea star				X	X		X		X							
	Hippasteria sp.	Sea star					X											X
	Holothuroidea sp.	Sea cucumber																X
	Leptosynapta albicans	Translucent sea cucumber														X		
	Linckia columbianus	Fragile star							X									
	Luidia foliolats	Sand star			X													
	Lytechinus anamesus	White urchin			X			X	X									
Echinodermata	*Lytechinus pictus*	White sea urchin		X	X													
	Mediaster aequalis	Red sea star		X	X	X	X				X							X
	Ophiocantha diplasia	Brittle star				X	X						X					
	Ophionereis sp.	Brittle star				X	X						X					
	Ophiura sp.	Brittle star										X	X					
	Ophiuroids, unident	Brittle star		X	X							X	X					
	Ophioplocus esmarki	Smooth brittle star							X					X				
	Ophiothrix spiculata	Brittle star												X				
	Orthasterias koehleri	Rainbow sea star							X		X			X	X			
	Parastichopus californicus	Sea cucumber	X	X	X				X				X					X
	Parastichopus leukothele	Sea cucumber																X
Echinodermata	*Parastichopus parvimensis*	Purple sea cucumber			X				X									
	Parastichopus sp.	Sea cucumber					X						X					X

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			Hard Substrate	Mixed-Bottom	Soft Substrate	Hard Substrate-high-relief	Hard Substrate-low-relief	Soft Substrate	Hard Substrate	Soft Substrate	Hard Substrate	Mixed-Bottom	Soft Substrate	Hard Substrate	Mixed-Bottom	Soft Substrate	Hard Substrate	Soft Substrate
	Peridontaster					X												
	Petalaster (luidia) foliolata	Leafy flat star		X	X			X					X					X
	Pisaster brevispinus	Pink sea star			X	X			X	X	X	X	X	X	X	X		
	Pisaster sp.	Sea star									X	X	X					
	Pisaster giganteus	Giant-spined sea star							X		X			X	X			
	Pisaster ochraceus	Ochre star							X	X				X	X			
	Poraniopsis inflata	Fat yellow sea star		X	X													
	Pteraster sp.	Sea star																X
	Pteraster tesselatus arcuatus	Fat sea star											X					
	Pycnopodia helianthoides	Sunflower star							X				X		X			X
	Rathbunaster californica	Multi-armed sea star				X	X						X					X
	Solaster dawsonii	Morning sun star											X					
	Strongylocentrotus franciscanus	Red sea urchin							X					X	X			
Echinodermata	*Strongylocentrotus purpuratus*	Purple sea urchin							X					X	X			
	Stylasterias forreri	Fish-eating star							X									X
	Tunicates					X	X											
	Archidistoma psammion	Compound ascidian									X							
Urorchordata	*Ascidia paratropa*	Glassy tunicate									X							
	Boltenia villosa	Spiny-headed tunicate									X			X	X			
	Cystodytes sp.	Lobed tunicate									X							
	Polyclinum planum	Elephant ear tunicate									X							
	Styela montereyensis	Stalked tunicate							X		X			X	X			

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			Hard Substrate	Mixed-Bottom	Soft Substrate	Hard Substrate-high-relief	Hard Substrate-low-relief	Soft Substrate	Hard Substrate	Soft Substrate	Hard Substrate	Mixed-Bottom	Soft Substrate	Hard Substrate	Mixed-Bottom	Soft Substrate	Hard Substrate	Soft Substrate
	Laqueus californianus	Lampshell															X	
Hemichordata	*Balanoglassus sp.*								X									
	Enteropneusia								X									

Appendix A-2: Macrobenthic Invertebrates and Alga Taxonomic List for Fiber Optic Cable Route Surveys Conducted in Coastal Southern and Central California Waters by Depth.

Scientific Name	Common Name	Hermosa Beach[1] (MBC 2001, AMS 2016)				Global West (SAIC 2000)		S. Cal. Bight (Occi. 2007)	Grover Beach (AMS 1998)	Morro Bay (SAIC 1999; AMS 2008)				Estero Bay (AMS 1998, Cha. 1998)	Monterey Bay (MBARI 2004)			
		9-30m	30-85m	85-100m	100-300m	30-150m	150-300m	9-30m	9-30m	9-30m	30-85m	85-100m	100-300m	9-30m	9-30m	30-85m	85-100m	100-300m
Protobacteria																		
Beggiatoa spp.	White filamentous bacteria		X															
Angiosperm		X																
Phyllospadix sp.	Surf grass, drift									X	X	X						
Phaeophyta																		
Egregia meanzinii	Feather boa kelp, drift							X		X	X	X						
Macrocystis pyrifera	Giant kelp, drift	X		X				X		X	X	X	X					
Nereocystis californica	Bull kelp, drift									X	X							
Phaeophyta, unident.	Unidentified brown algae	X	X															
Rhodophyta																		
Callophyllus sp.	Beautiful leaf algae													X				
Chondracanthus exasperatus		X		X										X				
Corallina officinalis														X				
Corallincea Unident., drift	Coralline algae, drift													X				
Cumathamnion decipiens																		
Cryptopleura violacea														X				
Mastocarpus papillatus	Turkish towel							X										
	Encrusting coralline algae									X	X	X						
Cystoseira osmundacea	Chain-bladder kelp							X										
Desmarestia ligulata	Acid kelp	X						X						X				
Desmarestia ligulata, drift	Drift acid kelp	X		X	X													
Eisenia arborea	Southern sea palm							X										
Gelidium coulteri														X				
Gracilaria														X				

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		9-30m	30-85m	85-100m	100-300m	30-150m	150-300m	9-30m	9-30m	9-30m	30-85m	85-100m	100-300m	9-30m	9-30m	30-85m	85-100m	100-300m
Halymena californica														X				
Halymena coccinea														X				
Halymena hollenbergii														X				
Gymnogongrus platyphyllus														X				
Mazzaella cordata														X				
Laminaria dentigera														X				
Laminaria farlowii	oarweed							X										
Laminaria setchellii	Southern stiff striped kelp							X										
Pterygopgora californica	Pom pom kelp							X										
Opuntiella californica														X				
Phycodrys setchellii														X				
Polyneura latissima														X				
Rhodoglossum owensiae														X				
Rhodymenia sp.														X				
Rhodophyta, unident.	Red algae unidentified	X	X															
Sargassum sp.	wireweed							X										
Undaria pinnatifida	wakame							X										
Porifera																		
Acarnus erithacus	Red volcano sponge													X				
Craniella arb	Gray puffball sponge							X						X				
Haliclona sp.														X				
Rhabdocalyptus sp.	Vase sponge			X	X													
Silicea (Porifera*) Sp. A*	Sponge-orange			X														
Silicea (Porifera*) Sp. B*	Sponge- Yellow			X														
Silicea (Porifera*) Sp. C*	Sponge, unident.			X														
Silicea (Porifera*) Sp. D*	Tan globular sponge										X	X	X					
Tethya aurantia	Orange puff ball sponge							X			X	X						

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		9-30m	30-85m	85-100m	100-300m	30-150m	150-300m	9-30m	9-30m	9-30m	30-85m	85-100m	100-300m	9-30m	9-30m	30-85m	85-100m	100-300m
Toxadocia spp.	White finger sponge							X										
Cnidaria																		
Acanthoptilum sp.	Sea Pen	X	X	X	X						X	X	X					
Actinaria unident.	Sea anemone														X	X	X	
Actinostola	Anemone					X	X											
Adelogorgia phyllostera	Orange gorgonian		X										X					
Amphianthus	Sea anemone					X	X											
Anthopleura artemsia?	Moonglow anemone				X						X			X				
Anthopleura elegantissima	Aggregating anemone							X						X				
Anthopleura sola	Solitary anemone							X										
Anthopleura xanthogrammica	Giant green anemone							X										
Balanophyllia elegans	Orange cup coral						X				X	X	X	X				
Bossiella														X				
Caryophillia sp.	White cup coral					X	X				X							
Cerianthidae, unident.	Cerianthid anemone										X	X				X	X	
Corallimorphus sp. 1	Colonial anthizoan																X	
Corynactis californica	Strawberry or club-tipped anemone					X				X				X	X			
Cyathoceras foxi	Cup corals			X														
Desmophyllum	Cup corals					X	X											
Eugorgia rubens	Purple gorgonian		X					X										
Eugorgia, spp.	Unidentified gorgonian coral				X													
Gorgonocephalus eucnemis	Giant basket star				X		X										X	
Hydrozoa	Corals				X			X										
Lophelia sp.	Branching white coral						X					X						
Lophogorgia chiliensis	Red gorgonian (sea whip)		X			X		X			X							

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		9-30m	30-85m	85-100m	100-300m	30-150m	150-300m	9-30m	9-30m	9-30m	30-85m	85-100m	100-300m	9-30m	9-30m	30-85m	85-100m	100-300m
Metridium farcimen (=giganteum)	White-plumed anemone		X	X	X	X	X				X	X	X	X	X	X	X	X
Muricea californica	Golden gorgonian							X										
Muricea fruticoas	Brown gorgonian							X										
Paracyathus stearnsi	Brown cup coral			X		X				X	X	X		X		X		
Parazoanthus sp.	Parasitic aggregating		X															
Pachycerianthus sp.	Tube anemone							X		X	X	X	X	X				
Pennatulacea sp.	Sea pen				X													
Plumularia sp.														X				
Polyorchis pencillatus	Bell medusa							X										
Ptilosarcus gurneyi	Orange or fleshy sea pen		X		X						X					X	X	X
Scytalium sp.	Sea pen										X	X	X					
Stomphia coccinea	Swimming anemone						X			X	X					X	X	
Stompia spp.	Swimming anemone															X	X	
Stylaster californicus (formerly Allopora californica)	California hydrocoral					X		X										
Stylatula elongata	White sea pen	X	X	X	X					X	X	X	X	X	X	X	X	X
Stylatula sp.	Sea pen					X				X	X	X	X					
Subselliflorae spp.	Sea whip, unidentified		X	X	X													
Urticina columbiana	Sand-rose anemone									X								
Urticina piscivora	White-spotted rose anemone									X	X			X				
Urticina sp.	Anemone, unident.									X	X	X	X					
Urticina lofotensis	White-spotted rose anemone							X		X				X				
Urticina mcpeaki	McPeak's urticina							X										

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		9-30m	30-85m	85-100m	100-300m	30-150m	150-300m	9-30m	9-30m	9-30m	30-85m	85-100m	100-300m	9-30m	9-30m	30-85m	85-100m	100-300m
Virgularia agassizii	Sea pen										X	X	X					
Virgularia californica	Sea pen									X	X	X	X					
Virgularia sp	Sea pen		X	X	X					X	X	X	X					
Virgularidae unident.	Sea pen									X	X	X	X					
Amphinomidae	Free living Polychaete												X					
Chaetopterus variopedatus	Parchment worm	X												X				
Chloeia pinnata?	Free living polychaete						X						X					
Cossura	Polychaete					X												
Dodecaceria fewesi														X				
Diopatra ornata	Ornate tube worm	X	X						X	X	X			X		X		
	Tube Worm, unident.									X	X	X	X					
Diopatra splendidissima	Splendid diopatra	X																
Laonice spp.														X				
Lumbrineris	polychaete					X	X											
Maldanidae	polychaete mound worms	X																
Mediomastus	Polychaete worm					X												
Nephtys	Catworm					X												
Paraprionospio	polychaete					X	X											
Pectenaria	Fanworm					X												
Phyllochaetopterus	Parchment worms	X																
Pista pacifica														X				
Prionospio						X												
Protula superba	Serpulid tube worm		X															
Sabellidae unident.	Feather duster worms		X					X										
Spiophanes						X												
Tharyx							X											
	Unknown feathered tube										X							

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		9-30m	30-85m	85-100m	100-300m	30-150m	150-300m	9-30m	9-30m	9-30m	30-85m	85-100m	100-300m	9-30m	9-30m	30-85m	85-100m	100-300m
	worm																	
Mollusca																		
Aplysia californica	California sea hare				X			X										
Axinopsida						X												
Bivalve Mollusk	Clam like bivalve										X					X		
Cadlina leuteomarginata	Yellow-edged cadlina							X						X				
Calliostoma annulatum	Purple ring top snail										X			X				
Calliostoma tricolor	Three colored top shell													X				
Calliostoma ligatum	Blue top snail													X				
Cancellaria cooperii	Cooper's nutmeg													X				
Ceratostoma foliatum	Leafy hornmouth							X						X				
Chaceia ovoidea	Wart-necked piddock							X										
Crassedoma giganteum	Rock scallop							X										
Cyclocardia						X												
Cypraea spadicea	Chestnut cowry							X										
Cryptochiton stelleri	Gumboot chiton													X				
Dendrodoris sp.	Dendrodorid nudibranch							X										
Diaulula sandiegensis	San Diego dorid							X						X				
Dirona albolineata	White-lined dirona							X										
Diodora aspera	Rough keyhole limpet													X				
Doris montereyensis	Monterey dorid							X										
Doriopsilla albopunctata	White spotted sea goddess													X				
Flabellinopsis iodinea	Spanish shawl nudibranch							X						X				
Gastropoda	Marine snail								X	X	X					X		
Haliotis corrugata	Pink abalone							X										
Haliotis fulgens	Green abalone							X										
Haliotis rufescens	Red abalone							X										

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		9-30m	30-85m	85-100m	100-300m	30-150m	150-300m	9-30m	9-30m	9-30m	30-85m	85-100m	100-300m	9-30m	9-30m	30-85m	85-100m	100-300m
Kelletia kellettii	Kellet's whelk	X						X						X				
Leopecten diegensis	San Diego scallop	X	X															
Lithopoma undosum	Turban snail							X										
Loligo sp.	squid									X	X	X	X					
Megathura crenulata	Giant keyhole limpet							X										
Megasurcula carpenteriana	Carpenter's turid		X															
Mexichromis porterae	Porter's chromodorid							X										
Mitra idae	Ida's miter													X				
Mitrella	Sea snail						X											
Nassarius sp.									X					X				
Norrisia norrisi	Norris's topsnail							X										
Nudibranch, dorid white	Sea slug															X		
Octopoda	Octopus				X	X								X		X	X	
Octopus bimaculoides	Two-spot octopus		X	X				X										
Octopus californicus	Deep water octopus			X	X													
Octopus rubescens	Octopus				X					X	X	X	X					
Olivella biplicata	Purple dwarf olive													X				
Parapholas californica	Scaleside piddock							X						X				
Parvilucina						X												
Peltodoris nobilis	Sea lemon							X										
Pleurobranchia californica	Sea slug			X	X		X				X	X	X			X	X	X
Polinices altus														X				
Polinices draconis														X				
Rictaxis punctulatus														X				
Tonicella lineata	Lined chiton													X				
Tritonia diomedea	Large triton slug			X														
Trivia calforinicana	Coffee bean trivia													X				

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		9-30m	30-85m	85-100m	100-300m	30-150m	150-300m	9-30m	9-30m	9-30m	30-85m	85-100m	100-300m	9-30m	9-30m	30-85m	85-100m	100-300m
Ectoprocta																		
	Bryozoa, orange branching										X							
	Bryozoa, orange encrusting									X	X	X						
	Bryozoa, pink encrusting									X	X	X						
	Bryozoa, unknown			X	X					X	X	X						
Cellaria sp.	Stick-figure bryozoan										X							
Arthropoda																		
Barnacle	Unidentified barnacle							X										
Brachyura, unident.	Crabs, unidentified			X	X													
Cancer antennarius	Brown rock crab							X										
Cancer anthonyi	Yellow crab			X	X													
Cancer gracilis	Slender crab									X	X	X	X					
Cancer productus	Red rock crab	X																
Cancer spp.	Crab			X	X	X				X	X	X	X		X	X	X	X
Euphilomedes						X												
Farbantepentaeus californiensis	Brown shrimp			X														
Galatheidae	Squat lobster					X	X											
Heterocrypta occidentalis	Sandflat elbow crab								X					X				
Hemisquilla ensigera	Manta shrimp		X		X													
Hinnites giganteus	Rock scallop							X			X							
Isocheles pilosus														X				
Loxorhynchus grandis														X				
Loxorhynchus crispatus	Masking crab							X		X				X				
Loxorhynchus grandis	Kelp crab			X														
Majidae, unident.	Masking spider crab			X														
Paguristes sp.	Hermit crab	X							X		X			X				

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		9-30m	30-85m	85-100m	100-300m	30-150m	150-300m	9-30m	9-30m	9-30m	30-85m	85-100m	100-300m	9-30m	9-30m	30-85m	85-100m	100-300m
Pandalid shrimp	Shrimp										X	X	X					
Pandalis jordani?	Pacific ocean shrimp										X	X	X					
Pandalus gurneyi	Coonstriped shrimp							X										
Pandalus platyceros	California spot prawn		X															
Panulirus interruptus	California spiny lobster							X										
Paralithodes californiensis	California king crab				X													
Photis	Amphipod					X												
Phyllolithodes papillosus	Heart crab													X				
Playtmera gaudichandii	Armed box crab			X	X													
Pugettia producta	Northern kelp crap							X						X				
Pugettia richii	Cryptic kelp crab							X										
Sicyonia	Prawn					X												
Echinodermata																		
Amphiodia urtica	Brittle star										X	X	X					
Amphiodia sp.	Brittle star					X	X				X	X	X					
Amphipholis sp.	Brittle star					X					X	X	X					
Asterina miniata	Bat star				X	X		X	X	X	X	X	X	X				
Asteroidea unident.	Sea star			X											X	X	X	
Astometis sertulifera	Fragile rainbow star							X										
Astropecten verrilli and/or A. armatus	Spiny sand star	X		X		X	X	X			X							
Brisaster	Sea urchin						X											
Brisingidae	Sea star						X										X	
Centrostephanus coronatus	Black sea urchin							X										
Ceramaster patagonicus	Cookie cutter sea star							X										
Crinoidea	Orange crinoid	X																
Cucumaria piperata	Salt-and-pepper sea							X										

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		9-30m	30-85m	85-100m	100-300m	30-150m	150-300m	9-30m	9-30m	9-30m	30-85m	85-100m	100-300m	9-30m	9-30m	30-85m	85-100m	100-300m
	cucumber																	
Dendraster ecentricus	Sand dollar										X							
Dermasterias imbricata	Leather star							X			X							
Echinoidea, unident.	Unidentified sea urchin			X														
Ecinoderm, juvenile unident.	Juvenile sea star									X	X							
Florometra serratissima	Crinoid						X											
Henricia spp.	Sea star					X		X										
Hippasteria sp.	Sea star					X												X
Holothuroidea sp.	Sea cucumber		X	X														
Leptosynapta albicans	Translucent sea cucumber													X				
Linckia columbianus	Fragile star							X										
Luidia foliolata	Sand star	X	X	X	X													
Lytechinus anamesus	White urchin		X	X	X	X		X										
Mediaster aequalis	Red sea star		X		X		X			X	X					X	X	X
Ophiocantha diplasia	Brittle star					X												
Ophionereis sp.	Brittle star					X	X				X							
Ophiocantha dispasia	Brittle star										X							
Ophiocanthus sp.	Brittle star										X							
Ophiothrix spiculata	Brittle star													X				
Ophiura sp.	Brittle star									X	X	X	X					
Ophiuroids	Brittle star		X	X	X					X	X	X	X					
Ophioplocus esmarki	Smooth brittle star							X						X				
Orthasterias koehleri	Rainbow sea star							X		X				X				
Parastichopus californicus	Sea cucumber	X	X	X	X			X										X
Parastichopus leukothele	Sea cucumber																	X
Parastichopus parvimensis	Purple sea cucumber			X				X										
Peridontaster							X											

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		9-30m	30-85m	85-100m	100-300m	30-150m	150-300m	9-30m	9-30m	9-30m	30-85m	85-100m	100-300m	9-30m	9-30m	30-85m	85-100m	100-300m
Parastichopus sp.	Sea cucumber	X			X	X						X						X
Peridontaster																		
Petalaster (luidia) foliolata	Leafy flat star		X		X					X	X	X	X			X	X	X
Pisaster brevispinus	Pink sea star	X						X	X	X	X			X				
Pisaster sp.	Sea star				X					X	X							
Pisaster giganteus	Giant-spined sea star							X		X	X	X		X				
Pisaster ochraceus	Ochre star							X	X					X				
Poraniopsis inflata	Fat yellow sea star				X													
Pteraster sp.	Sea star															X		
Pycnopodia helianthoides	Sunflower star							X		X		X		X	X	X		
Rathbunaster californica	Multi-armed sea star					X					X	X	X			X	X	X
Solaster dawsonii	Morning sun star										X							
Strongylocentrotus (Allocentrotus) fragilis	Pink sea urchin			X	X		X											
Strongylocentrotus franciscanus	Red sea urchin							X						X				
Strongylocentrotus purpuratus	Purple sea urchin							X						X				
Stylasterias forreri	Fish-eating star							X									X	X
Urorchordata																		
Boltenia villosa	Spiny-headed tunicate													X				
Cystodytes sp.	Lobed tunicate										X							
Polyclinum planum	Elephant ear tunicate										X							
Styela montereyensis	Stalked tunicate							X						X				
Brachiopoda																		
Laqueus californianus	Lampshell																	X

[1] AMS 2016 survey joined into Hermosa Beach columns where species occurring at depth ranges 19-23m, 29-72.5m, 73-114m, and 115m-185m were categorized into 9-30m, 30-85m, 85-100m, and 100-300m ranges, respectively.

Appendix A-3: Master Fish Taxonomic List for Fiber Optic Cable Route Surveys Conducted in Coastal Southern and Central California Waters.

Scientific Name	Common Name	Hermosa Beach (MBC 2001, AMS 2016)				Global West (SAIC 2000)	S. CA Bight (Occid 2007)	Morro Bay (SAIC 1999; AMS, 2008; SAIC-SLO 1999)				Estero Bay (AMS 1998, Chambers 1998)			Monterey Bay (MBARI 2004)
		Hard Substrate	Mixed Substrate	Soft Substrate	Water Column	Soft and Hard Substrate	Hard Substrate	Hard Substrate	Mixed Substrate	Soft Substrate	Water Column	Hard Substrate	Mixed Substrate	Soft Substrate	Soft Substrate
Alloclinus holderi	Island kelpfish						X								
Agonidae unident.	Poacher		X	X					X	X					X
Anisotremus davidsonii	Sargo						X								
Anoplodoma fimbria	Sablefish		X												X
Argentina sialis	Pacific Argentine		X	X											
Artedius corallinus	Coralline sculpin						X					X			
Atherinidae, unident.	Baitfish school			X	X										
Atherinops affinis	Topsmelt						X								
Atherinopsidae	Silverside						X								
Atherinopsis californiensis	Jack smelt						X								
Aulorhynchus flavidus	Tubesnout						X			X	X				
Balistes polylepis	Finescale triggerfish						X								
Brachyistius frenatus	Kelp perch						X								
Caulolatilus princeps	Ocean whitefish						X								
Cephaloscyllium ventriosum	Swell shark						X			X					
Cheilotrema saturnum	Black croaker						X								
Chilara taylori	Spotted cusk-eel									X					
Chilara sp.	Cusk-eel									X					
Chondrichthyes	Cartilaginous fishes														X
Chromis punctipinnis	blacksmith						X								
Clupeiformes	Ray finned fishes														X
Citharichthys sordidus	Pacific sanddab		X	X						X					
Citharichthys stigmaeus	Speckled sanddab			X								X	X	X	
Citharichthys spp	Sanddab			X						X					

Scientific Name	Common Name	Hermosa Beach (MBC 2001, AMS 2016)				Global West (SAIC 2000)	S. CA Bight (Occid 2007)	Morro Bay (SAIC 1999; AMS, 2008; SAIC-SLO 1999)				Estero Bay (AMS 1998, Chambers 1998)			Monterey Bay (MBARI 2004)
		Hard Substrate	Mixed Substrate	Soft Substrate	Water Column	Soft and Hard Substrate	Hard Substrate	Hard Substrate	Mixed Substrate	Soft Substrate	Water Column	Hard Substrate	Mixed Substrate	Soft Substrate	Soft Substrate
Clinidae	kelpfish						X								
Clinocottus analis	Wooly sculpin						X								
Coryphopterus nicholsi	Black eyed goby											X	X		
Cottidae unident.	Sculpin, cabezon							X	X	X					X
Cymatogaster aggregata	Shiner perch			X			X								
Embiotoca jacksoni	Black perch						X								
Embiotoca lateralis	Striped seaperch						X								
Engraulis mordax	Northern anchovy						X	X	X	X	X				
Enophrys taurina	Bull sculpin								X	X					
Eopsetta exilis	Slender sole					X									
Eptatretus stouti	Pacific hagfish					X				X					
Galeorhinus galeus	Soupfin shark						X								
Gibbonsia elegans	Spotted kelpfish						X								
Gibbonsia sp.	Kelpfish						X					X			
Girella nigricans	Opaleye						X								
Gobiidae	Unidentified goby						X								
Genyonemus lineatus	White croaker									X	X				
Glyptocephalus zachirus	Rex sole					X									X
Gymnothorax mordax	California moray						X								
Halichoeres semicinctus	Rock Wrasse						X								
Hermosilla azurea	Zebra perch						X								
Heterodontus francisci	Horn shark						X								
Heterostichus rostratus	Giant Kelpfish						X	X							
Hexagrammos decagrammus	Kelp greenling						X								
Hydrolagus colliei	Spotted ratfish			X						X					

Scientific Name	Common Name	Hermosa Beach (MBC 2001, AMS 2016)				Global West (SAIC 2000)	S. CA Bight (Occid 2007)	Morro Bay (SAIC 1999; AMS, 2008; SAIC-SLO 1999)				Estero Bay (AMS 1998, Chambers 1998)			Monterey Bay (MBARI 2004)
		Hard Substrate	Mixed Substrate	Soft Substrate	Water Column	Soft and Hard Substrate	Hard Substrate	Hard Substrate	Mixed Substrate	Soft Substrate	Water Column	Hard Substrate	Mixed Substrate	Soft Substrate	Soft Substrate
Hyperprosopon argenteum	Walleye surfperch						X								
Hypsurus caryi	Rainbow seaperch						X					X			
Hypsypops rubicundus	Garibaldi						X								
Leiocottus hirundo	Lavender scuplin						X								
Lethops connectens	Halfblind goby						X								
Lycodes sp.	Eelpout									X					X
Lycodes cortezanus	Bigfin eelpout					X									X
Lycodopsis pacifica	Blackbelly ellpout		X	X											
Lythrypnus dalli	Bluebanded goby						X								
Medialuna californiensis	halfmoon						X								
Micrometrus minimus	Dwarf surfperch						X								
Microstomus pacificus	Dover sole		X	X		X				X					X
Merluccius productus	North Pacific hake					X									X
Myliobatis californicia	California bat ray			X			X								
Ophiodon elongatus	Lingcod			X		X	X			X		X		X	X
Orthonopias triacis	Snubnose sculpin						X								
Oxyjulis california	Senorita			X			X					X			
Oxylebius pictus	Painted Greenling						X	X				X	X		
Paralabrax clathratus	Kelp bass						X	X							
Paralabrax neubulifer	Barred sandbass			X			X								
Paralichthys californicus	California halibut			X			X			X					
Phanerodon atripes	Sharpnose seaperch						X								
Phanerodon furcatus	White seaperch						X					X			
Platchthys stellatus	Starry Flounder			X											
Pleuronectes vetulas	English sole									X					X
Pleuronectifores, *unident.*	Flatfish			X											
Pleuronichthys coenosus	C-O sole			X								X			X

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		Hard Substrate	Mixed Substrate	Soft Substrate	Water Column	Soft and Hard Substrate	Hard Substrate	Hard Substrate	Mixed Substrate	Soft Substrate	Water Column	Hard Substrate	Mixed Substrate	Soft Substrate	Soft Substrate
Pleuronichthys ritteri	Spotted turbot			X											
Pleuronichthys verticulus	Hornyhead turbot			X											
Pleuronectidae Sp.	Sole			X						X					
Porichthys notatus	Plainfin midshipman					X									
Rathbunella alleni	Stripefin ronquil						X								
Raja binoculata	Big skate									X					
Raja rhina	Longnose skate			X						X					X
Raja sp.	Skate		X							X					
Rhacochilus toxotes	Rubberlip seaperch						X								
Rhacochilus (Damalichthys) vacca	Pile perch						X					X			
Rhinogobiops nicholsii	Blackeye goby						X								
Sarda chiliensis	Bonito				X		X								
Sardinops sagax	Pacific sardine						X								
Scomber japonicus	Pacific chub mackerel						X								
Scorpaena guttata	California scorpionfish	X		X			X								
Scorpaenichthys marmoratus	Cabezon						X								
Scorpaenodes xyris	Rainbow scorpionfish						X								
Sebastes atrovirens	Kelp rockfish						X								
Sebastes auriculatus	Brown rockfish	X					X					X			
Sebastes cimplex	Brown rockfish						X								
Sebastes carnatus	Gopher rockfish	X					X						X		
Sebastes caurinus	Cooper rockfish	X					X					X			
Sebastes crameri	Darkblotched rockfish														X
Sebastes chrysomelas	Blank-and-yellow rockfish						X								

Scientific Name	Common Name	Hermosa Beach (MBC 2001, AMS 2016)				Global West (SAIC 2000)	S. CA Bight (Occid 2007)	Morro Bay (SAIC 1999; AMS, 2008; SAIC-SLO 1999)				Estero Bay (AMS 1998, Chambers 1998)			Monterey Bay (MBARI 2004)
		Hard Substrate	Mixed Substrate	Soft Substrate	Water Column	Soft and Hard Substrate	Hard Substrate	Hard Substrate	Mixed Substrate	Soft Substrate	Water Column	Hard Substrate	Mixed Substrate	Soft Substrate	Soft Substrate
Sebastes dallii	Calico rockfish						X								
Sebastes diplopora	Splitnose rockfish														X
Sebastes elongatus	Green stripped rockfish							X							X*
Sebastes jordani	Shirtbelly rockfish														X
Sebastes maliger	Quillback rockfish							X							
Sebastes melanostomus	Blackgill rockfish					X									
Sebastes miniatus	Vermillion rockfish	X					X								
Sebastes mystinus	Blue rockfish						X					X			
Sebastes paucispinus	bocaccio						X								
Sebastes pinniger	Orange rockfish		X	X											
Sebastes rastrelliger	Grass rockfish						X								
Sebastes rosaeeus	Rosy rockfish	X						X							
Sebastes rubrivinctus	Flag rockfish	X	X												
Sebastes saxicola	Stripetail rockfish														X
Sebastes semicinctus	Half banded rockfish	X	X	X				X							
Sebastes serriceps	Tree fish						X	X							
Sebastes serrinoides	Olive rockfish						X	X	X	X					
Sebastes serrinoides/flavidus	Olive/yellowtail rockfish						X								
Sebastes umbrosus	Honeycomb rockfish	X	X				X								
Sebastes spp. (juveniles)	Rockfish (juveniles)	X		X				X	X	X					
Sebastes spp. (adult)	Rockfish (adult)	X		X			X	X		X					X
Sebastolobus alascanus	Shortspine thornyhead					X									
Semicossyphus pulcher	California sheephead						X								
Seriphus politus	Queenfish			X											
Sphyraena argentea	Pacific barracuda						X								
Squalus acanthias	Dogfish shark		X												
Squatina californica	Pacific angel shark			X			X			X					

Scientific Name	Common Name	Hermosa Beach (MBC 2001, AMS 2016)				Global West (SAIC 2000)	S. CA Bight (Occid 2007)	Morro Bay (SAIC 1999; AMS, 2008; SAIC-SLO 1999)				Estero Bay (AMS 1998, Chambers 1998)			Monterey Bay (MBARI 2004)
		Hard Substrate	Mixed Substrate	Soft Substrate	Water Column	Soft and Hard Substrate	Hard Substrate	Hard Substrate	Mixed Substrate	Soft Substrate	Water Column	Hard Substrate	Mixed Substrate	Soft Substrate	Soft Substrate
Stereolepis gigas	Giant sea bass						X								
Symphurus atricauda	California tonguefish									X					
Synodus luciocepsis	California lizardfish			X											X
Torpedinidae	Torpedo ray														X
Torpedo californica	Pacific electric ray									X					
Trachurus symmetricus	Jack mackerel						X								
Triakis semifasciata	Leopard shark						X								
Urobatis halleri	Round stingray						X								
Xeneretmus leiops	Smootheye poacher					X									
Xenistius californiensis	salema						X								
Xystreurys liopepsis	Fantail sole			X											
Zalembius rosaceus	Pink surfperch		X	X				X							X
Zaniolepi frenata	Shortspine combfish			X											
Zaniolepis latipinnus	Longspine combfish		X	X						X					
Zaniolepi spp.	Combfish			X											
Zapteryx exasperata	Banded guitarfish			X						X					
Zoarcidae unident.	Eelpout														X

Appendix A-4: Fish Taxonomic List of Observed Fish Species in Southern and Central Coastal California Waters by Depth.

Scientific Name	Common Name	Hermosa Beach[1] (MBC 2001, AMS 2016)				South. CA Bight (Occidental 2008)	Global West (SAIC 2000)		Morro Bay (SAIC 1999; AMS 2008; SAIC-SLO 1999)				Estero Bay (AMS 1998, Chambers 1998)	Monterey Bay (MBARI 2004)			
		9-30m	30-85m	85-100m	100-300m	9-30m	30-150m	150-300m	9-30m	30-85m	85-100m	100-300m	9-30m	9-30m	30-85m	85-100m	100-300m
Agonidae unident.	Poacher		X							X	X						X
Alloclinus holderi	Island kelpfish					X											
Anisotremus davidsonii	Sargo					X											
Anoplodoma fimbria	Sablefish		X													X	X
Artedius corallinus	Coralline sculpin					X							X				
Argentina sialis	Pacific Argentine	X	X		X												
Atherinidae, unident.	Baitfish school	X			X												
Atherinops affinis	Topsmelt					X											
Atherinopsidae	Silverside					X											
Atherinopsis californiensis	Jack smelt					X											
Aulorhynchus flavidus	Tubesnout					X			X			X					
Balistes polylepis	Finescale triggerfish					X											
Caulolatilus princeps	Ocean whitefish					X											
Cephaloscyllium ventriosum	Swell shark					X			X								
Cheilotrema saturnum	Black croaker					X											
Chilara taylori	Spotted cusk-eel								X	X	X	X					
Chilara sp	Cusk-eel								X	X	X	X					
Chromis punctipinnis	blacksmith					X											
Citharichthys sordidus	Pacific sanddab	X	X	X	X					X	X	X					

Scientific Name	Common Name	Hermosa Beach[1] (MBC 2001, AMS 2016)				South. CA Bight (Occidental 2008)	Global West (SAIC 2000)		Morro Bay (SAIC 1999; AMS 2008; SAIC-SLO 1999)				Estero Bay (AMS 1998, Chambers 1998)	Monterey Bay (MBARI 2004)			
		9-30m	30-85m	85-100m	100-300m	9-30m	30-150m	150-300m	9-30m	30-85m	85-100m	100-300m	9-30m	9-30m	30-85m	85-100m	100-300m
Citharichthys spp	Sanddab									X	X	X		X	X	X	X
Citharichthys stigmaeus	Speckled sanddab												X				
Clinidae	Kelpfish					X											
Clinocottus analis	Wooly sculpin					X											
Coryphopterus nicholsi	Black eyed goby												X				
Cottidae unident.	Sculpin									X	X	X			X	X	X
Cymatogaster aggregata	Shiner perch	X				X											
Embiotoca jacksoni	Black perch					X											
Embiotoca lateralis	Striped seaperch					X											
Engraulis mordax	Northern anchovy					X			X	X	X	X					
Enophrys taurina	Bull sculpin									X							
Eptatretus stouti	Pacific hagfish									X	X	X					
Galeorhinus galeus	Soupfin shark					X											
Genyonemus lineatus	White croaker									X							
Gibbonsia elegans	Spotted kelpfish					X											
Gibbonsia sp.	Kelpfish					X							X				
Girella nigricans	Opaleye					X											
Glyptocephalus zachirus	Rex sole							X									X
Gobiidae	Unidentified goby					X											
Gymnothorax mordax	California moray					X											
Hydrolagus colliei	Spotted ratfish				X					X							
Halichoeres semicinctus	Rock Wrasse					X											

Scientific Name	Common Name	Hermosa Beach[1] (MBC 2001, AMS 2016)				South. CA Bight (Occidental 2008)	Global West (SAIC 2000)		Morro Bay (SAIC 1999; AMS 2008; SAIC-SLO 1999)				Estero Bay (AMS 1998, Chambers 1998)	Monterey Bay (MBARI 2004)			
		9-30m	30-85m	85-100m	100-300m	9-30m	30-150m	150-300m	9-30m	30-85m	85-100m	100-300m	9-30m	9-30m	30-85m	85-100m	100-300m
Hermosilla azurea	Sebraperch					X											
Heterodontus francisci	Horn shark					X											
Heterostichus rostratus	Giant Kelpfish					X											
Hexagrammos decagrammus	Kelp greenling					X											
Hyperprosopon argenteum	Walleye surfperch					X											
Hypsurus caryi	Rainbow seaperch					X							X				
Hypsypops rubicundus	Garibaldi					X											
Leiocottus hirundo	Lavender scuplin					X											
Lethops connectens	Halfblind goby					X											
Lycodes sp.	Eelpout									X	X	X					X
Lycodes cortezanus	Bigfin eelpout							X									X
Lycodes pacifica	Blackbelly ellpout			X	X												
Lythrypnus dalli	Bluebanded goby					X											
Medialuna californiensis	Halfmoon					X											
Merluccius productus	North Pacific hake			X	X			X									
Micrometrus minimus	Dwarf surfperch					X											
Microstomus pacificus	Dover sole		X	X	X			X		X	X						X
Myliobatis californicia	California bat ray	X				X											

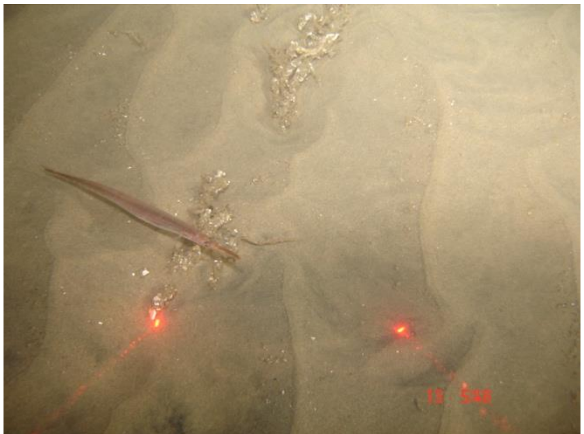
Scientific Name	Common Name	Hermosa Beach[1] (MBC 2001, AMS 2016)				South. CA Bight (Occidental 2008)	Global West (SAIC 2000)		Morro Bay (SAIC 1999; AMS 2008; SAIC-SLO 1999)				Estero Bay (AMS 1998, Chambers 1998)	Monterey Bay (MBARI 2004)			
		9-30m	30-85m	85-100m	100-300m	9-30m	30-150m	150-300m	9-30m	30-85m	85-100m	100-300m	9-30m	9-30m	30-85m	85-100m	100-300m
Ophiodon elongatus	Lingcod				X	X		X		X			X				X
Orthonopias triacis	Snubnose sculpin					X											
Oxyjulis california	Senorita	X				X							X				
Oxylebius pictus	Painted Greenling					X							X				
Paralabrax clathratus	Kelp bass					X			X	X							
Paralabrax neubulifer	Barred sandbass	X				X											
Paralichthys californicus	California halibut	X		X	X	X				X	X	X					
Phanerodon atripes	Sharpnose seaperch					X											
Phanerodon furcatus	White seaperch					X							X				
Platichthys stellatus	Starry flounder				X												
Pleuronectes vetulas	English sole									X	X						X
Pleuronectidae unident.	Sole									X	X	X					
Pleuronichthys coenosus	C-O sole			X	X								X				
Pleuronichthys ritteri	Spotted turbot	X															
Pleuronichthys verticalis	Horneyhead turbot			X	X												
Porichthys notatus	Plainfin midshipman							X									
Raja binoculata	Big skate									X							
Raja rhina	Longnose skate		X	X	X						X				X	X	X
Raja sp.	Skate				X					X	X				X		
Rathbunella alleni	Stripefin ronquil					X											
Rhacochilus toxotes	Rubberlip seaperch					X											
Rhacochilus (damalichthys) vacca	Pile perch					X							X				
Rhinogobiops nicholsii	Blackeye goby					X											

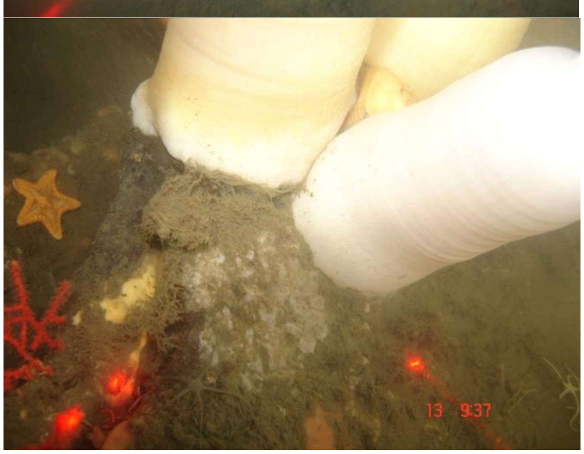
Scientific Name	Common Name	Hermosa Beach[1] (MBC 2001, AMS 2016)				South. CA Bight (Occidental 2008)	Global West (SAIC 2000)		Morro Bay (SAIC 1999; AMS 2008; SAIC-SLO 1999)				Estero Bay (AMS 1998, Chambers 1998)	Monterey Bay (MBARI 2004)			
		9-30m	30-85m	85-100m	100-300m	9-30m	30-150m	150-300m	9-30m	30-85m	85-100m	100-300m	9-30m	9-30m	30-85m	85-100m	100-300m
Sarda chiliensis	Bonito				X	X											
Sardinops sagax	Pacific sardine					X											
Scomber japonicus	Pacific chub mackerel					X											
Scorpaena guttata	California scorpionfish		X	X		X											
Scorpaenichthys marmoratus	Cabezon					X											
Scorpaenodes xyris	Rainbow scorpionfish					X											
Sebastes atrovirens	Kelp rockfish					X											
Sebastes auriculatus	Brown rockfish			X		X							X				
Sebastes cimplex	Brown rockfish					X											
Sebastes carnatus	Gopher rockfish			X		X							X				
Sebastes caurinus	Cooper rockfish			X		X							X				
Sebastes crameri	Darkblotched rockfish																X
Sebastes chrysomelas	Blank-and-yellow rockfish					X											
Sebastes dallii	Calico rockfish			X	X	X											
Sebastes diplopora	Splitnose rockfish																X
Sebastes elongatus	Green stripped rockfish																X
Sebastes jordani	Shirtbelly rockfish															X	X
Sebastes melanostomus	Blackgill rockfish							X									
Sebastes miniatus	Vermillion rockfish			X		X											
Sebastes mystinus	Blue rockfish					X							X				
Sebastes paucispinus	Bocaccio					X											
Sebastes pinniger	Orange rockfish		X														
Sebastes rastrelliger	Grass rockfish					X											

Scientific Name	Common Name	Hermosa Beach[1] (MBC 2001, AMS 2016)				South. CA Bight (Occidental 2008)	Global West (SAIC 2000)		Morro Bay (SAIC 1999; AMS 2008; SAIC-SLO 1999)				Estero Bay (AMS 1998, Chambers 1998)	Monterey Bay (MBARI 2004)			
		9-30m	30-85m	85-100m	100-300m	9-30m	30-150m	150-300m	9-30m	30-85m	85-100m	100-300m	9-30m	9-30m	30-85m	85-100m	100-300m
Sebastes rosaeeus	Rosy rockfish			X					X	X							
Sebastes rubrivinctus	Flag rockfish		X	X	X												
Sebastes saxicola	Stripetail rockfish																X
Sebastes semicinctus	Half banded rockfish		X	X	X												
Sebastes serriceps	Tree fish					X											
Sebastes serrinoides	Olive rockfish					X				X							
Sebastes serrinoides/ flavidus	Olive/yellowtail rockfish					X											
Sebastes spp. (juveniles)	Rockfish (juveniles)								X	X	X	X		X	X		X
Sebastes spp. (adult)	Rockfish (adult)	X	X	X	X	X			X	X	X	X					
Sebastes umbrosus	Honeycomb rockfish		X	X		X											
Sebastolobus alascanus	Shortspine thornyhead							X									
Semicossyphus pulcher	Califonria sheephead					X											
Seriphus politus	Queenfish	X															
Sphyraena argentea	Pacific barracuda					X											
Squalus acanthias	Dogfish shark				X												
Squatina californica	Pacific angel shark	X		X	X	X				X							
Stereolepis gigas	Giant sea bass					X											
Symphurus atricauda	California tonguefish									X	X						
Synodus luciocepsis	California lizardfish	X	X	X	X										X	X	
Torpedinidae	Torpedo ray														X	X	
Torpedo californica	Pacific electric ray									X							
Trachurus symmetricus	Jack mackerel					X											
Triakis semifasciata	Leopard shark					X											

Scientific Name	Common Name	Hermosa Beach[1] (MBC 2001, AMS 2016)				South. CA Bight (Occidental 2008)	Global West (SAIC 2000)		Morro Bay (SAIC 1999; AMS 2008; SAIC-SLO 1999)				Estero Bay (AMS 1998, Chambers 1998)	Monterey Bay (MBARI 2004)			
		9-30m	30-85m	85-100m	100-300m	9-30m	30-150m	150-300m	9-30m	30-85m	85-100m	100-300m	9-30m	9-30m	30-85m	85-100m	100-300m
Urobatis halleri	Round stingray					X											
Xeneretmus leiops	Smootheye poacher							X									
Xenistius californiensis	Salema					X											
Xystreurys liolepis	Fantail sole			X													
Zalembius rosaceus	Pink surfperch		X	X	X					X	X				X	X	X
Zanioles spp.	Combfish	X	X	X	X												
Zanioleis frenata	Shortspine combfish			X	X												
Zanioleis latipinnis	Longspine combfish		X	X	X						X						
Zapteryx exasperata	Banded guitarfish			X						X							
Zoarcidae unident.	Eelpout																X

[1] AMS 2016 survey joined into Hermosa Beach columns where species occurring at depth ranges 19-23m, 29-72.5m, 73-114m, and 115m-185m were categorized into 9-30m, 30-85m, 85-100m, and 100-300m ranges, respectively.





Marine Aquatic Habitats and Biological Resources Offshore Grover Beach, California:

Addendum 1- BtoBE Cable Route Characterization

April 2019

Prepared for:

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APPLIED marine SCIENCES

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Table of Contents

BtoBE Cable Route (Grover Beach, CA Landing)

The proposed routing of the BtoBE fiber optic cable through the nearshore coastal environment of Central California is illustrated in Figures 1.1, 1.5, and 1.8. These Figures also illustrate the proximity of the BtoBE offshore cable route to the PAC 1 Segment 1 (Seg 1), PC 1 Segment S (Seg S), and PC 1 Segment E (Seg E) fiber optic cables. All three of these cables have landings in Grover Beach, California. The habitat along the proposed BtoBE cable route is principally comprised of soft sand and silt/clay substrate with occasional pockets of gravel and cobble. Some mixed and low to high substrate hard bottom occurs to the north of the proposed cable route. Seafloor mapping information from a recently completed geophysical survey of the BtoBE cable route (EGS 2018) was combined with marine biological community data from numerous ROV and diving surveys near the BtoBE cable location to develop the technical descriptions of habitat and associated marine communities along the BtoBE cable route. The discussion of habitat and associated marine biological communities has been broken out by route segments that corresponds with key water depth ranges.

This discussion of the BtoBE cable route is prepared as an Addendum to its parent document entitled *Marine Aquatic Habitats and Biological Resources Offshore Grover Beach, California*. As such it references data tables and other information contained within that document.

BtoBE Cable Route Segment 1 between 16-25 m (52-82 ft) Water Depth

This segment of the BtoBE cable route commences at the bore pipe exit point, located at a water depth of approximately 16.5 m (82 ft), and transits perpendicular to the shoreline, parallel to and immediately northward of the PC 1 Seg E, Seg S and PAC 1 Seg 1cable routes, out to 25 m (82 ft) water depth (Figure 1.1). The seafloor along this segment of the cable route is characterized in the geophysical seafloor mapping survey conducted by EGS Surveys as, “fine to medium sand” (EGS 2018). Within this segment of the seafloor, occasional patches of “coarse sediment” containing “bull kelp (*Nereocystis luetkeana*) meadows over loose silty sand” were also characterized by EGS (Figure 1.1). The proposed BtoBE cable route attempts to avoid all these areas by exiting the cable conduit just offshore of the largest mapped coarse sediment patch identified as potentially supporting bull kelp. (Figure 1.1).

Whereas EGS identified gravel/cobble beds that potentially support bull kelp beds in the nearshore waters offshore Grover Beach, more recent reviews of aerial images for the area do not reveal any major kelp beds south of the Pismo Beach Pier. Additionally, scientific diver surveys of the PC 1 and PAC 1 cable borehole exit locations, and similar locations located along the shallower subtidal route of these cables which were also previously characterized as supporting kelp beds in the geophysical seafloor mapping surveys conducted for those cables (Figure 1.2), reported that the seafloor habitat within this region was composed of silt, sand and clay substrates with no mixed or hard substrate present (AMS 1998). It is obvious from the current (EGS 2018) and previous geophysical surveys, that the nearshore subtidal region (< 31m, 102 ft.) offshore Grover Beach, California is highly dynamic and constantly changing, with periodic large swells and shifting seafloor sediments. Although some mixed bottom[1] habitat may be present, or exposed for brief periods of time, it may become reburied with sand moved by wave and tidal action. In addition, a thin veneer of sand or sediment may provide reflectivity in the geophysical survey data making it difficult to accurately characterize hard substrate.

The AMS diving survey also observed a persistent nepheloid layer (murky fine sediment-laden water) present within 0.5 meters of the seafloor. Sand ripples averaged 1-2 cm in height and 5-10 cm apart. The

[1] Mixed Hard Bottom is a combination of exposed rock shelf, large cobbles and/or small boulders, intermixed with soft sediment. Soft substrate is typically the dominant habitat type.

survey also reported the presence of terrestrial plant debris that was assumed to have originated from winter storm flow (AMS 1998). Both the plant debris and the nepheloid layer may make it more difficult to accurately characterize the area geophysically. In addition, turbidity is not conducive towards the establishment of kelp (Springer *et. al* 2007). Bull kelp is an annual plant with spores being released in the spring and growth occurring throughout the year before the plant dies (Springer *et. al* 2007). It is conceivable that during a period of oceanographic conditions that an area of suitable mixed habitat might become exposed long enough in the spring to enable some bull kelp plants to establish themselves, only to have the holdfasts buried under moving sand and sediment later in the year, preventing additional plant establishment the following year.

Based on the findings reported in the 1998 AMS report and personal communications with area commercial fishermen (Tognazzini 2019), it is hypothesized that the occurrence of bull kelp south of the Pismo Beach Pier (between the Pismo Beach Pier and Mussel Rock) is very limited. In contrast, the nearshore region of San Luis Obispo Bay, between Port San Luis and the Pismo Beach Pier, contains extensive areas of exposed hard substrate that supports bull kelp beds.

The biological community offshore of Grover Beach that will be impacted by the BtoBE cable route is likely to be similar to the communities associated with the Asia America Gateway (AAG) S-5 (AMS 2008) and MCI/WorldCom fiber optic cable projects offshore Montana del Oro/Morro Bay (SAIC 1999), located approximately 20 miles north of the proposed BtoBE cable route. The epibenthic communities inhabiting the soft substrate in this depth range, included the ornate tube worm *Diopatra ornata (*Figure 1.3*); cancer crabs (Cancer sp.);* the slender crab *Cancer gracilis,* the masking crab *Loxorhynchus crispatus,* the octopus *Octopus rubescens*, the squid *Loligo sp.,* the white sea pen *Stylatula elongata*, occasional polychaete tube worms, *Pachycerianthus* anemones, brittle stars, and the sea stars *Petalster* (*Luidia) foliolata* and *Pycnopodia helianthoides*. The sea stars *Asterina miniata* and *Mediaster aequalis*, were observed inhabiting soft sediment habitat adjacent to or in close proximity to exposed hard substrate (Table A-1 and A-3).

The PC and PAC fiber optic cable landfalls and inshore route survey 15-23 m (50-75 ft.) conducted by SCUBA divers reported the occurrence of the ornate tube worm *D. ornata*; gastropods including the mud snail *Nassarius sp.*, the arthropods *Heterocrypta occidentalis* and *Paguristhes sp*., and the sea stars *A. miniata*, *Pisaster ochraceous*, and *P. brevispinus* (AMS 1998).

The predominant taxa inhabiting mixed bottom habitat in the 15-23 m depth range include the red alga *Rhodymenia* sp.; orange encrusting bryozoans; encrusting coralline algae; unknown tan globular and white foliose sponges; the brown cup coral *Paracyathus stearnsi*; assorted sea stars, including *Mediaster aequalis*, *P. brevispinus, and P. giganteus;* and assorted anemones, including *Urticina columbiana*, *U. piscivora*, *Metridium* sp., and *Stomphia coccinea* (AMS 2008, SAIC 1999*).*

Fish taxa observed at these water depths along included Speckled sanddab *(Citharichthys stigmaeus);* Tubesnout (*Aulorhynchus flavidus) (*Figure 1.3*);* Swell shark (*Cephaloscyllium ventriosum); C*usk eel *(Chilari sp.);* Kelp bass *(Paralabrax clathratus);* and Northern anchovy *(Engraulis mordax).* In addition, squid (*Loligo* sp.) (Figure 1.4) were periodically observed swimming in the water column (Tables A-2 and A-4) (AMS 2008), SAIC 1999).

BtoBE Cable Route Segment 2 Between 25-100 m (82-328 ft) Water Depth

The seafloor habitat along the BtoBE cable route through these water depths was predominantly characterized by the EGS seafloor survey (EGS 2018) as loose silty sand (Figure 1.5). Between 63m (207 ft.) and 81 m (266 ft.) and again at between 88 m (289 ft.) and 97 m (312 ft.) mixed, low, moderate and high relief hard substrate occurs 200-600 m (656-1,969 ft.) to the north of the route (Figure 1.5).

Figure 1.1: BtoBE Cable Route Between 5-25 Meters (16-82 Feet) Water Depth.

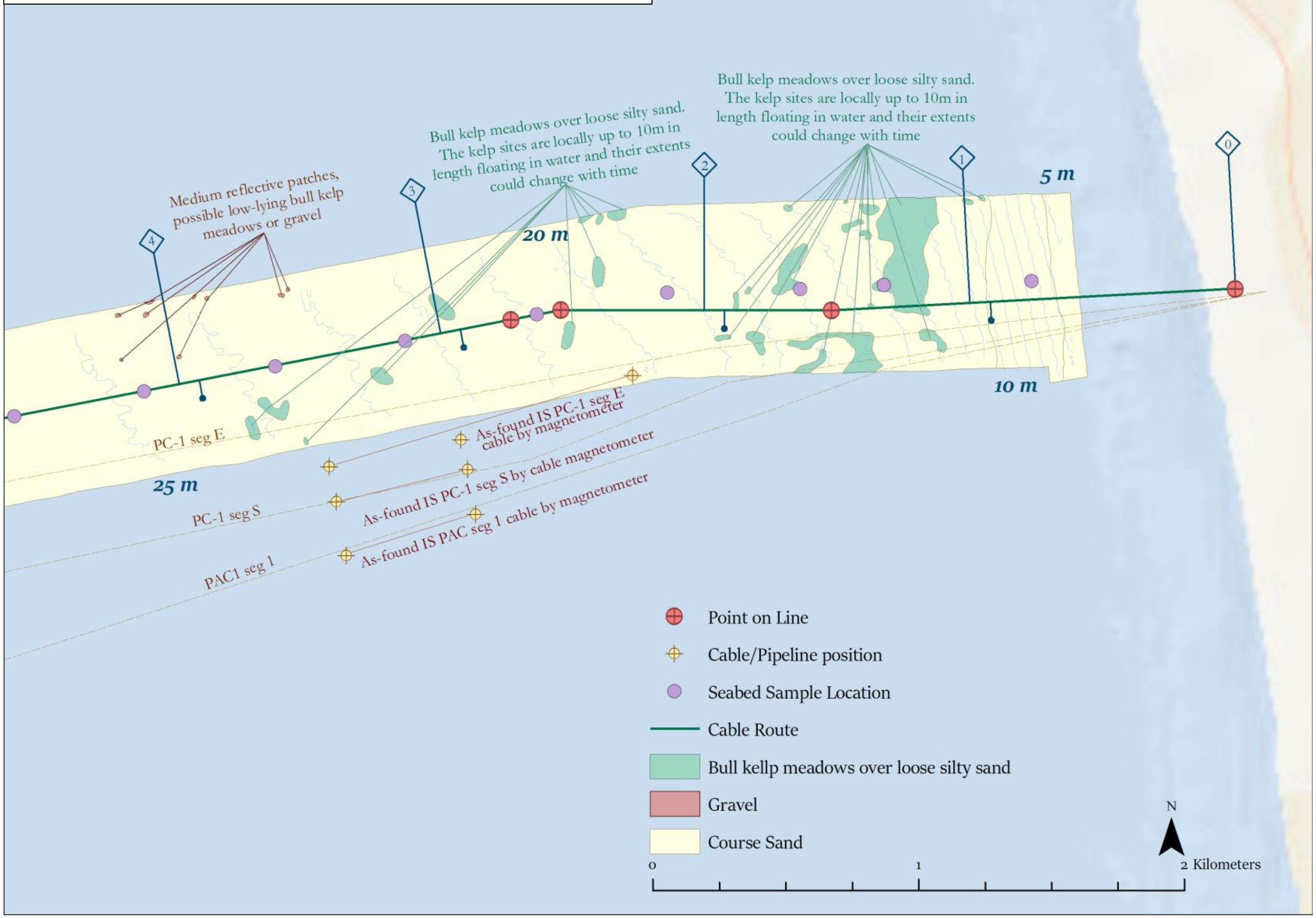
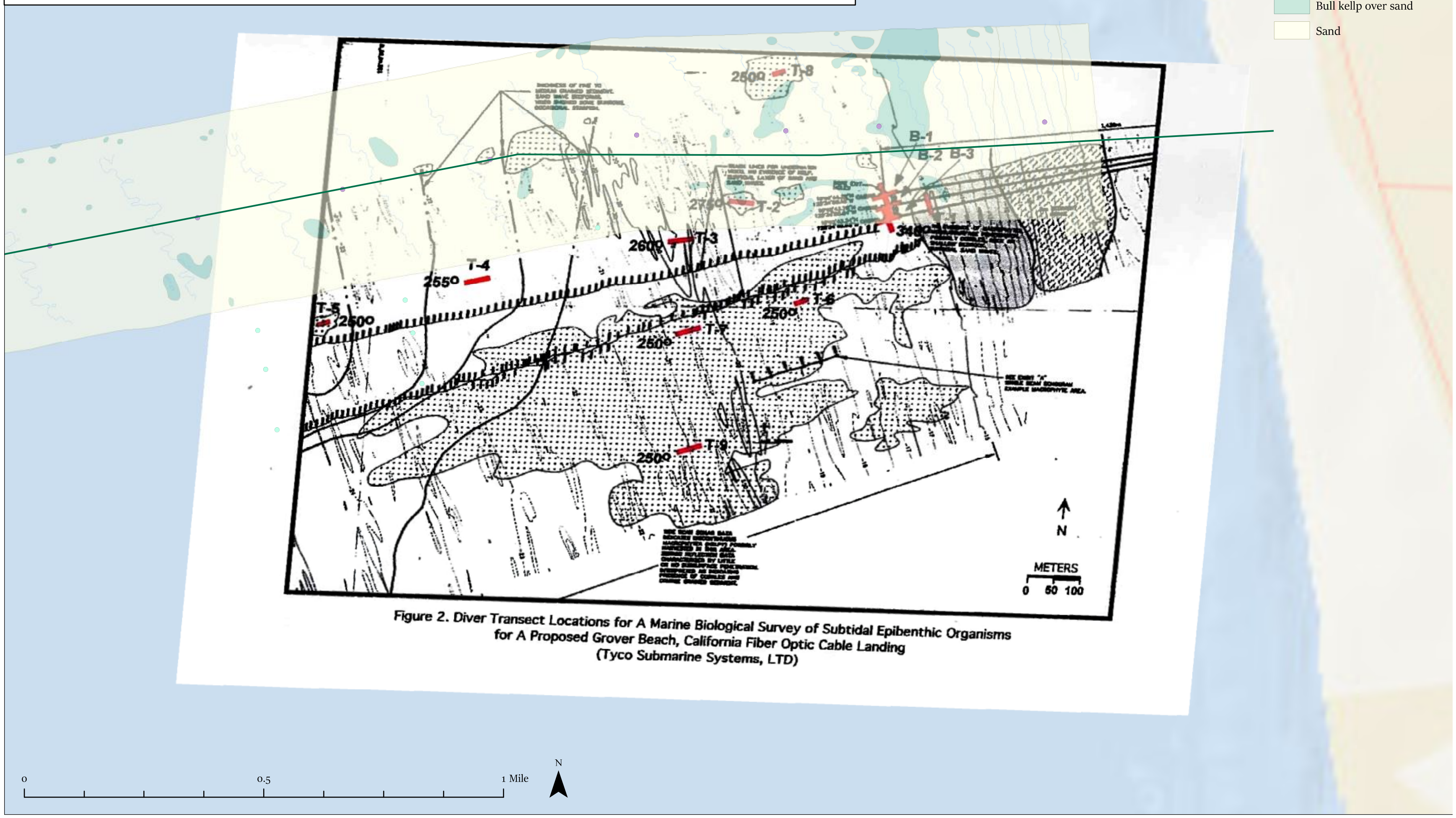


Figure 1.2: BtoBE and the PC-1 (Seg 1) Nearshore Cable Routes Illustrating the Geophysical Seafloor Mapping Characterizations for Both Cable Routes and Scientific Diver Survey Transect Locations on Characterized Hard Substrate Habitat.



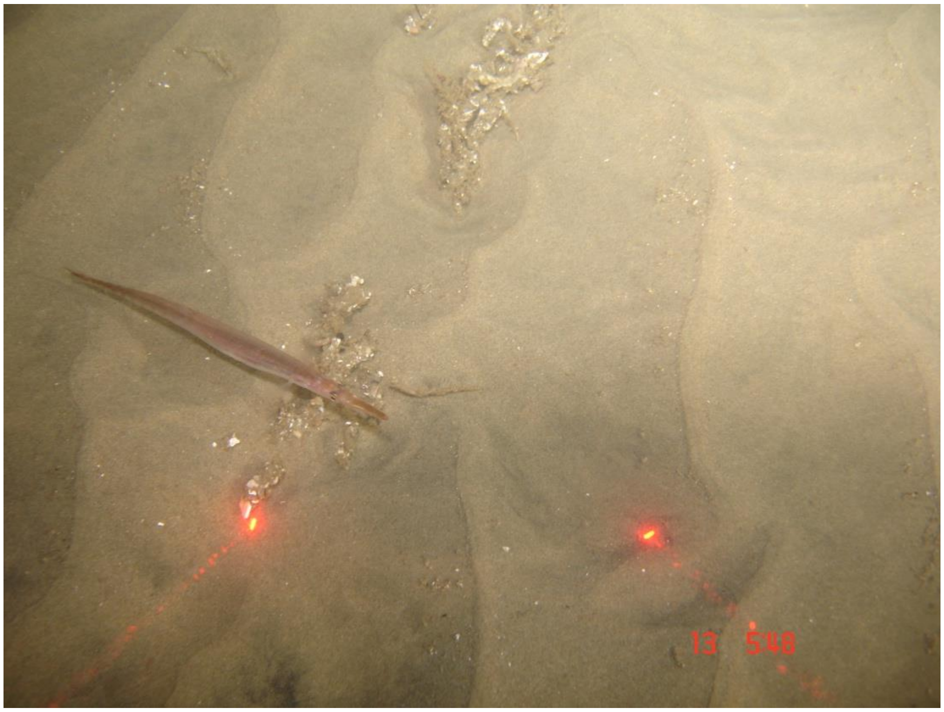


Figure 1.3: Coarse sand substrate with wave induced ripples, ornate tube worms (*Diopatra ornata*) and a Tubesnout (*Aulorhynchus flavidus)* (Source AMS 2008).

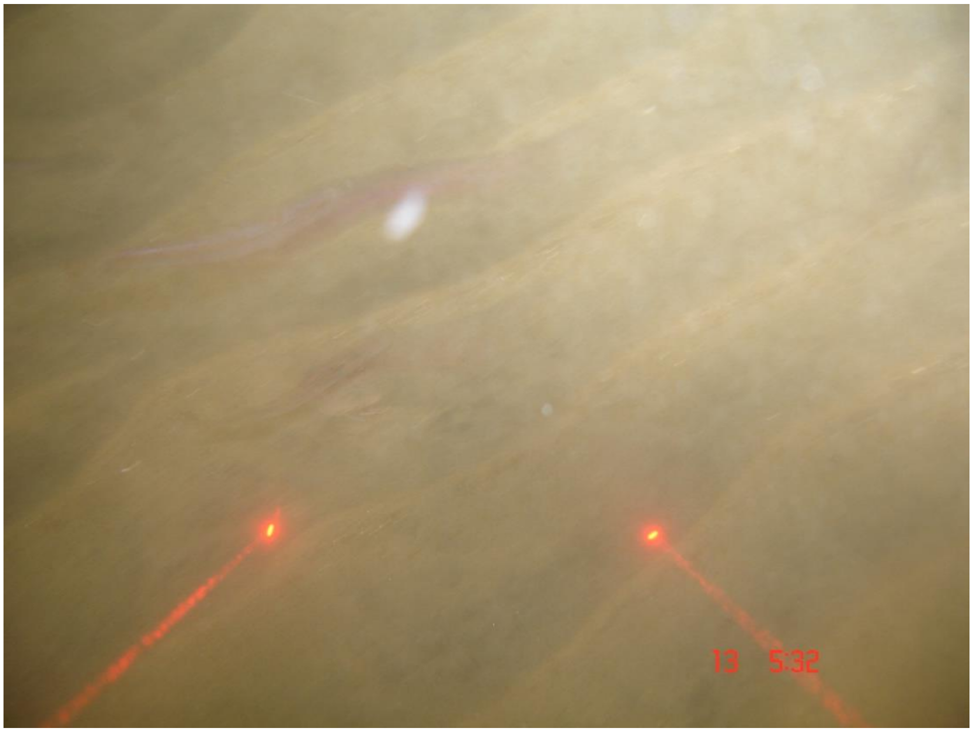
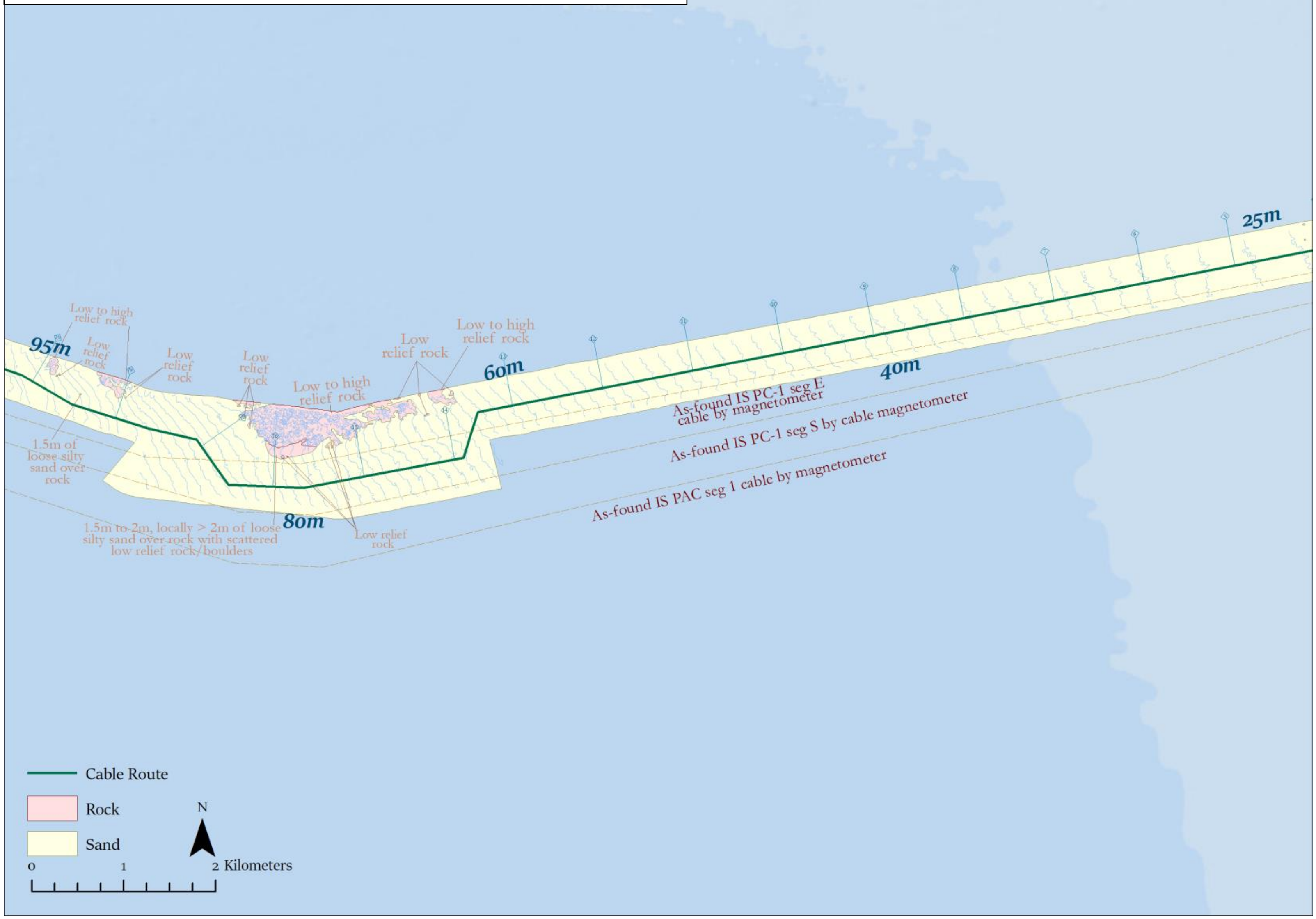


Figure 1.4: Coarse sand substrate with sand ripples and squid (*Loligo sp.*) (Source AMS 2008)

Figure 1.5: BtoBE Cable Route Between 25-100 Meters (82-328 Feet) Water Depth.



Along the AAG S-5 and MCI/WorldCom fiber optic cable routes offshore Montana Del Oro/Morro Bay, California more than 40 algal and invertebrate taxa were observed. At these deeper water depths, the sediment composition shifted to finer silts and clays, compared with the shallower depths where sands predominated (AMS 2008, SAIC 1999). Observed invertebrate biota included sea pens, mostly *S. elongata*, *Acanthoptilum sp*., *Virgularia spp*., *Virgularia californica*, and *Ptilosarcus gurneyi;* brittle stars, including *Ophioneries* sp.; the cerianthid anemones, including *Pachycerianthus sp*. (Figure 1.6); the anemones *Urticina piscivorus Urticina sp*., *Anthopleura artemisia*, and *S. coccinea*; tube worms, cancer crabs including the slender crab *Cancer gracilis*; shrimp such as *Pandalus sp*.; occasional marine snails (Gastropoda); the California sea slug *Pleurobranchia californica*; the hermit crab *Paguristhes sp*.; and several species of sea stars including *P. brevispinus*, *Petalaster (luidia) foliolata*, *Rathbunaster californica, A. miniata,* the spiny sand star, *A. armatus,* and *Solaster dawsonii (Tables A-1 and A-3).*

Within the shallower water depths of this route segment, dominated by sandier sediments, the ornate tube-worm *D. ornata* and occasional isolated *Dendraster ecentricus* sand dollars were observed. Assorted algae, including *Phyllospadix* spp., surfgrass, the giant kelp *Macrocystis pyrifera*, and the bull kelp *N. californica*, originating from locations closer to shore or upcoast, were also be expected to be present along the seafloor. At this depth, squid such as *Loligo* sp. and the octopus, *O. rubescens*, also frequently inhabit the water column (Table A-2) (AMS 2008, SAIC 1999).

The sea pen *P. gurneyi* and the sea star *P. brevispinus* were observed only at water depths of 48.8 m (160 feet) or less. The most abundant invertebrate organisms were sea pens, including *S. elongata*, *Acanthoptilum sp*., and *Ptilosarcus gurneyi,* brittle stars (Ophiuroids), especially *Ophioneries* sp., tube worms, and the sea stars *P. brevispinus, A. miniata,* and *R. californica* (AMS 2008, SAIC 1999).

Fish species that occurred along the soft substrate habitats of this water depth range included sanddabs, *Citharichtys sp*., the California halibut *Paralichthys californicus*, the Dover sole *Microstomus pacificus*, the, English sole *Pleuronectes vetulas*, the Tonguefish *Symphurus atricauda*, the Banded guitarfish *Zapteryx exasperata*, the Pacific electric ray *Torpedo californica*, *Raja* spp. Skates, the Pacific angel shark *Squatina californica,* both adult and juvenile Rockfish *Sebastes* spp., the Eelpout *Lycodes* sp., the Cuskeels *Chilara* spp, Poachers (Algonidae), Sculpins (Cotidae), and the Hagfish *Eptatretus stouti*. The dominant and most frequently observed fish taxa were the assorted flatfish, especially the Pacific sanddab *C. sordidus* Cusk-eels, Poachers and Rockfish. Assorted baitfish (Atherinidae), such as the Northern anchovy *Engraulis mordax*, were also commonly observed in the water column (Tables A-2 and A-4) (AMS 2008, SAIC 1999).

As indicated above and illustrated in Figure 1.5, the hard bottom substrate that occurs within this segment of the BtoBE cable route is located more than 200 m (656 ft.) to the north of the proposed cable routing. Based on the EGS (2018) seafloor survey, these hard substrate features begin with mixed bottom and low relief features that progress into moderate and high relief features. Based on survey data collected for similar hard substrate features occurring in similar water depths along the AAG S-5 and MCI/WorldCom fiber optic cable routes (AMS 2008, SAIC 1999), it can be expected that these features will be inhabited by turfs of *Komokoiacea* foraminiferans *(Figure 1.7),* hydroids, encrusting bryozoans, ectoprocts, lumpy tan sponges, the orange puffball sponge *Tethya aurantia*, the brown cup coral *Paracyathus stearnsi*, the orange cup coral *Balanophyllia elegans,* the giant white anemone *Metridium farcimen (=giganteum),* the red gorgonian coral *Lophogorgia chiliensis*, the orange gorgonian coral *Adelogorgia phyllostera*, the California hydrocoral *Stylaster californicus (=Allopora californica*), the giant keyhole limpet *Megathura crenulate*, cancer crabs, brittle stars (Ophiuroidea), the feather star *Florometra serratissima*, and the sea stars *Pisaster giganteus*, the cookie cutter sea star *Ceramaster patagonicus*, and the bat star *Patiria miniata*. On the sides of the higher relief features, it can be anticipated that the branching white coral *Lophelia sp*. may be present (AMS 2007, SAIC 1999).

Figure 1.6: Fine sandy silt substrate with a ceriantheid anemones (*Pachycerianthus sp*.) and brittle stars (Source AMS 2008).

Figure 1.7: Low-relief hard bottom habitat with turf of Komokoiacea foraminifer and and hydroids, globular sponge, the leather star, *Dermasterias imbricata*, orange cup corals (*Balanophyllia elegans*) (Source AMS 2008)

Dominant fish taxa that can be expected to occur include sculpins (Cottidae), and juvenile and adult rockfish including the Olive rockfish *Sebastes serranoides*, the Rosy rockfish *Sebastes rosaceus*, and the Brown rockfish *Sebastes auriculatus* (Table A-2 and A-4) (AMS 2008, SAIC 1999).

BtoBE Cable Route Segment 3 Between 100-183 m (328-600 ft) Water Depth

The seafloor habitat along the BtoBE cable route between 100-183 m (328-600 ft) was predominantly characterized by the EGS seafloor survey (EGS 2018) as loose silty sand (Figure 1.8). Based on previous seafloor surveys of Central California, sediments would be expected to be dominated by fine silts and clays,with a very small percentage of fine sands and in the shallower protion (<200 m) of the segment (AMS 2007, SAIC 1999).

The soft substrate biological community expected to occur along this segment of the BtoBE cable route include the sea pens *Stylatula, sp, Virgularia californica, Virgularia agassizii, Scytallum* sp,, and *Scytallopsis* sp., brittle stars including *Amphiophodia urtica*, *Amphiopholis* sp,, *Amhiodia* sp., *Ophionereis sp, and Ophiura* sp. (Figure 1.9); the squid *Loligo* sp.; the octopus O. *rubescens*; the California sea slug *Pleurobranchia californica*; several species of anemones including *Urticina sp.* and *Pachycerianthus sp*.; the sea stars *A. (Luidia) foliolata* (Figure 1.10), *Rathbunaster californica*, *Astropecten sp*., *and P. foliolata;* polychaete fire worms (Amphinomidae); and occasionally the sea cucumber *Parastichopus sp.* (AMS 2007, SAIC 1999).

Fish taxa expected to occur along this segment of the BtoBE cable route include the pink surfperch *Zalembius rosaceus*, poachers (Algonidae), the hagfish *Eptatretus stouti*, juvenile and adult rockfish (*Sebastes* spp.), the anchovy *E. Mordax*, the tonguefish *S. atricauda*, skates including longnose skate and the big eye skate *Raja binoculata,* flatfish including sanddabs (Citharichtys sp.), sole (Pleuronectidae), eelpouts (*Lycodes* sp.), and cuskeels (*Chilara* sp.) (AMS 2007, SAIC 1999).

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Figure 1.8: BtoBE Cable Route Between 100-183 Meters (328-600 Feet) Water Depth.

Figure 1.9: Fine soft substrate with *Virgularia sp*. sea pens and brittle stars (Source AMS 2008)

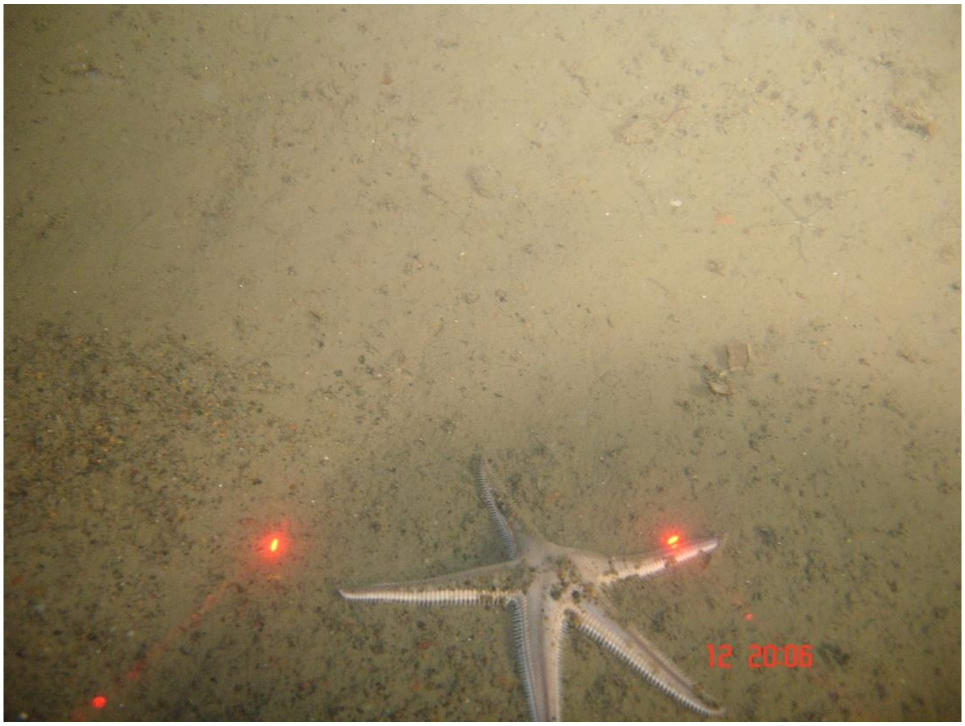

Figure 1.10: Fine silty substrate with fire worms (Amphinomidae) and the sand star *Luidia foliolata* (Source AMS 2008)

APPENDIX D

Marine Cultural Resources Technical Report for RTI Infrastructure, Inc.'s Grover Beach Subsea Cables Project

Marine Cultural Resources Technical Report for RTI Infrastructure, Inc.'s Grover Beach Subsea Cables Project

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January 2020

MARINE CULTURAL RESOURCES REPORT

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LIST OF ABBREVIATIONS AND ACRONYMS

AUV	autonomous underwater vehicle
BOEM	Bureau of Ocean Energy Management
B.P.	before present
CEQA	California Environmental Quality Act
CRHR	California Register of Historical Resources
CSLC	California State Lands Commission
km	Kilometer
LMH	landing manhole
MHW	mean high-water mark
NAGPRA	Native American Graves Protection and Repatriation Act
NAHC	Native American Heritage Commission
nm	nautical mile
NRHP	National Register of Historic Places
OCS	outer continental shelf
OGB	ocean ground bed
Project	Grover Beach Subsea Cables Project
PRC	Public Resources Code
ROV	remotely operated vehicle
RTI	RTI Infrastructure, Inc.
TCP	traditional cultural property

Introduction

The proposed RTI Infrastructure, Inc. Grover Beach Subsea Cables Project (Project) would require work in both terrestrial (land) and marine (ocean) areas in Grover Beach, San Luis Obispo County. This Project would install four fiber optic cables carrying telecommunication data to connect the United States with Singapore, Hong Kong, Guam, and Australia (Figure 1).

The Grover Beach portion of the Project would be implemented in four phases—one phase for each of the four cable systems. The first phase of work will include installation of all terrestrial infrastructure to receive up to four fiber optic cables and bring the very first fiber optic cable from Singapore to Grover Beach. Phase 2 would connect California to Guam. Phase 3 would connect California to either Asia or Australia (not yet determined which would be installed first), and Phase 4 would connect Asia or Australia to California (not yet determined which would be installed first).

This report focuses on the marine Project components and discusses regulatory issues associated with the California landing and addresses only state and local components. The prehistoric and historic maritime activities in central California provide the context for review and analysis of the Project. A separate cultural resources report has been prepared for the terrestrial Project components.

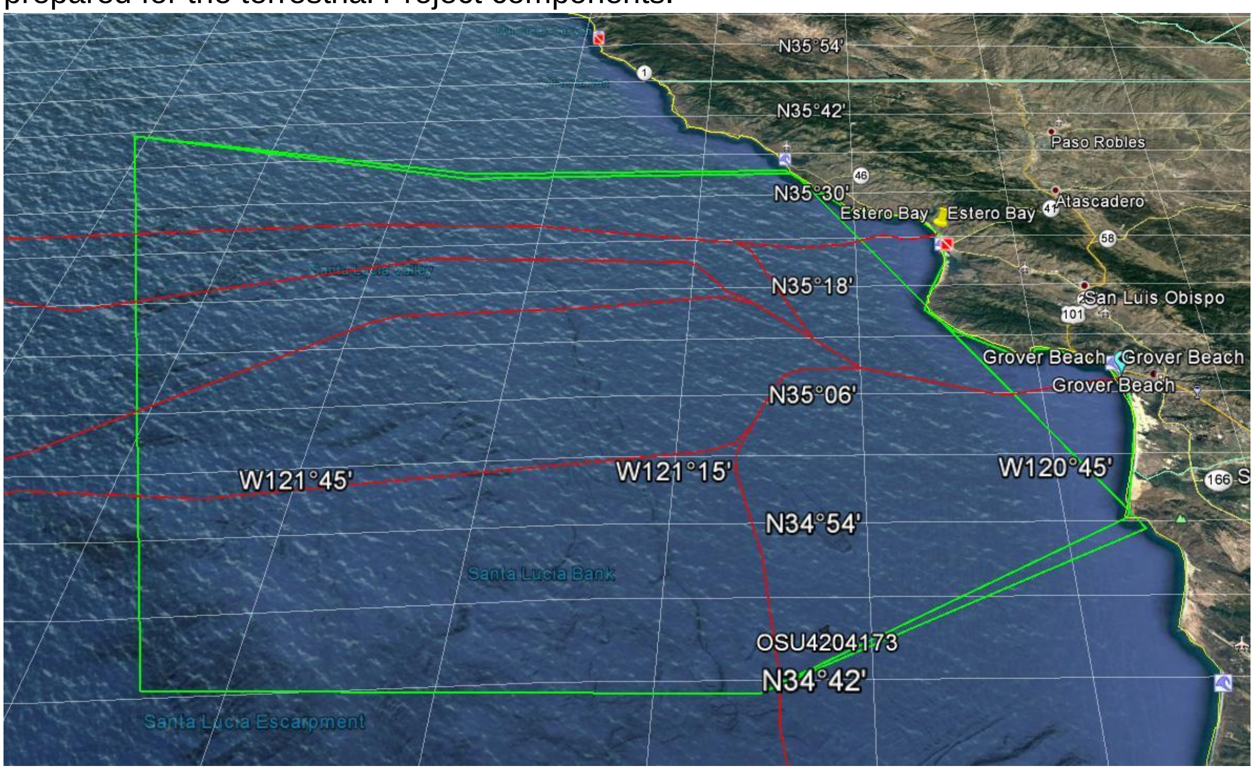

Figure 1. Project Location (cables shown in red)

Summary of Marine Project Components

The following marine Project components would be needed to install up to four fiber optic cables and their related structures from the LMH to offshore in the outer limits of the Outer Continental Shelf (OCS) (approximately 68.4 miles offshore and approximately 5,904 feet deep[1]) as seen in Figure 2:

- **Landing Pipes.** As explained earlier in the terrestrial Project components, up to four landing pipes (approximately 5 to 6 inches in diameter) with a total of length of 3,600 linear feet would be buried offshore at least 35 feet deep under the beach and the ocean floor by using the HDD construction methods. These landing pipes would be a total of 4,600 linear feet starting from the LMH and ending offshore approximately 33 feet below the ocean water so fiber optic cables could be pulled through them and brought into the LMH to connect with the cables coming from the CLS.
- **Fiber Optic Cables.** Since the OCS is approximately 68.4 miles offshore and 5,904 feet deep, each fiber optic cable would be placed directly on the ocean floor where the water is deeper than 5,904 feet. Where the water is less than 5,904 feet deep, these fiber optic cables would be installed by plowing or by post-lay burial method (depending on ocean floor characteristics). The cable-lay ship (with the help of a work vessel and divers) would bring the fiber optic cable to the end of the landing pipe out at about 3,600 linear feet offshore (33 feet deep below the ocean water). Then, the fiber optic cable would be pulled through its own individual landing pipe (constructed in Phase 1) to the LMH.
- **Ocean Ground Beds (OGBs).** The OGBs would be installed onshore or offshore for each subsea fiber optic cable to ground it since electrical signals would be traveling through these fiber optic cables. The OGB would be needed for cathodic protection to control corrosion and to provide a ground for the electricity that would power the marine cable amplifiers.

  If installed onshore, the OGBs would be within approximately 100 feet of the LMH. If installed offshore, the OGBs would be placed beginning at approximately 50 feet beyond the end of each landing pipe, installed along the fiber optic cable, and buried.

Marine Cultural Resource Categories

Three broad categories of marine cultural resources are considered in this report, all of which are currently submerged, and may be encountered during marine installation of the Project: (1) historic period shipwrecks and unidentified debris; (2) prehistoric period

[1] U.S. federal jurisdiction extends to the edge of the OCS under the Outer Continental Shelf Lands Act.

watercraft; and (3) prehistoric archaeological resources, both as *in situ* site deposits and isolated artifacts.

Prehistoric Period Watercraft

Native Americans used watercraft for transportation and fishing, in addition to offshore hunting of otters, seals, and sea lions. During the approximately 13,000 years of Native American navigation through the study area, some native vessels may have been inundated, stranded, or capsized. Given the fragile nature of these craft, in terms of construction methods and perishable materials, it is unlikely that evidence of such vessels would be preserved in the nearshore environment.

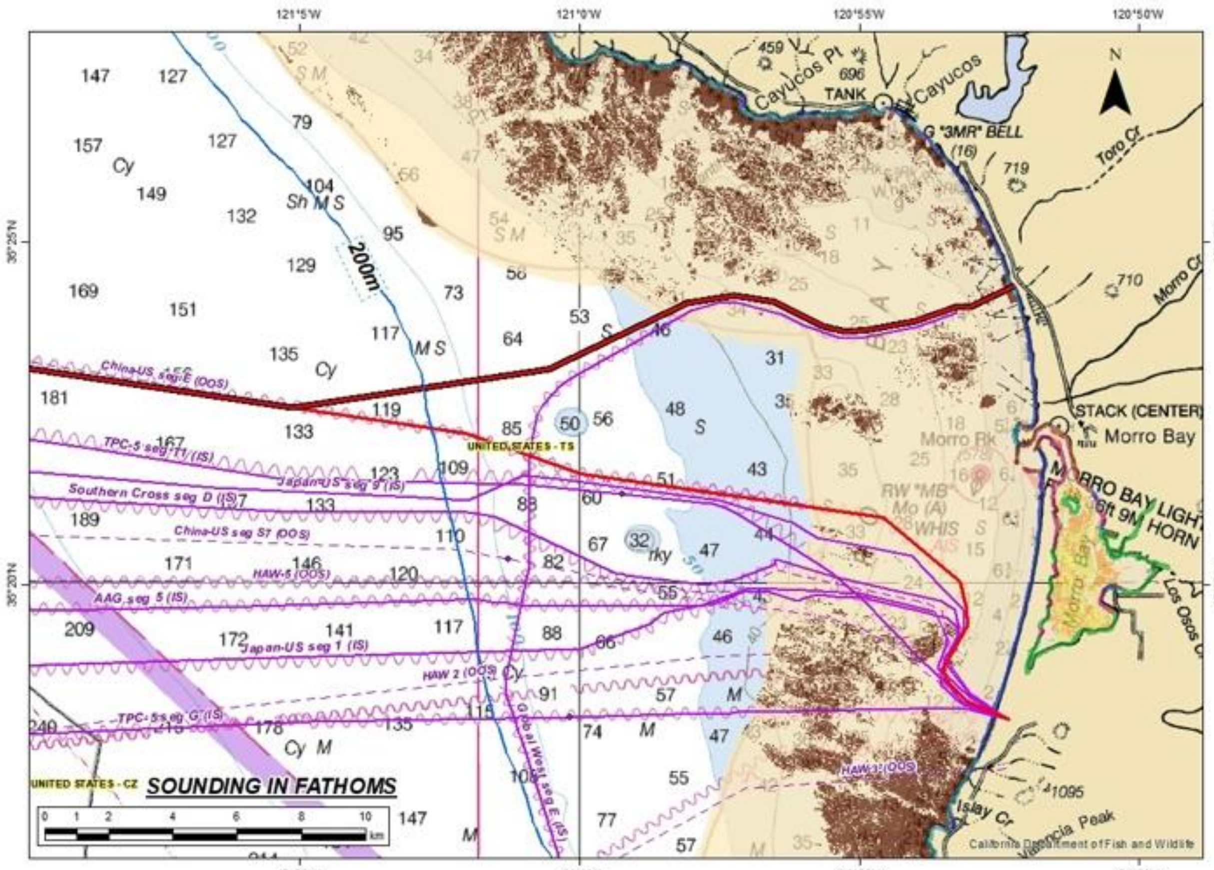

Figure 2. Grover Beach Landing Site Survey Corridor (NOAA Chart No. 18700)

Prehistoric Archaeological Resources

Prehistoric archaeological resources include places that Native Americans lived, performed activities, altered the environment, and created art before they sustained contact with Europeans. Prehistoric resources contain features left behind by these activities as well as artifacts and subsistence remains. They also may contain human remains in the form of burials, cairns, or cremations. Although originally deposited on a non-marine landscape (dry land), changes in sea level have resulted in such resources currently being submerged. Such sites may date from the terminus of the Pleistocene through Holocene periods. These sites and isolated artifacts may be buried at varying depths, depending on their age and the depositional history of the location in which each is found.

Historic Watercraft

Historic-period shipwrecks consist of the remains of watercraft that were used as early as the 16th century to traverse the waters of the study area and unidentified debris. Many of the shipwrecks in this area occur near shoreline rocks, coves, historic landings, anchorages, wharves, and lighthouses; but shipwrecks also occurred in deeper waters offshore. These historic-period watercraft came to rest on the ocean floor due to marine casualties such as capsizing, foundering, stranding, explosion, fire, and collision during their travel on the Pacific Ocean. Currently, their remains may be partially or wholly obscured by sediments and in rocky strata along the ocean floor.

Debris may include flotsam (scattered debris due to the process of wrecking), jetsam (items such as cargo or other equipment purposely jettisoned or accidentally lost from traveling vessels), and items deposited on the seafloor through salvage of vessels or their cargoes and past economic activities such as fishing or marine exploration.

Regulatory Background

Federal Regulations

Federal protections for scientifically significant cultural resources primarily derive from the **National Historic Preservation Act (NHPA) of 1966** as amended. If a project involves a federal property, federal permit, or federal funding, it may be considered a federal undertaking and is required to comply with Section 106 of the NHPA (36 Code of Federal Regulations Part 800). This regulation sets forth the responsibilities that federal agencies must meet in regard to cultural resources. Federal agencies must conduct the necessary studies and consultations to identify cultural resources that may be affected by an undertaking, evaluate those cultural resources to determine whether they are eligible for listing in the National Register of Historic Places (NRHP), assess the potential of the undertaking to affect NRHP-eligible resources, and take action to resolve any adverse effects that may result from the undertaking. The NRHP eligibility criteria are very similar to those for the California Register of Historical Resources (CRHR) (see below).

The ***Outer Continental Shelf Lands Act of 1953*** provides that the subsoil and seabed of the OCS are subject to United States jurisdiction and triggers other laws, including NHPA. The ***Antiquities Act of 1906***, enacted to protect cultural resources on lands owned or controlled by the federal government, has successfully been used to protect important cultural resources on the OCS in national marine monuments and other federal marine protected areas but has not yet been applied on the OCS outside of such areas (BOEM 2013:31–32).

The ***Native American Graves Protection and Repatriation Act (NAGPRA) of 1990*** was enacted for the protection and repatriation of the remains of Native Americans and associated grave objects. The act applies to tribal and federal lands, defining *federal lands* as any land other than tribal lands that are controlled or owned by the U.S. government. Although no case has yet been recorded of the application of NAGPRA in a marine context in the study area, it appears reasonable that NAGPRA would apply to the remains of Native Americans and associated objects on the OCS when discovered during intentional excavation and as a result of inadvertent discoveries (BOEM 2013:47–48). It is the opinion of the authors that NAGPRA would provide the authority to protect Native American remains and associated grave objects on the OCS (BOEM 2013:49).

Submerged cultural resources within the waters of the State of California and federal waters from the 3-nm State limit to the OCS margin may be within the jurisdiction of the U.S. Army Corps of Engineers, Los Angeles District (Section 404, Clean Water Act, Nationwide 12 Authorization) and the Bureau of Ocean Energy Management (BOEM). It is the policy of the U.S. Army Corps of Engineers and BOEM to consult with the appropriate State Historic Preservation Officer regarding all federally permitted offshore activities.

State Regulations

California Environmental Quality Act (CEQA) (Public Resources Code [PRC] Section 21000 et seq.). Historical, archaeological, and paleontological resources are afforded consideration and protection by CEQA (PRC Section 21083.2). CEQA Guidelines define significant cultural resources under two regulatory designations: historical resources and unique archaeological resources (14 California Code of Regulations [CCR] Section 15064.5).

A *historical resource* is defined as a "resource listed in, or determined to be eligible by the State Historical Resources Commission, for listing in the California Register of Historical Resources"; or "a resource listed in a local register of historical resources or identified as significant in a historical resource survey meeting the requirements of Section 5024.1(g) of the Public Resources Code"; or "any object, building, structure, site, area, place, record, or manuscript which a lead agency determines to be historically significant or significant in the architectural, engineering, scientific, economic, agricultural, educational, social, political, military, or cultural annals of California, provided the agency's determination is supported by substantial evidence in light of the whole record" (14 CCR Section 15064.5[a][1]–[3]). Although traditional cultural properties (TCPs) and cultural landscapes are not directly called out in the state definitions of historical resources, TCPs are places and cultural landscapes are areas, and places and areas are included as types of historical resources. Historical resources that are automatically listed in the CRHR include California historical resources listed in or formally determined eligible for the NRHP and California Registered Historical Landmarks from No. 770 onward (PRC Section 5024.1[d]). Locally listed resources are entitled to a presumption of significance unless a preponderance of evidence in the record indicates otherwise.

Under CEQA, a resource generally is considered *historically significant* if it meets the criteria for listing in the CRHR. A resource must meet at least one of the following four criteria (PRC Section 5024.1; 14 CCR Section 15064.5[a][3]) for eligibility:

A. It is associated with events that have made a significant contribution to the broad patterns of local or regional history, or the cultural heritage of California or the United States.

B. It is associated with the lives of persons important to local, California, or national history.

C. It embodies the distinctive characteristics of type, period, region, or method of construction, or represents the work of a master or possesses high artistic values.

D. It has yielded or has the potential to yield information important to the prehistory or history of the local area, California, or nation.

Historical resources also must possess integrity of location, design, setting, materials, workmanship, feeling, and association (14 CCR 4852[c]).

An archaeological artifact, object, or site can meet CEQA's definition of a *unique archaeological resource*, even if it does not qualify as a historical resource (14 CCR 15064.5[c] [3]). An archaeological artifact, object, or site is considered a unique archaeological resource if "it can be clearly demonstrated that, without merely adding to the current body of knowledge, there is a high probability that it meets any of the following criteria (PRC Section 21083.2[g]):

- Contains information needed to answer important scientific research questions and that there is a demonstrable public interest in that information.

- Has a special and particular quality such as being the oldest of its type or the best available example of its type.

- Is directly associated with a scientifically recognized important prehistoric or historic event or person."

Under California law, *cultural resources* are defined as buildings, sites, structures, or objects, each of which may have historical, architectural, archaeological, cultural, and/or scientific importance. All resources nominated for listing in the CRHR must have integrity; the authenticity of a historical resource's physical identity is evidenced by the survival of characteristics that existed during the resource's period of significance. Therefore, resources must retain enough of their historical character or appearance to convey the reasons for their significance. Integrity is evaluated with regard to the retention of location, design, setting, materials, workmanship, feeling, and association. It also must be judged with reference to the particular criteria under which a resource is proposed for nomination (PRC Section 5024.1).

CEQA Guidelines, CCR Title 14, Section 15064.5. When an initial study identifies the existence of, or the probable likelihood of, Native American human remains within a project area, a lead agency is directed to work with the appropriate Native Americans as identified by the Native American Heritage Commission (NAHC). The applicant may develop an agreement for treating or disposing of, with appropriate dignity, the human remains and any items associated with Native American burials with the appropriate Native Americans identified as the Most Likely Descendant by NAHC.

PRC Section 5097.5 states that no person shall willingly or knowingly excavate, remove, or otherwise destroy a vertebrate paleontological site or paleontological feature without the express permission of the overseeing public land agency. PRC Section 30244 further states that any development that would adversely affect paleontological resources shall require reasonable mitigation. These regulations apply to projects located on land owned by or under the jurisdiction of the state or a city, county, district, or other public agency.

PRC Section 5097.9 et seq. (1982) establishes that both public agencies and private entities using, occupying, or operating on state property under public permit shall not interfere with the free expression or exercise of Native American religion and shall not cause severe or irreparable damage to Native American sacred sites. This section also creates the NAHC, charged with identifying and cataloging places of special religious or social significance to Native Americans, identifying and cataloging known graves and cemeteries on private lands, and performing other duties regarding the preservation and accessibility of sacred sites and burials.

The ***California Coastal Act of 1976*** establishes policies pertaining to cultural resources investigations conducted for impact analysis pursuant to CEQA, NEPA, and NHPA Sections 106 and 110. The act provides that "[w]here development would adversely impact archeological or paleontological resources as identified by the State Historic Preservation Officer, reasonable mitigation measures shall be required" (PRC Section

30244). Anyone who proposes any development in the coastal zone must secure a **Coastal Development Permit** from the **California Coastal Commission**.

The ***Abandoned Shipwreck Act*** (enacted by Congress in 1987) transferred ownership of submerged historic shipwrecks embedded in the bottomlands of a state's waters to the state. Under this law, submerged historic shipwrecks occurring within 3 nm of a state's shoreline are owned by that state. The act provides authority for states to protect and manage submerged, abandoned shipwrecks through state law (BOEM 2014:42).

Local Regulations

San Luis Obispo County

San Luis Obispo County provides for the discovery and protection or investigation of cultural resources as mandated by CEQA in the San Luis Obispo Archaeological Resource Program Guidelines (October 2009) and applicable county ordinances.

City of Grover Beach

The City of Grover Beach and California State Parks require protection of archaeological and historical resources to the greatest extent feasible. Management of archaeological and historical resources is addressed by the City of Grover Beach Coastal Program Section 3.0 Archaeological Resources Component that briefly outlines Coastal Act Policy Section 30244 (www.grover.or/DocumentCenter/Home/View/1808, page 44).

Environmental Setting

The Project area is located at and offshore of Pismo State Beach Park, south of the Oceano Dunes Natural Preserve in the City of Grover Beach. The cable landing site is situated along the San Luis Obispo County coast. The study area for marine cultural resources consists of the proposed cable routes shown in Figures 1 and 2, and a 10-nm buffer around each route, beginning at the mean high-water mark (MHW) out to the edge of OCS at a water depth of approximately 5,904 feet (1,800 meters, or 984 fathoms). The broad-scale buffer zone allows for inaccuracies inherent in the reported locations of historic shipwrecks. There is some overlap in the buffers around each route. The boundary for the marine archaeological record search is shown in Figure 1. The study are includes marine areas within California's jurisdiction that extend 3 nm (4.8 kilometers [km]) from MHW, as well as marine areas under federal jurisdiction that extend beyond the 3-nm State jurisdiction on the OCS where the submarine cables will be buried to the extent feasible.

The prehistoric and historic maritime activities in Central California provide the context for review and analysis of the Project.

Paleogeography

Marine deposition, coastal sedimentation, and resulting landforms on the coast of Central California have been dominated throughout the Pleistocene by the combined effects of climatic and tectonic patterns (Bradley and Griggs, 1976; Dupre et al. 1980 in MMS 1987:36). The early and middle Pleistocene were times of folding and major tectonic activity in California. The late Pleistocene, by contrast, was dominated by erosional and depositional events related to sea level fluctuations responding to glacial and interglacial stages.

During the Pleistocene periods of lower sea stands, westerly flowing fluvial systems likely incised the exposed continental margin, depositing sediments in floodplain, deltaic, and terraced marine environments. Sediments were reworked into beach and shallow marine deposits, which were reworked again during subsequent transgression. Wave-cut platforms or abrasion platforms developed along the coast as the result of wave abrasion during ancient still stands (MMS 1990:II-54). With a change in sea level, platforms may be submerged or raised. Raised platforms are marine terraces. Pleistocene marine terraces occur discontinuously along much of the coast of the study area. The late Pleistocene/Wisconsin sediments (30,000 to 18,000 Before Present [B.P.]) are probably preserved on the present-day continental slopes only below 120 meters (394 feet, 66 fathoms) or as early fill in some of the submarine canyons, slope gullies or deep shelf river channels (MMS 1987:38).

The most recent regression affecting the study area started during the onset of the Wisconsin glaciations, approximately from 30,000 to 35,000 B.P. About 30,000 B.P., sea level dropped from a level near or slightly below the present sea level. Between 21,000 and 18,000 B.P., sea level dropped to a level about 120 to 130 meters (394 to 427 feet, 66 to 72 fathoms) below the present level, exposing Late Pleistocene deposits (Curray 1965; Bloom, 1977; Bloom et al. 1974 in MMS 1990:II-69). Holocene stratigraphy of the OCS in the study area represents deposits resulting from the eustatic sea level rise, known as the Flandrian Transgression, which began about 18,000 years B.P. in response to climate change. From the onset of the Holocene transgression to about 10,000 to 7,500 years B.P., a rapid inundation of the OCS occurred. The rate of sea level rise has since slowed and has been stable or fluctuating slightly during the past 3,000 years (Kulm et al. 1968 in MMS 1990:II-54). Holocene sediments deposited on the OCS vary in thickness and consist mostly of unconsolidated sand, silt, clay, and gravels (Wagner et al. 1972 in MMS 1990:II-54). Surficial sediment distribution on the central California shelf can generally be divided into a nearshore sand and mid- to outer-shelf silt and mud in depths of 60 to 80 meters (197 to 263 feet, 33 to 44 fathoms). Sources of overlying sediments in the study area can be attributed to river outflows of suspended sediments. The OCS in the study area has been controlled by four major cycles of shoreline advance and retreat. During glacial periods, the shoreline retreated to near the edge of the modern OCS. During interglacial periods, the shoreline advanced to near modern levels. These changes in sea level occurred rapidly relative to geologic time and resulted in formation of the broad, gently sloping, sediment-veneered, wave-cut platform that makes up the modern OCS. The OCS ranges from 2.7 nm (5 km) off Point Estero to about 10.8 nm (20 kilometers) off Grover City/Pismo Beach and 11 nm (20.4 km) wide southward at Point Sal. The maximum late Pleistocene low stand is found at a depth of about 120 meters (394 feet, 66 fathoms).

As the Flandrian Transgression pushed the shore easterly, valleys incised during the glacial low stand began to back-fill with fluvial sediments, which in turn were covered with marine post-Wisconsin deposits as sea level was reaching its present level. The shelf between Point Estero to Point San Luis is mainly exposed Franciscan bedrock, a hard, erosion-resistant rock with several post-Wisconsin terraces and sea cliffs cut into it (Wagner 1974 in MMS 1987:49). A wedge of post-Wisconsin sediment is found seaward of the outcrop that is thought to be about 10 to 20 meters (33 to 66 feet) thick. The shelf between Point San Luis to Point Sal ranges from 9 to 11 nm (17 to 20.4 km) wide and is dominated by a lens of post-Wisconsin sediments to a maximum thickness of 40 meters (131 feet). Outcrops are rare in the area between Point San Luis and Point Sal. The underlying bedrock is thought to be folded and truncated Miocene and Pliocene beds (MMS 1987:49).

Geology and Oceanography

Geology and oceanography in the Project area are summarized in BOEM (2013:13).

The western coastal region of California in which the Project is located is composed of four geomorphic provinces (the Klamath Mountains, the northwest-trending Coast Ranges, the west trending Transverse Ranges, and the northwest treading Peninsular Ranges. The Project area is in the southern part of the Coast Ranges Geomorphic Province. The province is characterized by parallel, linear mountain ranges trending obliquely to the coastline, thus forming a series of rocky headlands and broad sandy bays. The prominent San Luis and Santa Lucia Mountain Ranges extend across the area to the south and to the east and north, respectively. The ranges are separated by the Los Osos and San Luis Valleys.

The OCS between Point Estero and Point Conception, where the Grover Beach Project area is located, is oriented north-south. The continental shelf meets the continental slope at a change of gradient marked between 125 and 200 m of depth. The continental shelf in the study area from Cape San Martin to Morro Bay is described as narrow, averaging less than 10 km in width (MMS 1990:II-62). McCulloch et al. (in MMS 1990:II-62) describes this portion of the shelf as not exhibiting a well-developed shelf surface and, therefore no well-developed shelf/slope break in topography. The width of the shelf between Point Estero and Point San Luis ranges from 3 to 7. 4 miles (5 to 12 km) and broadens to 12.4 miles (20 km) off Pismo Beach. It is generally flat and featureless, with slopes west-southwesterly at less than 1 percent. The present shelf break is found at a depth of about 394 feet (120 meters) which is at or near the maximum late Pleistocene low stand.

Wagner (1974, in MMS 1987) indicates that the shelf consists of hard, erosion-resistant rock, with several post-Wisconsin terraces and sea cliffs cut into it. A wedge of post-Wisconsin sediment is found seaward of the area of outcrop.

Prehistoric Setting

Prehistoric Occupation of the Marine Study Area

At the height of the Wisconsin glaciation (approximately 18,000 to 24,000 years B.P.), the sea level was as much as 120 meters (394 feet, 66 fathoms) below its present altitude (Milliman & Emory 1968). At that time, the California shoreline was near the edge of the OCS, approximately 6 nm offshore of the present shoreline (uncorrected for local offshore deposition or uplift rates) within the study area.

Recent Geographic Information System studies summarized in BOEM (2013:21) indicate that the sea level rose an average of 6.3 millimeters per year, or 6.3 meters every 1,000 years, over the 19,000-year period since the Last Glacial Maximum. This rate was not constant, but varied over time. Sea level continues to rise incrementally along the California coast.

Human populations have occupied the California coast for at least the past 13,000 years and enjoyed the products of the littoral zone for much of that time. The littoral zone includes the nearshore intertidal area where many edible resources, including shellfish, can be harvested. Sea level 11,000 years B.P. was at about 46 meters (151 feet, 25 fathoms) below the present level. It is reasonable to assume that prehistoric occupation sites where debris from villages and campsites accumulated as far out as what is now the OCS, were abandoned as they were inundated by the rising sea level during the Holocene transgression (Nardin et al. 1981; Bloom 1977). As sea levels rose after the Last Glacial Maximum, prehistoric people moved their sites farther inland to stay above shifting shorelines and to access shifting resource areas (BOEM 2013:21).

If the preference for site locations remained the same over time, even as the sea level rose, we would expect to find inundated prehistoric period archaeological sites offshore in places where former streams once came together to flow into larger streams and rivers, and where they entered the ocean as they crossed bluffs and beaches (Stright

1988). Former estuaries, bay mouth bars, tombolos (a bar of sand or shingle joining an island to the mainland), and backshore beaches as well as nearby bluffs also would be sensitive locations for offshore prehistoric archaeological sites.

Prehistoric archaeological sites are formed from the accumulation of layers of soil and debris from daily activities that have been deposited over time. Typically, the longer the period of occupation and the larger the group of people, the greater the accumulation of debris. Archaeological sites at or near the shoreline most often are characterized by concentrations of whole and fragmentary seashells, while archaeological sites that are more distant from the shoreline most often lack such concentrations of shell and include the debris from the exploitation of inland habitats. Such debris may include stone tools and the remains of animals that were hunted, butchered, and cooked, as well as tools for grinding nuts and seeds. Archaeological sites on the OCS may be composed of a series of deposits that document the sea level rise and resulting change in the relative distance of the site from the sea. As the sea level rose, sites that once were used for exploitation of terrestrial resources may have become bases for exploitation of intertidal resources before being abandoned as the sites became inundated. As stated in BOEM (2013:23), the order of site occupations recorded in such layered archaeological sites can reveal the sequences of environmental changes associated with rising sea levels and the resulting changes in human behavior and resource preferences.

Not all prehistoric sites would have been well preserved. Prehistoric sites on the paleolandscape of the Pacific OCS would have been subjected to the erosive effects of water as rising sea levels advanced the shoreline of the Pacific Ocean to the east. Inman (1983) suggests that erosion would be widespread and sites may not have been preserved except in exceptional circumstances, where conditions on the landscape, such as clusters of plants and trees or rocky overhangs, would have protected such deposits from erosion. Such conditions might be expected in the ecological and geomorphic contexts associated with lagoons and terraces. Snethkamp et al. (1990 III:106-108); Bickel 1978, 1988) suggest that the same classes of physiographic locations with a high potential for site preservation on land may have offered the highest potential for preservation during and following the process of inundation.

Site preservation depended on at least three factors: the degree of protection of site deposits by overlying sedimentation prior to inundation, the duration of exposure to increased forces of erosion associated with time spent in the intertidal zone during the transgression, and the intensity of wave energy. As is true of sites on dry land, rapid burial of sites prior to inundation would have created the best conditions for preservation during inundation. An example of rapid burial on dry land occurs when a river overflows its banks and leaves behind a thick layer of sediment and debris on the surrounding landscape. The burial of sites on the OCS most likely occurred in river floodplains and terraces. Prehistoric sites that were not rapidly buried, but which remained on or near the surface of the Pacific OCS, most likely were washed away (BOEM 2013:25). The erosive effects of the Pacific's wave actions on buried archaeological sites would have been reduced through time, as the sea level continued to rise and the depth of the water increased.

The subtidal zone includes all of the seafloor below the normal reach of high wave energy and offers a more stable environment conducive to the preservation of inundated sites, especially if they had been buried beneath sediments prior to inundation (Snethkamp et al. 1990 III:105 in MMS 1990; BOEM 2013:26). All of the OCS within the study area is located within the subtidal zone and, as sea level rose, the intertidal zone migrated landward and left behind a layer of sand in the subtidal zone.

BOEM (2013:54, Figure 16) depicts shoreline contours in the study area that were present on the exposed Pacific OCS coastal landscape during the time since the Last Glacial Maximum. Contours depicted include 12,000 B.P., 13,000 B.P., 14,000 B.P., 16,000 B.P., and 18,000 B.P. shorelines west of the study area. It is also possible that inundated prehistoric sites on the Pacific OCS that may have been preserved along the margins of paleochannels or intervening buried landforms were buried under a substantial layer of sediment and are deep enough to remain unaffected by the proposed Project. However, the depth of such protective sedimentation compared with the depth of anticipated Project-related ground disturbance has not yet been analyzed.

In summary, the study area has the potential for as yet undiscovered prehistoric archaeological deposits. Zones within the study area of moderate to high potential for such deposits are highly localized, and identification of these localities would require a sophisticated analysis of the pre-submergence landscape within the study area, and modeling of subsequent conditions of submergence and rate of deposition throughout the marine transgression.

Native American Settlement and Occupation

Human occupation of the California coast spans at least the last 13,000 years, although some have claimed a much greater antiquity for this habitation (e.g., Carter 1957; Moriarty and Minshall 1972); however, these claims are met with skepticism by many (BOEM 2013:83).

The earliest evidence for habitation of the central California coast may have been obscured by environmental factors (BOEM 2013:83). The earliest identified California coastal sites are located on the Northern Channel Islands offshore of southern California and date to between 13,000 and 12,000 B.P. (Erlandson et al. 2007a, b; Arnold et al. 2004; Erlandson 1997 in BOEM 2013:83). The oldest site is located at Arlington Springs, Santa Rosa Island (CA-SRI-173) and represents the earliest human remains encountered on the Pacific coast, contemporaneous with Clovis (Erlandson et al. 2007b and Arnold et al. 2004 in BOEM 2013:83). The large number of marine/littoral sites dating to between 12,000 and 10,000 B.P. offers some of the best evidence for early persistent use of marine resources in the Americas (Rick et al. 2001 and Arnold et al. 2004 in BOEM 2013:83). Ascribed to the Paleoindian Tradition, the assemblages consist of abundant flaked stone tools and a distinct lithic technology (BOEM 2013:83).

Conflicting hypotheses on the origin of the Paleocoastal peoples (e.g., independent settling of coast, descending from inland Paleoindian peoples) have been suggested by Morrato (1984) and Davis et al. (1969), but data from the earliest Channel Island sites (Arlington Springs [CA-SRI-173]), Daisy Cave [CA-SMI-261]) with components dating to between 13,000 and 11,000 B.P. suggest that Paleocoastal peoples did not descend from inland Paleoindian peoples but arrived on the coast independently (Rick et al. 2001 and Erlandson 1997, 2007b in BOEM 2013:83). The paucity of sites contemporaneous to the Santa Rosa Island and San Miguel Island sites may reflect the site destruction processes of rising eustatic sea levels along the mainland coast. In addition to the many early Channel Island sites, large numbers of sites dating to between 10,000 and 8,000 B.P. are present along the entire California mainland coast, although the majority are located in southern California.

The onshore segment of the fiber optic cable landings at Grover City are within the territory historically occupied by the Obispeno Chumash, the northernmost of the Chumash-speaking peoples of California (Heizer 1978; Landberg 1965; Greenwood 1972).[2]

Archaeological evidence has revealed that the ancestors of the Obispeño settled in San Luis Obispo County over 9,500 years ago. The Obispeño area from San Simeon Creek to Avila Bay contains at least 2,500 archaeological sites that span many years of occupation by the Chumash and their ancestors. Following an annual cycle of hunting, fishing, fowling, and harvesting, the Chumash peoples adapted to changing environmental and social conditions and grew into a large, complex society that persists today.

At the time of Spanish contact, the area inshore of the proposed offshore cable corridors was occupied by speakers of the Obispeño dialect of the Chumash language. The Chumash were a group of hunter-gatherer-fishers who attained an extraordinary level of social complexity given their means of subsistence. The Obispeño Chumash occupied the northern limits of the Chumash occupation sphere, beginning near the Nipomo area and extending northward as far as San Simeon and beyond.

[2] 0rr (1967) indicates evidence of hunting on Santa Rosa Island possibly as early as 15,820 B.P.; however, Moratto (1984) and Taylor (1985) indicate a date of 11,000 B.P. based on the majority of current evidence.

In the world of the Chumash, the long years of prehistory have been divided into several periods that have been sub-divided into chronologically-successive phases (King 1981). The earliest aboriginal settlement in the area historically occupied by the Chumash is a poorly known period between 12,000 and 9500 B.P. A Paleo-period fluted point from this era was found in the coastal area east of Point Conception.

Much of the long history of the Chumash and their ancestors has been based on general patterns of social, technological, and subsistence changes observable in the archaeological record and has been separated into three major periods: Early, Middle, and Late (King 1981).

The Early Period (11,000 to 3000 B.P.) is the first period in California with sites that represent remains of permanent settlements with associated cemeteries. The earliest site in San Luis Obispo County (CA-SLO-2) is found at Diablo Canyon, with radiocarbon dates to between 9900 and 9300 B.P. (Greenwood 1972). The important Lodge Hill site in Cambria also has a substantial Early Period component that has been radio-carbon dated to 8000 B.P. It shows extensive use of local raw materials and coastal marine food resources.

While a number of sites along the San Luis Obispo County coast are known to exist prior to 8000 B.P., very few have been discovered between 8000 and 5500 B.P. The rare occurrence of archaeological sites in this 2,500-year period may be due to the Altithermal, a very dry, warm period in California history when populations may have decreased or been clustered near permanent water sources. After 5500 B.P., many sites were again occupied. Coastal sites in this later part of the Early Period are known from Diablo Canyon, the Morro Bay sand spit, Toro Creek, Cayucos, Cambria, San Simeon Creek, and elsewhere.

Early Period sites often contain milling stones and manos, which indicate extensive use of seed plants in addition to intensive harvesting of shellfish. A basic array of rectangular shell bead ornaments also occurs throughout the Early Period. Village life was well organized, with use of formal cemeteries and specialized resource sites.

Artifacts and food remains recovered from these early contexts indicate that people living along the coast fished with bone hooks, sometimes using boats or rafts, and occasionally taking sea mammals and large fish. Deer and other bones, stone points, and knives indicate that hunting was important. Residential sites often contain milling stones and manos used to process small seeds. During much of the Early Period, society was organized as egalitarian, so that anyone could attain positions of power and wealth. Political power was largely dependent on the acquisition of wealth and ritual power. During the later phases of the Early Period, Olivella barrel beads were the dominant type of bead used throughout Chumash territory. Olivella barrel beads require additional grinding of the base and often the spire to reduce the size of the bead, which increases the manufacturing costs of this type of bead (King 1990). This increased cost per bead is suggested to indicate that these beads were used in economic contexts.

The increasingly standardized size of the Olivella barrel beads and clam disc beads throughout the Early Period also suggest that both were used in changing and developing economic exchange systems. Early settlements often were small hamlets defensively situated on elevated landforms. Throughout the Early Period, while most villages contained 30 to 60 people, some settlements increased in size to several hundred.

The end of the Early Period and beginning of the Middle Period occurs between 3000 and 2600 B.P. and is marked by changes in ornaments and other artifacts, which indicate the development of hereditary control of political and economic power. Cemeteries in this period indicate a separation of “church and state,” between chiefs and priests or religious leaders. Toward the end of the Early Period, milling stones decreased in frequency as mortars and pestles became more common. Subsistence patterns appear to shift from small seeds to larger nuts, particularly the acorn and islay as well as fruits. Storage of these foods also increased. Social and marriage networks were established to regulate these food stores and to even out fluctuations of the acorn harvest in different regions. Also during the Middle Period, the importance of fishing from boats increased, and fish became a more important food resource. Village locations during this period tended to be less defensive, as villages became integrated into larger political units to promote inter-village and inter-regional trade.

Although the Early Period economic system used clam disc/cylinder beads and Olivella barrel beads, both types of beads became rare in the Middle Period—indicating a major change in the utility of economic systems during this time. During the Middle Period, political control systems, not economic systems, were adequate to regulate the Chumash society. The most common beads were Olivella saucers (discs) that were used in necklaces during political exchanges between village chiefs and other high-status members of the society. The villages during the Middle Period grew larger in size and number. Toward the end of the Middle Period, there was a shift from the use of large points to small projectile points, and bows and arrows became common throughout California after about 500 to 700 A.D.

The Middle Period of Chumash prehistory spans the centuries between 2500 B.P. and 1150 A.D. During this time, Chumash society shifted into a very organized state with hereditary rights to political and religious power. Artifact types changed in the Middle Period, and shell ornaments became more diverse. An important economic adaptation, the use of acorns, is indicated by the decline in milling stones and the increased use of mortars and pestles. Population size increased and trade networks became well established in the Middle Period. Some cemeteries show evidence of warfare.

The Late Period (1150 to 1790 A.D.) is marked by the differentiation of new bead types, indicating that new economic subsystems again were necessary to regulate the growing Chumash society. This later economic system switched to Olivella callus beads (cup, lip, and cylinder beads) and produced a greater volume of money and invested more energy per bead in the economic system than the Early Period populations. During the 800 years the Late Period economic system operated, shell beads became larger—using less grinding time and thus cheaper to produce—and became more numerous. This healthy trend in economic systems is commonly known as inflation.

Large trade centers were established, and all aspects of Chumash society rapidly grew. Many small sites also were established during this period as a response to the growth of an economic system that supported more specialists and intensive exploitation of many different resources. Ritual objects were seldom owned by individuals but rather were controlled by institutions. Chiefs and many other important political and social positions were inherited along "royal" family lines. Social and political organizations encompassed most of the Chumash nation from Malibu to the northern edge of San Luis Obispo County.

Economic changes continued within the Chumash world. Bead jewelry indicates that there were divisions in wealth between family lines. Money was invented and extensively used as an indication of political as well as economic power. The long process of localized adaptation evident throughout Chumash prehistory became even more established. With the arrival of the Spanish, especially after 1769 A.D., rapid changes altered Chumash political and economic achievements as well as reducing the size of the population. By the end of the Mission era, the Chumash continued to live on their ancestral lands, but their former cultural achievements were largely changed forever.

By 1805, all native people in San Luis Obispo County and beyond had been baptized and their villages abandoned. In the course of only 30 years from the first Spanish expedition in 1769, the traditional way of life had forever been changed for the Chumash people. Once moved to the missions or returned to the various outposts, native people adopted a new way of life, using domestic plants and animals and working to support the Franciscan missions. Those surviving the Spanish period adapted to the ranchos of the Mexican and American periods and later integrated into modern society after the turn of the century.

During prehistory, the area surrounding the San Luis and Morro Bay areas were rich in wild food resources. This abundance of resources is believed to be the reason for the high number and large size of sites per mile relative to neighboring locations, especially to the north and east inland. This high frequency of prehistoric sites makes these areas extremely important in regard to interpreting prehistoric cultures. The likelihood of encountering large substantial prehistoric sites increases as one nears bays and estuaries. Conversely, most of the sites located in the nearby foothills, away from the resources of the bay, are small ephemeral sites, often used for special purpose activities.

Archaeological studies continue to contribute to our knowledge of past cultural patterns and add considerably to our store of information on ancient environments and climatic conditions. Information generated by the systematic surface surveys and subsurface testing of archaeological deposits contributes a significant element to the scientific history of California and to the history of San Luis Obispo County.

Archaeological sites also are an integral part of the modern day Native American community. Their history is contained in the sites, and most contemporary Chumash believe that cultural resources are best left in their natural state. When unavoidable adverse impacts are proposed, most Native Americans strongly support the best sensitive scientific study that will benefit their culture and the general community. Today, many Chumash people are involved in protecting their native heritage and practicing traditional beliefs in the same territory as their ancestors have for over 9,000 years.

A more complete discussion of the Obispeno Chumash may be found in the terrestrial cultural resources section of the Mitigated Negative Declaration.

Historic Setting

Historic Exploration, Settlement, and Commerce

Juan Rodriguez Cabrillo, a Portuguese pilot and navigator, commanded an expedition to explore the California coast north of Cedros Island in Baja California. With the hope of locating the fabled northwest passage, the “Strait of Annan,” and determining whether Asia could be reached by following the Pacific Coast north, he departed Navidad near Acapulco in June of 1542 in the *San Salvador* and the *Victoria* (Bancroft 1886:1). Cabrillo’s was the first European expedition to explore along the California coast. Cabrillo died during the voyage, and his remains are believed to be buried on one of the Channel Islands, possibly San Miguel Island (Moriarty and Keistman 1973; Hole and Heizer 1973). When Cabrillo died, Bartolome Ferrer assumed command of the expedition and led it as far north as the southern Oregon border.

Other explorers followed the Cabrillo expedition, including Pedro de Unameno, who opened the Acapulco-Manila trade route between the Philippines and Mexico in 1565, allowing Spain to realize Columbus' dream of a new trade route with the Indies. The Manila galleon trade lasted until 1815 (Schurz 1939). Another expedition led by

Sebastian Vizcaino in 1602 produced fairly accurate charts of the coast and harbors of southern and central California.

Sir Francis Drake, during his circumnavigation of the world by sea in 1579, is believed to have landed on the west coast of North America. Drakes Bay near Point Reyes is considered as the likely landing spot.

The development by Spain of the Manila galleons in 1565, which transported Chinese porcelain, silk, ivory, spices, and other exotic goods from Asia to Spanish settlements in Mexico, resulted in the inclusion of the West Coast into global trade (BOEM 2013:188). The Manila galleons sailed annually from the Philippines bound for Acapulco. The sailing masters steered the galleons as near to 30 degrees north latitude as possible, often needing to travel farther north to find favorable winds. After the long trip across the Pacific, the ships turned south upon seeing the first indications of land and thus avoiding the uncharted hazards of the California coast (MMS 1987). If all went well, the first land seen by the sailors would be the tip of the Baja peninsula. The ship then sailed to Acapulco. Many galleons never made it to safe harbor in Acapulco. Some of these included the *Capitana* (unknown location, circa 1600); *Nuestro de Senora Aguda* (Catalina Island, circa 1641); and *Francisco Xavier* (Columbia River, Oregon, circa 1707). Galleons also fell prey to pirates such as the *Sir Francis Drake* and *Thomas Cavendish* (Santa Ana, off the tip of Baja, 1587), and *George Compton* (San Sebastian, aground on Catalina Island, 1754) (Schurz 1939; Bancroft 1886; Meighan and Heizer 1952).

When Spain finally colonized California, all Spanish ships sailing along the California coast, including the Manila galleons, were required to stop at Monterey. Schurz (1939) states that more than 30 Manila galleons were lost over the 250 years of trade. A few were wrecked on the westward passage, and others shortly after leaving Manila. At least a dozen galleons remain unaccounted for.

Spanish (1769–1818) and Mexican Colonial Period (1818–1848)

The years of the Spanish-Mexican dominance in California saw increasing numbers of vessels arriving on the California coast. These engaged in the sea otter fur trade, smuggling, and legal trade of China's goods in exchange for California’s abundant hides and tallow from the vast herds of cattle kept at various private ranchos (Ogden 1923, 1941).

In 1812, the Russian-American Fur Company was established near Fort Ross and flourished for 20 years (MMS 1990:98). The sea otter trade, existing roughly from 1784 to 1848 although declining markedly after 1830, and the hide and tallow trade of the 1830s and 1840s were the major international commercial activities that brought ships to California until the Gold Rush of 1849. Although certain Spanish and later Mexican citizens were authorized to conduct business on behalf of the government, most commerce consisted of smuggling by Yankee ships from East Coast ports. Spanish and later Mexican authorities made trading, except through specified ports, either outright illegal or imposed exceedingly high tariffs to protect their economic interests.

To the inhabitants of colonial locations like California, participating in these smuggling ventures was the only way to acquire some common conveniences and luxury goods. Smugglers in the otter trade would buy as many skins as possible in California and then sail to China and trade them for goods that brought high prices in New England or Europe. Otter furs initially were supplied by Native Americans working for the missions. Later, Aleut Islanders from Alaska working for the Russians competed for this lucrative trade.

The hide and tallow trade consisted of buying cattle hides from the ranchos in California and shipping them to New England's expanding industrial base for the production of leather goods for domestic use and export. Most of the hide and tallow trade took place in southern California. The Mexican-American War of 1846 and the Gold Rush of 1849 permanently changed the character of California shipping (MMS 1987:82). Clipper ships and side-wheel steamers soon eclipsed the outdated sailing brigs, and what had in Hispanic times been a sparsely populated coast with a livestock-raising economic base supplemented by some fur trading was transformed into a thriving, densely populated, American state with a diverse economy.

American Period (after 1848)

With the discovery of gold in California in 1848, the primacy of San Francisco as the principal port on the West Coast was confirmed, as thousands of vessels made their way to San Francisco as part of the Gold Rush. The Pacific depended on ships bringing raw and manufactured goods, immigrants, and capital until the completion of the transcontinental railroad in 1869 offered an alternative method of transportation for commerce (Delgado 1990:8). California waters soon were alive with clipper ships and side-wheel steamers. Lumber, bricks, food, machinery, and labor were provided by vessels because San Francisco and the rest of California had only scarce agricultural and industrial output. Soon, however, reciprocal trade burgeoned with the establishment of lumber mills, farms, factories, and ranches.

Schooners were developed as vessels used for short hauls that could maneuver in the close quarters required at smaller landings. Generally having two masts, schooners were faster, easier to handle, needed smaller crews, could be made of wood, and were less expensive to operate than other sailing ships (Lindstrom 2013). The schooners were shorter, wider, had shallower hull depths (draft), and generally weighed less than 200 tons. Lindstrom (2013) indicates that, from 1860 to 1884, about 70 percent of vessels built were sail-powered only; and after 1884, most vessels had steam engines or were converted to steam power. Steam allowed the boats to travel even without wind and allowed vessels to move up rivers. In addition, steam schooners still had sails in case the engine or boiler failed. As can be attested to by the number of shipwrecks reported in the study area, loss of vessels through stranding, grounding, or other damage was common. Steam schooners became prevalent by 1897. Far fewer losses of steam-powered schooners are listed than the earlier schooners.

Coastal trade in California continued to grow with the expansion of mining, agriculture, fishing, and manufacturing. California's flourishing economy, coupled with the natural physical barrier of the mountains of the Sierra Nevada to terrestrial commerce, resulted in coastal growth at an unparalleled rate (Caughey 1970 in MMS 1987:82). Rapid industrial growth and the advent of rapid technological development in the shipping industry in the latter half of the 19th century resulted in increasingly larger wood, iron, and steel ships. Southbound sidewheel steamers carried gold shipments from the gold fields.

Spanish ships bringing grain from Chile were common during the last half of the 19th century. In the last quarter of the 19th century, lumber schooners were bringing lumber and railroad ties from the north, while huge British iron barks were bringing rails and heavy machinery round the horn (Caughey 1970 in MMS 1987:82).

With the development of agriculture in California, barks could carry grain out instead of sailing "in ballast" (without any cargo). Steamships and schooners were being built on the West Coast, and steel-hulled ships were being built on the East Coast and elsewhere. The increasing need for coal brought in British ships from Newcastle, which later were used along with San Francisco ferryboats as fishing barges up and down the coast. Other ships were converted into cargo barges for use in the coastal trade. A large percentage of these ships sank along the California coast and constitute a significant element of the cultural resources that may be found in the study area. From the latter quarter of the 19th century, the Japanese dominated the California fishing industry with vessels of traditional Japanese design. During the first quarter of the 20th century, the Japanese fishing communities gradually were supplanted by Portuguese and Italian fishermen and finally were displaced altogether when World War II brought about Japanese-American relocation (BLM 1979:IV–115).

Coastal growth resulted in ships of all kinds from all over the world bringing in a variety of goods and distributing California products to ports worldwide (MMS 1987:82). The latter half of the 19th century saw rapid industrial growth and the advent of rapid technological development within the shipping industry. By the end of the 19th century, steamships were replacing sailing vessels as the primary mode of transportation, and the Pacific Coast of the United States became prominent in shipbuilding. By World War I, the diesel engine and the oil-burning steam turbine had replaced sail for all but bulk cargoes. As steam replaced sail, the internal combustion engine became popular. California became the American gateway to the Pacific world; and virtually every type of ship, large and small, was seen in California waters.

The U.S. Navy fleet pertains to all vessels built for or used by the U.S. Navy during World War I or World War II that were decommissioned and converted for pleasure, fishing, transport, survey, or other uses that were lost offshore of northern California. While not apparent by their use at their time of loss, some may have battle stars or other historic associations that may require further research to determine their significance and eligibility for listing in the NRHP. Vessels built or commissioned by the U.S. Navy have not been identified by current research in the study area.

Historic Sea Routes and Shipwreck Distribution

Coastal and overseas routes in use north of Point Conception originally followed the southbound longshore California current, the North Pacific current (sometimes called the North Pacific Drift, a slow warm water current that flows west to east between 30 and 50 degrees of latitude), and the Japanese west- to east-flowing Kuroshio or Japanese current. While traversing coastal waters without stops, motorized ship traffic travels within the established shipping lanes. Sailing vessels, however, must constantly tack and jibe in order to make headway up the coast because of the prevailing northwesterly wind pattern. Sailing ships running down the coast usually will not tack or jibe because they are running before the wind. These routes are compiled from descriptions in the historic record and idealized depictions taken from route charts published by various shipping lines (MMS 1987:85).

Numerous vessels have been reported lost in the study region. A large number of vessels whose coordinates remain unknown were lost en route along the California coast. BOEM generally has confined archaeological search to the areas considered most sensitive (i.e., waters less than or equal to 120 meters deep (394 feet, 66 fathoms) and areas of potentially high shipwreck density as determined by historical data. The planned cable routes cross through these documented areas that are sensitive for the occurrence of shipwrecks and known historic shipping lanes. Although most shipwrecks in the study are may be anticipated to be located nearshore, any of these vessels may be located within or near the deeper water portion of the study area. The distribution of shipwrecks is influenced by environmental factors (e.g., wind; current; weather; and nearshore hazards such as sandbars, rocks and reef areas), it is influenced even more by vessel traffic patterns.

Branching of shipping lanes to reach local ports varies with the point of origin, destination and the direction and force of winds that changes with the seasons. In addition ships often take shortcuts to reduce running time outside of the established shipping lanes. Although historic shipping lanes can be plotted, they are not always adhered to, and vessel losses may occur within the lanes or shoreward. The density of losses increases with the occurrence of natural hazards such as rocky shoals, headlands, reefs, as well as in the vicinity of ports-of-call.

Coastal and overseas routes in the Santa Maria Basin were established by the Spanish (MMS 1987:84). While motorized vessels can readily maintain travel within these shipping lanes, sailing vessels must constantly tack and jib in order to make headway of the coast due to prevailing northwesterly wind patterns. Sailing ships running down coast usually don't have to tack and jib because they running before the wind (MMS 1987:84). The sea lanes established historically are still in use today and appear on modern navigational charts. Transit to local ports branch off from the established sea lanes that increases traffic and collisions as does seasonal fog of varying densities.

The nine Manila galleons reported lost offshore of the California coast could be located anywhere in the Pacific; however, given the southerly destination of Mexican ports and probable use of the North Pacific current, they may be encountered within the proposed cable routes in the study area.

Marine Cultural Resources

As noted earlier, three broad categories of marine cultural resources are considered in this report, all of which currently are submerged and may be encountered during the marine installation of the Project: (1) historic period shipwrecks and unidentified debris; (2) prehistoric period watercraft; and (3) prehistoric archaeological resources, both *in situ* site deposits and isolated artifacts. No downed aircraft are listed in the California State Lands Commission (CSLC) or BOEM databases for the study area (Figure 1).

Historic Period Shipwrecks and Unidentified Debris

Historic period shipwrecks consist of the remains of watercraft that were used as early as the 16th century in the study area to traverse Pacific waters and unidentified debris. While the majority of shipwrecks reported in the study area occurred near natural hazards (e.g., rocky shoals, headlands, and reefs; and in the vicinity of coves, historic landings, anchorages, wharves, and lighthouses) or other ports of call, they also may have occurred in deeper waters such as those associated with historically established shipping lanes. Ports of call are accessed from the coastal shipping lane.

These historic watercraft most often came to rest on the ocean floor due to numerous causes such as equipment failure, inclement weather, and associated marine casualties such as capsizing, foundering, stranding, explosion, fire, and collision during their travels on the Pacific Ocean. They also may be present due to purposeful scuttling. Their *in-situ* remains may be partially or wholly obscured by sediments and in rocky strata along the ocean floor in the study area.

As noted earlier, debris may include flotsam, jetsam, and items deposited on the seafloor through salvage of vessels or their cargoes and past economic activities such as fishing or marine exploration.

Prehistoric Period Watercraft

The historic and prehistoric period watercraft came to rest after they were abandoned during travel across bodies of water, and they currently may be partially or wholly obscured by sediments of the ocean floor.

Native Americans used watercraft during their approximately 13,000 years of navigation through the study area for transportation and for fishing and hunting offshore for otters, seals, and sea lions. Three different kinds of watercraft were used: (1) the tule balsa canoe (*tomol 'ishtapan*) was used on both the esteros and the ocean; (2) dug-out canoes (*'ah̲ipe'nesh*) hewn from a single log of willow, cottonwood, or poplar, were used on the esteros or in the smooth waters of a cove; and (3) the plank canoe (*tomol*) made largely from driftwood was used on the ocean (Hudson et al. 1987:27–36). The *tomol* was less common in San Luis Obispo County than in Santa Barbara County although its use in Cayucas to the north has been cited (Hudson et al. 1978:36).

It is known that some native vessels may have been inundated, stranded, or capsized in the esteros and ocean. Given the fragile nature of these craft, in terms of construction methods and perishable materials, it is unlikely that evidence of such vessels would be preserved in the nearshore environment.

Prehistoric Archaeological Resources

The prehistoric period archaeological sites and isolated artifacts were deposited during occupation of what is now ocean floor, but what was dry land at the time of their deposition. These sites and isolated artifacts may be buried at varying depths depending on their age and the depositional history of the location in which each is found.

Prehistoric archaeological resources include places that Native Americans lived; performed activities; altered the environment; and created material culture such as tools, art, and subsistence remains prior to contact with Europeans. Additionally, they may contain human remains in the form of burials, cairns, or cremations. Although originally deposited on a non-marine landscape, changes in sea level have resulted in such resources currently being submerged. Such sites may date from the terminus of the Pleistocene through Holocene periods.

Such sites may be situated on relict submerged landforms either mantled with unconsolidated sediments or exposed on bedrock outcrops. Underwater prehistoric sites also may represent remains deposited subsequent to the Holocene Transgression that are situated on the seafloor or within unconsolidated recent sediments. The latter remains primarily are isolated artifacts deposited as a result of random loss (e. g., cliff erosion, fishing, and ceremonial activities).

Preservation of intact prehistoric resources along the California coast is considered unlikely due to the high energy nature of the shoreline environment. Preservation of such submerged sites may potentially occur, however, in association with protected environments (i.e., buried under alluvium or estuary silt, mud. or peat prior to inundation; or where the erosive force of the sea may have been lessened by an intervening landform such as reefs or rocky headlands). Although the former conditions occur in the study area, to date no i*n-situ* remains of intact prehistoric habitation sites have been reported in or near the study area. The probability of submerged prehistoric sites occurring in the study area, except where burial under deltaic sediments or within esteros has produced a more protective environment, therefore, is considered low.

There is a somewhat greater probability for the occurrence of isolated bottom-founded artifacts in the study area. Isolated artifacts have been documented in depths of less than I00 feet (30 meters) in the western Santa Barbara Channel and southward to San Diego (Hudson 1976). The closest artifact location to the study area is reported at Avila Beach (Port San Luis), south of the study area.

Local Maritime History

City of Grover Beach–Pismo Beach

The City of Grover Beach is a coastal city in San Luis Obispo County. The city's western boundary is Pismo Beach State Park and the Pacific Ocean, and its northern boundary is Pismo Beach with Highway 1 running parallel.

The area was claimed by Jose Ortega, who had a Mexican land grant in 1842. The 8,838-acre Ortega Land Grant was claimed by Isaac Sparks in 1867. Sparks named the area El Pizmo Rancho. *Pizmo* is the Chumash word for tar, which was gathered from tar springs in Price Canyon near Pismo Beach. The Pismo clam was named for the long, wide beach where they were once found in numerous quantities.

Sparks sold half of the acreage to John Michael Price, the founder of Pismo Beach in 1887. Price sold 1,149.11 acres of the Pismo rancho to D. W. Grover, a lumberman from Santa Cruz, and his associate George Gates for $22,982.20 in gold. They named the area the Town of Grover and Hunting Beach, hoping that the Southern Pacific Railroad would extend its range from where it ended at San Miguel past the town of Grover.

D .W. Grover laid out streets in a grid pattern, naming them for popular beaches of the time, with land set aside for a train depot, a hotel and a city park hoping to foster commercial growth (www.grover.or/index.aspx?NID-121). Grand Avenue was laid out at that time to stretch from Arroyo Grande to the Pacific seashore.

Grover hired the Carnall-Hopins Company of San Francisco to take care of land sales in an auction in August 1887. D. W. Grover and two of his friends registered the paperwork for their land endeavor corporation, calling it the Southern Land and Colonization Company of San Luis Obispo, California. Although D. W. Grover tried to make Grover City a train depot in the 1890s, the Southern Pacific Railroad decided to construct their depot in the unincorporated town of Oceano. The town of Grover became a city in 1959. It became Grover Beach in 1992.

While there are no indications in the literature that Grover Beach had any major maritime interests, the need for a shipping wharf other than John Hartford's at Port San Luis was recognized. In 1881, a wharf was built by the Merherin Brothers at Pismo Beach for shipping crops and asphaltum by boat. The ocean end of the 1,400-foot-long wharf stood in 18 feet of water at low tide, which allowed access for boats shipping goods to and from San Francisco.

The wharf created competition for shipping with the Pacific Coast Steamship Company. With completion of the Pacific Coast Railway to Arroyo Grande in 1882, the wharf served to create a rate war with the Pacific Coast Steamship Company. Despite damage to the pier in 1884 by a storm that washed out 250 feet of the wharf and a fire in 1885, Price subdivided his Rancho El Pismo adjacent to the wharf in 1887; and a townsite map was filed under the name of Town of El Pismo.

The creation of an economically successful wharf near Grover Beach increases the potential of the study area for the occurrence of shipwrecks and debris offshore.

Impact Analysis

The impact analysis for marine cultural resources discusses methods and significance thresholds, and identifies impacts and mitigation measures.

Methods

Research methods were limited to an archival and records search to inventory marine cultural resources. All marine cultural resources cited consisted of shipwrecks. No downed aircraft or prehistoric archaeological sites and isolated artifacts were listed. The inventory completed for the study area covers the four potential routes plus a 10-nm buffer. No remote sensing survey of the ocean floor for shipwrecks and other debris or predictive modeling for prehistoric archaeological resources has yet been completed for the marine portion of the study area. Sources consulted included cultural resource inventories (shipwreck and downed aircraft listings) provided by the CSLC, BOEM Pacific OCS Region (BOEM 2013; BLM 1979 [Stickel & Marshack]), the Minerals Management Service (MMS 1990 [Gearhart et al.]), and the National Oceanic and Atmospheric Administration (NOAA) Automated Wreck and Obstruction Information System (AWOIS) database (1988). The NRHP, California Historical Landmarks, California Inventory of Historical Resources, and local archives also were consulted.

Other sources consulted include the U.S. Army Corps of Engineers, Los Angeles and San Francisco Districts; National Maritime Museum in San Francisco; Los Angeles Maritime Museum; Commerce Department files at the National Archives in Washington D.C. and San Bruno; Regional Records Centers at Laguna Nigel and San Bruno; The Huntington Library in San Marino; the published volumes of Lloyds of London Ships Registry 1850–1980 and 1885–1950; the U.S. Department of Commerce Merchant Vessels of the United States 1867–1933; the U.S. Coast Guard Merchant Vessels of the United States 1933–1982 and U.S. Coast Guard Supplements 1982–1988 located at the University of California Library at the University of California at Santa Barbara and Long Beach Library; and at the State Library and State Archives and Records Office.

Results

Submerged Prehistoric Resources (Offshore)

The records search yielded no maritime finds of prehistoric origin within the study area for the proposed cable routes. All known underwater prehistoric resources on file appear to be located in Oregon and southern California waters. It should be recognized, however, that the potential exists for remains of prehistoric and historic sites, artifacts, and Native American water craft to be present offshore, although there is a lower potential for their preservation *in-situ*.

Submerged Historic Resources (Offshore)

Submerged historic cultural resources include historic period shipwrecks and debris. No evidence of downed aircraft was found in the archival search for the study area.

The locations of historic period shipwrecks are characterized by inaccuracies in reported location. Many, if not most, vessels reported as lost in the study area have not been accurately located or assessed for their eligibility for listing in the CRHR. Therefore, the potential for the Project to affect these shipwrecks cannot be accurately assessed. However, given the large number of shipwrecks reported within or near the study area, it is likely that one or more may be found by site-specific remote sensing surveys for each of the four routes.

The 10-nm buffer included in the study area records search reflects the most conservative interpretation of the potential accuracy of a shipwreck's location reported

(Figure 1). The CSLC, BOEM, NOAA AWOIS, and in-house shipwreck databases were checked for listings within the study area.

Although the majority of shipwrecks of known approximate location (i.e., accurate from within 1 to 10 miles) are situated close to shore, numerous shipwrecks are reported that may fall within or near the cable routes as they pass through offshore waters to the 3-nm State limit and beyond to U.S. territorial waters. In order to further verify locations of the vessels reported lost within the study area, original sources were reviewed and information such as “at”, “near”, and “off” a land reference that had been removed from State Lands shipwreck listings were added back into the data..

Shipwrecks tend to concentrate along approaches to historic harbors and landings. Shipwrecks also are concentrated along the shoreline, especially along treacherous points of land because of dense fog or other sea conditions. These factors indicate that the highest density of shipwrecks are expected to occur close to shore, given the number of anchorage, wharves and landings in the study area. Shipwrecks also may occur anywhere within State waters and high priority should be given to collecting additional side-scan sonar and magnetometer data from Project routes in this area.

Fewer shipwrecks may be expected to occur in extremely deep waters outside of the normal lanes of traffic. Shipwrecks in deep water generally are thought to be the result of marine casualties but also may include those abandoned due to purposeful scuttling. One or more shipwrecks may be documented by site-specific remote sensing surveys using both side-scan sonar and magnetometer. The presence or absence of the older, more fragile shipwreck localities can be determined only by magnetometer survey. Without magnetometer survey, such resources may go undetected and may be disturbed, damaged, or destroyed during the pre-lay grapnel run or during cable installation and burial. In the case of historic wooden shipwrecks, disturbance of any portion of the shipwreck or overlying substrate would facilitate a more rapid decomposition through physical, chemical, and biological processes and a loss of information on a site or sites significant in the history of California.

Shipwrecks were mapped in relation to the cable routes based on their reported coordinates or other relevant information. Centered on the Grover Beach cable origin, the study area includes the waters offshore of Cambira, Cayucas State Beach, Morro Beach Strand, Atascadero Beach, Morro Bay, Spooners Cave, Montaña del Ora State Park, Point Buchon, Diablo Canyon/Pecho, Point San Luis, Port of San Luis and Avila Beach in San Luis Obispo Bay, Shell Beach, Pismo Beach, Grover City, Oceano, Santa Maria, Mussel Point, and Point Sal. The limits of the study area are shown in Figure 1. Roughly plotted, the study area includes all shipwrecks reported lost between 34º 42’ to 35º 36’ north latitude and -120º 48’ to -122º 05 west longitude. Sixty-seven shipwrecks have been reported lost within the study area (Table 1 [at the end of the report]). In addition to these shipwrecks, 24 shipwrecks are reported as off the California coast, California coast, and Pacific Ocean (Table 2 [at the end of the report]). Any of these shipwrecks could occur within the study area.

Of the 68 shipwrecks reported lost in the study area, the most likely to occur in the fiber optic cable corridors generally are thought to be those shipwrecks reported lost offshore rather than “at” a specific geographic location. However, mariners view “at” from a different perspective. While researching shipwreck data for this report, we found that mariners may define “at” as within visual range of a specific geographic location from a location offshore unless other information is available. For example, if the combined vessel’s and observer’s height above sea level is 15 to 25 feet, a distance of 4.5 to 5.9 nm (8.3 to 10.9 km) is visible, assuming clear weather and a calm sea. Shipwrecks, therefore, cannot be excluded from consideration simply based on the location reported as “at” a specific location unless the coordinates have been accurately recorded.

Nine of the reported shipwrecks (*Annie Lysle*, *Challenge*, *Electra*, *Lena*, *Little Dipper*, *Golden Gate*, *Otsego*, an unknown schooner, and an unknown metal hulk) are reported as grounded on rocks or ashorem and are considered unlikely to occur within the planned cable routes except where their estimated coordinates place them at or near the location of cable origin.

One shipwreck, an unnamed wooden Chinese boat that capsized in a squall in 1866 off the coast of San Luis Obispo, has been evaluated as significant (MMS 1987, 1990). Nine shipwrecks (*Annie Lysle*, *Challenge*, *Elg*, *Golden Gate*, *La Cresenta* [*La Cresentia*], *Lena Otsego*, *ROANOKE*, *Santa Cruz*, and *Svea*) including five of those mentioned above, have been evaluated as moderately significant (MMS 1987, 1990). Of these vessels, the *Challenge*, *Golden Gate*, *Lena*, and *Otsego* were subjected to salvage. Salvage usually indicates that the vessel was accessible from shore, grounded on rocks or sand bars, or kept afloat after wrecking. Only one vessel, the *Otsego*, is listed as removed or refloated. None of these vessels have been accurately located (MMS 1987, 1990).

Sixteen shipwrecks have been evaluated as insignificant (*Bridget II*, *Cibola Negra*, *D. M. Renton*, *Donnie Boy*, *Hattie H*., *Jan Lin*, *Liberty*, *Louisa*, *Mello Boy*, *Miss Judy*, *Petrina*, *Santa Lucia*, *Snagerak*, an unknown metal hulk, an unknown pilot boat, and the *Whale*—a former American barkentine converted to a barge (MMS 1987, 1990; Macfarlane N.D.). Two of these vessels have been accurately located (*Patrina* and *Louisa*).

The remaining shipwrecks have never been evaluated, although two (an unknown wreck and the *Vienni Su*) have been accurately located.

The vessels reported lost were found to range in size from 10 to 370 tons, with one additional vessel, a steamship of 2,354 tons. Nineteen shipwrecks had no recorded tonnage. Nine shipwrecks were reported as grounded, on the rocks, or ashore and thus may be excluded from the analysis. One of the vessels lost in the study area is reported as having been removed or refloated. Four of the vessels lost in the study area are reported to have been salvaged, including the vessel reported as removed or refloated. Their coordinates remain in the shipwreck table because cargo or associated machinery may still remain at the loss location. One vessel, an American barkentine of wood construction named *Whale*, was converted to a wood barge prior to its loss.

Eighteen of the 40 shipwrecks were built during World War II. Many small vessels built during World War II were repurposed as pleasure and work boats in the years following the war. Should any of these small vessels be found during any of the marine archaeological surveys recommended herein, they would need to be identified and researched as to whether they were used in the war effort and whether they were issued battle stars. Historically, during World War II and the Korean War, commendations called “battle stars” were issued to U.S. Navy warships for meritorious participation in battle, or for having suffered damage during battle conditions. This information can be found on file at the Maritime Museum in San Francisco and the National Archives and Records Administration at San Francisco and Washington D.C.

The distribution of the types of vessels identified in the study area and their range of built and loss dates is presented in Table 3. The distribution of the types of vessels identified off the California coast and their range of built and loss dates is presented in Table 4.

Table 3. Distribution of Shipwrecks in the Study Area by Rig/Service and Built and Lost Dates

Rig/Service	Number	Built	Lost
American barkentine (wood barge conversion)	1	1925	1925
American steamship (wood), steam screw	1	1906	1922
Chinese boat (wood)	1	Unknown	1866
Gas screw	8	1908–1945	1921–1962
Lighter	1	Unknown	1872
Schooner, lumber	2	1864	1894
Oil screw	38	1912–1972	1936–1977
Unknown, metal hulk of ship	1	Unknown	1850’s
Unknown, pilot boat	1	Unknown	1877

Table 4. Distribution of Shipwrecks off the California Coast by Rig/Service and Built and Lost Dates

Rig/Service	Number	Built	Lost
Barque	2	1874–1902	1896–1925
Clipper	1	1870	1881
Schooner	2	1892	1878–1908
Schooner, steam screw	1	1906	Unknown
Steam screw	1	Unknown	1922
Oil screw	7	1912–1974	1960–1974
Unknown	9	Unknown	1826–1955

Additional research for subsequent remote sensing surveys may provide additional information on the accuracy of the coordinates recorded. The following describes the shipwrecks anticipated to occur within the maximum 10-nm radius of the proposed routes. The MMS (1987, 1990) databases discuss eligibility for listing in the CRHR only in terms of historical significance. Unfortunately, these three levels of significance, insignificant (not eligible for listing in the NRHP), moderate (potentially eligible for listing in the NRHP), and significant (eligible for listing in the NRHP), were not assigned to CSLC or BOEM listings available for the study area.

For the purposes of this environmental document, any property listed in the NRHP also is considered eligible for listing in the CRHR. None of the shipwrecks listed in CSLC or BOEM databases and in the study area has been evaluated for NRHP eligibility.

Summary

In summary, numerous shipwrecks and maritime shoreline resources consisting of historic wharves, landings, coves and anchorages, and historic ports of call are located in the study area between Point Sal in the south and Cayucos in the north. Maritime sites significant to the study area include historic Port Harford (now seen as Port San Luis and Avila Beach), the historic piers at Pismo Beach built by the Meherin Brothers in 1870, the Williams and Riley Pier built in 1870 at Morro Bay, and the Cayucos Pier built by Captain James Cass in 1872. In the era before wharves were built, vessels would anchor offshore along beaches and at river mouths, and lighter in their cargoes and passengers ashore in isolated cow counties such as San Luis Obispo (Patton 1989; Middlecamp 2013).

Although use of the cable landing site at Grover Beach as an historic landing is not documented in the literature, such usage cannot be discounted prior to the 1870s. Major coastal traffic has been documented between the Pismo Beach Pier, Port Harford/Avila Beach, Morro Bay, and Cayucas, which would have brought vessel traffic to the Project vicinity and increases the potential for shipwrecks and other debris to occur offshore the cable landing and corridor locations.

The references consulted as part of the records search for submerged historic period cultural resources provided information on the locations of shipwrecks, unknown wreckage, and debris. As noted earlier, the causes of vessel losses include marine casualties due to equipment failure, inclement weather, fire, explosion, collision, capsizing, wrecking, stranding, and foundering. Stranding generally occurs when a vessel runs aground, becomes caught on a sandbar or reef, is becalmed, runs out of fuel, or has engine trouble—although this term is often misused by mariners to indicate trouble with the engine or ship machinery, rather than with the vessel itself. Vessels that foundered are those that took on water and sank below the surface of the water.

A total of 68 shipwrecks and unknown wreckage or debris locations have been reported in the study area between the 1850s and 1977. All resources that could be placed to within 10 nm of each of the proposed cable routes have been included for consideration and are listed in Table 1 (at the end of the report). An additional 24 shipwrecks are listed as California coast, off the California coast, and the Pacific Ocean.

The accuracy of the coordinates provided for the shipwrecks varies. Neither the accuracy of location nor the significance of the vessels listed by the CSLC database and MMS 1990 or BOEM 2013 have been evaluated. Many of the resources listed contain information that, regardless of the documented coordinates, place the vessels north of the southern most route. This information can neither be verified nor denied based on the information available. Considerably more research will need to be conducted as part of the remote sensing surveys to validate the locations cited. Many shipwreck locations may never be found based on the inaccuracy of coordinates sited or their degraded conditions on or within the ocean sediments.

With additional information, several more shipwrecks could be eliminated from the numbers cited above. Without confirmation of the accuracy of the coordinates cited, they cannot be completely eliminated.

Eligibility for Listing in the California Register of Historical Resources

With reference to their potential eligibility for listing in the NRHP and, by extension, the CRHR, the MMS 1990 reference uses the terms “significant,” “probably significant,” and “not significant.” Alternative terminology, used by the BOEM 2013 reference, includes “probably eligible,” “may be eligible,” and “not eligible” for inclusion in the NRHP. Unless the resource has been evaluated according to the criteria established for inclusion in the NRHP, these statements of significance and eligibility remain informal suggestions. Based on previous evaluations, all those shipwrecks with a loss of life are generally evaluated as significant. Significance also may be accrued based on the importance of the ship's designer or builder, materials, type of engine or other equipment, association with an early built date, or date of loss. Eleven of the reported shipwrecks have the potential to be eligible for inclusion in the NRHP.

One shipwreck is evaluated as significant (MMS 1987, 1990) and eligible for inclusion in the NRHP:

- Unnamed wooden Chinese boat reported to have capsized in a squall in 1866 off the coast of San Luis Obispo.

Ten shipwrecks are evaluated as moderately significant (MMS 1987, 1990) and may be eligible for inclusion in the NRHP:

- *Annie Lysle*, a 13-ton schooner built in 1875 was reported to have foundered and gone ashore in the same year.
- *Challenge*, a three-masted schooner was lost in 1877 at Morro Bay. The vessel is listed as salvaged.
- *Elg*, a vessel of unknown type/rigging or service, sank in 1938 at Port San Luis/Avila Beach.
- *Golden Gate*, a three-masted schooner built in 1873, parted cables and washed ashore at Morro Bay in 1873 due to lack of wind. The vessel may have gone ashore in the vicinity of the northern channel entrance.
- *La Cresenta* [*La Cresentia*], a steam-powered tanker, was reported missing off Port San Luis in 1935 enroute from Port San Luis to Osaka, Japan.
- *Lena*, a schooner built in 1866, struck rocks and sank in 1866 at Morro Bay.
- *Otsego,* a schooner built in 1872 and stranded ashore in the same year, drifted ashore after parting lines 1,000 yards south of Morro Rock while kedging (i.e., moving a boat by hauling in a hawser attached to a small anchor dropped at some distance). The vessel was reported as salvaged, removed, or refloated.
- *ROANOKE*, A 278- by 40.5-foot, 2,354-ton steel steamship with three decks and two masts, was built in 1882. The ship foundered in 1916 when its cargo shifted, and the ship turned over and sank about 15 miles west of Port Harford (Port San Luis), with 47 lives lost. Some cargo is reported to have been jettisoned.
- *Santa Cruz*, a steam-powered vessel, was wrecked in 1904 at San Luis Reef near Port San Luis.
- *Svea*, a wooden 370-ton American steamship built in 1906, was run down in 1916 by the steel vessel *NEWPORT* 6 miles off of Port San Luis.

None of these vessels have been accurately located (MMS 1987, 1990).

Of the 67 shipwrecks that may fall within the study area, only the 11 cited above are considered eligible or may be eligible for listing in the NRHP without further information. Any resource eligible for listing in the NRHP also is eligible for listing in the CRHR. Sixteen of the 67 vessels listed are considered insignificant and not eligible for listing in the NRHP. The eligibility of the remaining 40 vessels remains undetermined.

The recent (post-1950s) shipwrecks in the BOEM (2013) database have been included as a means of eliminating finds from consideration should they appear in the results of sonar, magnetometer, autonomous underwater vehicle (AUV), or multibeam surveys.

It is considered historically significant that the majority of shipwrecks listed are between 10 and 370 tons, which would have allowed them access to the available pier/wharves in the study area as well as transit from the major ports of call of Port San Luis and Morro Bay to and from San Francisco.

It should be noted that vessels built prior to 1950 should be evaluated for significance to the extent possible, but that effort is not within the range of the present scope of work. Vessels lost after 1950 with an early building date, a specific or unusual design, are associated with significant loss of life, or other historic association also may be evaluated as potentially significant (MMS 1990) and are “probably eligible for listing in the NRHP” (BOEM 2013).

Vessels used after 1950 that were built as part of the World War II effort and converted to pleasure craft, passenger transport, fishing boats, or other service craft may be considered eligible if research showed that they were used in the war effort and that they were issued battle stars.

For the most part, all vessels built after 1950 have been recommended as not eligible for listing in the NRHP (Minerals Management Service [Pierson et al.] 1987). The majority of these vessels are diesel-, gas-, or sail-powered vessels of wood, fiberglass, steel, and more rarely cement construction. As stated above, these vessels were included in the updated BOEM 2013 shipwreck database so that they could be eliminated as potential historic cultural resources during the interpretation of side scan sonar, magnetometer, automated underwater vehicle, and multibeam records. Vessels reported lost in the study area that were built between 1940 and 1945 may be associated with the war effort and may bear battle stars or have other historic associations that have not yet been evaluated.

Of the 24 shipwrecks reported without geographic location other than “California coast,” 5 are evaluated as significant (MMS 1987, 1990) and are eligible for nomination to the NRHP. They include the following:

- *Alice D. Snow*, a clipper built in 1870, was reported lost in 1881. This vessel is reported as removed or refloated.
- *Blossom*, a vessel of unknown rig or service but assumed to be a sailing ship, was reported lost in 1826.
- *Cora*, a vessel of unknown rig or service but assumed to be a sailing ship, was reported lost in 1884.
- *Ella Francis*, a vessel of unknown rig or service but assumed to be a sailing ship, was reported destroyed by a storm in 1866.
- *Forest Monarch*, a vessel of unknown rig or service but assumed to be a sailing ship, was lost in 1859.
- *Senegal*, a vessel of unknown rig or service but assumed to be a sailing ship, was lost in 1893.

Five vessels are evaluated as moderately significant (MMS 1987, 1990) and may be eligible for nomination to the NRHP. They include:

- *City of Honolulu*, a steam powered vessel lost in 1922.
- *General Hugh L. Scott*, a vessel of unknown rig or service lost in 1941.
- *Pacific*, a schooner reported abandoned in 1878.
- *Steel Chemist*, a vessel of unknown rig or service lost in 1955.
- *Ticonderoga*, a vessel of unknown rig or service lost in 1953.

None of these vessels have been accurately located.

Although not evaluated by MMS in 1987 or 1990, the following vessels were added to the list by Macfarlane (N.D.) and may be eligible for nomination to the NRHP but require additional research to support this finding. They include:

- *Amazon*, a 1,167-ton four-masted barque built in 1902 and burned at sea in 1925.
- *Discovery*, a 450-ton barque built in 1874 and lost in 1896.
- *Eclipse*, a schooner lost in 1908 at the edge of United States territorial waters.
- *The Independence*, a wood vessel of unknown rig or service that burned in 1853.

Significance Thresholds

Under CEQA, lead agencies are to protect and preserve resources with cultural, historic, scientific, or educational value. State CEQA Guidelines Section 15064.5 provides significance criteria for determining a substantial adverse change to the significance of a cultural resource. Appendix G of the State CEQA Guidelines provides additional guidance in determining a project's impact on cultural resources. The information provided in the State CEQA Guidelines has been used to develop the significance criteria for cultural resources for the proposed Project. State CEQA Guidelines also require reasonable mitigation measures for impacts on archaeological resources that result from development on public lands.

A Project activity would result in a significant impact ton a cultural resource if it would:

- Cause a substantial adverse change in the significance of a historical resource as defined in State CEQA Guidelines Section 15064.5 and PRC Section 21083.2.
- Cause a substantial adverse change in the significance of an archaeological resource pursuant to State CEQA Guidelines Section 15064.5 and PRC Section 21083.2.

Until identified cultural resources can be evaluated for their eligibility for nomination to the NRHP and California Historic Places, they must must be considered potentially significant until otherwise eliminated by additional research, avoidance, or a program of data recovery.

Impacts and Mitigation Measures

Impacts on cultural resources are classified as Class I or Class I, as follows:

Class I: Significant impact; cannot be mitigated to a level that is not significant. A Class I impact is a significant adverse effect that cannot be mitigated below a level of significance through the application of feasible mitigation measures. Class I impacts are significant and unavoidable.

Class II: Significant impact; can be mitigated to a level that is not significant. A Class II impact is a significant adverse effect that can be reduced to a less than significant level through the application of feasible mitigation measures.

Impacts

RTI proposes to install four transpacific submarine cables to land at Grover Beach. The Project will be implemented in four phases—one phase for each of the four cable systems at Grover Beach.

The marine segments of the cable systems refer to those segments between mean high water line and the outer limit of the OCS, where seawater depth is approximately 5,904 feet (1,800 meters, or 984 fathoms). They consist of the marine conduit, cables, splice boxes, and cable regenerators. Cables consist of a double-armored design, used in rocky areas or coarse substrates and where protection from fishing gear may be warranted; and a light-weight armored cable, similar to the doubled-armored cable, used where the risk of damage due to substrate conditions or fishing is reduced by burial of the cable in soft-bottom sediments using a seaplow or remotely operated vehicle (ROV). Both cables are less than 2 inches (5 centimeters) in diameter.

The following Project activities have the potential to affect submarine archaeological resources.

Marine Directional Bores. Four marine directional bores would be conducted, one for each of the cable systems, to provide a housing for the fiber-optic conduit. Each directional bore would extend approximately 1.210 meters (4,000 feet) offshore into the Pacific Ocean from the LMH to water depths of 12 meters (40 feet).

Impacts from directional bores are anticipated to result during anchoring activities. A workboat would be anchored to the seafloor via a four-point mooring, with an anchor spread of 328 feet (100 meters). A smaller secondary workboat would set and retrieve anchors. All anchors would be set and retrieved vertically to avoid dragging them across the seafloor.

Ocean Ground Beds. The OGBs would be installed onshore or offshore for each subsea fiber optic cable to ground it since electrical signals would be traveling through these fiber optic cables. Impacts are anticipated to occur during installation of the OGB

If installed onshore, the OGBs would be within approximately 100 feet of the LMH. Each OGB would consist of up to six anodes constructed of cast iron and encased in a magnesium canister 10 inches in diameter and up to 84 inches in length. The anodes would be placed in a line and spaced at 10-foot intervals. The tops of the anodes would be approximately 10 feet below grade. Ground cable would be buried approximately 6 feet below grade and lead from each OGB to the LMH. The OGBs would be located approximately 250 feet landward of the mean high-water mark.

Onshore installation involves drilling holes from the LMH down to the seawater level with a well-drilling machine and then installing the iron anodes in the drilled holes. The copper ground cable would be installed by excavation between the tops of the iron anodes to connect the tops of the anodes to one another and back to the ground cable in the LMH.

Alternatively, the OGBs would be installed in the ocean beginning at the seaward side of the landing pipes. The tubular anodes would be mixed metal oxide rods approximately 11.8 inches in diameter and approximately 4.9 feet in length. Three to five anodes would be connected together in a linear or string fashion to create an anode string assembly. Each anode on the array would be approximately 9.8 feet apart and connected by an insulated copper conductor. The MMO anode string assembly would be installed by diver jet burial in the same operation as the marine cable burial. The offshore anode array system would be placed beginning at approximately 50 feet beyond the end of each landing pipe and installed along the fiber optic cable. The fiber optic cable and the ocean anode string assembly would be tied together and buried as part of the same burial operation.

Pre-Lay Grapnel Run. Impacts may result during the pre-lay grapnel run to clear debris, such as discarded fishing gear, from the seafloor along corridors where the cables are to be buried. A grapnel, typically of the flatfish type, would be dragged along the cable routes prior to cable installation. The grapnel would be attached to a length of chain to ensure contact with the seafloor and towed by the cable ship or a workboat at a speed of about 1.2 miles per hour (about 1 knot or 1.9 km per hour). The arms of the grapnel are design to hook debris laying on the seafloor or shallowly buried to about 0.4 meter (1.3 feet). Any debris hooked would be retrieved by winch, stowed on the vessel, and subsequently be disposed of onshore.

Cable Laying and Plowing. At the end of the bore pipe, the cable would be temporarily laid directly on the seafloor to a water depth of approximately 100 meters (328 feet) until it can be post-lay buried by divers or by an ROV. Cable plowing can be used between water depths of 100 and 926 meters (328 and 3,037 feet). A cable plow is a burial tool consisting of a large sled that is deployed by the main cable ship. Divers assist with loading the cable into the plow's articulated feed chute and burial shank. As it is towed by the ship, the plow slices a narrow furrow through ocean floor sediments about 1 meter (3.3 feet) wide and mechanically feeds and buries the cable to its desired depth. The plow, supported by two outriggers, would affect a total width of approximately 6.1 meters (20 feet). Together the weight of the soil and the sled serve to fully close and compact the furrow. The plow operates at 0.95 kilometer per hour (0.5 knot or 0.6 mile per hour).

Diver-Assisted Post-Lay Burial. This technique can be used in shallow depths between 10 and 30 meters (33 and 98 feet). Divers using hand jets open a narrow furrow beneath the cable, the cable drops into the furrow as it is opened, and disturbed sediments settle back over the cable. Depending on bottom conditions, the cable would be buried to a depth of 1.0 meter (3.3 feet) where feasible based on localized conditions. Between depths of 30 meters (98 feet) and 100 meters (328 feet), an ROV would be used to bury the cable. Sections of cable not buried would be laid temporarily on the ocean floor by the cable ship, with post-lay burial at a later date.

Remotely Operated Vehicle Post-Lay Burial. Between water depths of 30 meters (98 feet) and 100 meters (328 feet), or where the cable plow cannot achieve the targeted burial depth, an ROV would be used to bury the cable. The post-lay burial of the cable by ROV would disturb the seafloor. The ROV would loosen the seafloor sediments beneath the cable, allowing the cable to settle to the desired depth. The sediments then would settle back over the area, burying the cable. The typical width of disturbance would be 4.6 meters (15 feet). The ROV operates at an average rate of speed, about 0.12 mile per hour (about 0.1 knot or 0.19 km per hour). The ROV moves at a rate of 0.36 mile per hour but may take up to three passes to complete the burial.

Emergency cable repair, retirement, abandonment, or removal of the cable systems are likely to result in impacts similar to installation impacts. If significant impacts are identified, the types of measures proposed to mitigate installation impacts would be equally feasible to mitigate removal impacts to less than significant levels.

Impact CR-1: ***Project-related ground-disturbing activities have the potential to disturb or destroy previously unknown or inaccurately recorded submerged prehistoric archaeological resources or historic shipwrecks.***

As identified in the construction techniques above, marine construction activities have the potential to disturb, disrupt, or degrade extant cultural resources such as inundated prehistoric sites and watercraft and historic shipwrecks on the seafloor or within seafloor sediments from the mean high water line to the outer limit of the OCS—that is, where the seawater depth is approximately 1,000 fathoms (6,000 feet or 1,830 meters). Prehistoric archaeological sites associated with buried late Pleistocene and Holocene paleo-landforms in the study area are unlikely to be disturbed during construction, operation, or repair of the four cables proposed given the anticipated depth of overlying sediments. Such resources, should they be present, would have a significant covering of marine sediments 20 to 30 meters (66 to 98 feet) thick. Subsurface disturbance of a potentially significant or significant shipwreck may result from anchoring activities associated with directional boring through nearshore sediments from the LMH to water depths of 9.2 meters (30 feet); from diver-assisted burial at water depths of 12 to 300 meters (49 to 98 feet); from cable plow, diver ,or ROV-assisted post-lay burial in water depths of 30 to 1,200 meters (98 to 3,937 feet); and from direct surface lay in water depths greater than 1,200 meters (3,937 feet).

In addition, although cable-laying and support vessels would be dynamically positioned rather than requiring anchoring or anchor mooring systems at locations along the proposed cable routes, anchoring may be anticipated to occur for a variety of reasons such as bad weather, repair, or other problems. These unanticipated anchoring activities also have the potential to disturb, disrupt, or degrade extant cultural resources.

Mitigation Measures CR-1a, CR-1b, and CR-c would reduce impacts to a less than significant level (Class II) by requiring identification and avoidance of any potentially significant resources by rerouting the cable.

Mitigation Measures

CR-1a. Conduct a Pre-Construction Offshore Archaeological Resources Survey. Using the results of an acoustic survey (e.g., a CHIRP System survey) for evidence of erosion/incision of natural channels, the nature of internal channel-fill reflectors, and the overall geometry of the seabed, paleochannels and the surrounding areas will be analyzed for their potential to contain intact remains of the past landscape with the potential to contain prehistoric archaeological deposits (e.g., Schmidt et al. 2014). The analysis will include core sampling in various areas, including but not limited to, paleochannels to verify the seismic data analysis. Based on the CHIRP and coring data, a Marine Archaeological Resources Assessment Report shall be produced by a qualified maritime archaeologist and reviewed by the California Coastal Commission or the State Historic Preservation Officer to document effects on potentially historic properties.

CR-1b. Conduct a Pre-Construction Offshore Historic Shipwreck Survey. A qualified maritime archaeologist, in consultation with the lead agency, shall conduct an archaeological survey of the proposed cable routes. The archaeological survey and analysis shall be conducted following CSLC, BOEM, and U.S. Army Corps of Engineers (San Francisco and Sacramento Districts) standard specifications for underwater/ marine remote sensing archaeological surveys (Guidelines for Providing Geological and Geophysical, Hazards, and Archaeological Information pursuant to 30 Code of Federal Regulations Part 585).

The archaeological analysis shall identify and analyze all magnetic and side scan sonar anomalies that occur in each cable corridor, defined by a lateral distance of 0.5 km on each side of the proposed cable route. This analysis shall not be limited to side scan and magnetometer data and may include shallow acoustic (subbottom) data as well as AUV and multibeam data that may have a bearing on identification of anomalies representative of potential historic properties. The analysis shall include evaluation to the extent possible of the potential significance of each anomaly that cannot be avoided within the cable corridor. If sufficient data are not available to identify the anomaly and make a recommendation of potential significance, the resource(s) shall be considered as potentially eligible for listing in the NRHP and CRHR and treated as a historic property. If any cultural resources are discovered as the result of the marine remote sensing archaeological survey, the proposed cable route or installation procedures shall be modified to avoid the potentially historic property. BOEM administratively treats identified submerged potentially historic properties as eligible for inclusion in the NRHP under Criterion D, and requires project proponents to avoid them unless the proponent chooses to conduct additional investigations to confirm or refute their qualifying characteristics. BOEM typically determines a buffer (e.g., 50 meters) from the center point of any given find beyond which the project must be moved, in order to ensure that adverse effects on the potential historic property will be avoided during construction.

CR-1c. Prepare a Cultural Resources Avoidance Plan. Pursuant to Sections 30106 and 30115 of the Coastal Act of 1976, “where developments would adversely impact archaeological…resources as identified by the State Historic Preservation Officer, reasonable mitigation measures shall be required” (PRC Section 30244). An avoidance plan, therefore, shall be developed and implemented to avoid all documented resources from the Marine Archaeological Resources Assessment Report and the Offshore Historic Shipwreck Survey Report, provide for addressing discoveries of as yet unidentified resources encountered during planned marine survey and construction, and provide mitigation monitoring if deemed necessary during construction to ensure compliance.

Cumulative Effects

Introduction

Cumulative impacts on cultural resources take into account the impacts of the project in combination with those of other past, present, and reasonably foreseeable projects. The geographic extent of cumulative analysis for cultural resources encompasses a large region due to the interrelated nature of the region's prehistoric, historic, and ethnographic resources. The geographic region for the analysis of cumulative impacts for submerged cultural resources includes the offshore submerged lands beneath the Santa Maria Basin. For purposes of this cumulative analysis, impacts on cultural resources could result at any time throughout the life of the project but are most likely to occur during ground-disturbing activities associated with construction.

This report provides a historical background for the study area and describes the inventory of known cultural resources in the area. The types of resources that are found in the study area are similar to those found within the broader geographic region considered for the cumulative analysis.

The condition of these cultural resources varies considerably, and depends on the types and extent of human and natural factors that may have affected the integrity of individual resources or group of resources. Construction activities offshore can destabilize sediments, thereby increasing erosion at archaeological sites. Many shipwrecks in the offshore environment are buried or partially buried in sediments. The portions of the vessel under sediments are protected from sediment shifting, active biological predation, and chemical processes that degrade exposed portions of the shipwreck. Exposure of even a small portion of a shipwreck to aerobic seafloor conditions can very quickly degrade wood-hulled shipwrecks such as those prevalent in the study area.

Project Contribution to Cumulative Impacts

Direct impacts on marine cultural resources may be avoided through adequate site identification and mandated avoidance as the preferred mitigation. Similar to construction of the proposed Project, should resources be discovered during the construction of current and future projects, they would be subject to legal requirements designed to protect them, thereby reducing the effect of encountering unknown cultural resources. Because of the planning of the marine cable routes to avoid cultural resources that may exist on the sea floor, as well as implementation of Mitigation

Measures CR-1a, CR-1b, and CR-1c, the Project would be unlikely to make a substantial contribution to cumulative impacts on marine cultural resources.

The isolated prehistoric artifacts that have been recovered from the seabed south of the study area by divers and current archaeological research support the assessment that there is the potential to encounter prehistoric archaeological sites during construction of the submerged portion of the cables. The same is true for historic shipwrecks. A number of shipwrecks have been reported within the study area; however, the level of accuracy of these reports is not adequate to determine with certainty that any of the cables will encounter a shipwreck.

Mitigation measures require identification of areas of high potential for specific submerged cultural resources, which would reduce any impact to a less than significant level. No past projects have reported encountering submerged historic shipwrecks or prehistoric archaeological resources in the study area, and currently no other proposed projects have the potential to disturb or destroy such resources. Therefore, the project's contribution to cumulative impacts on marine cultural resources would not be significant.

Summary of Impacts, Mitigation Measures, and Significance Conclusions

Table 5 provides a summary of the impacts identified and associated mitigation measures to reduce or avoid the impact, if warranted. Mitigation measures are required for each significant impact but are not required for impacts that are not significant.

Table 5. Summary of Cultural Resources Conclusions

Impact	Mitigation Measures
CR-1 Project-related seafloor activities have the potential to disturb or destroy previously unknown or inaccurately recorded submerged prehistoric and historic maritime cultural resources	CR-1a. Conduct a Pre-Construction Offshore Archaeological Resources Survey CR-1b. Conduct a Pre-Construction Offshore Historic Shipwreck Survey CR-1c. Prepare a Cultural Resources Avoidance Plan

Site-specific impacts will be identified as a result of the pre-construction offshore archaeological survey. Although impacts may occur as the result of construction of the planned cables, implementation of mitigation measures CR-1a, CR-1b, and CR-1c should reduce impacts to Class II less than significant levels.

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