PXP

Plains Exploration & Production Company

Revisions to the Platform Hidalgo Development and Production Plan to Include Development of the Western Half NW/4 of OCS-P 0450

Accompanying Information Volume
Essential Fish Habitat Assessment

Submitted to:
The Bureau of Ocean Energy Management
Pacific OCS Region

Submitted by:
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1.0 Overview

Global oil consumption during 2012 is projected at approximately 90 million barrels per day (bbl/d), nearly a quarter of which (20 million bbl/d) is attributable to the U.S. During 2012, the Energy Information Administration (EIA) expects U.S. total crude oil production to achieve an average 6.2 million bbl/d, the highest level of production since 1998. By 2020, the EIA anticipates production levels to reach 6.7 million bbl/d, while U.S. demand for oil is expected to reach 27 million bbl/d (EIA 2012). As the demand for energy resources continues to grow both domestically and abroad, the Bureau of Ocean Energy Management's (BOEM) role in striking an appropriate balance between the development of our nation's oil and gas resources, maintaining energy security, and providing adequate protection of the environment becomes harder to achieve.

The 49 active oil and gas leases offshore southern California produce approximately 24 million barrels of oil and 47 billion cubic feet of gas annually (BOEM 2012). Of this amount, the Point Arguello Field currently contributes approximately 5,000 bbl/d (1.8 million bbl annually). Although production from the southern California Outer Continental Shelf (OCS) comprises only a small fraction of the total domestic production, offshore exploration and development of natural gas and oil reserves have been, and continue to be, an important aspect of the U.S. economy.

2.0 Purpose

Essential Fish Habitat (EFH) is defined in the Sustainable Fisheries Act (1996) as those "waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." Under Section 305 (b) (2) of the Magnuson Fishery Conservation and Management Act (16 U.S.C. 1801 *et seq*) as amended by the Sustainable Fisheries Act on October 11, 1996, Federal agencies are required to consult with the Secretary of Commerce on any actions that may adversely affect EFH. The Department of Commerce published an interim final rule (50 CFR Part 600) in the Federal Register (December 19, 1997, Volume 62, Number 244) that detailed the procedures under which Federal agencies would fulfill their consultation requirements. As set forth in the regulations, EFH Assessments must include: 1) a description of the proposed action; 2) an analysis of the effects, including cumulative effects, of the action on EFH, the managed species, and associated species by life history stage; 3) the Federal agency's views regarding the effects of the action on EFH; and 4) proposed mitigation if applicable.

Section 600.920 (h) describes the abbreviated consultation process the BOEM is following for the proposed Development of the Electra Field reserves described in the associated biological evaluation (BOEM 2012). The purpose of the abbreviated consultation process is to address specific Federal actions that may adversely affect EFH, but do not have the potential to cause substantial adverse impacts.

3.0 Project Description

Plains Exploration & Production Company (PXP) is proposing to develop hydrocarbon reserves in the western half of the northwestern quarter (NW/4) of Federal Lease OCS-P 0450, known as the Electra Field. The field is located in the southern portion of the Santa Maria Basin. The development and production of the Electra Field oil and gas reserves will be accomplished by drilling two extended-reach wells from Platform Hidalgo using existing well slots, pipelines, equipment and facilities. Platform Hidalgo, is located approximately six miles offshore of Point Arguello, California (Latitude 34°29'42.06" N, Longitude 120°42'08.44" W) on the eastern portion of Federal Lease OCS-P450 within the Point Arguello Field Unit. The proposed wells (C-16 and C-17) will utilize a combination of electrical submersible pumps and gas-lift technology. No new equipment or facilities will be needed to develop and produce the Electra Field under this proposal.

All the production from the Electra Field will be combined with the Point Arguello Field oil and gas production (MMS 2000, 2003; Whiting Petroleum Corporation 2000). The produced liquid from Platform Hidalgo is a combination of crude oil, gas, and water. The gas exists as free gas or is in solution in the oil, and the water exists both as free water and emulsion in the oil. Oil would be dehydrated and stabilized on the platforms using existing crude stabilizer vessels and reboilers to strip the light hydrocarbons and hydrogen sulfide (H_2S) out of the production stream. The resulting pipeline quality crude would be transported to the Gaviota facility via the existing PAPCO (Hermosa to shore) pipeline. At Gaviota, the oil will be metered and heated, stored temporarily in the Gaviota Terminal Company storage tanks, then transported via the All-American Pipeline to various refining destinations.

Gas from the Electra Field will be combined with Point Arguello Unit gas on the production platforms. The combined gas will be sweetened for platform use or sale to shore via the existing Point Arguello Natural Gas Line (PANGL) pipeline. A portion of the gas will also be used for gas lift operations. Gas volumes in excess of platform needs or sales to shore will be injected into the producing reservoir for later recovery and use or sales.

Development of the reserves from the Electra Field will be accomplished within the expected remaining lifetime of the Point Arguello Field. The two proposed wells, which will both be drilled from the Hidalgo platform, are expected to recover 2.5 to 3.5 million barrels of oil each. Even with the addition of the two proposed wells, the total number of development wells for the Point Arguello Field and Platform Hidalgo will be significantly less than the number of wells originally anticipated and approved for the Point Arguello Unit.

The proposed drilling program sequence includes rig installation and necessary minor platform modifications (i.e., switch gear and electrical distribution), drilling and tripping operations, setting the well casing, well logging, and well completion and testing. Total well drilling and completion times are estimated at approximately 70 days to drill and 20 to 30 days for well completion (i.e., ~100 days total) per well. PXP's project description anticipates that drilling of the first well will begin in July 2013, with production beginning in October 2013. The second well will be drilled immediately following completion of the first well, with production from the second well online in January 2014. Overall, drilling activities are projected to take approximately six months.

The discharge of drilling muds to be used for the proposed Electra Field drilling program will comply with the National Pollution Discharge Elimination System (NPDES) General Permit (Permit No. CAG280000) currently in force (EPA 2000a,b). Under this discharge permit, Platform Hidalgo is authorized to discharge up to 6,000 bbl of cuttings and 23,000 bbl of drilling fluids annually per well. Over the anticipated 6-month drilling program for the proposed project, a total of 5,697 bbl of water-based cuttings and 14,036 bbl of drilling fluids are expected to be produced for well C-16. Similarly, 5,512 bbl of water-based cuttings and 13,575 bbl of drilling fluids are expected to be produced for well C-17.

Produced water generated from the proposed project would be discharged in accordance with the existing NPDES General Permit. Under the permit, Platform Hidalgo is authorized to discharge up to 18,250,000 bbl of produced water per year, which is an average of 50,000 bbl/d. Currently, Platform Hidalgo has a peak produced water discharge of 10,000 bbl/d. The development and production of the Electra Field is anticipated to generate an additional 6,500 bbl/d of produced water. With the addition of the Electra Field, total produced water discharges will still remain well below the permitted levels. Produced water may also be reinjected back into the reservoir.

PXP estimates that production would begin in January 2014. Overall production from the Electra Field (assuming development of Electra in 2013) is estimated to peak in 2014, resulting in an annualized rate for the combined Electra Field and Point Arguello Field of just over 6,300 bbl/d and just under 9.0 mmscfd of gas. A more detailed project description can be found in the Environmental Evaluation document.

4.0 Managed Species

The Pacific Fishery Management Council (PFMC) manages over 100 species of fish under four Fishery Management Plans (FMPs): 1) Pacific Groundfish FMP; 2) Coastal Pelagics FMP; 3) Highly Migratory Species FMP; and 4) Pacific Salmon FMP (Tables 4.1 through Table 4.4) (Pacific Coast Fisheries Management Plan 2008, 2011a, b, and c). Of these, slightly more than 40 species have been identified as regularly present near oil platforms on the southern California OCS.

Table 4.1 Species Managed by the Pacific Groundfish Fishery Management Plan

Common name	Scientific name	Common name	Scientific name
Flatfish			
Butter sole	*Isopsetta isolepis*	Rex sole	*Glyptocephalus zachirus*
Curlfin sole	*Pleuronichthys decurrens*	Rock sole	*Lepidopsetta bilineata*
Dover sole	*Microstomus pacificus*	Sand sole	*Psettichthys melanostictus*
English sole	*Parophrys vetulus*	Arrowtooth flounder	*Atheresthes stomias*
Flathead sole	*Hippoglossoides elassodon*	Starry flounder	*Platichthys stellatus*
Petrale sole	*Eopsetta jordani*	Pacific sanddab	*Citharichthys sordidus*
Roundfish			
Cabezon	*Scorpaenichthys marmoratus*	Pacific cod	*Gadus macrocephalus*
Kelp greenling	*Hexagrammos decagrammus*	Pacific whiting (hake)	*Merluccius productus*
Lingcod	*Ophiodon elongatus*	Sablefish	*Anoplopoma fimbria*
Sharks and other species			
Big skate	*Raja binoculata*	Leopard shark	*Triakis semifasciata*
California skate	*Raja inornata*	Soupfin shark	*Galeorhinus zyopterus*
Longnose skate	*Raja rhina*	Spiny dogfish	*Squalus acanthias*
Finescale codling	*Antimora microlepis*	Ratfish	*Hydrolagus colliei*
Pacific rattail grenadier	*Coryphaenoides acrolepis*		
Rockfish			
Aurora rockfish	*Sebastes aurora*	Mexican rockfish	*Sebastes macdonaldi*
Bank rockfish	*Sebastes rufus*	Olive rockfish	*Sebastes serranoides*
Black rockfish	*Sebastes melanops*	Pink rockfish	*Sebastes eos*

Table 4.1 Species Managed by the Pacific Groundfish Fishery Management Plan

Common name	Scientific name	Common name	Scientific name
Black and yellow rockfish	*Sebastes chrysomelas*	Pinkrose rockfish	*Sebastes simulator*
Blackgill rockfish	*Sebastes melanostomus*	Pygmy rockfish	*Sebastes wilsoni*
Blue rockfish	*Sebastes mystinus*	Pacific ocean perch	*Sebastes alutus*
Bocaccio	*Sebastes paucispinus*	Quillback rockfish	*Sebastes maliger*
Bronzespotted rockfish	*Sebastes gilli*	Redbanded rockfish	*Sebastes babcocki*
Brown rockfish	*Sebastes auriculatus*	Redstripe rockfish	*Sebastes proriger*
Calico rockfish	*Sebastes dallii*	Rosethorn rockfish	*Sebastes helvomaculatus*
California Scorpionfish	*Scorpaena gutatta*	Rosy rockfish	*Sebastes rosaceus*
Canary rockfish	*Sebastes pinniger*	Rougheye rockfish	*Sebastes aleutianus*
Chilipepper rockfish	*Sebastes goodie*	Sharpchin rockfish	*Sebastes zacentrus*
China rockfish	*Sebastes nebulosus*	Shortbelly rockfish	*Sebastes jordani*
Copper rockfish	*Sebastes caurinus*	Shortraker rockfish	*Sebastes borealis*
Cowcod	*Sebastes levis*	Shortspine thornyhead	*Sebastolobus alascanus*
Darkblotched rockfish	*Sebastes crameri*	Silvergray rockfish	*Sebastes brevispinus*
Dusky rockfish	*Sebastes ciliatus*	Speckled rockfish	*Sebastes ovalis*
Dwarf-red rockfish	*Sebastes rufianus*	Splitnose rockfish	*Sebastes diploproa*
Flag rockfish	*Sebastes rubrivinctus*	Squarespot rockfish	*Sebastes hopkinsi*
Gopher rockfish	*Sebastes carnatus*	Starry rockfish	*Sebastes constellatus*
Grass rockfish	*Sebastes rastrelliger*	Stripetail rockfish	*Sebastes saxicola*
Greenblotched rockfish	*Sebastes rosenblatti*	Swordspine rockfish	*Sebastes ensifer*
Greenspotted rockfish	*Sebastes chlorostictus*	Tiger rockfish	*Sebastes nigrocinctus*
Greenstriped rockfish	*Sebastes elongatus*	Treefish	*Sebastes serriceps*
Harlequin rockfish	*Sebastes variegatus*	Vermilion rockfish	*Sebastes minatus*
Honeycomb rockfish	*Sebastes umbrosus*	Widow rockfish	*Sebastes entomelas*
Kelp rockfish	*Sebastes atrovirens*	Yelloweye rockfish	*Sebastes ruberrimus*
Bocaccio	*Sebastes paucispinus*	Yellowmouth rockfish	*Sebastes reedi*
Longspine thornyhead	*Sebastolobus altivelis*	Yellowtail rockfish	*Sebastes flavidus*

Most of the species observed near OCS platforms are groundfish, dominated by Sebastes (rockfish), which are managed by the Pacific Groundfish FMP. The remaining species are coastal pelagic species, namely, Pacific sardine, jack mackerel, and northern anchovy, which are managed under the Coastal Pelagics FMP. Video surveys of the bottom of Platform Hidalgo conducted between 1995 and 2002 recorded the presence of bocaccio (*Sebastes paucispinis*), flag rockfish (*Sebastes rubrivinctus*), greenspotted rockfish (*Sebastes chlorostictus*), pygmy rockfish (*Sebastes wilsoni*), starry rockfish (*Sebastes constellatus*), vermilion rockfish (*Sebastes miniatus*), yelloweye rockfish (*Sebastes ruberrimus*), and lingcod (*Ophiodon elongatus*) (Love and Schroeder 2003, Love et al 2006).

Table 4.2 Species Managed by the Coastal Pelagics Fishery Management Plan

Common name	Scientific name	Common name	Scientific name
Northern anchovy	*Engraulis mordax*	Jack mackerel	*Trachurus symmetricus*
Pacific sardine	*Sardinops sagax*	Market squid	*Loligo opalescens*
Pacific (chub) mackerel	*Scomber japonicus*	Krill	*Euphausiacea*

Table 4.3 Species Managed by the Pacific Salmon Fishery Management Plan

Common name	Scientific name	Common name	Scientific name
Chinook salmon	*Oncorhynchus tshawytscha*	Pink salmon	*Oncorhynchus gorbuscha*
Coho (silver) salmon	*Oncorhynchus kisutch*		

Table 4.4 Species Managed by the Highly Migratory Species Fishery Management Plan

Common name	Scientific name	Common name	Scientific name
North Pacific albacore tuna	*Thunnus alalunga*	Common thresher shark	*Alopius vulpinus*
Yellowfin tuna	*Thunnus albacares*	Shortfin mako shark	*Isurus oxyrinchus*
Bigeye tuna	*Thunnus obesus*	Blue shark	*Prionace glauca*
Skipjack tuna	*Katsuwonus pelamis*	Pacific swordfish	*Xiphias gladius*
Northern bluefin tuna	*Thunnus orientalis*	Striped marlin	*Tetrapturus audax*
Dorado (dolphinfish)	*Coryphaena hippurus*		

Most of the individuals observed near the platforms are adults, but older juveniles are also present. Density patterns at Platform Hidalgo and the other OCS platforms strongly imply that the platforms are major exporters of fish larvae, and that the platforms represent important regional sources of larvae and young-of year fish for regional fish production (Carr et al 2003; Carr 1990, Schroeder et al. 2000).

Notwithstanding the contribution of the individual platforms, the marine environment offshore Point Arguello is especially rich in fish species because this area constitutes a transition zone between southern warm-temperate, subtropical waters and northern cold-temperate waters. The area also provides a wide variety of habitats created by many banks, ridges, and deep-sea basins. Nearly all of the species managed by the PMFC can be found within the Project area at some point during their life cycle. Therefore, this analysis will be broad in scope and will discuss the effects of the identified impacting sources on a wide range of fish prey and forage, fish habitats, and fish species.

5.0 Potentially Significant Impact Sources

Three potential impacting sources associated with the routine operations of the proposed Development of the Electra Field reserves have been identified: 1) Noise and disturbance; 2) Effluent discharges; and 3) Oil spills. A summary description of each impacting source is included in the following section. A detailed description of each of these sources can be found in the Biological Assessment, which is part of the accompanying information volume.

6.0 Impacts to Essential Fish Habitat (EFH)

6.1 Noise and Disturbance

There is a long historic record of human awareness that fish produce and use sounds in a wide variety of behaviors (see Moulton 1963). However, studies of fish hearing and sound production (bioacoustics), and the importance of sounds to the lives of fish, were not begun until the early part of the 20th century (Moulton 1963 and Tavolga 1971). The level of investigation into fish hearing and sound production increased considerably in the second half of the 20th century (Zelick et al. 1999; Popper et al. 2003; Ladich and Popper 2004). We now know that fishes, as with most vertebrates, glean a great deal of information about their environment from the general sound field. Fish use sounds to detect predators and prey, as well as for schooling, mating, and navigating (Myerberg 1980; Popper et al. 2003).Whereas visual signals are very important and useful for things near the animal and in the line of sight, substantial information about the unseen part of an animal's world comes from acoustic signals.

Hearing and detection of vibrations are the best-developed senses in most fish, making good use of the efficient propagation of low frequency sound through water. The main sensory organs involved in this process are the lateral-line system, which detects low-frequency (<100 Hz) particle motion in the water contacting the flanks of the fish, and the inner ear, which is sensitive to frequencies of up to 1-3 kHz. The inner ear is thought to be the main sensory organ involved, while the lateral line organ is almost certainly involved in acoustic repulsion when the sound source is close at hand (within a few body lengths of the fish) such as when fish are seen schooling. The inner ear, which lies within the skull of the fish is sensitive to vibration rather than sound pressure. In teleost species (bony fishes) possessing a gas-filled swimbladder, this organ may also act as a transducer that converts sound pressure waves to vibrations, allowing the fish detect sound as well as vibration.

Current data suggest that most fish species detect sounds from 50 to 1,000 Hz, with a few fish hearing sounds above 4 kHz (Popper 2008, Yan et al 2010). It is believed that most fish have their best hearing sensitivity from 100 to 400 Hz (Popper 2003, Popper and Fay 2010). Additionally, some clupeids possess ultrasonic hearing (i.e., able to detect sounds above 100,000 Hz) (Astrup 1999). Not surprisingly, sensitivity to sound differs among fish species based on the level of development of their swimbladder and its connection to the inner ear.

Species with little or no swim bladder, or one that is not well connected to the ear generally have relatively poor auditory sensitivity (auditory generalists) and usually cannot hear sounds at frequencies above 1 kHz (See Table 6.1). Auditory generalists include elasmobranchs (e.g. sharks, skates, and rays), flatfish, salmonids, and tuna (Popper et al. 2003). In contrast, some fishes have swim bladders that are connected directly to the inner ear (e.g. herring, smelt), which substantially increases their hearing sensitivity (auditory specialists). Most auditory specialists can hear sounds up to around 3 kHz.

Table 6.1 Fish Auditory Thresholds

Noise Source	Frequency (Hertz)	Pressure (dB re 1 μPA)
Fish Hearing Thresholds		
Hearing generalists	up to ~1,000	>120
Hearing specialists	up to ~3,000	>60
Lateral line sensitivity	~ ≤100	–

Note: dB re 1 μPa (decibels measured relative to one microPascal) is a measure of underwater sound pressure. 20 dB re 1 μPa is about the hearing threshold, while 140 dB re 1 μPa is the pain threshold. dB re 1 $\mu Pa^2/Hz$ is a measure of sound-pressure density per unit frequency. It is used to describe sounds distributed across broad frequency bands.

Noise sources associated with the proposed Electra development project may generate sound pressure that can disrupt or damage marine life, including fishes. Additionally, increasing levels of background noise may also have a negative effect on fish in the form of auditory masking (Popper et al 2004, Popper and Hastings 2010). Auditory masking refers to the presence of noise that interferes with an organism's ability to hear biologically relevant sounds. The masking of sounds associated with behaviors such as schooling, predator and prey detection, and mating could have impacts to fish by reducing their ability to perform these key biological functions.

Additionally, it has been documented in the mammalian literature that temporary threshold shifts reach an asymptote after a specific duration of noise exposure. Recent studies have shown that similar shifts occur in fish, with hearing specialists more greatly affected by background noise exposure than hearing generalists (Smith et al. 2004).

Three noise and disturbance sources associated with the proposed Electra project have been identified: 1) offshore drilling, and offshore production, 2) vessel traffic, and 3) aircraft traffic (Table 6.1). However, the sound levels produced by these sources are unlikely to impact EFH. Table 6.2 contains a listing of ambient and project-related noise sources and levels on the Pacific OCS.

Table 6.2 Noise Sources on the Pacific OCS

Noise Source	Frequency (Hertz)	Pressure (dB re 1 µPA)
Ambient Ocean Noise		
Wind and waves	200–1000	66–95
Precipitation	>500	
Baleen whales	20–20,000	150–190
Other Biologicals (shrimp, fish, and marine mammals)	12–100,000	95–210
Platform Operations	5-500	146-169
Vessel Traffic		
Outboards and small boats	~100–1,000	150–160
Vessels 180 to 280 ft (55 to 85m) in length	<100–500	170–180
Large container ships/supertankers	<100–500	185–200
Helicopter traffic	~<100–500	150-165

Note: dB re 1 µPa (decibels measured relative to one microPascal) is a measure of underwater sound pressure. 20 dB re 1 µPa is about the hearing threshold, while 140 dB re 1 µPa is the pain threshold. dB re 1 $\mu Pa^2/Hz$ is a measure of sound-pressure density per unit frequency. It is used to describe sounds distributed across broad frequency bands.

In their Final Environmental Impact Statement (U.S. Department of Navy 2002) the U.S. Navy characterized the average baseline noise levels within the nearby portion of the Santa Barbara Channel (SB Channel) encompassing the area bordered by Anacapa Island, the south side of Santa Cruz Island to San Nicholas Island and Santa Barbara Island, at 50-55 decibels (dB).This level of ambient noise would be indicative of the background noise level in the Project area.

Noise associated with conventional drilling platforms remains relatively unstudied. Recently, noise from a semi-submersible drilling rig and its support vessels working in 114 m waters in the Bering Sea did not exceed ambient noise levels beyond a 1-km range (Sakhalin 2004). Broadband underwater noise from a drilling rig in the Timor Sea was measured at 146 dB re 1 uPA when not actively drilling, and 169 dB re 1 uPA during drilling. The noise dropped steadily and was not audible beyond 11 km from the rig under quiet ambient conditions (Woodside 2002; Pidcock et al. 2003). Other rigs were recorded at 154 dB re 1uPA for the frequency band 10-500 Hz (Woodside 2002).

Off the California coast, Richardson et al. (1995) cite only one example of recorded noise from drilling platforms (Gales 1982), which resulted in auditory levels that were nearly undetectable even alongside the platforms. No sound levels were computed, but the strongest received tones were very low frequency, below approximately 5 Hz. Therefore, no impacts to EFH are expected from this source.

No new helicopter trips will be required for the Electra Field development, beyond the 3 to 5 trips per week per platform currently estimated to occur in the Pacific Region (Bornholdt and Lear 1995). Regardless, aircraft noise is temporary in nature and not expected to impact EFH.

The rotors are the primary sources of sound from helicopters (Richardson et al., 1995). The rotation rate and the number of blades determine the fundamental frequencies which are usually below 100 Hz, with most dominant tones below 500Hz (see Table 6.2). Richardson et al. (1995) present an estimated source level for a Bell 212 helicopter of about 150 dB at altitudes of 150-600 m, with the dominant frequency a 22-Hz tone with harmonics. Elsewhere a source level of 165 dB is presented for broadband helicopter noise (frequencies 45-7070 Hz). Source levels of the Sykorski Model 76A helicopters that are used to transport crew on Platform Hidalgo from the Santa Maria airport have been estimated at about 150 dB at altitudes of about 100 m.

Finally, the drilling rig, heavy drilling equipment, rig supplies, and bulk drilling mud and cement materials for the project will be transported to Platform Hidalgo by supply boat from Port Hueneme. Vessels are the major contributors to overall background noise in the sea (Richardson et al., 1995). Sound levels and frequency characteristics are roughly related to ship size and speed. The dominant sound source is propeller cavitation, although propeller "singing," propulsion machinery, and other sources (auxiliary, flow noise, wake bubbles) also contribute.

Vessel noise is a combination of narrowband tones at specific frequencies and broadband noise (See Table 6.2). Richardson et al. (1995) give estimated source levels of 156 dB for a 16-m crew boat (with a 90-Hz dominant tone) and 159 dB for a 34-m twin diesel (630 Hz, 1/3 octave). Broadband source levels for small, supply boat-sized ships (55-85 m) are about 170-180 dB. Most of the sound energy produced by vessels of this size is at frequencies below 500 Hz. Many of the larger commercial fishing vessels that operate off southern California fall into this class.

Currently, six supply boat trips occur per month. During drilling, vessel traffic to and from the platforms is projected to consist of an additional four round trips per month (1 trip per week). During rig installation and removal, supply boats will also make 28 round trips to the platform for rig transport. Manpower requirements and boat schedules can vary depending on the workload. Following the completion of drilling activities, which are anticipated to last for approximately five months, supply vessel traffic is expected to return to current baseline levels (i.e. 6 supply boat trips per month). Therefore, no adverse effects to EFH are expected from the slight, temporary increase in vessel traffic that would occur with the proposed project.

6.2 Effluent Discharges

Under Section 402 of the Clean Water Act, the Environmental Protection Agency (EPA) is authorized to issue National Pollutant Discharge Elimination System (NPDES) permits to regulate the discharges of pollutants to waters of the U.S., the territorial sea, contiguous zone, and ocean (EPA 1976). The use of the General Permit streamlines the permitting process for facilities that are not anticipated to significantly affect marine environments. In 2000, EPA prepared Biological Evaluation and conducted an EFH assessment for the re-issuance of a NPDES General Permit for offshore oil and gas facilities in southern California (SAIC 2000a,b,c). The overall conclusions of the EFH assessment were that the continued discharge from the 22 platforms located in federal waters offshore California will not adversely affect EFH outside the mixing zones, described as a 100 m radius from the discharge point.

Within the 100 m radius mixing zone, discharges from oil and gas exploration, development, and production may have localized effects on water quality and resident marine organisms, including EFH and fish. The assessment further concluded that while there may be effects on EFH from certain discharges, such as drilling fluids and produced water within the mixing zone near an outfall, these effects should be minor overall given the very small area which may be affected relative to the size of the EFH off the Pacific Coast, and the mitigation provided by the various effluent limitations proposed for the permit.

The EPA provided a copy of the EFH assessment to the National Marine Fisheries Service (NMFS) to initiate the consultation. As a result of the consultation, the NPDES General Permit incorporated a requirement that the permittees conduct a study of the direct lethal, sublethal, and bioaccumulative effects of produced water on federally managed fish species on the Pacific OCS at key life stages that occupy the mixing zone of produced-water discharges. The permit further requires that the permittees model results describing the dilution and dispersion plumes from each point of discharge of produced water (for all platforms covered by the permit) to determine the extent of the area in which federally managed fish species may be adversely affected. The permit also requires the permittees to propose mitigation measures if either of the studies indicates substantial adverse effects to federally managed fish species or EFH occur.

In response, a single comprehensive report was submitted by the permittees (MRS 2005). It provided a detailed quantitative assessment of potential impacts from produced-water discharges on federally managed fish species from each of the California OCS dischargers, including Platform Hidalgo. Although maximum contaminant concentrations beyond the 100-m mixing zone are usually well within NPDES permit limits, the study focused on the toxicity and bioaccumulation potential of produced-water discharges to the fish populations that reside within the 100-m mixing zone beneath the platforms. These fish populations consist mostly of rockfish that utilize the platforms as habitat, rarely venturing far from the protection of the structure. Consequently, contaminant concentrations at locations 100-m from the platform have little bearing on the potential impacts experienced by these fish.

Nevertheless, the quantitative exposure assessment found a general absence of impacts from most of the major produced-water constituents. Most produced-water constituents that are normally of concern for the protection of marine organisms were below biological effects levels prior to discharge. Four constituents (benzene, cyanide, silver, and ammonia) had end-of-pipe concentrations that were slightly elevated in produced water compared to thresholds of potential effects in finfish. However, the produced-water discharges achieve high dilution almost immediately upon discharge. As a result, the plume volumes containing concentrations of potential biological significance were exceedingly small compared to the volume of habitat contained within the mixing zones.

In September 2005, EPA concurred with the overall conclusions of the study and forwarded them to NMFS as part of the EFH consultation required by the General Permit. In October 2005, NMFS notified EPA that the study met the intent of the conservation recommendations incorporated in the General Permit and that the EFH consultation was complete. Revisions to the NPDES General Permit, which included new compliance criteria for several of the platforms and a revision to the undissociated sulfide criterion, were approved in November 2009 (Weston Solutions Inc. and MRS 2006). Thus, potential impacts to finfish within the 100-m mixing zone around Platform Hidalgo are not likely to be significant.

6.3 Oil Spills

Risk Analysis. The following is a summary of the risk analysis associated with the proposed development of the Electra Field. In the course of normal, day-to-day platform operations, occasional accidental discharges of hydrocarbons may occur. However, such accidents are typically limited to discharges of quantities of less than 1 bbl of crude oil. See Appendix B for the complete risk analysis of an oil spill associated with the proposed project.

The BOEM's U.S. Oil Spill Database (C. Anderson, unpubl. data) includes all Pacific and Gulf of Mexico OCS spills of greater than 1 bbl recorded between 1964 and 2010. The database contains platform and pipeline spills, but does not include barge or tanker spills. Of the 2,161 total spills in the oil spill database, more than 92 percent (1,998) are of less than 50 bbl in size. The mean volume of the 143 spills that were over 50 bbl in size is 62 bbl for those spills (64) less than 100 bbl in size, and 259 bbl for those spills (82) between 100 and 999 bbl in size.

Between 1969 and 1999, a total of 836 spills of less than 50 bbl (99 percent of the total) occurred on the Pacific OCS, resulting in slightly less than 320 bbl of oil being discharged into the ocean (C. Anderson, unpubl. data). Due to the infrequency and small volumes of accidental discharges on the Pacific OCS, and their location (generally away from sensitive species and habitats), spills of less than 50 bbl were not considered an impact-producing agent for this evaluation. In contrast to these small spills, larger oil spills may occur from loss of well control (if wells are free flowing), pipeline breaks, operational errors, or vessel-platform collisions. The largest and most recent spill of more than 50 bbl in volume was the 163-bbl Platform Irene pipeline spill in September 1997.

On that occasion, a rupture in the Torch pipeline that extends from Platform Irene to the shoreline released an estimated 162 to over 1,242 bbl (26 to 197+ m^3) of crude oil into State waters (Torch/Platform Irene Trustee Council 2007). The rupture resulted in the oiling of approximately 40 miles (64 km) of coastline, stretching from the northern end of Minuteman Beach to Boat House in Santa Barbara County. Approximately 100 acres (40 hectares) of sandy beach were disturbed by oiling and cleanup operations. In addition, another 263 acres (106 hectares) of sandy beach were very lightly oiled (less than or equal to 10 percent oiling by area), but were relatively undisturbed by heavy equipment during cleaning operations (Torch/Platform Irene Trustee Council 2007).

The oil spill risk analysis predicts that over the life of the proposed project there is a 4.4 percent chance that one or more spills between 50 to 1,000 bbl in size could occur. For the purposes of the Biological Evaluation (BOEM 2012), BOEM assumed that one spill of greater than 50 bbl could occur over the life of the project. An effort was also made to estimate the likely size of such a spill. Given these data and the experience in the Pacific Region over the last nearly half century, BOEM expects that such a spill would probably be less than 200 bbl, and almost certainly less than 500 bbl in volume.

BOEM also has estimated the number of oil spills of equal to or greater than 1,000 bbl that could occur as a result of the proposed action. The major spill (≥1,000 bbl) estimate is based on the estimated production of oil over the life of the proposed project, including the subsea pipeline transport of hydrocarbons to shore. Based on the accident spill rates from all U.S. platforms and pipelines (Anderson and LaBelle 2000), the estimated probability that one or more large spills (≥1,000 bbl) will occur over the lifetime of the proposed Electra Field development project is 0.1 percent for a platform spill and 0.3 percent for a pipeline spill.

Federal regulations concerning oil spill response plans for OCS facilities also require operators to calculate worst-case discharge volumes using the criteria specified in 30 CFR §254.47. These include 1) the maximum capacity of all oil storage tanks and flow lines on the facility, 2) the volume of oil calculated to leak from a break in any pipelines connected to the facility, and 3) the daily production volume from an uncontrolled blowout of the highest capacity well associated with the facility. Since these are worst-case estimates, intended to insure that an operator has the capacity to respond to the largest imaginable spills, they are based on unlikely events.

This is particularly true of the estimates for the first and third spill types described above. A catastrophic event would be required to empty all storage tanks and flow lines on the production platform. Similarly, with the implementation of modern blowout prevention equipment, operating procedures, and the BSEE inspection program, blowouts are rare. As discussed above, no blowout resulting in the release of measurable quantities of oil has occurred on the Pacific OCS since the 1969 Santa Barbara spill. Nevertheless, as was evident in the case of the 2010 *Deepwater Horizon* event, accidents can and do occur.

In the wake of the 2010 *Deepwater Horizon* well blowout and oil spill in the Gulf of Mexico, the BOEM substantially revised and increased the requirements for worst case discharge scenario calculations. Among some of the changes were the incorporation of the time to drill a relief well and an added level of conservatism in assumptions regarding the operational ability of blow out preventer equipment following a catastrophic event.

Using the BOEM methodology, the most likely maximum size of a major oil spill from the Electra Field development is the maximum volume of oil calculated to be spilled from a well blow out that occurs at well C-16, "after the well reaches total depth with the drill pipe out of the well, before installing the 7 inch liner". Under these conditions, the scenario results in an estimated spill rate of 1,190 bbl/d. However, the scenario also assumes that there is no functioning blow out prevention equipment in place, requiring the drilling of a relief well to stem the flow of oil into the environment. For the Electra Field and Platform Hidalgo, it has been conservatively estimated that it will require 80 to 111 days to drill a relief well, bringing the total worst-case spill size to 95,200 to 132,090 bbl of oil. This blowout spill size is similar in size to what was addressed in the 1984 EIR/EIS for the Point Arguello Field that use a 100,000 barrel spill for a severe blowout.

The most likely scenario, however, as discussed above, is that one oil spill in the 50-1,000 bbl range would occur over the life of the proposed project (with approximately a 4.4 percent chance of occurrence), and that such a spill or spills would be less than 200 bbl in volume.

Fate and Effects. When an oil spill occurs, many factors determine whether that oil spill will cause heavy, long lasting biological damage; comparatively little damage or no damage; or some intermediate degree of damage. Among these factors are the type, rate, and volume of oil spilled, geographic location, and the weather and oceanographic and meteorological conditions at the time of the spill. These parameters determine the quantity of oil that is dispersed into the water column; the degree of weathering, evaporation, and dispersion of the oil before it contacts a shoreline; the actual amount, concentration, and composition of the oil at the time of shoreline or habitat contact; and a measure of the toxicity of the oil. Additionally, the level of oil spill preparedness, rapidity of response, and the cleanup methods used can also greatly influence the overall impact levels of an oil spill.

A spill of 200 bbl could oil several kilometers of coastline along the south-central California coast. The likely result would be patches of light to heavy tarring of the intertidal zone resulting in localized changes to the community structure. The recovery time for these communities would depend on the environment. High energy rocky coast will be mostly self-cleaned within several months, while low energy lagoons and soft-sediment embayments can retain stranded oil residue for several years. The same impacts would be expected from a 132,090-bbl oil spill, but would be spread over a substantially larger area.

Oil in the marine environment can, in sufficient concentrations, cause adverse impacts to fish (NRC 1985; GESAMP 1993). The effects can range from mortality to sublethal effects that inhibit growth, longevity, and reproduction. Benthic macrofaunal communities can be heavily impacted, as well as intertidal communities that provide food and cover for fishes.

The field observations of oil spill impacts on the marine environment have generally been taken from very large oil spills (>1,000 bbl) that have occurred throughout the world over the past three decades. Table 6.3 contains a partial listing of some of the most notable maritime spills to occur during this timeframe, including the *Deepwater Horizon* spill, and the *Exxon Valdez* spill.

Table 6.3 Significant Maritime Oil Spills Since 1980

Event	Date	Location	Approximate Spill Size (bbl)	Spill Type
Kuwait oil spill	January 1991	Persian Gulf	4-6,000,000	Various
Deepwater Horizon	April-July 2010	Gulf of Mexico	5,000,000	Well blowout
Ixtoc I	June 1979-March 1980	Gulf of Mexico	3,000,000	Well blowout
Exxon Valdez	March 1989	Prince William Sound, Alaska	270,000	Vessel accident
Sea Empress	February 1996	Southwest Wales	540,000	Vessel accident
Mega Borg	June 1990	Gulf of Mexico	120,000	Vessel accident
MT Hebei Spirit	December 2007	South Korea	80,000	Vessel accident
Prestige	November 2002	Galicia, Spain	50,000	Vessel accident
Montara	August-November 2009	Timor Sea, Western Australia	30,000	Well blowout
American Trader	February 1990	Huntington Beach, California	10,000	Vessel accident
MV Pacific Adventurer	March 2009	Queensland, Australia	2,000	Vessel accident
MV Cosco Busan	November 2007	San Francisco, California	1,400	Vessel collision

Sources: NOAA Office of Response and Restoration 2012.

In contrast, the most recent spill greater than 50 bbl to occur in the Project area was in September 1997, when a rupture in a 20-inch offshore pipeline emanating from Platform Irene resulted in the discharge of at least 6,846 gallons (163 bbl) of crude oil off the Santa Barbara coast. The spill resulted in the fouling of approximately 17 miles of coastline, and caused impacts to a variety of natural resources, including seabirds, sandy and gravel beach habitats, rocky intertidal shoreline habitats, and use of beaches for human recreation. Similarly, in 2007 the freighter *Cosco Busan* collided with the San Francisco-Oakland Bay Bridge in San Francisco Bay resulting in the release of nearly 1,400 bbl (58,000 gallons) of fuel oil. Fouling associated with this spill was reported as far north as Pt. Reyes and as far south as Pacifica; approximately 2,083 birds were oiled, of which 1,381 were either recovered dead or later died.

Fishes. Fish can be affected directly by oil, either by ingestion of oil or oiled prey, through uptake of dissolved petroleum compounds through the gills and other body epithelia, through effects on fish eggs and larval survival, or through changes in the ecosystem that supports fish. Although fish can accumulate hydrocarbons from contaminated food, there is no evidence of food web magnification. Fish have the capability to metabolize hydrocarbons and can excrete both metabolites and parent hydrocarbons from the gills and the liver (NRC 1985). Nevertheless, oil effects in fish can occur in many ways: histological damage, physiological and metabolic perturbations, and altered reproductive potential (NRC 1985). Many of these sublethal effects are symptomatic of stress and may be transient and only slightly debilitating. However, all repair or recovery requires energy, and this may ultimately lead to increased vulnerability to disease or to decreased growth and reproductive success.

The egg, early embryonic, and larval-to-juvenile stages of fish seem to be the most sensitive to oil. Damage may not be realized until the fish fails to hatch, dies upon hatching, or exhibits some abnormality as a larva, such as an inability to swim (Malins and Hodgins 1981). There are several reasons for this vulnerability of early life stages. First, embryos and larvae lack the organs found in adults that can detoxify hydrocarbons. Second, most do not have sufficient mobility to avoid or escape spilled oil. Finally, the egg and larval stages of many species are concentrated at the surface of the water, where they are more likely to be exposed to the most toxic components of an oil slick.

Although sensitivity is demonstrated in laboratory studies, only in a few instances have adverse effects been observed on fish following major oil spills. Examples include the *Florida* spill off West Falmouth, Massachusetts, and the *Amoco Cadiz* spill off the coast of Brittany. In both cases, sublethal effects on fish were documented. In the *Florida* spill, killifishes from contaminated marshes had a lower rate of lipogenesis than their counterparts from uncontaminated sites (Sabo and Stegeman, 1977). In the *Amoco Cadiz* spill, a large number of histological abnormalities were noted in estuarine flatfish (*Pleuronectes platessa*) (Haensly et al. 1982). Additionally, NOAA scientists and collaborators reported Pacific herring embryos in shallow waters died in unexpectedly high numbers following the *Cosco Busan* oil spill in San Francisco Bay, and have suggested an interaction between sunlight and the oil's chemicals might be responsible (Incardona et al. 2011). However, mortality rates returned to pre-spill levels within 2 years. In contrast, Straughan (1971) found no indications of fish kills or other evidence of effects on fishes from the Santa Barbara Channel blowout in 1969.

The *Exxon Valdez* oil spill (~270,000 bbl) provides several examples of how oil affects fish. For the sensitive stages of fish (eggs, larvae, and juveniles) the *Exxon Valdez* spill could not have occurred at a worse time. Pacific herring spawned along the shores of Prince William Sound within weeks of the *Exxon Valdez* oil spill in March 1989, resulting in increased egg mortality and larval deformities. Also, fry from pink salmon emerged from their gravel spawning redds and entered the nearshore marine environment during the spill. Site-specific occurrences of instantaneous mortality suggest that a significant reduction in herring larval production occurred because of the oil spill. Brown et al. (1996) estimated that over 40 percent of the 1989 year-class was affected by *Exxon Valdez* oil at toxic levels. The herring population in Prince William Sound also suffered heavy losses in 1993 due to disease. However, it is not known what role, if any, exposure to oil may have played in the disease outbreak; natural variability and density-dependent effects could not be ruled out as the cause of the small year-class and disease. Despite the reduction in larval production, reduced abundance in the 1989 year-class recruiting as 4-year old adults in 1993 could not be determined because natural processes affecting herring recruitment are poorly understood (Brown et al. 1996).

Pink salmon, Dolly Varden, sockeye salmon, and cutthroat trout exposed to oil from the *Exxon Valdez* spill all showed reduced growth rates the season following the oil spill even though changes in food availability were not detected (Spies 1996). Pink salmon also showed increased egg mortality in oiled-versus-unoiled streams through the 1993 season (Rice et al. 1996). Exposure to oil was documented by oil in the stomachs of salmon fry, measurements of polynuclear aromatic hydrocarbons (PAH) in salmon fry, and by increases in P450 and bile hydrocarbon metabolites in Dolly Varden (*Salvelinus malva*) (Spies 1996). Geiger et al. (1996) estimated that 1.9 million adult pink salmon failed to return to Prince William Sound in 1990, primarily because of a lack of growth in the critical nearshore life stage when they entered seawater in spring 1989 during the height of the spill. By 1991, 60,000 wild adult pink salmon failed to return.

In perspective, in the years preceding the oil spill, returns of wild pink salmon in Prince William Sound varied from a maximum of 23.5 million fish in 1984 to a minimum of 2.1 million in 1988. The decade preceding the oil spill was a time of very high productivity for pink salmon in the sound, and, given the tremendous natural variation in adult returns, it was impossible to measure directly the extent to which wild salmon returns since 1989 were influenced by the oil spill. Based on intensive studies and mathematical models following the oil spill, however, researchers determined that wild adult pink salmon returns to the sound's Southwest District in 1991 and 1992 were most likely reduced by a total of 11 percent (Exxon Valdez Oil Spill Trustee Council 1999). However, the salmon were listed as recovered within a decade after the spill, and rockfish as very likely recovered (EVOSTOC 2010).

In 1990, after the *American Trader* spilled 416,000 gallons (~10,000 bbl) of North Slope crude oil offshore Huntington Beach, California, oil stranded along 22 km of coastline (Gorbics et al. 2000). The natural resource trustees (representatives from USFWS, CDFG, and NOAA) determined that post larval juvenile white sea bass were adversely impacted by the oil. Specifically, 10-15mm juvenile fish were killed by oil when it mixed with drift algae found near the surf line. The drift algae found in this area are the normal habitat for juvenile white sea bass and other croakers during and after the time of the spill (Gorbics et al. 2000).

Despite the fact that laboratory experiments and field observations indicate that fish are susceptible to adverse effects from hydrocarbons, with the exception of the *Exxon Valdez* and *American Trader* oil spills, direct impacts on fishery stocks have rarely been observed following catastrophic spills. This is due in part to the complexities involved with the natural process of recruitment, which produces tremendous natural variations in year-class abundance that bear little relation to the size of the parent stock. Thus, any impacts from catastrophic oiling on fish stocks are probably masked by the natural variations in abundance. Also, massive fish kills during oil spills have not occurred, or if they have it is only in the egg and larval stages found in the surface waters.

An estimated 40 to 50 percent of the egg biomass of the Pacific herring (*Clupea pallasi*) deposited within Prince William Sound was exposed to oil during developmental stages (Brown et al. 1996). The resulting 1989 year class of herring showed sublethal effects such as premature hatch, low weights, reduced growth, and increased morphologic and genetic abnormalities (Brown et al. 1996). The 1989 year class recruiting as 4-year old adults in 1993 was one of the smallest cohorts observed in Prince William Sound, and it returned to spawn with an adult herring population that was reduced by approximately 75 percent (Brown et al. 1996).

Adult fish, due to their mobility, may be able to avoid or minimize exposure to spilled oil. However, there is no conclusive evidence that fish will avoid spilled oil (NRC 1985). One of the worst spills in recent times, the tanker *Sea Empress*, released 72,000 tonnes (~540,000 bbl) of crude oil and 480 tonnes (~4000 bbl) of fuel oil into the sea off Milford Haven waterway in southwest Wales on February 15, 1996. Oil came ashore along 200 km of coastline, much of it in a National Park and an area of international scientific interest. The *Sea Empress* Environmental Evaluation Committee, an independent committee set up by the UK government, reported that

"Although tissue concentrations of oil components increased temporarily in some fish species, most fish were only affected to a small degree, if at all, and very few died" (SEEEC 1998). The study found that about 40 percent of the oil evaporated soon after the spill and around 52 percent dispersed into the water where it was broken down by microorganisms. Surveys at sea showed that the oil was not deposited in sediments in significant quantities. Between 5 percent and 7 percent (~36,000 bbl) of the oil stranded on shore; however, one year after the spill less than 1 percent remained on the shore.

Although many factors contribute to the overall impacts realized from an at-sea oil spill, fish are generally not adversely impacted at the population level. Given the high energy and high productivity environment of the Point Arguello area, the common meteorological and oceanographic conditions, and the oil spill preparedness and response capabilities in place, direct measurable effects to any fish stock abundance from a 200 bbl oil spill off the coast of Point Arguello, California are unlikely.

Food Web and Habitat. Fish can also be affected indirectly by oil through changes in the ecosystem that affect prey species and habitats. Perhaps the most important food on which all fish rely during their larval and juvenile stages is plankton. In general, the studies to date indicate that zooplankton are more susceptible to effects from oil spills than are phytoplankton. Even if a large number of algal cells were affected during a spill, regeneration time of the cells (9-12 hours), together with the rapid replacement by cells from adjacent waters, probably would obliterate any major impact on a pelagic phytoplankton community (NRC, 1985). After the *Tsesis* spill in the Baltic Sea, there was a decrease in zooplankton in the vicinity of the wreck. The quantity of phytoplankton increased briefly and it was concluded that the change was due to a decrease in the amount consumed by zooplankton. Similar results have been obtained in long-term oiling experiments.

Individual organisms in oil spills have been affected in a number of ways: direct mortality (fish eggs, copepods, mixed plankton), external contamination by oil (chorion of fish eggs, cuticles and feeding appendages of crustacea), tissue contamination by aromatic constituents, abnormal development of fish embryos, and altered metabolic rates (Longwell 1977; Samain et al. 1980). The effects appear to be short-lived and there are seldom prolonged changes in biomass or standing stocks of zooplankters in open water near spills, due largely to their wide distribution and rapid regeneration (Van Horn et al. 1988). During the *Exxon Valdez* spill, Celewycz and Wertheimer (1996) studied the impact of the spill on zooplankton and epibenthic crustaceans, potential prey species of pink salmon. They did not detect any reduction in abundance of either zooplankton or epibenthic crustaceans between the oiled and non-oiled locations in either 1989 or 1990. However, as of 2010, intertidal sediments and benthic communities were still listed as recovering (Exxon Valdez Oil Spill Trustee Council 2010).

Intertidal and subtidal macrophytes provide shelter and food for fish and for fish prey species at various life stages along the northern Santa Barbara County coast. The habitats involved here include both high energy rocky shorelines, sand and cobble beaches, and the nearshore subtidal environment. Intertidally, the red alga *Endocladia muricata* and the brown alga *Pelvetia* spp. are species common to the area, as is surf grass (*Phyllospadix spp.)*. Giant kelp, *Macrocystis pyrifera* is also common to the nearshore subtidal area. Intertidal macrophytes seem to be more vulnerable to oiling than subtidal macrophytes. Losses of intertidal algal cover have been described after several spills. However, recovery appears to occur quite readily (Topinka and Tucker 1981), though imbalances in the macrophyte community can persist for years. The proliferation of opportunistic intertidal algal species after a spill is invariably a direct result of the elimination, by the oil, of naturally occurring grazers--limpets and other intertidal herbivores (NRC 1985). Little evidence exists that kelp is harmed by oil (MMS 1992).

An oil spill of 200 bbl would probably result in light to heavy tarring of the intertidal zone if oceanographic conditions carried the oil to shore. For comparison, following the Torch spill (163 bbl) at Point Arguello, large amounts of fresh oil and tar were observed on rocks throughout the middle to lower intertidal zone just north of the Boat House. Tar was observed on sea stars and obscuring the respiratory holes of black abalone, leading observers to conclude that some mortality may have occurred (Raimondi et al. 1999).

Impacts to intertidal macrophytes would be minimal and patchy over an estimated 10 km or less of shoreline. Raimondi (1998) reported that species abundance at two research sites within the exposure zone of the 163 bbl Irene pipeline spill showed no significant changes that could be attributed to the oil spill. Barnacle abundance at one site decreased in the fall 1997 and spring 1998 surveys, however no fresh tar or oil was observed at the site. In spring 1998 surveys, the same site also showed decreases in mussels and surf grass cover, but these impacts were attributed to the effects of strong El Nino enhanced storms that ravaged the site in January and February of 1998. No measurable impacts would be expected to subtidal macrophytes from a 200 bbl oil spill.

Fluctuations of benthic and intertidal invertebrate populations may affect the fishes that normally feed on them. Considerable work has been done studying the effects of oil on macroinvertebrates. Most susceptible are those species inhabiting the intertidal zone, especially those found in lagoons, embayments, estuaries, marshes, and tidal flats. This risk derives from two factors: high oil concentrations and shallow depth of the water column.

Aside from the physiologically toxic effect, intertidal organisms may be entrapped or suffocated by oil. In fact, a major impact of the *Sea Empress* spill was to the intertidal invertebrate community. Heavy limpet mortalities were recorded, and periwinkles and topshells died, though in lesser numbers. Amphipod mortalities were extensive, although substantial recolonization was evident at most sites one year later (SEEEC, 1998). Gorbics et al. (2000) reported that overall mortality of bean clams as a result of the *American Trader* spill (~10,000 bbl of crude oil) in February 1990 was estimated to be 24 percent. Sand crabs showed an increase in the body burden of aliphatic hydrocarbons until June 1990. It can be assumed that the oil from the *American Trader* that stranded along 22 km of coastline near Huntington Beach resulted in a significant increase in the mortality of intertidal invertebrates (Gorbics et al., 2000).

It can take several years for limpet and other mollusc populations to recover completely at heavily impacted sites. A 200-bbl oil spill off Point Arguello that contacted shore would likely result in mortality to various intertidal macroinvertebrates, including barnacles, limpets, mussels, starfish, anemones, and black abalone. Smothering would be the most common cause of mortality and would be limited to direct contact with weathered tar balls from the oil spill. After the 163 bbl Irene pipeline spill in September 1997, sand crabs within the spill zone showed significant hydrocarbon contamination (J. Dugan, UCSB, pers. com.). Sand crabs are an important component of the diet of several fishes. Though fish can metabolize hydrocarbons they accumulate, this process requires energy and may lead to an increased vulnerability to disease and decreased growth or reproductive success. Since sand crabs were contaminated after the oil spill, one can also assume that other invertebrates such as myssids, amphipods, and polychaetes were also affected.

Coastal and offshore waters and benthic subtidal environments are important habitat for all of the fish species managed by the PFMC (Tables 4.1 to 4.4). The coastal and offshore waters are any areas seaward of the low tide level and include bays, open coastal waters, and the deep ocean. Oil spills in the open ocean do not appear to have as severe an effect on the biota as oil in coastal waters or in the shore zone (NRC 1985). This may be due to the fact that the shore zone and coastal waters are generally subject to serious effects from chronic pollution and an oil spill in such areas would be impacting an already stressed environment.

Benthic subtidal environments may be impacted when oil spilled onto the surface of the water column is transferred to bottom sediments through sorption on clay particles and subsequent sinking, sinking of dead organisms, uptake and packaging as fecal pellets by zooplankton, or direct mixing to the bottom in shallow water. This may impact fish both directly and indirectly. After the *Tsesis* oil spill, herring reproduction was significantly reduced in the spill area. Nellbring et al. (1980) reported that the reduced reproduction was due to a decrease in amphipod populations that graze on fungi growing on the fish eggs, leaving the eggs susceptible to fungal damage. Oiling of the sediments following the *Amoco Cadiz* spill had deleterious effects on plaice and sole, including reduced growth and increased incidence of fin and tail rot (Conan and Friha, 1981). In fact, flatfish may be particularly susceptible to oil spill impacts, since they spend a considerable amount of time lying on the bottom or even partially buried in the sediments.

Conclusion. An evaluation of the literature reveals that oil spills can cause mortality and sublethal effects on fish at all life stages, their prey, and their habitat. However, whether or not these impacts result in measurable adverse effects on essential fish habitat is more difficult to determine. In 1985, a National Research Council committee found “no irrevocable damage to marine resources on a broad oceanic scale” as a result of oil pollution from either chronic, routine sources or from occasional major spills. At the same time, however, it cautioned that further research is needed before an unequivocal assessment of the environmental impact of oil pollution can be made, particularly as it applies to specific locations and conditions. The size of the oil spills that were analyzed in the NRC study, and on which the above statement was made, ranged from 5,000 tons (~38,000-bbl) spilled from the tanker *Zoe Colocotroni* to 223,000 tons (~1.7 million-bbl) spilled from the tanker *Amoco Cadiz*.

Based on the amount of oil that would be handled from the Electra Field reserves, an oil spill risk analysis predicts there is a 4.4 percent chance that a 50 to 1000-bbl oil spill could occur over the projected life of the proposed project. As discussed earlier, an effort also was made to estimate the likely size of such a spill. Given the national oil spill data collected from the Gulf of Mexico and Pacific Region OCS programs over the last 48 years, BOEM expects that such a spill would probably be less than 200 bbl (Anderson et al. 2000).

Given the location, normal meteorological and oceanographic conditions, and oil spill response capabilities of the area, only minimal adverse effects are expected to EFH from an oil spill of

200 bbl in size. Direct mortality to fish would probably occur only in the egg and larval stages found in the surface waters in the immediate vicinity of the spill. Depending on the oceanographic conditions at the time of the spill, some oiling of the intertidal zone along the south central California coast or the northern Channel Islands is expected. Under normal conditions for the area, significant mixing and weathering of the oil would evaporate much of the toxic light-end hydrocarbons into the atmosphere, disperse the oil into the water column, and likely break the slick into smaller patches. The weathered tar balls would likely cause some mortality to intertidal macrophytes and invertebrates through smothering. Elevated hydrocarbon levels in nearshore invertebrates would be likely, leading to increased stress and potential decreases in growth and reproduction in fish feeding upon the invertebrates. These effects are expected to be short-term under normal conditions; however, oil may become sequestered in the sediments of low-energy embayments and persist for several years.

In the event of a larger spill from the proposed project, including a ≥1000-bbl oil spill, for which there is only a 0.3 percent probability of occurrence over the life of the project, impacts to EFH would likely be similar to those of a 200 bbl spill. Direct mortality to fish would still likely be limited to the egg and larval stages found in the nearby surface waters; however, the spatial extent of the spill would likely be much greater and affect a larger area of ocean surface and coastline which could affect more shallow benthic habitats.

7.0 Cumulative Impacts

The three impacting sources identified for the proposed project are: 1) noise and disturbance, 2) effluent discharges, and 3) oil spills. Of these three sources, only the increased risk of an oil spill associated with the proposed project would substantially add to, or interact with, effects from related or unrelated actions or projects.

This cumulative impact analysis is based on the fact that the proposed project would occur from existing facilities, which were previously evaluated in the Point Arguello Field and Gaviota Processing Facility Area Study and Chevron/Texaco Development Plans EIR/EIS (ADL 1984) and the ESA Section 7 consultation for Point Arguello (FWS 1984; NMFS 1984). The proposed project will fall within the approved level of activity already scheduled to occur at Platform Hidalgo, and will not add spatially to the impacts caused by effluent discharges, and noise and disturbance sources that were scheduled to occur and are covered under existing permits at Platform Hidalgo. Additionally, the proposed project will not extend the productive life of the Point Arguello facilities.

Table 7.1 identifies three similar non-federal projects that are reasonably likely to occur and will be considered in the cumulative effects analysis. These actions include activities that could produce impacts on EFH in the project area during the expected life of the Point Arguello Unit development project. These projects include the resumption of production at Pier 421, development of State leases from Platform Hogan, and the development of the Paredon Field near Carpinteria. These projects would slightly increase the risk of an oil spill occurring. The projects will occur from existing facilities and within the levels of activity planned and analyzed for the facilities. Thus, none of the projects would add to the impacts caused by effluent discharges, and noise and disturbance sources that were scheduled to occur and are covered under permits at the respective platforms or onshore locations.

Table 7.1 Cumulative Offshore Energy Projects (Non-federal)

#	Project, Applicant	Description	Status
1	Resumption of State Lease PRC-421, Venoco	Oil and Gas Development Project	Under Review
2	Carpinteria Field Redevelopment, Carone and PACOPS	Oil and Gas Development Project	Under Review
3	Paredon Project, Venoco	Oil and Gas Development Project	Under Review

Resumption of State Lease PRC-421, Venoco. In May 2004, Venoco proposed to bring two idle Coastal Zone oil production wells within State Lease PRC-421 back into production. The wells are located in the City of Goleta on two adjacent piers. Pier 421-1 supports an idled water and gas injection well, while Pier 421-2 supports an idled oil production well. Venoco proposes to install new production equipment and reactivate the oil well on Pier 421-2, and reactivate the injection well on Pier 421-1 for disposal of wastewater and natural gas.

Based upon current projections, the estimated life of the proposed project would be twelve years of oil production; production would be expected to be no more than 700 bbl/d of oil in the first year, tapering off to approximately 100 bbl/d by year 12 (CSLC, 2005). On May 17, 2004, the City of Goleta went on record in opposition to resumed oil and gas production from SL 421. On May 19, 2004, Venoco re-submitted a recommissioning plan to the California State Lands Commission (CSLC), Santa Barbara County, and City of Goleta which is currently under environmental review, pending resolution of "vested rights" legal issues The proposed project would marginally increase the likelihood of an oil spill off the south-central California coast.

Carpinteria Field Development Project, Carone and PACOPS. This project includes directional drilling from Platform Hogan into existing State Leases PRC-4000, PRC-7911, and PRC-3133. The applicant has proposed to drill up to 25 wells. Estimated peak production from Platform Hogan would increase to approximately 6,000 bbl/d of oil and 6 mmscfd of gas after the first six years of production, and then would decline. The project would be expected to have a 12-year economic life. The resulting oil and gas production will be sent to La Conchita Facility for processing via the existing pipelines. Oil and gas produced from this project would flow through submerged pipelines to the CPF.

Previously, the environmental analysis process determined that the structural integrity of Platform Hogan needed to be verified to determine if the platform is capable to support a drilling rig needed to accomplish this project. Therefore, the project was placed on hold for several years until the determination was completed. If the structural integrity is not adequate, some construction work may be required at Platform Hogan to reinforce the platform's structure. The proposed project would marginally increase the likelihood of an oil spill off the south-central California coast. The environmental analysis for this proposed project is ongoing. The proposed project would marginally increase the likelihood of an oil spill off the south-central California coast.

The Paredon Prospect Development, Venoco. The project would utilize extended-reach drilling from an onshore site located within Venoco's Carpinteria Processing Facility (CPF), to develop and produce oil and gas from hydrocarbon-bearing reservoirs (the Paredon Prospect) lying primarily offshore of the Carpinteria area in State Leases PRC 3150 and PRC 3133. The Paredon

Prospect is estimated to contain recoverable reserves of approximately 23.5 million bbl of oil and 43 billion standard cubic feet (bscf) of natural gas (10,000 bbl/d of oil and 10 mmscfd of gas). An environmental impact report (EIR) was prepared for the project; and on May 19, 2008, the City of Carpinteria's Environmental Review Committee (ERD) held a public meeting on the Proposed Final EIR. The ERD voted to delay issuance of the project – thereby postponing the final decision regarding certification of the document.

The status of this project is therefore still pending. Venoco is currently reviewing both onshore and offshore alternatives for the location of the drilling rig and wells. Although Venoco stated that it intended to provide a proposal to the CSLC by February 2012, a proposal has not yet been received. Regardless, the proposed project would marginally increase the likelihood of an oil spill off the south-central California coast.

Oil and Gas Development. There are currently a total of 49 OCS oil and gas leases (43 producing leases and 6 non-producing leases) offshore of Southern California. Production from these OCS leases is expected to continue for up to the next 25 years.

Offshore oil and gas reserves are harvested via the 23 existing oil and gas platforms located in Federal waters and 4 platforms located in State waters. The cumulative effects of these structures and development activities on the OCS can be found in numerous reports, and environmental documents (MMS 1992, 1995, 1996). The proposed inclusion of the Development of the Electra Field reserves would add only minimally to the overall oil spill risk associated with ongoing OCS oil and gas activities in the Pacific Region (MMS 1996). The proposed Carpinteria Field Development and Paredon projects would incrementally increase the overall oil spill risk offshore southern California based on their larger recovery volumes.

The six undeveloped OCS leases were acquired between 1968 and 1982 but never developed primarily due to a combination of delays by regulators, the State's environmental and safety concerns, and various lawsuits. A lawsuit by the state of California prevented the federal government from allowing development on 36 federal leases issued before the congressional moratorium was instituted. In November 2005, a federal judge ordered the U.S. government to repay the original bonus bids, totaling just over $1.1 billion, to the oil and gas companies that hold these leases. The decision was affirmed by the U.S. Court of Appeals for the Federal Circuit and the government repaid the bonus bids. Additionally, the BOEM currently has no proposals for the decommissioning of offshore facilities.

Other Activities. NMFS (1998ab) has identified a variety of fishing and non-fishing activities that may cause adverse impacts to EFH along the Pacific Coast. These include dredging and discharge of dredged material, water intake structures, aquaculture, wastewater discharge, oil and hazardous waste spills, coastal development, agricultural runoff, commercial marine resource harvesting, and commercial fishing. Most of these activities occur throughout the California, Oregon, and Washington coastal habitat and all of these activities and impacting agents exist in the southern California coastal zone. As a result, marine water quality within much of the SCB has been impacted by municipal, industrial, and agricultural waste discharges and runoff (MMS 1992, Bight'98 Steering Committee 2003). However, the water quality from the Point Conception area north and offshore the Channel Islands generally remains very good.

The project area is very productive and is important habitat for many of the species covered under the Coastal Pelagics Fishery Management Plan (FMP), Highly Migratory Species FMP, Pacific Salmon FMP, and the Groundfish FMP. An oil spill resulting from the Electra project would impact the water quality of this habitat. Although only minimal adverse impacts to fish populations and their prey species would be likely result from such an event, EFH in the Southern California Bight is already stressed due to overfishing, and degraded water quality in estuaries south of Point Conception. Degradation of the water quality north of Point Conception due to an oil spill would cause further stress to EFH. However, impacts to water quality from an open ocean spill of less than 200 bbl would be short-term and not expected to last more than several days.

8.0 Mitigation

The mitigation measures and stipulations for the proposed development of the Electra Field reserves will not be finalized until the revised Development and Production Plan is approved.

BOEM has met the applicable recommended conservation measures for oil and gas production described in Amendment 11 to the Groundfish FMP and in Amendment 8 to the Coastal Pelagics FMP. This includes containment equipment and sufficient supplies to combat spills on-site at Platform Hidalgo. All offshore facilities are covered by oil spill response plans that are revised semi-annually.

Additionally, BOEM places mitigation measures and conditions of approval on all OCS activities when appropriate. BSEE monitors all lease operations to ensure that industry is in compliance with relevant requirements. This includes conducting scheduled and unscheduled inspections of facilities, and scheduled and unscheduled oil spill drills. The BSEE Pacific OCS Region also has a rigorous pipeline inspection program in place. Appendix B describes in detail the oil spill prevention and response programs in place for the Pacific Region and includes a description of BSEE's Pacific Region's platform inspection and oil spill drill program, pipeline inspection program, and the oil spill response and cleanup capabilities of the area.

9.0 Conclusions

Under routine operations, adverse impacts associated with the proposed project are not expected to affect EFH identified in the Coastal Pelagics FMP, Highly Migratory Species FMP, Salmon FMP, or the Groundfish FMP. Specifically, the proposed project would occur from existing facilities and will fall within the level of activity already planned to occur at Platform Hidalgo and associated Point Arguello facilities. Thus, the proposed project will not add to the impacts (spatially) caused by effluent discharges and noise and disturbance that were scheduled to occur, were analyzed in prior environmental documents, and are covered under permits at Platform Hidalgo or the associated facilities.

Under upset conditions, the proposed development of the Electra Field using extended reach drilling technology may cause minimal to moderate adverse impacts on EFH if an oil spill associated with the proposed project was to occur. It is estimated that there would be a 4.4 percent chance of an oil spill between 50 and 1,000 bbl occurring due to the proposed development of the Electra Field reserves. However, based upon historical data, such a spill would likely be less than 200 bbl in size. Minimal adverse impacts to EFH are expected from a spill this size, even if the spill were to contact land. Given the dynamic environment of the south-central coast, however, such a spill, while likely having a greater spatial footprint, would still likely result in only minimal to moderate adverse impacts on EFH.

Additionally, as little as 20 years ago, extended reach drilling from Platform Hidalgo to the Electra Field reserves would not have been feasible. In previous years, development of the Electra Field resources would have required the construction and placement of a new offshore platform structure to develop the reserves at much greater environmental risk and damage.

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