3 AFFECTED ENVIRONMENT

3.1 INTRODUCTION

The proposed action would apply to oil and gas (O&G) operations and activities within 43 existing Federal leases in the POCS. Among these lease areas, 14 oil and gas fields are currently being produced by 23 platforms (22 producing platforms and one platform used for processing only); 15 platforms are located offshore of Santa Barbara County, four platforms offshore of Ventura County, and four platforms offshore Long Beach, near the boundary of Los Angeles County and Orange County (Aspen Environmental Group 2005) (Figure 3-1). Descriptions of the platforms are presented in Table 3-1). The 23 platforms on the POCS occur in water depths ranging from about 95 to 1,200 ft (29 to 366 m), and they are about 3.7 to 10.5 mi (6 to 17 km) from shore. For the purposes of this PEA, the 43 lease areas where WSTs may be carried out represent the project area for the proposed action. The geographic range of the potential effects extends beyond the project area to areas where effects could occur from activities within the project area.

3.2 GEOLOGY AND SEISMICITY

3.2.1 Regional Description and Physiography

The portion of the POCS from just north of Point Sal to the United States–Mexico border largely coincides with the physiographic region known as the California Continental Borderland (Gorsline and Teng 1989). This region is a complex of basins, ridges, islands, and banks that make up the boundary between the Pacific and North American tectonic plates (Given et al. 2015). These features follow the northwest–southeast trend of the Peninsular Ranges in the south, the east–west trend of the Transverse Range in the Santa Barbara–Ventura Basin and the northwest trending southern Coast Ranges in the northernmost part of the area. Structurally, the region is a sequence of elongated thrust blocks separated by major faults. Numerous offshore basins have been identified in this region, including the offshore Santa Maria, Santa Barbara–Ventura, and San Pedro Basins, where oil and gas well platforms on the Federal OCS are currently in operation (Figure 3-2).

The submerged part of the California Continental Borderland covers an area of about 27,000 mi^2 and has a length of about 560 mi. Its maximum width from shore to the base of the Patton Escarpment (the seaward edge of the continental shelf) is about 155 mi; this occurs at the latitude of the United States–Mexico border (Gorsline and Teng 1989).

3.2.2 Geology of the Santa Maria Basin

The offshore portion of the Santa Maria Basin, shown in Figure 3-3, lies within the Central California province (Figure 3-2). It is a northwest-trending basin that extends from about

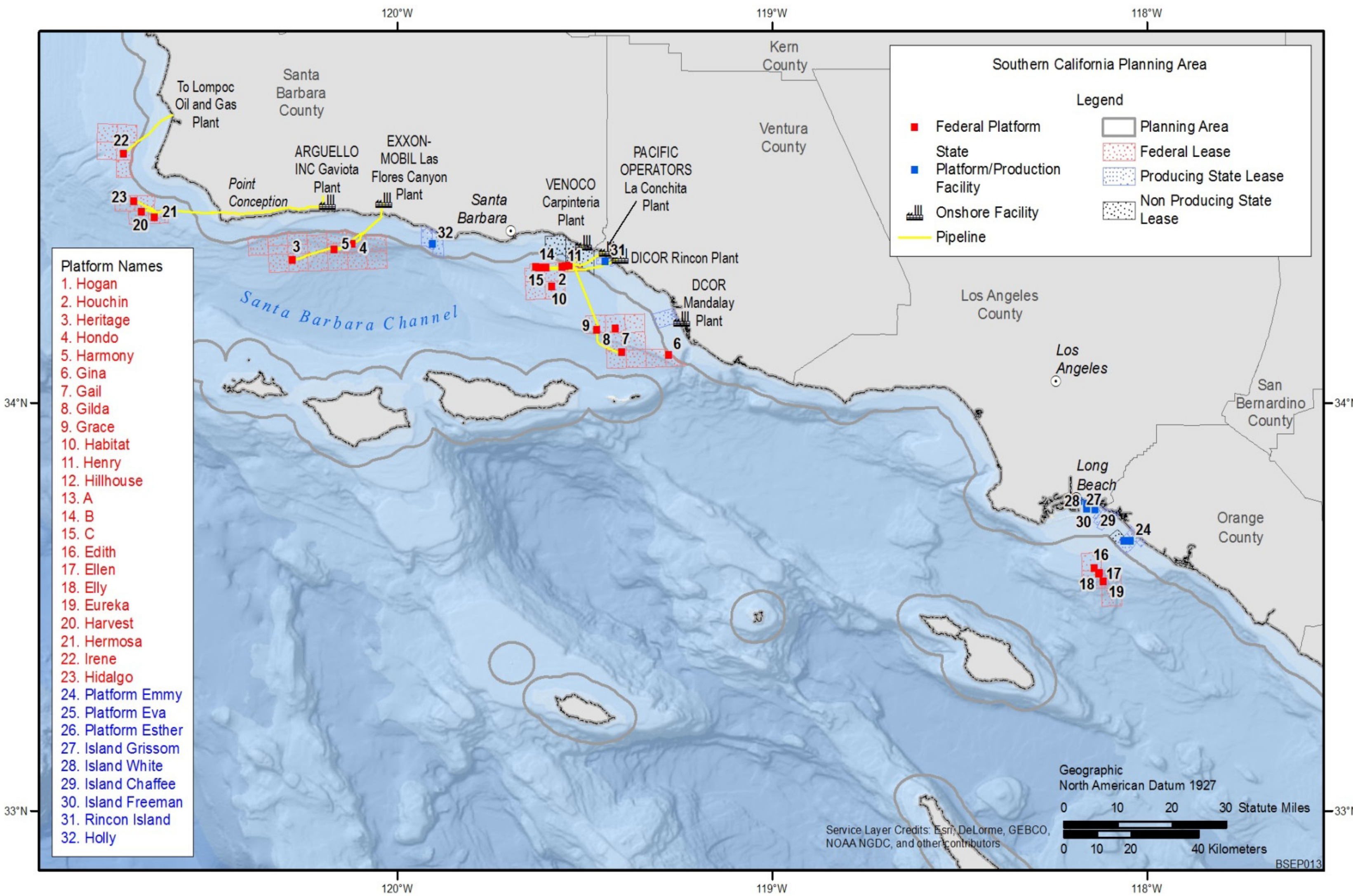

FIGURE 3-1 Locations of Current Lease Areas, Platforms, and Pipelines of the POCS (Also shown are platforms and production facilities in offshore State waters adjacent to the Federal OCS. Platforms in Federal waters are shown in red, and those in State waters are shown in blue.)

TABLE 3-1 Production and Processing Platforms on the Southern California Outer Continental Shelf

Platform	Date Installed	Location	Operator	Water Depth (ft)	Distance from Shore (mi)	No. of Well Slots[a]
Tranquillon Ridge Field						
Irene	8-7-1985	Santa Maria Basin	Freeport-McMoRan Oil & Gas, LLC	242	4.7	72
Point Arguello Field						
Harvest	6-12-1985	Santa Maria Basin	Freeport-McMoRan Oil & Gas, LLC	675	6.7	50
Hermosa	10-5-85	Santa Maria Basin	Freeport-McMoRan Oil & Gas, LLC	603	6.8	48
Hidalgo	7-2-86	Santa Maria Basin	Freeport-McMoRan Oil & Gas, LLC	430	5.9	56
Hondo Field						
Hondo	6-23-76	Santa Barbara Channel	ExxonMobil Corporation	842	5.1	28
Harmony	6-21-89	Santa Barbara Channel	ExxonMobil Corporation	1,198	6.4	60
Pescado Field						
Heritage	10-7-89	Santa Barbara Channel	ExxonMobil Corporation	1,075	8.2	60
Carpinteria Offshore						
Houchin	7-1-1968	Santa Barbara Channel	Pacific Operators Offshore, LLC	163	4.1	60
Hogan	9-1-1967	Santa Barbara Channel	Pacific Operators Offshore, LLC	154	3.7	66
Henry	8-31-1979	Santa Barbara Channel	DCOR, LLC	173	4.3	24
Dos Cuadras Field						
Hillhouse	11-26-1969	Santa Barbara Channel	DCOR, LLC	190	5.5	60
A	9-14-1968	Santa Barbara Channel	DCOR, LLC	188	5.8	57
B	11-8-1968	Santa Barbara Channel	DCOR, LLC	190	5.7	63
C	2-28-1977	Santa Barbara Channel	DCOR, LLC	192	5.7	60
Pitas Point Field						
Habitat	10-8-1981	Santa Barbara Channel	Pacific Operators Offshore, LLC	290	7.8	24
Santa Clara Field						
Gilda	1-6-1981	Santa Barbara Channel	DCOR, LLC	205	8.8	96
Grace	7-30-1979	Santa Barbara Channel	Venoco, Inc.	318	10.5	48

TABLE 3-1 (Cont.)

Platform	Date Installed	Location	Operator	Water Depth (ft)	Distance from Shore (mi)	No. of Well Slots[a]
Sockeye Field						
Gail	4-5-1987	Santa Barbara Channel	Venoco, Inc.	739	9.9	36
Hueneme Field						
Gina	12-11-1980	Santa Barbara Channel	DCOR, LLC	95	3.7	15
Beta Field						
Edith	1-12-1984	Offshore Long Beach, CA	DCOR, LLC	161	8.5	72
Elly	3-12-80	Offshore Long Beach, CA	Beta Operating Company, LLC	255	8.6	NA[b]
Ellen	1-15-80	Offshore Long Beach, CA	Beta Operating Company, LLC	265	8.6	80
Eureka	7-8-1984	Offshore Long Beach, CA	Beta Operating Company, LLC	700	9.0	60

[a] A well slot is an opening in the platform through which a developmental well can be drilled. The greater the number of well slots on a platform, the greater the number of developmental wells that can be drilled from the platform.

[b] Platform Elly is a processing facility.

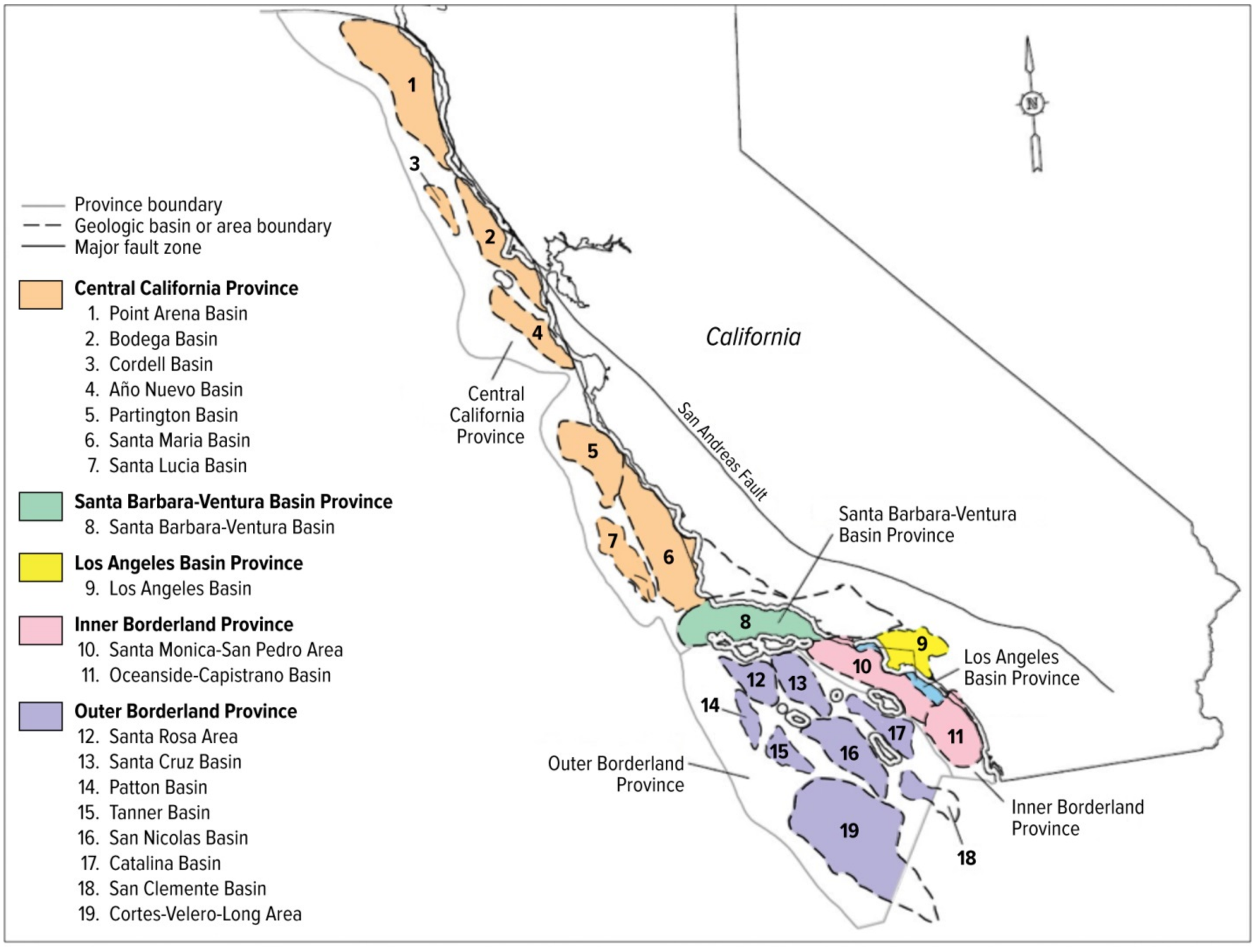

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FIGURE 3-2 Map of the POCS Region Showing the Offshore Geologic Basins (MMS 1997)

Point Arguello northward to Point Piedras Blancas (Mayerson 1997; BOEM 2014). It is bounded on the east by the Hosgri Fault Zone, on the west by the Santa Lucia Bank Fault, and by structural highs to the north and south. The basin is about 100 mi long and 25 mi wide and covers an area of about 2,500 mi^2. Water depths range from 300 ft near Point Sal to 3,500 ft in the southwestern part of the basin.

The Santa Maria Basin experienced rapid subsidence as a result of regional extension during the early Miocene. Normal-faulting of basement blocks formed sub-basins that are filled with volcanic rocks and biogenic and clastic sediments of Miocene and Pliocene age. In the early Pliocene, uplift and structural inversion of the basin reactivated the normal faults and caused folding of the Miocene and Pliocene strata into anticlines[1] that are traps for much of the oil in the basin (Mayerson 1997).

[1] An anticline is a geologic structure created by compressional stress and comprised of folded strata, convex up, with the oldest beds at its core.

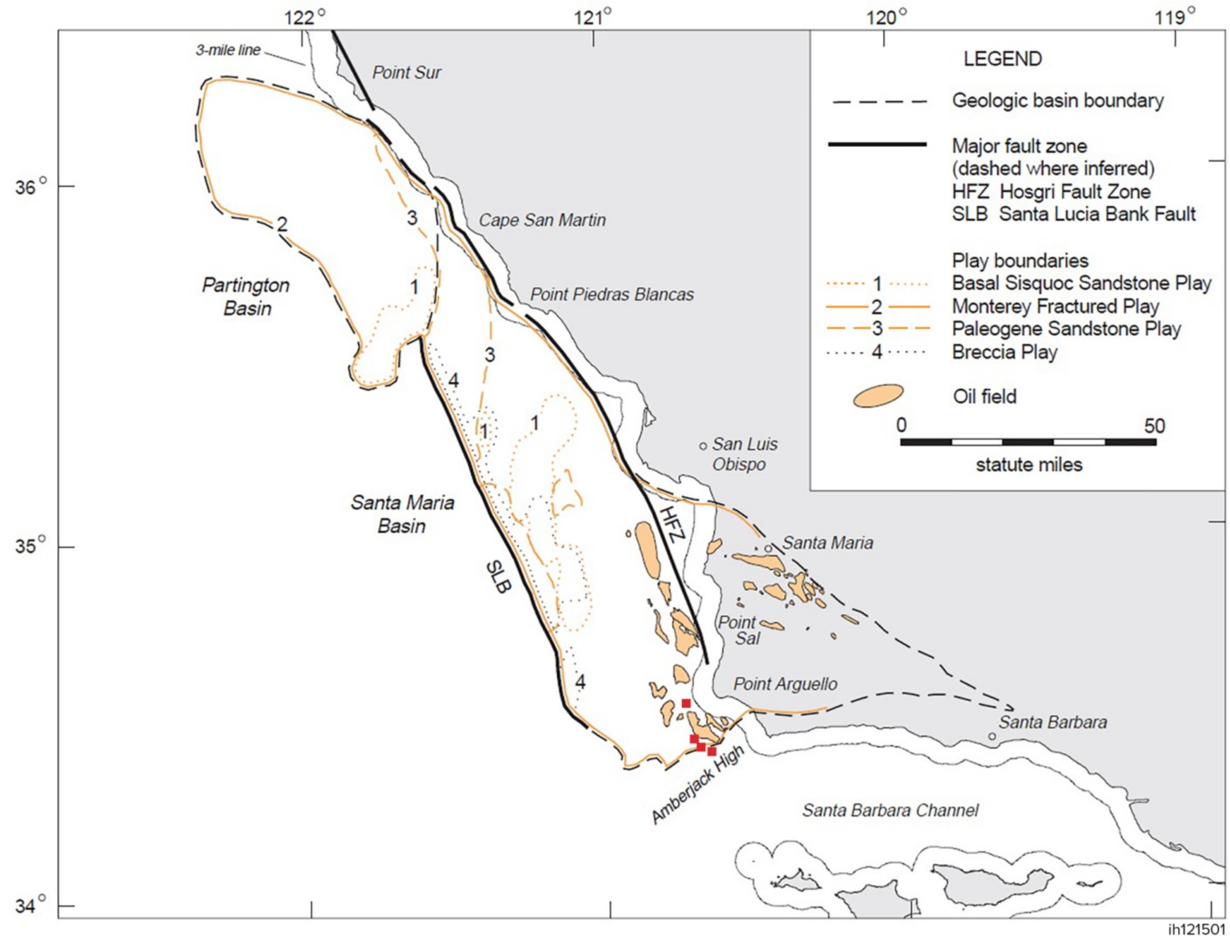

FIGURE 3-3 Location, Geologic Plays, and Oil Fields of the Santa Maria Basin (Platforms in Federal waters are shown in red.) (Modified from Mayerson 1997)

3.2.2.1 Stratigraphy

The stratigraphy of the Santa Maria Basin is shown in Figure 3-4. Logs of exploratory wells drilled in the southern and central portions of the offshore basin (most bottoming in basement rocks of the Jurassic Franciscan Complex) show Paleogene rocks are missing in most wells.

The first exploratory well was drilled in the offshore Santa Maria Basin in 1964. The well, located about 15 mi northwest of Point Sal, had abundant shows of oil in the Monterey Formation. Since 1980, when the first discovery well was drilled at the Point Arguello field, the Monterey Formation has been the primary exploration target in the basin (Mayerson 1997). Four of the 14 producing fields in the POCS Region are in the offshore Santa Maria Basin (Point Arguello, Rocky Point, Tranquillon Ridge, and Point Pedernales fields).

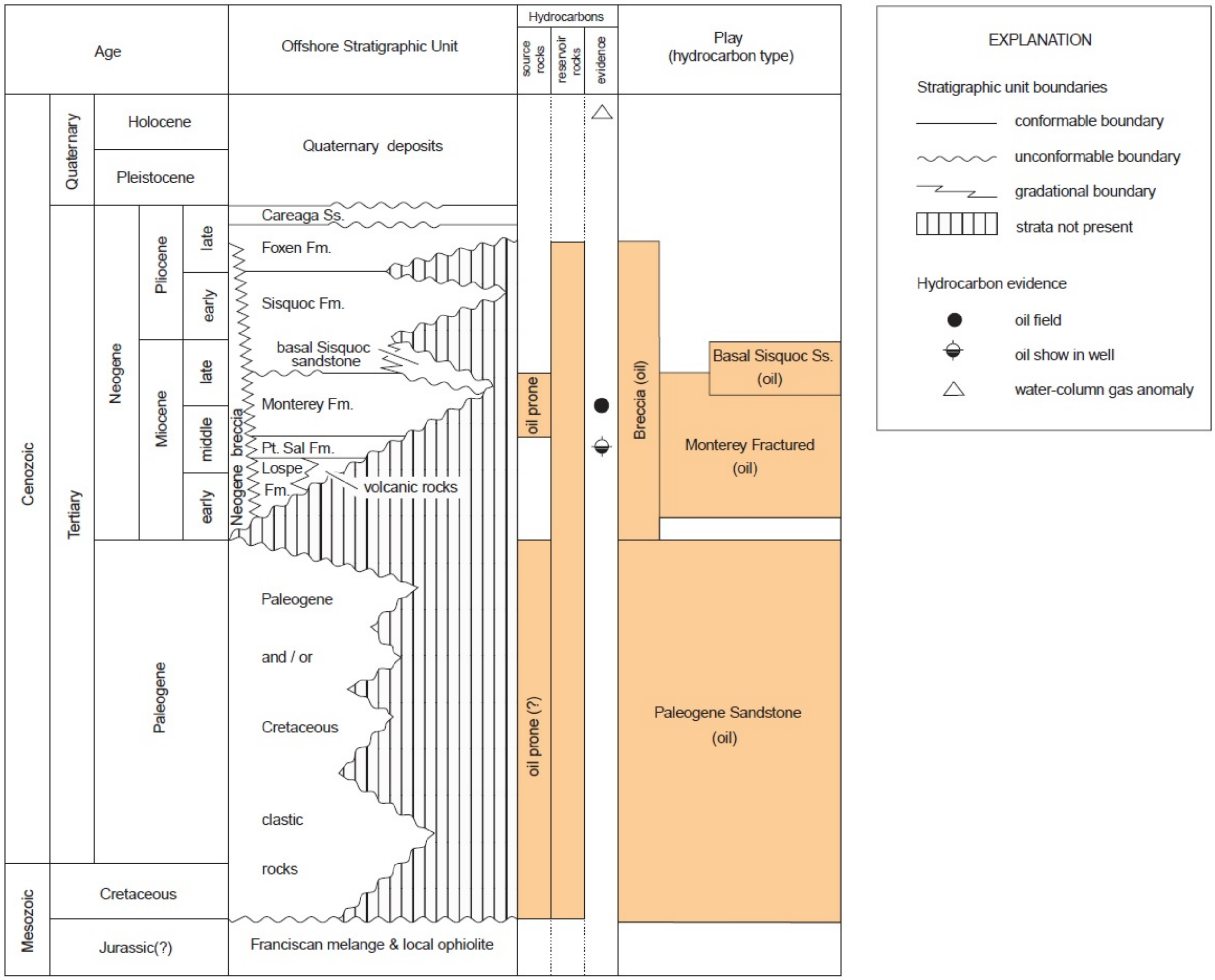

FIGURE 3-4 Stratigraphy of the Santa Maria Basin (Mayerson 1997)

The Monterey Formation. The vast majority of petroleum production in the offshore Santa Maria Basin comes from the Monterey Formation. The Monterey Formation is most productive where it has been diagenetically altered to highly fracturable quartz, and in shallower areas, opal-CT (crystobalite/tridymite). This play is established both onshore and offshore. The primary source rock for the play is the organic-rich shales and phosphatic rocks of the Monterey Formation itself (Mayerson 1997; Figure 3-4).

Reservoirs in the Monterey Formation include oil and associated gas accumulations in fractured siliceous and dolomitic rocks of the middle and upper Miocene (Figure 3-4). In the entire offshore Santa Maria Basin, the Monterey Formation covers an area of about 3,800 mi^2 and occurs at burial depths of about 0 (exposed on the seafloor) to 11,000 ft (Figure 3-3). The Monterey Formation is its own source and reservoir rock. Researchers report that total organic carbon content of the formation ranges from 3 to 17%. Minor reservoir rocks also include sandstones of the Point Sal and Lospe Formations (Figure 3-4). As mentioned above, the quality of the reservoir is thought to be controlled by the diagenetic grade of its siliceous strata, with the best reservoirs having been diagenetically altered from opal-CT) to quartz, because of the increased fracture density associated with quartz-phase strata (Isaacs 1992; Mayerson 1997). This diagenetic boundary has been correlated with a seismic reflector than can be traced throughout much of the offshore basin. Traps in the offshore Santa Maria Basin producing reservoirs are primarily structural and occur in faulted and/or fault-bounded anticlines. Many of the fields discovered in the central portion of the offshore basin and, therefore, are associated with fault zones, especially along the basin's eastern boundary (Figure 3-3; Mayerson 1997).[2]

3.2.2.2 Potential for Application of WST

The most recent estimate of remaining oil and gas reserves in the four fields of the offshore Santa Maria Basin are approximately 42 million bbl of oil and 61 billion ft^3 of gas (BOEM 2014). WST, via hydraulic fracturing, currently has limited applicability because the Monterey Formation reservoirs producing in the basin are already naturally fractured. Onshore, WST (i.e., hydraulic fracturing) of the vast areas of the Monterey Formation has had only marginal success. Therefore, WST is expected to be incidental rather than fundamental to the development of these basins (Long et al. 2015).

3.2.3 Geology of the Santa Barbara–Ventura Basin

The Santa Barbara–Ventura Basin is located both onshore and offshore southern California (Figure 3-5). The depositional basin is bounded to the north by the Santa Ynez and related faults; to the east by the San Gabriel fault; to the south by a series of thrust faults and lateral faults related to the Malibu Coast-Santa Monica fault zone, the Santa Cruz Island fault, and the Santa Rosa fault; and to the west by the Amberjack High, a poorly defined basement trend that lies between Point Conception and Point Arguello (Figure 3-5). The submerged (offshore) portion of the basin, shown in green in Figure 3-5, is designated as the Santa Barbara–Ventura Basin province in MMS (1997). It is about 90 mi long and 20 mi wide and covers an area of about 1,800 mi^2. The province is commonly referred to as the Santa Barbara Channel (Galloway 1997; BOEM 2014).

3.2.3.1 Stratigraphy

Petroleum seeps in the Santa Barbara Channel have been exploited since prehistoric times. At least 155 oil and gas fields have been discovered since 1861, 33 of which were discovered before 1901. The first offshore oil wells in North America were drilled in the Summerland field in 1894; the first Federal lease in the channel was issued in 1966 (Galloway 1997). Currently, nine fields (Hondo, Hueneme, Pescado, Pitas Point, Sacate,

2 Although there are only three producing fields in the offshore Santa Maria Basin, many more discoveries have been made and economically viable fields have been delineated. The leases on which these fields are located were the subject of litigation and ultimately bought back by the government.

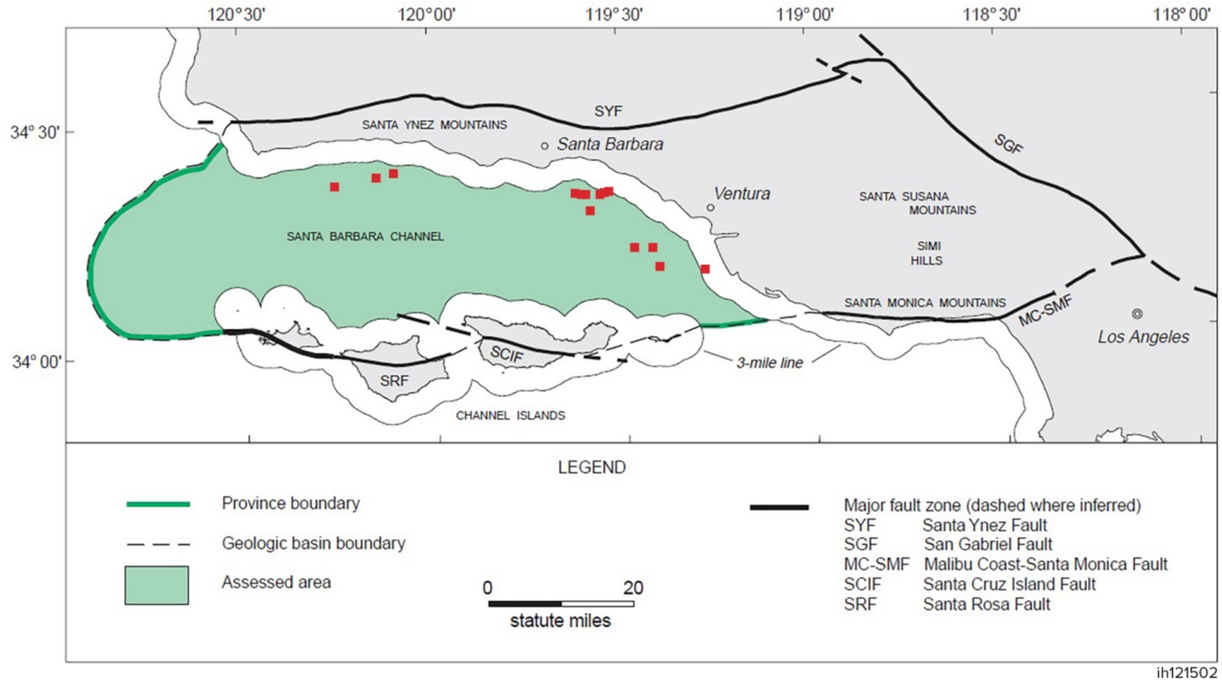

FIGURE 3-5 Location of the Santa Barbara–Ventura Basin (Platforms in Federal waters are shown in red.) (Modified from MMS 1997)

Dos Cuadras, Carpinteria, Sockeye, and Santa Clara) are in production. Together, these fields are estimated to contain reserves of almost 220 million bbl of oil and 500 billion ft^3 of gas.

Oil and gas reservoirs have been identified in nearly every formation in the Santa Barbara Channel. The major producing reservoirs in the Santa Barbara–Ventura Basin are listed in Table 3-2 along with the fields in which they produce.

Pico-Repetto Sandstone. The Pico-Repetto Sandstone is an established O&G play that includes known and prospective oil and gas accumulations in Pliocene and early Pleistocene reservoirs. Although Pliocene strata are distributed throughout the basin, the Federal offshore portion of the play is limited to the eastern part of the basin where reservoir sandstones are abundant and depositional thickness is greater than 2,000 ft. Where this formation occurs in the Santa Barbara–Ventura Basin, it covers an area of about 400 mi^2. Reservoir rocks are mainly sandstones of the Repetto and Pico Formations (Figure 3-6); these compose over 50% of the rock volume in parts of the play. The Repetto Formation is reaches thicknesses in excess of 4,000 ft in parts of the basin and the Pico Formation has a maximum thickness exceeding 10,000 ft.

The Monterey Formation is the likely source rock for O&G in the Pico-Repetto play; deeply buried lower Pliocene claystones and mudstones may be another source (although whether the Pliocene section is thermally mature is uncertain). Traps are predominantly structural (anticlines, faulted anticlines, and fault blocks), with less common stratigraphic traps also occurring along unconformities on the flanks of folds and permeability barriers.

TABLE 3-2 Major Producing Formations and Associated Fields on the POCS

Formation	OCS Field
Pico	Carpinteria
Repetto	Carpinteria, Dos Cuadras, Pitas Point, Santa Clara
Monterey	Hondo, Pescado, Sacate, Santa Clara, Sockeye
Topanga	Sockeye
Hueneme	Hueneme, Sockeye
Vaqueros	Hondo
Sespe	Hueneme, Santa Clara, Sockeye

Monterey Formation. The Monterey Formation is an established play that includes known and prospective oil accumulations in middle to late Miocene reservoirs. The Monterey Formation is distributed throughout the basin. Reservoir rocks of the play are fractured zones formed by silica diagenesis (which causes the rock mass to become increasingly brittle) and late Neogene compressional tectonics.

The Monterey Formation is its own source rock; traps within the play are predominantly complexly faulted anticlines but also include normal- and thrust-faulted blocks.

Topanga Sandstone. The Topanga Sandstone is an established play that includes known and prospective oil and associated gas accumulations in early to middle Miocene reservoirs. Reservoir rocks of the play are primarily sandstones with good porosity (20–30%) and good permeability (400 to 600 millidarcies). Sandy zones may be thicker than 1,000 ft.

Source rocks are the Monterey Formation and, locally, the clay shales of the Rincon Formation. Traps are predominantly structural (faulted anticlines), but may also contain important stratigraphic elements (e.g., channel sandstones).

Sespe, Hueneme and Vaqueros Sandstones. The Sespe, Hueneme, and Vaqueros sandstones are an established play that include known and prospective accumulations of oil and associated gas (and non-associated gas)[3] in reservoirs of late Eocene and Oligocene to early Miocene age. Reservoir rocks are coarse nonmarine and marine clastics of the Sespe Formation and shallow marine sandstones of the coeval Alegria Formation (Figure 3-6). The shallow marine and fan deposits of the Hueneme and Vaqueros sandstones represents a nearshore to shelf deposit and, locally, submarine canyon fill. The Sespe, Hueneme, and Vaqueros section is more than 7,500 ft thick in parts of the basin but averages about 3,000 to 4,000 ft.

3 Non-associated gas is typically a local phenomenon and likely is sourced from land-derived woody or coaly debris deposited in a shallow marine or continental-marine transitional environment.

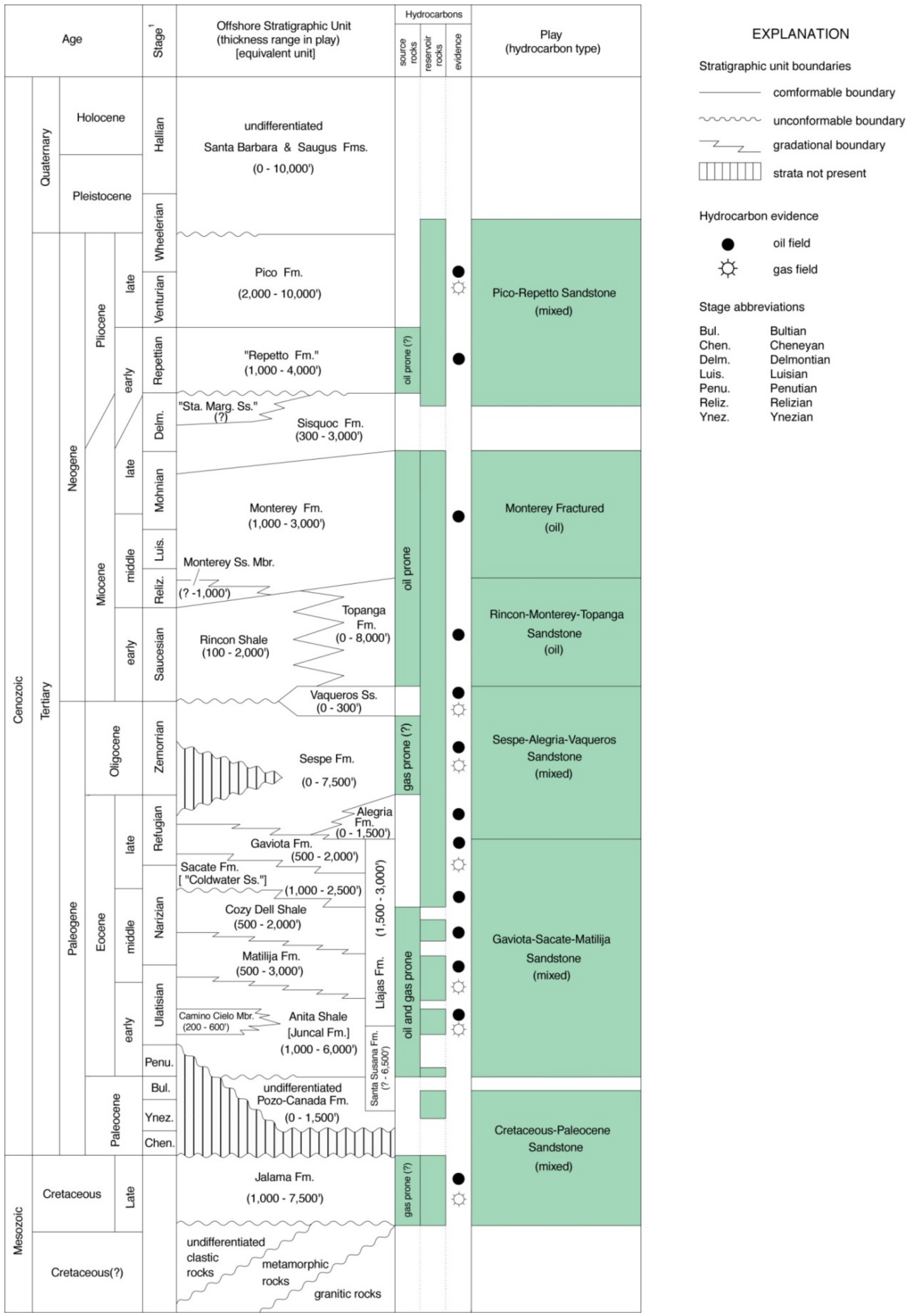

FIGURE 3-6 Major Producing Formations in the Santa Barbara–Ventura Basin and the Fields from Which They Produce (Modified from MMS 1997)

Source rocks are likely the Eocene deep-water shales and overlying Miocene formations; traps are most commonly structural (anticlines, faulted anticlines, and fault blocks), but may contain important stratigraphic elements.

3.2.3.2 Potential for Application of WST

As stated above for the offshore Santa Maria Basin, WST, via hydraulic fracturing, currently has limited applicability because the Monterey Formation reservoirs that are producing in the basin are already naturally fractured. Onshore, WST (i.e., hydraulic fracturing) of the vast areas of the Monterey Formation has had only marginal success. In fact, hydraulic fracturing of the Monterey has been attempted in some of the Monterey Fields, including the Santa Clara Field from Platform Grace in the early 1980s and more recently the Sockeye Field from Platform Gail in 2010. The stimulation was not deemed economically successful. Only four of the six stages achieved injection, and although total fluid recovery increased, this was primarily due to an increase in produced water rather than an increase in oil recovery. POCS operators that produce from the Monterey were informally polled in 2013 regarding future plans to use hydraulic fracturing in the Monterey Formation. Although none would rule it out completely, they all stated that they had no future plans to do so (Mayerson 2015).

A hydraulic fracture program was undertaken by one POCS operator in 2014. Completions in two vertically drilled wells, each using 60,000 gal (1,429 bbl) of injection fluid, were fractured in the indurated Repetto sandstone of the Santa Clara field and achieved some promising initial results. According to the operator, wing lengths of the fractures were planned to be small, on the order of 100 to 200 ft in length. The operator has not submitted subsequent APMs to hydraulically fracture additional wells, but the potential for additional fracture applications exists.

A small number of wells in the Santa Barbara–Ventura Basin have had matrix acidization performed. For these activities, volumes of acid listed in the initial applications were approximately 10,000 gal [238 bbl]). Based on results of matrix acidizing tests of the Monterey Formation by Plains Exploration (2003), the Monterey Formation at the Point Arguello field does not respond to acid like a carbonate reservoir. "The high siliceous content and layering interferes with the formation of worm holes and limits the treatment to the natural fractures that exist." In short, it appears that no new permeability is created.

3.2.4 Geology of the Beta Field off of San Pedro, California

The Beta Field is located in the San Pedro Basin, part of the southernmost extension of the Los Angeles Basin. The San Pedro Basin is structurally bounded by the Palos Verdes (PVF) and Newport-Inglewood fault (NIF) systems. Both faults accommodate a significant amount of regional slip between the Los Angeles Basin and adjacent Inner Continental Borderland Tectonic provinces (Wright 1991), and they also serve as the major hydrocarbon-trapping structures within the San Pedro Basin. Structurally, the Beta Field is located on the sub-thrust section of a broad, northwest-trending anticline bounded by the Palos Verdes Fault (Figure 3-7). The

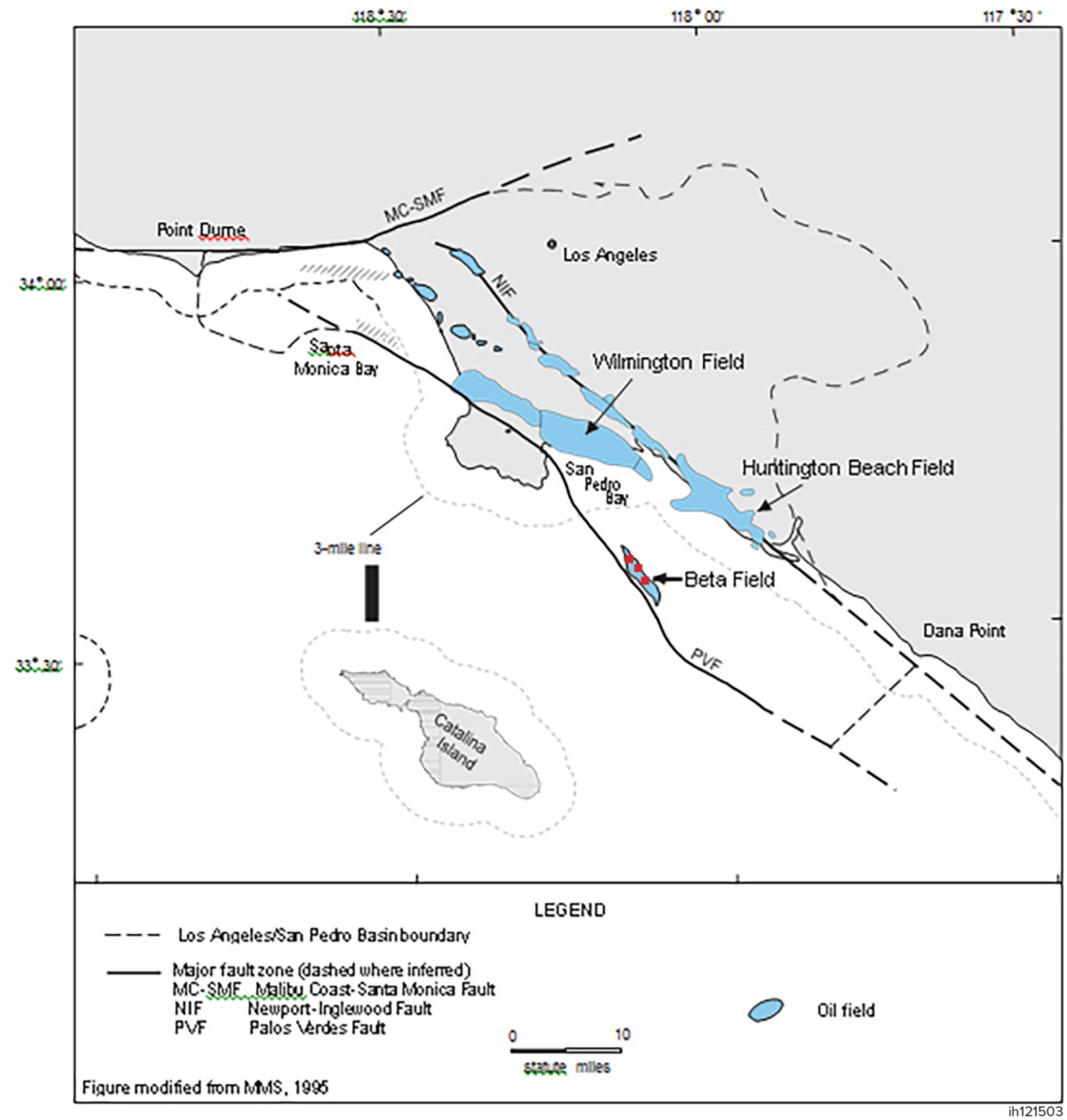

FIGURE 3-7 Location of the San Pedro Shelf and Basin (Platforms on the POCS are shown in red.) (Modified from Drewry and Victor 1997)

present-day PVF extends for approximately 66 mi southeastward from Santa Monica Bay across the northeast portion of the PVF and offshore across the San Pedro Shelf to Lasuen Knoll.

3.2.4.1 Stratigraphy

Within the Beta Field and San Pedro Basin, more than 10,000 ft of Tertiary sedimentary fill overly Cretaceous basement. Local Tertiary strata include the Miocene San Onofre Breccia, the Miocene Monterey Shale, the Miocene/Pliocene Puente Sandstone, the Pliocene Repetto Formation, the Pliocene Pico Formation, and younger Quaternary marine strata (Figure 3-8). Although the adjacent Wilmington, THUMS, Huntington Beach, and other Los Angeles Basin oil fields derive a majority of oil and gas production from the Pico, Repetto, and Monterey Formations, only the Puente Formation is productive within the Beta Field. Several wells were tested for production potential within the Monterey Formation in the Beta Field, but no meaningful oil was recovered. The lack of oil in the Monterey Formation in the Beta Field is probably a consequence of the synchronous deposition of the Monterey

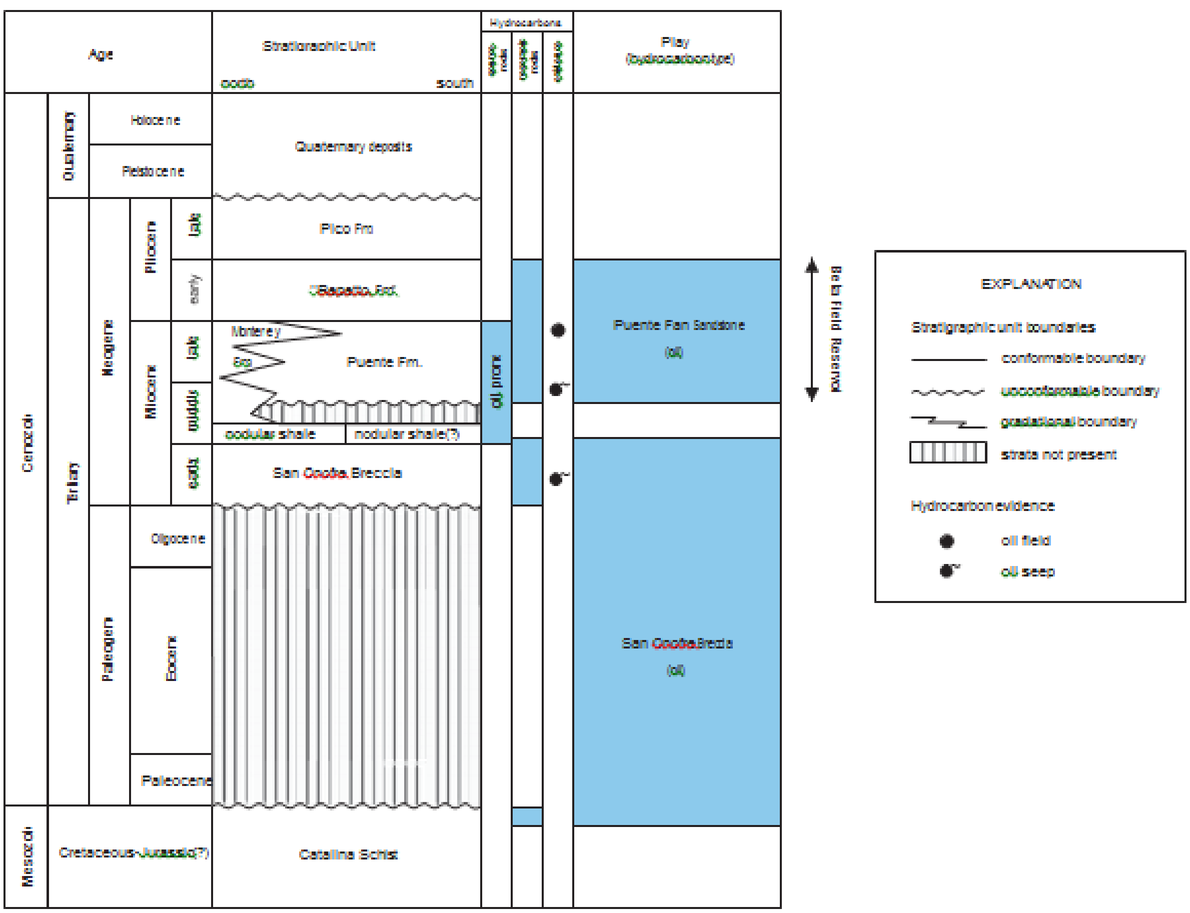

Figure modified from MMS, 1995

FIGURE 3-8 Stratigraphy of the San Pedro Shelf and Basin Region (Modified from Drewry and Victor [1995])

Formation along the southwest-dipping Miocene Palos Verdes Fault, which resulted in the majority of the Monterey Formation deposited west of the sub-thrust anticline that forms the structural trap of the Beta Field (Brankman and Shaw 2009).

The Puente Formation. The Puente Formation is a fan deposited sandstone interbedded with deep water marine shales from which the production at the Beta Field takes place. The depth to the Puente ranges from -2500 ft near the Palos Verdes Fault to about –5000 ft on the northeast flank of the Beta structure. Cumulative production through 2013 from the Beta Field is approximately 100 million bbl of oil and 32 billion ft^3 of gas. Remaining reserves for the Beta Field are estimated at 15 million bbl of oil and a little less than 5 billion ft^3 of gas.

The Monterey Formation. Below the Puente Formation is the Mohnian age equivalent of the Monterey Formation. It is a sand and shale sequence of middle Miocene age. Evaluations of the Monterey Formation in the Beta area for potential development have not obtained positive results.

3.2.4.2 Potential for Application of WST

The total volume of undiscovered, technically recoverable resources in the offshore Inner Borderland province (including the Los Angeles Basin, the Santa Monica Basin, and the San Pedro Shelf and Basin) is estimated to be 0.89 Bbbl of oil and 1.03 Tcf of associated gas (BOEM 2014; Long et al. 2015). Most of these resources are expected to be found in highly permeable sandstone reservoirs (BOEM 2014). The development of these resources, therefore, would not require the application of WST. Although low-permeability reservoirs occur offshore, it is unlikely that large-scale program involving hydraulic fracturing technology would be employed because of logistical issues (Long et al. 2015).

3.2.5 Seismicity

The ridges and basins of the California Continental Borderland are bounded by several major active faults that are capable of producing damaging earthquakes (and tsunamis) in close proximity to metropolitan areas of southern California (Given et al. 2015). Figure 3-9 shows the Quaternary faults[4] of the onshore and offshore California borderland. The major, best-known fault in the region is the San Andreas Fault.

Earthquake activity in the region is monitored by the Southern California Seismic Network (SCSN), an automated seismic network managed by the U.S. Geological Survey (USGS) in cooperation with the California Institute of Technology. Figure 3-10 is a seismicity map of the offshore California borderland showing earthquake events between 1932 and

[4] Quaternary faults are faults that have been observed at the surface and for which there is evidence of movement in the past 1.6 million years, the duration of the Quaternary Period.

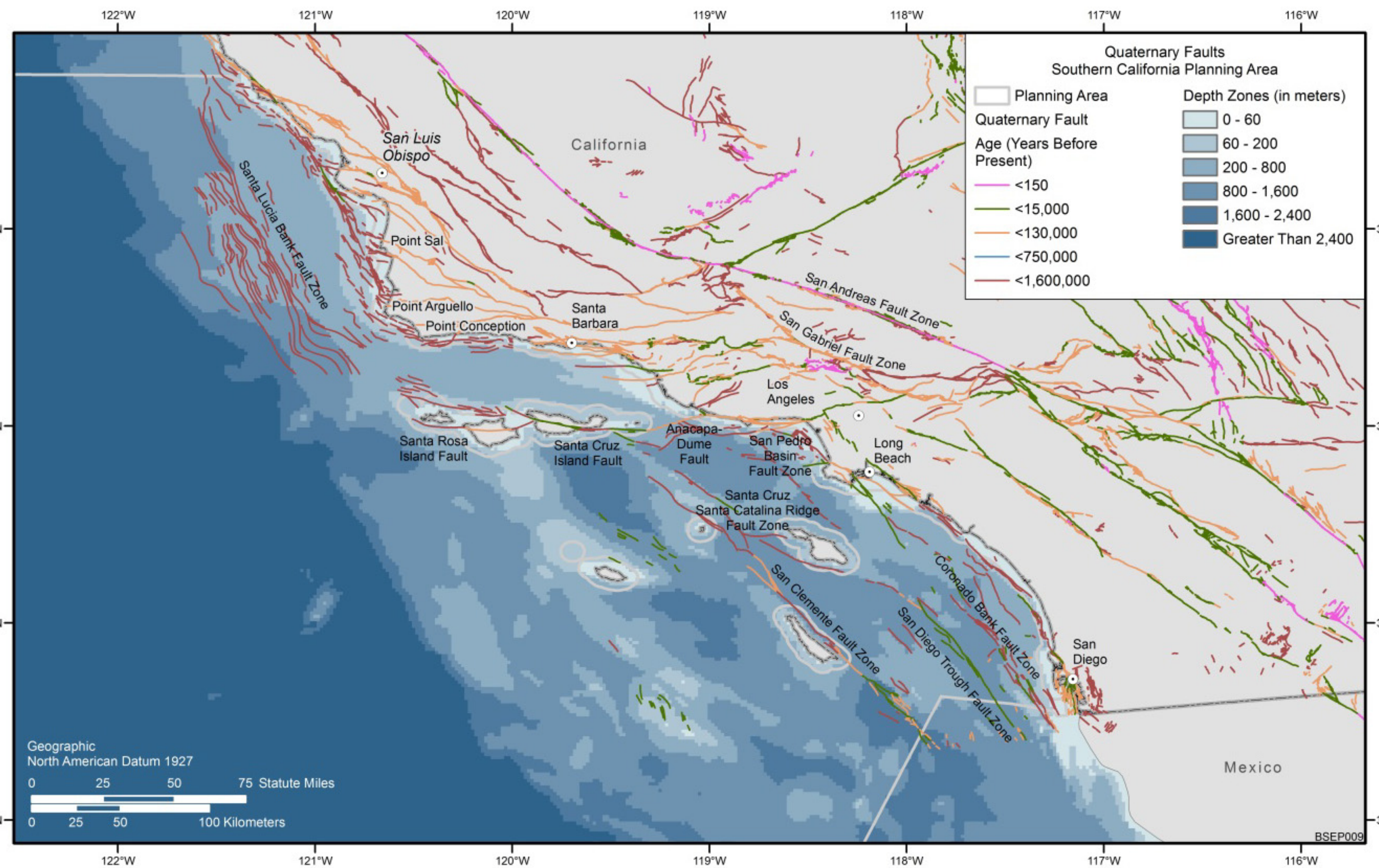

FIGURE 3-9 Quaternary Faults in the California Borderland Region (Data source: USGS 2015a)

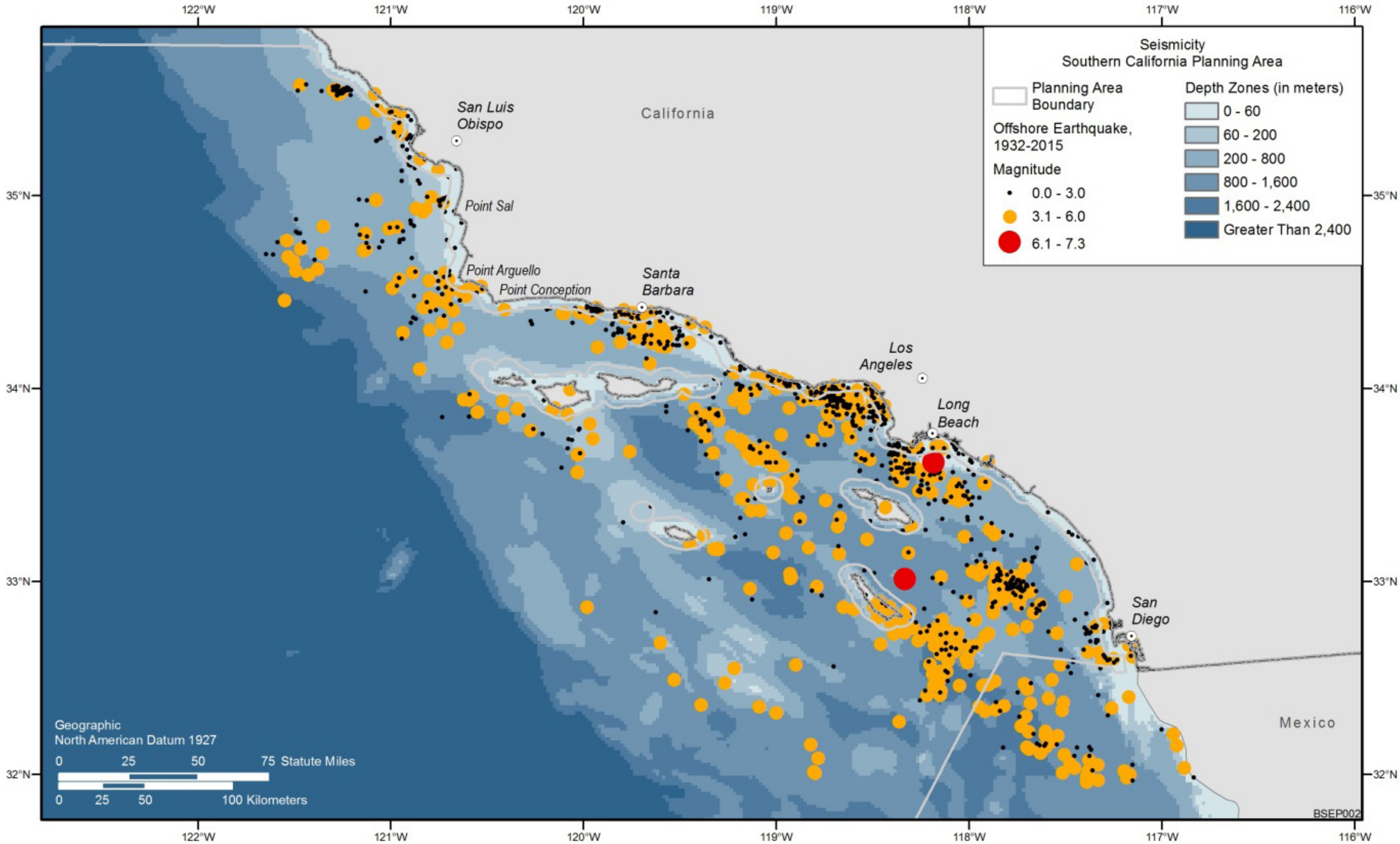

FIGURE 3-10 Seismicity of the Offshore California Borderland Region (Data source: USGS 2015c)

May 2015 in three magnitude (moment magnitude or Richter scale) categories: (1) 0 to 3; (2) 3.1 to 6.0; and (3) 6.1 to 7.3. Most of the earthquakes are of relatively small magnitude, in the 0 to 3 range. However, several significant earthquakes (Richter magnitude of 6 or greater or Modified Mercali intensity scale VIII or greater) have occurred in historic times on the San Pedro Shelf just offshore of Long Beach, to the southeast of the Santa Barbara Channel. The last significant onshore earthquake in the Santa Barbara and Ventura county area occurred in 1857. This quake, known as the "Fort Tejon" quake, has been estimated to have had a magnitude at 7.9 on the Richter scale (USGS 2015b). The earthquake epicenters shown on Figure 3-10 generally follow a northwest–southeast trend because they occur along the many transform faults in the offshore and nearshore areas.

3.3 AIR QUALITY AND METEOROLOGY

Meteorological conditions, as well as current air quality conditions, are important in evaluating the potential effects of air emissions that may occur under the proposed action. In addition, there are a number of Federal and State air quality regulations and requirements that target air quality. This section describes the meteorological conditions and air quality for the four coastal counties in southern California (Santa Barbara, Ventura, Los Angeles, and Orange Counties) that border the project area for the proposed action, and the regulatory arena that would apply to the proposed action. Note that Orange County, which has no offshore facilities, is included in this analysis, because the County may be affected by OCS activities due to its downwind proximity.

3.3.1 Meteorology

Several climatic factors affect air quality on the POCS and adjacent shoreline areas encompassing the project area. The following subsections describe these factors.

3.3.1.1 Climate

A dominating factor in the weather of California is the semi-permanent high-pressure area (so-called Pacific high) of the North Pacific Ocean, which plays an important role in seasonal climatic variations (WRCC 2015a). This pressure center moves northward in the summer, holding storm tracks well to the north, and as a result, California receives little or no precipitation from this source during that period. In the winter, the Pacific high retreats southward permitting storm centers to swing into and across California. These storms bring widespread, moderate precipitation to the State.

During the summer, the California Current of the Pacific Ocean moves southward along the California coastline bringing in cool waters of arctic origin. Extensive upwelling of colder sub-surface waters adds further cooling. Chilling of air from cool coastal water causes frequent occurrences of fog and low clouds. In addition, the cool California coastal waters hinder the development of tropical cyclones in the region.

Associated with the Pacific high, California generally experiences hot, dry summers and mild, wet winters. However, along the western side of the Coastal Range, including the project area, the climate is dominated by the Pacific Ocean, characterized by warm winters, cool summers, small daily and seasonal temperature ranges, and high relative humidity (WRCC 2015a). With increasing distance from the ocean, the maritime influence decreases.

Around the Channel Islands, the Catalina eddy can bring cooler weather, fog, and better air quality into Southern California by pushing the marine boundary layer further inland. It can stretch across up to 120 mi, last up to a few days, and is most common between April and October, peaking in June (NASA 2015). Several times per year during the non-summer season, a high pressure area centered on the Great Basin periodically produces strong and extremely dry downslope Santa Ana winds over southern California (WRCC 2015a).

3.3.1.2 Wind

California lies within the zone of prevailing westerlies, with winds primarily from the west or northwest during most of the year (WRCC 2015a; NCDC 2015a). On the open waters off southern California, the most frequent wind direction is from the west in the Santa Barbara and Santa Monica Basins, with average wind speeds ranging from 8 to 17 mph (NOAA 2015a). Wind patterns are altered depending on coastline orientation, due to local and diurnal sea/land breeze circulation. For example, southeasterly winds occur as often as westerly winds at Santa Barbara, and southerly winds as often as northwesterly winds at Long Beach. Wind speeds at land stations along the coastline range from 4 to 9 mph, which is lower than those at buoy stations with lower surface friction.

3.3.1.3 Temperature

Annual average temperatures off the southern California coast have historically ranged over 56–60°F (NOAA 2015a). Due to a moderating influence of the Pacific Ocean, monthly variations in ambient temperatures are relatively small (about 6–8°F). Minimum monthly temperatures occur in February through March, ranging from 53 to 56°F, while maximum monthly temperatures occur in either September or October, ranging from 59 to 65°F.

Inland locations along the coast typically experience ambient temperatures that are lower and more moderate than those located farther inland, but slightly higher than those offshore. Annual average temperatures range from 57 to 65°F (WRCC 2015b). December and January are the coldest months, with minimum temperatures ranging from 51 to 58°F, and August is the warmest month with average maximums ranging from 63 to 74°F.

3.3.1.4 Precipitation

Annual precipitation in the project area has averaged about 17 in., ranging 11–30 in. (WRCC 2015b). On average, about 35 days a year (ranging from 27 to 46 days a year) have measurable precipitation (0.01 in. [0.025 cm] or higher). California seldom receives precipitation from Pacific storms during the summer. About 60% of the annual precipitation occurs during the winter months when the Pacific high decreases in intensity and retreats southward (WRCC 2015a). The presence of the coastal mountains contributes to rainfall in the project area. There has been negligible measurable snowfall in the area that has been recorded.

3.3.1.5 Atmospheric Stability

Atmospheric stability plays an important role in dispersing gases or particulates emitted into the atmosphere. Vertical motion and pollution dispersion are enhanced in an unstable atmosphere and are suppressed in a stable atmosphere. For southern California coastal areas, unstable conditions occur about 20% of the time, while neutral and stable conditions each occur about 40% of the time (Doty et al. 1976). In the project area, the atmosphere over the water area tends to be neutral to slightly unstable.

3.3.1.6 Mixing Height

Mixing height provides a measure of the height in the lower atmosphere through which atmospheric pollutants are dispersed. The mixing height depends on the heat flux (rate of warming of the surface layer) and wind speed. Due to steady moderating influences of the Pacific Ocean, diurnal and seasonal variations in mixing heights over water and at coastal stations in the project area are relatively small, compared to those at inland locations.

Over the water, the air-sea temperature differences change slowly with time; thus, the mixing heights are relatively constant and low, with a typical marine mixing height of about 1,640 ft over low latitude oceans (LeMone 1978). In contrast, overland there is considerable diurnal variation, with low mixing heights at night and high mixing heights associated with daytime heating. Mixing heights along the coasts of the four counties adjacent to the project area typically range between 1,640 and 3,280 ft, with annual average morning and afternoon mixing heights of 1,800 and 2,790 ft, respectively (Holzworth 1972).

3.3.1.7 Severe Weather

Severe weather events have been reported in the National Climatic Data Center (NCDC) *Storm Events Database* (NCDC 2015b) for the four coastal counties adjacent to the project area. High or thunderstorm winds, floods, wintery weather, high surf, and wildfires are frequently reported but tornadoes, hail, and tropical storms are reported only on occasion. Except for wildfires and tropical storms, these events occurred in any month of the year but occurred more frequently in colder months, when the Pacific high decreases in intensity and migrates to the south.

Hurricanes and tropical storms formed off the coast of Central America and Mexico dissipate and rarely hit California due to the cold-water current off the California coast, which weakens storms from the south. In addition, the general trend in hurricane motion is to the west-northwest due to the prevailing winds (NOAA 2015b) which takes hurricanes away from the California coast. Historically, only four tropical depressions passed within a 100-mi radius of the project area and no hurricanes or tropical storms have hit north of central California.

3.3.2 Air Quality

3.3.2.1 Ambient Air Quality Standards

Under the Clean Air Act (CAA), the U.S. Environmental Protection Agency (EPA) has established the National Ambient Air Quality Standards (NAAQS) for pollutants considered harmful to public health and the environment (40 CFR 50). The EPA has set NAAQS for six principal pollutants (known as "criteria" pollutants): ozone (O_3), particulate matter (PM) with an aerodynamic diameter of 10 microns (μm) or less and 2.5 μm or less (PM_{10} and $PM_{2.5}$, respectively), carbon monoxide (CO), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), and lead (Pb) (EPA 2015a). Collectively, the levels of these criteria pollutants are indicators of the overall quality of the ambient air.

The CAA established two types of NAAQS: primary standards (also referred to as "health effects standards") to provide public health protection, including protecting the health of sensitive populations such as asthmatics, children, and the elderly; and secondary standards (referred to as the "quality of life standards") to provide public welfare protection, including protection against decreased visibility and damage to animals, crops, vegetation, and buildings. Many of the NAAQS standards address both short- and long-term exposures (e.g., 1 hr, 8 hr, 24 hr, 30 day, and annual).

The Air Resources Board (ARB), the clean air agency of the State of California, has established separate ambient air quality standards (California Ambient Air Quality Standards, CAAQS) to protect human health, safety, and welfare (ARB 2015a). The CAAQS include the same six criteria pollutants as in the NAAQS, but in contrast with the NAAQS they also include standards for visibility reducing particles, sulfates, hydrogen sulfide, and vinyl chloride. In general, the CAAQS are more stringent than the NAAQS, except for 1-hr NO_2 and SO_2 standards that were established in 2010. Table 3-3 presents the current CAAQS and NAAQS.

3.3.2.2 Area Designations

The EPA assigns area designations based on how the air quality of an area compares to the NAAQS. Areas with air quality that is as good as or better than NAAQS are designated as "attainment areas" while areas in which air quality is worse than NAAQS are designated as "nonattainment areas." Areas that previously were nonattainment areas but where air quality has improved to meet the NAAQS are redesignated "maintenance areas," and any area that cannot be classified on the basis of available information as meeting or not meeting the NAAQS for any pollutant is defined as an "unclassified area." These area designations impose Federal regulations

1 **TABLE 3-3 California Ambient Air Quality Standards and National Ambient Air Quality**
2 **Standards**

			NAAQS[b]	
Pollutant	Averaging Time	CAAQS[a]	Primary[c]	Secondary[d]
Ozone (O_3)	1 hr	0.09 ppm (180 μg/m^3)	—[e]	—
	8 hr	0.070 ppm (137 μg/m^3)	0.070 ppm	Same as Primary Standard
Respirable particulate matter (PM_{10})	24 hr	50 μg/m^3	150 μg/m^3	Same as Primary Standard
	Annual	20 μg/m^3	—	—
Fine particulate matter ($PM_{2.5}$)	24 hr	—	35 μg/m^3	Same as Primary Standard
	Annual	12 μg/m^3	12 μg/m^3	15 μg/m^3
Carbon monoxide (CO)	1 hr	20 ppm (23 mg/m^3)	35 ppm	—
	8 hr	9.0 ppm (10 mg/m^3)	9 ppm	—
	8 hr (Lake Tahoe)	6 ppm (7 mg/m^3)	—	—
Nitrogen dioxide (NO_2)	1 hr	0.18 ppm (339 μg/m^3)	100 ppb	—
	Annual	0.030 ppm (57 μg/m^3)	53 ppb	Same as Primary Standard
Sulfur dioxide (SO_2)	1 hr	0.25 ppm (655 μg/m^3)	75 ppb	—
	3 hr	—	—	0.5 ppm
	24 hr	0.04 ppm (105 μg/m^3)	—	—
Lead (Pb)	30 day	1.5 μg/m^3	—	—
	Rolling 3 month	—	0.15 μg/m^3	Same as Primary Standard
Visibility reducing particles	8 hr	See footnote f	—	—
Sulfates	24 hr	25 μg/m^3	—	—
Hydrogen sulfide	1 hr	0.03 ppm (42 μg/m^3)	—	—
Vinyl chloride	24 hr	0.01 ppm (26 μg/m^3)	—	—

[a] Detailed information on attainment determination criteria for CAAQS and reference method for monitoring is available in ARB (2015a).

[b] Detailed information on attainment determination criteria for NAAQS and reference method for monitoring is available in 40 CFR 50 and EPA (2015a).

[c] Primary standards provide public health protection, including protecting the health of "sensitive" populations such as asthmatics, children, and the elderly.

[d] Secondary standards provide public welfare protection, including protection against decreased visibility and damage to animals, crops, vegetation, and buildings.

[e] Not applicable.

[f] In 1989, the ARB converted both the general Statewide 10-mi visibility standard and the Lake Tahoe 30-mi visibility standard to instrumental equivalents, which are "extinction of 0.23 per kilometer" and "extinction of 0.07 per kilometer" for the Statewide and Lake Tahoe Air Basin standards, respectively.

Sources: ARB (2015a); EPA (2015a).

on pollutant emissions and a time period in which the area must again attain the standard, depending on the severity of the regional air quality problem. The ARB similarly designates areas, but on the basis of the CAAQS.

Based on the most recent available monitoring data, a summary of the attainment status for the six criteria pollutants in Santa Barbara, Ventura, Los Angeles, and Orange counties is presented in Table 3-4. All four counties are designated as either attainment or unclassified areas for all NAAQS criteria pollutants except Los Angeles and Orange Counties, which are nonattainment areas for both O_3 and $PM_{2.5}$. Ventura County is a nonattainment area for O_3, and part of Los Angeles County is a nonattainment area for lead. Based on the CAAQS, all four counties are designated as nonattainment areas for O_3 and PM_{10}, and Los Angeles and Orange Counties are nonattainment areas for $PM_{2.5}$ (ARB 2015b). All four counties are in attainment for other the CAAQS criteria pollutants.

3.3.2.3 Prevention of Significant Deterioration

The prevention of significant deterioration (PSD) regulations (see 40 CFR 52.21), which are designed to limit the growth of air pollution in attainment areas, apply to a major new source or modification of an existing major source within an attainment area or an unclassified area. While the NAAQS (and CAAQS) place upper limits on the levels of air pollution, PSD limits the total increase in ambient pollution levels above the established baseline levels for SO_2, NO_2, PM_{10}, and $PM_{2.5}$ to prevent "polluting up to the standard." The allowable increase is smallest in Class I areas, such as national parks (NPs) and wilderness areas (WAs). The rest of the country is subject to larger Class II increments. States can choose a less stringent set of Class III increments, although currently no State has done so.

TABLE 3-4 Summary of State and Federal Attainment Designation Status[a] for Criteria Pollutants in Santa Barbara, Ventura, Los Angeles, and Orange Counties

	O_3		PM_{10}		$PM_{2.5}$		CO		NO_2		SO_2		Pb	
County	State	Fed.	State	Fed.	State	Fed.	State	Fed.	State	Fed.	State	Fed.	State	Fed.
Santa Barbara	N	A/U	N	U	U	A/U	A	A/U	A	A/U	A	U	A	A/U
Ventura	N	N	N	U	A	A/U	A	A/U	A	A/U	A	A	A	A/U
Los Angeles	N	N	N	A/U	NP	NP	A	A/U	A	A/U	A	A/U	A	NP
Orange	N	N	N	A	N	N	A	A/U	A	A/U	A	A	A	A/U

[a] A = attainment; N = nonattainment; NP = nonattainment in part of the county; and U = unclassified. Nonattainment is highlighted in gray.

Sources: ARB (2015b); EPA (2015b).

Major (large) new and modified stationary sources must meet the requirements for the areas in which they are located and the areas they impact. For example, a source located in a Class II area in close proximity to a Class I area would need to meet the more stringent Class I increment in the Class I area and meet the Class II increment elsewhere, in addition to any other applicable requirements. Aside from capping increases in criteria pollutant concentrations below the levels set by the NAAQS, the PSD program mandates stringent control technology requirements for new and modified major sources. The CAA requires Federal land managers to evaluate whether the proposed project will have an adverse impact on air quality-related values in Class I areas, including visibility. As a matter of policy, the EPA recommends that permitting authorities notify Federal land managers when a proposed PSD source would locate within 62 mi (100 km) of a sensitive Class I area. There are several Federal Class I areas in California within 62 mi of the project area, including the San Rafael Wilderness Area, the San Gabriel Wilderness Area, and the Cucamonga Wilderness Area.

3.3.2.4 Air Emissions

The estimated annual-average emissions of criteria pollutants and reactive organic gases (ROG) in each of the four coastal counties along the project area are presented in Table 3-5 (ARB 2015c).

The total emissions for Los Angeles County, the most populous county in California, account for about two-thirds of the total annual emissions of all criteria pollutants and ROG (which play a major role in the creation of photochemical oxidants in the atmosphere) for the four counties, except for SO_X. About half of the four-county total for SO_X comes from Los Angeles County. Orange County accounts for about 15–21% of the four-county total for all pollutants, except that it only accounts for about 5% of SO_X. Santa Barbara and Ventura Counties are similar, accounting for no more than 15% for any of the criteria pollutants and ROG, except for SO_X. Santa Barbara County accounts for about 40% of the four-county total of SO_X (Table 3-5). The high annual average SO_X emissions in Santa Barbara County are associated with the large number of ocean-going vessels burning fuel oil with a high sulfur content visiting its ports.

Emissions from on-road motor vehicles and other mobile sources (including off-road equipment and vehicles, aircraft, train, boats and vessels) are the largest and second-largest contributors, respectively, to four-county total emissions of ROG, CO, and NO_X. Emissions from miscellaneous processes (including residential fuel combustion, cooking, construction/demolition, road and wind-blown dusts, etc.) and on-road motor vehicles are the largest and second-largest contributors, respectively, to both PM_{10} and $PM_{2.5}$. Other mobile sources account for about 60% of the SO_X emissions' total, followed by fuel combustion (about 22%). On-road motor vehicles and solvent evaporation are the largest and second-largest contributors, respectively, to total ROG emissions.

TABLE 3-5 2012 Estimated Annual-Average Emissions of Criteria Pollutants and Reactive Organic Gases, by County and by Source Category (tons per day)

	ROG	CO	NO_x	SO_x	PM_{10}	$PM_{2.5}$
By county						
Santa Barbara	29.40	123.46	83.35	13.15	15.38	5.84
Ventura	33.94	144.09	47.20	1.83	16.56	6.00
Los Angeles	287.33	1,406.56	355.07	16.22	101.29	44.64
Orange	93.69	446.31	84.39	1.67	24.29	11.25
Four county total	**444.36**	**2,120.42**	**570.01**	**32.87**	**157.52**	**67.73**
By source category						
Fuel Combustion	8.59	51.83	49.01	7.12	6.33	5.41
Waste Disposal	5.35	1.30	2.07	0.52	0.39	0.23
Cleaning & Surface Coatings	40.98	0.35	0.13	0.01	1.89	1.82
Petroleum Production & Marketing	42.37	4.91	1.51	2.26	1.67	1.44
Industrial Processes	8.17	1.37	0.58	0.75	16.73	5.72
Solvent Evaporation	103.90	0.00	0.00	0.00	0.01	0.01
Miscellaneous Processes	13.53	83.78	19.94	0.71	94.29	29.61
On-road Motor Vehicles	120.46	1,242.34	265.67	1.79	23.96	12.39
Other Mobile Sources	101.01	734.54	231.10	19.71	12.25	11.10
Four county total	**444.36**	**2,120.42**	**570.01**	**32.87**	**157.52**	**67.73**

Source: ARB (2015c).

Natural emission sources include biogenic emissions from plants and trees, geogenic emissions from marine seeps on the continental shelf, wildfires, and windblown dust. In Santa Barbara and Ventura Counties, natural emissions are comparable to or higher than man-made emissions for ROG or PM (ARB 2015c). Emissions of ROG from marine seeps can be a significant source of ROG, which is a precursor to smog-forming ozone (Hornafius et al. 1999). In contrast to ubiquitous biogenic or wildfire emissions, geogenic emissions in this region are largely limited to Santa Barbara and Ventura Counties, where they are as much as 60% and 11%, respectively, of average annual man-made ROG emissions totals for these counties.

In general, greenhouse gas (GHG) emissions data are not available at the county level. In California, the total Statewide gross[5] GHG emissions in 2012 (the most recent information available) were estimated to be about 459 million metric tons (MMT) carbon dioxide equivalent (CO_2e)[6] (ARB 2015d), which was about 7.0% of the total GHG emissions in 2012 for the United States (EPA 2015c). About 85% of the California total GHG emissions are CO_2, followed by

[5] Excluding GHG emissions removed due to forestry and other land uses.

[6] A measure to compare the emissions from various GHGs on the basis of the global warming potential (GWP), defined as the ratio of heat trapped by one unit mass of the GHG to that of one unit mass of CO_2 over a specific time period. For example, GWP is 21 for CH_4, 310 for N_2O, and 23,900 for SF_6. Accordingly, CO_{2e} emissions are estimated by multiplying the mass of a gas by the GWP.

CH_4 (8%), high-global warming potential GHG[7] (4%), and N_2O (3%). By sector, transportation is the single largest source of GHG emissions (about 37%) in California, followed by industrial sources (22%) and electricity production (21%).

3.3.2.5 Regulatory Controls on OCS Activities That Affect Air Quality

The EPA has authority for Clean Air Act (CAA) compliance of air quality on the POCS as granted under Section 328 of the 1990 CAA Amendments (CAAA). On September 4, 1992, the EPA Administrator promulgated requirements (40 CFR Part 55) to control air pollution from POCS sources to attain and maintain Federal and State air quality standards and to comply with CAAA provisions for the Prevention of Significant Deterioration.

EPA delegated control of offshore facilities to the local air districts under their individual regulatory programs as if the facility were located onshore. Within this planning area, oil and gas platforms in the project area are assigned to air districts of the corresponding onshore area (COA). The 15 structures offshore of Santa Barbara County are assigned to the Santa Barbara County Air Pollution Control District (SBCAPCD). The four structures offshore of Ventura County are assigned to the Ventura County Air Pollution Control District (VCAPCD). The remaining four structures offshore Long Beach, near the boundary of Los Angeles County and Orange County, are assigned to the South Coast Air Quality Management District (SCAQMD).

Congress established a program under Title V of the 1990 CAAA to help find a solution to reduce air pollution. A Title V Operating Permit, which applies to stationary sources with air emissions over major source thresholds of air emissions (e.g., 100 tons per year), consolidates all applicable air quality regulatory requirements into a single, legally enforceable document. These permits are designed to improve compliance by clarifying what air quality regulations apply to a facility. Currently, 18 platforms on Federal waters have Title V Operating Permits, and five platforms, including Habitat off Santa Barbara County and four platforms off Long Beach (Edith, Ellen, Elly, and Eureka), have local (non-Title V) permits.

SBCAPCD, VCAPCD, and SCAQMD regulate emissions from offshore platforms, with Permits to Operate that define permitted emissions from specified equipment and service vessels. Primary air emissions from WSTs include engine exhaust from diesel frack engines and VOCs from flowback water. Diesel particulate matter (DPM) has been designated a carcinogen in the State of California. Frack engines are currently regulated by the ARB "Airborne Toxic Control Measure (ATCM) for Diesel Particulate Matter from Portable Engines Rated at 50 Horsepower and Greater" (17 *California Code of Regulations* [CCR] § 93116). In addition, VCAPCD regulations prohibit open sumps, pits, and ponds. In Ventura County, all crude oil and produced water must be contained in closed-top tanks equipped with vapor recovery. Thus, no new permit or modification to an existing permit related to WST use is required because regulations for WST activities are already in place (Zozula 2015).

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[7] Fluorinated GHGs, including sulfur hexafluoride (SF_6), nitrogen trifluoride (NF_3), perfluorocarbons (PFCs), and hydrofluorocarbons (HFCs).

3.4 WATER QUALITY

The project area for the proposed action occurs within the Southern California Bight (SCB), which encompasses marine waters from Point Conception at the northwest end of the Santa Barbara Channel to a point just south of the U.S.–Mexico border (see Figure 3-1). This section describes the water quality and pollution sources in the project area, the 43 lease areas where WST activities may be carried out, and the water quality–related regulatory framework and requirements that would apply to the proposed action.

3.4.1 Regulatory Framework

Water resources in the United States are protected under the Federal Water Pollution Control Act of 1972, which was reauthorized as the Clean Water Act (CWA) in 1977, 1981, 1987, and 2000 (MMS 2005). Under Section 402 of the CWA, the U.S. 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 United States, the territorial sea, contiguous zone, and ocean. Implementation of the NPDES has resulted in greatly reduced pollution discharges into U.S. waters, including the study area. Discharges are regulated to maintain levels that will not cause exceedance of water quality criteria established under the CWA (EPA 1976) as updated in 2003 (FR 68, No. 250, 75507–75515), based on revised EPA guidance (EPA 2002).

Discharges from offshore O&G exploration, development, and production facilities in Federal waters off the southern California coast are currently regulated under NPDES General Permit No. CAG 280000 issued by EPA Region 9, effective on March 1, 2014, and expiring on February 28, 2019 (EPA 2013a). The EPA uses General Permits to streamline the permitting process for facilities that are anticipated to discharge within the limits of the permit and thereby would not significantly affect marine environments.

The General Permit issued by EPA regulates 22 identified discharges from O&G facilities, including those of well treatment, completion, and workover fluids, and covers effluents that are relevant to this PEA. The General Permit sets forth effluent limitations and monitoring and reporting requirements, including pollutant monitoring and toxicity testing of effluents. The point of compliance for effluents is the edge of the mixing zone, which extends laterally 100 m in all directions from the discharge point and vertically from the ocean surface to the seabed. The permit covers all 23 platforms (22 production and one processing) on the POCS. The permit also covers exploration facilities discharging in the permit area.

A December 2012 draft General Permit was reviewed by EPA Region 9 and the California Coastal Commission (CCC) for consistency with the California Coastal Management Plan pursuant to the requirements of the Coastal Zone Management Act. In the final permit, EPA Region 9 renewed its commitment to independent monitoring with BSEE of discharges and to independently evaluate compliance with the limits specified in the General Permit (EPA 2013b).

The State of California regulates ocean discharges into State waters, which extend to 3 mi from the coast, via a comprehensive water pollution control plan first issued in 1972 known as the California Ocean Plan (California EPA 2012). This plan includes effluent limitations for 84 pollutants, which apply to any facility which discharges into State waters (Aspen Environmental Group 2005). Oil platforms in State waters, it should be noted, do not discharge into the ocean.

With respect to oil spill prevention and response planning, in 1991 Executive Order 12777, which implements provisions of the Oil Pollution Act of 1990, removed offshore facilities from jurisdiction under EPA and placed them under the jurisdiction of the Department of Interior, BSEE. Offshore operators are required to submit Oil Spill Response Plans to BSEE for review in accordance with 30 CFR 254 (EPA 2013b).

3.4.2 Physical Oceanography and Regional Water Quality

The circulation of the SCB is dominated by the Eastern Boundary Current of the North Pacific Gyre system, namely the California Current (Figure 3-11). The cold, low-salinity, highly oxygenated subarctic water brought in by the California Current, flowing toward the equator with an average speed of approximately 0.25 m/s, is joined by moderate, saline, central north Pacific water flowing into the bight from the west, and warm, highly saline, low-oxygen-content water entering the bight from the south via the California Counter-Current and the California Undercurrent. The top 200 m of these waters, with subarctic origins, is typically low in salinity and high in oxygen content, with temperatures between 9 and 18°C. Waters between 200 and 500 m in depth are high in salinity and low in dissolved oxygen, reflecting their equatorial Pacific origins; this water mass has temperatures between 5 and 9°C (MMS 2001).

South of San Diego, part of the California Current turns eastward into the SCB and then poleward, forming the California Counter-Current, where it joins the deeper, inshore, California Undercurrent, which is generally confined to within 100 km of the coast. Below 200 m, the California Undercurrent brings warm, saline, low-dissolved-oxygen equatorial waters poleward into the SCB. Within the Santa Barbara Channel, the California Undercurrent shows considerable seasonal variability. At its weakest in winter and early spring, the California Undercurrent is found below 200 m depth; surface flow is typically equatorward. From late summer to early winter, poleward core flow increases and ascends to shallower depths, occasionally reaching the surface, where it joins from the inshore Countercurrent.

Winds blowing predominantly toward the southeast off the entire coast of California during the late spring to early fall move surface waters offshore. This gives rise to upwelling of cold, nutrient-rich, bottom water at the coast that, in turn, moves this water mass offshore in a continual cycle (MMS 2001).

Water quality in the SCB is generally good, particularly in the Santa Maria Basin area, and points north due to low population and lack of major industry. The Santa Barbara channel region, which extends from Point Conception to Point Fermin and includes most of the OCS oil platforms, has larger influxes of pollutants from municipal sewage treatment discharges, power

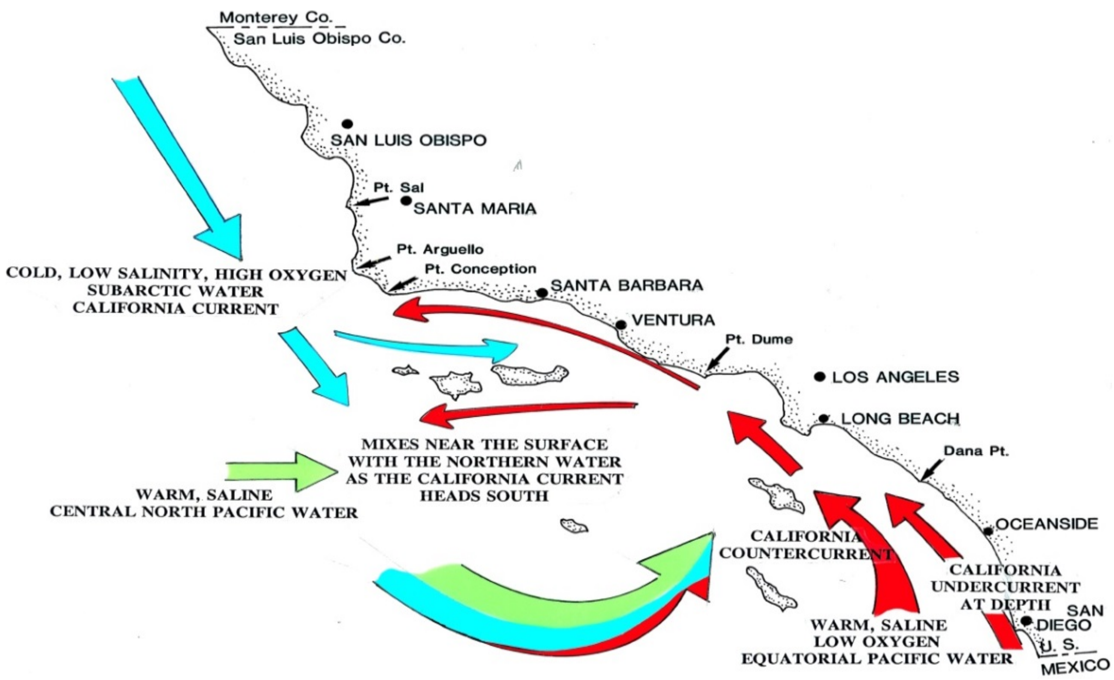

FIGURE 3-11 Characteristic Oceanic Circulation in, and Sources of Water of, the Southern California Bight (MMS 2001)

plant cooling water discharges, and industrial waste sources than points further to the north. A 1994 comprehensive regional monitoring survey conducted by the SCB Pilot Project, however, found water quality to be good throughout the SCB (MMS 2001). A more recent water quality survey with the objective of determining whether anthropogenic nutrient sources were influencing algal blooms in the SCB found that at a bight-wide scale, natural nutrient sources made a much larger contribution of nutrients than anthropogenic sources. However, at smaller spatial scales, anthropogenic and natural nitrogen sources were found to be comparable within orders of magnitude. Moreover, because the coastal waters in the SCB are generally nitrogen limited, any nitrogen inputs would be likely have an impact on biological productivity (Howard et al. 2012).

Since the introduction of the NPDES program, the SCB has seen great reductions in pollutants, including 50% for suspended solids, 90% of combined trace metals, and more than 99% for chlorinated hydrocarbons. Measurements of sediments, fish, and marine mammals all show decreasing contamination. This has occurred despite great increases in population and volumes of discharged wastewater (MMS 2001). This reduction was accomplished through source control, pretreatment of industrial wastes, reclamation and treatment plant upgrades (MMS 2001). There is no reason to expect that this trend would have been reversed in the ensuing years since this 2001 report given the ongoing implementation of the NPDES program.

Regulated point sources and unregulated nonpoint sources contribute to water pollution. Major sources of pollutants are agricultural runoff, which includes pesticides and fertilizer nutrients delivered to marine waters by local rivers and storm drains, publicly owned treatment works (POTW) outfalls, chlorinated power plant cooling water, and atmospheric fallout from metropolitan areas (MMS 2001, 2005; Kaplan et al. 2010; Lyon and Stein 2010). Among these, POTWs represent the largest point source contributors to the SCB. Other important regional inputs include chemicals from harbors, dumping activities, dredging, vessel traffic, military activities, and industrial activities including oil production (Kaplan et al. 2010).

Offshore O&G operations are smaller contributors of pollution, but contribute relatively higher amounts of hydrocarbon pollutants than do the other anthropogenic sources mentioned (Lyon and Stein 2010). The largest contributors of hydrocarbons to offshore waters are the naturally occurring seeps within the Santa Barbara Channel. These seeps often produce localized, visible sheens on the water and lead to the production of tar balls commonly found on beaches after weathering and oxidation of oil (Hostettler et al. 2004; Farwell et al. 2009).

Although overall water quality has improved in recent decades as a benefit of the NPDES program, the frequency of algal blooms, particularly harmful algal blooms, has increased in the area. Algal blooms are primarily attributed to natural nutrient upwelling (Kaplan et al. 2010); however, nutrient pollution from agriculture population growth may play a contributing role on the sub-regional scale from riverine sources and effluents (Howard et al. 2012). Blooms of *Pseudo-nitzschia*, several species of diatoms that produce the neurotoxin domoic acid, are becoming more common and have been attributed to numerous strandings of marine mammals in the study area.

Beach closings due to fecal coliform outbreaks have also become more frequent in recent years, and are attributable to pollutants brought to coastal waters from stormwater runoff (MMS 2005). Oil spills from offshore O&G operations and associated onshore pipelines have occasionally polluted coastal waters.

3.4.2.1 Discharge Sources from Offshore Oil and Gas Activities

Offshore discharges from past and present O&G operations (in both State and Federal waters) include cooling water, produced water, sanitary waste, fire control system test water, well completion fluids, and miscellaneous other liquids. Of these, produced water represents by far the greatest discharge of petroleum-related chemical constituents. Well completion and treatment fluids represent the second largest (but relatively minor) source of chemical discharges to POCS waters.

Drilling Wastes. Steinberger et al. (2004) reviewed NPDES discharge monitoring reports for the platforms currently operating in POCS waters to quantify discharges to the SCB in 1996 and 2000. For drilling operations, oil platforms were reported to have discharged 12,128 and 2,955 metric tons (mt) of mostly drill cuttings to the SCB in 1996 and 2000, respectively. Over four times more solids were discharged from platforms in 1996 than in 2000 (12,000 mt vs. 3,000 mt), while discharges of drilling muds were five times greater in 1996 than in 2000 (55 mt vs. 11 mt). These declines in the amounts of solid and drilling muds discharged are the consequence of the number of wells drilled in the respective years. In 1996, 31 new wells were drilled (spudded) at offshore oil platforms in the POCS, while in 2000, only 13 new wells were spudded.

Total drilling discharges in 2005 included 7 million liters (L) of drilling fluids and 2,313 mt of cuttings; these amounts were lower than levels reported in 1996 (Steinberger et al. 2004; Lyon and Stein 2010). Current discharges would be expected to be similar to or lower than these levels, given current reduced levels of drilling and production. Almost all monitoring results for 2005 drilling discharges were in compliance with permit requirements, including all cadmium and mercury concentrations in discharged drilling fluids. All measures of discharges from Platform Hidalgo were in compliance in 2005, while three other drilling platforms had single drilling-related exceedances. Platforms Gail and Hogan each had one drilling fluids toxicity test exceedance, and Platform Heritage had one static sheen test exceedance, indicating the presence of oil in the drill cuttings.

Produced Water. Produced water is water that is brought to the surface from an oil-bearing formation during oil and gas extraction. Generally, the amount of produced water is low when production begins, but increases over time near the end of the field life. Produced water is a mixture (an emulsion) of oil, natural gas, and formation water (water naturally occurring in a formation), as well as any specialty chemicals that may have been added to the well for process purposes (e.g., biocides and corrosion inhibitors). Produced water total volume from all POCS platforms was 9.4 billion L in 2005. Total permitted platform discharges were 60 billion L, the vast majority of which was cooling water (59.5 billion L) (Lyon and Stein 2010). Annual average total produced water discharge for 2012 through 2014 was 5.2 billion L (Houseworth and Stringfellow 2015), indicating a substantial reduction from 2005. These values compare to 10.43 billion L total allowed under the NPDES permit. Constituent concentration for oil and grease, ammonia, copper, undissociated sulfides, and zinc were also generally, with a few exceptions, well below permitted levels for 2012–2014 (Houseworth and Stringfellow 2015). Production data for 2014 provided on the BSEE website for the POCS[8] indicate that 126,000,000 bbl (20 billion L) of water were produced from 400 wells for an average of 310,000 bbl (49 million L) of water produced per well. Oil production in 2014 of 18,480,000 bbl gives an average ratio of 6.8 bbl of water produced per 1 bbl of oil. Of the 126,000,000 bbl of water produced, 73,000 bbl, or 58%, of the produced water was reinjected into the formation through 133 separate injection wells. The remaining 53,000,000 bbl (8.4 billion L) was either discharged to the ocean or injected into onshore injection wells.

Produced water is primarily reinjected into producing formations at Platforms Irene, Ellen, Eureka, and Gail. Platform Elly, a processing-only platform, sends all produced water to platforms Ellen and Eureka. All remaining platforms discharge produced water into the ocean either directly or via another platform (Houseworth and Stringfellow 2015). All 23 platforms (whether processing or producing) are addressed under the NPDES General Permit for ocean discharges (EPA 2013a).

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8 See https://www.data.bsee.gov/homepg/data_center/production/PacificFreeProd.asp.

Produced water is typically the largest volume waste stream associated with O&G exploration and production, can exceed 10 times the volume of oil produced over the lifespan of a well, and may account for as much as 98% of extracted fluids during the later stages of production. In offshore operations, the produced water emulsion is first sent to a tank on the oil platform to separate the dissolved natural gas, which is typically used for fuel on the platform. The remaining produced water emulsion is then treated further, either on the platform or onshore, to separate the oil from the remaining water and other impurities.

Following separation of the oil from the produced water, constituents in the remaining produced water may include trace metals and dissolved hydrocarbons, including benzene, toluene, ethylbenzene, and xylene (collectively termed BTEX). Dissolved metals may include arsenic, barium, chromium, cadmium, copper, zinc, mercury, lead, and nickel. Inorganic constituents may include cyanides and sulfides (Kaplan et al. 2010). Table 3-6 lists "end of the pipe" concentrations of chemical constituents measured in produced water samples from 15 platforms discharging to the POCS, representing several years of sampling as reported in Discharge Monitoring Reports (MRS 2005). Most produced water is brine, with total dissolved solids too high for human consumption or for agricultural use.

Produced water is treated to make it suitable for discharge under the NPDES permit or for reinjection. Treatment methods include the use of heat, corrugated plate coalescers, electrostatic precipitation, bubbling, and chemical treatment. The NPDES General Permit calls for a mixing zone of 100 m radius from the point of discharge. Calculated concentrations of the constituents at the edge of the mixing zone, after accounting for dilution, must meet the permit limits. All ocean discharges must meet the NPDES discharge limits, and are tracked through quarterly Discharge Monitoring Reports required by the NPDES permits (Kaplan et al. 2010).

A 2003 study of produced water discharge plumes from platforms Hogan, Harvest, Habitat, and Gina used rotamine dye to trace discharge plumes from the platforms and measure the effects of platform discharges on water quality in the immediate vicinity of the platforms (Applied Ocean Science 2004). Due to dilution, there were no differences in salinity, temperature, or turbidity between background locations and locations within 25–50 m of platforms. The study also reported no measurable impact on temperature, salinity, density, and turbidity of the receiving waters within the zone of initial dilution (i.e., within 100 m). Tracer dye was detectable out to distances of 0.4 to 1.5 km from the platforms.

Producing platforms that do not discharge produced water either transfer water to other platforms or to an onshore facility for treatment. Water treated on a platform may be discharged to the ocean or injected into an offshore subsurface reservoir. Water separated at an onshore facility can be disposed of onshore through injection to a subsurface reservoir, or be sent back to the offshore platform for disposal via injection or discharge to the ocean.

Other Production and Non-Production Effluents. Besides produced water, platform operations produce a variety of other liquid wastes. For example, in 1996 and 2000, the 23 platforms in Federal waters in the SCB discharged roughly 56 billion and 48 billion L of (non-drilling) liquid effluent, respectively (Steinberger et al. 2004). Almost 90% of this

TABLE 3-6 Concentrations (ug/L) of Chemical Constituents in Produced Water Samples from Platforms on the POCS

Class	Chemical	No. of Samples	No. of Detects (%)	Median Concentration[a]	95th Percentile Concentration[b]
Phenol	Phenol	405	269 (66%)	9.7	313
Phenol	2,4-Dimethylphenol	136	70 (51%)	25.1	2341
PAH	High-MW PAHs[c]	449	13 (3%)	0.10	3.2
PAH	Naphthalene	146	78 (53%)	10.5	97
Metal	Arsenic	425	28 (7%)	0.975	14.5
Metal	Cadmium	425	29 (7%)	0.091	1.13
Metal	Chromium	421	114 (27%)	0.68	13.6
Metal	Copper	429	106 (25%)	1.25	21.4
Metal	Lead	425	44 (10%)	0.463	7.6
Metal	Mercury	4210	24 (6%)	0.0058	0.0687
Metal	Nickel	419	72 (17%)	2.47	49.2
Metal	Selenium	180	6 (3%)	0.51	4.5
Metal	Silver	412	43 (10%)	0.25	6.7
Metal	Zinc	419	165 (39%)	5.9	168
BTEX	Benzene	233	193 (83%)	93.5	1,346
BTEX	Ethylbenzene	198	152 (77%)	23	271
BTEX	Toluene	199	150 (75%)	127	1,586
	Cyanide	388	27 (7%)	1.3	6.4
	Ammonia (w/o Harmony)	187	136 (73%)	9,405	85,486
	Ammonia (Harmony)	47	47 (100%)	85,831	335,277
	Undissociated Sulfide	99	82 (83%)	653	5,684

[a] The median concentration is that concentration that half of the samples exceed and the other half are below.

[b] The 95th percentile concentration is the concentration below which 95% of all the measured concentrations fall.

[c] PAHs with high molecular weights.

Source: MRS (2005).

discharge in each year was seawater used for various purposes on the platforms (i.e., cooling water, fire control system water), which was then discharged back to the ocean in accordance with NPDES permit requirements; only 10–12% was produced water. In 2005, discharges from the 23 oil platforms in the POCS totaled 60 billion L, of which 16% was produced water (Lyon and Stein 2010). Operational discharges accounted for the remaining volume, 99% of which was cooling water. Fire control system water, sanitary and domestic wastes, deck drainage, and minor discharges contributed the remaining 1% of this volume.

Discharges from platforms have been reported to be relatively minor compared to effluents from large and small POTWs, with respect to both effluent volume and constituent mass. In addition, oil seeps may contribute almost 10 times more hydrocarbons to coastal waters than produced water discharges, while the transportation sector contributes about twice as much hydrocarbon pollution to the coastal ocean than does offshore oil and gas production

(Steinberger et al. 2004). Hydrocarbon pollution from combustion sources, including the transportation sector, enters the ocean primarily in stormwater runoff during the rainy season after atmospheric deposition of particulate combustion products onto land surfaces. Stormwater discharges from rivers can sometimes create turbid plumes carrying chemical and bacterial contamination that can extend for several kilometers offshore (Kaplan et al. 2010).

Well Treatment, Workover, and Completion Fluids. Other platform discharges may include chemicals associated with well treatment, workover, and completion fluids (Kaplan et al. 2010). These chemicals can be classified into three categories:

- Production-treating chemicals: scale inhibitors, corrosion inhibitors, biocides, emulsion breakers, and water treating chemicals, including reverse emulsion breakers, coagulants, and flocculants;

- Gas-processing chemicals: hydrate inhibitors, dehydration chemicals, and occasionally H_2S removal chemicals; and

- Stimulation and workover chemicals: mineral acids, dense brines, and other additives.

After injection and use, WST fluids return to the platform at diluted concentrations as part of the produced water and crude oil streams. Oil, gas, and water are separated, and the component of WST fluids included in the produced water steam is treated and discharged along with those produced under the NPDES General Permit or reinjected into the formation (Houseworth and Stringfellow 2015). WST chemicals are used intermittently and in small volumes, and following treatment are highly diluted by the much higher volumes of produced water before discharge. Such dilution often reduces final concentrations in discharge samples to levels that are difficult to measure (Kaplan et al. 2010). Accidental releases of well stimulation fluids have not been reported in spill data available through 2011 (Houseworth and Stringfellow 2015).

Hydrogen Sulfide. Hydrogen sulfide (H_2S), a toxic gas, may be produced along with oil and gas. H_2S is not an approved EPA waste that can be discharged. On some platforms, it is captured and separated via several different waste separation systems (e.g., amine or Sulfurox). The resulting waste is then taken to shore for disposal. H_2S is strictly monitored as an air pollutant due to its toxicity to humans.

Shell Mounds. Large mounds of mussel shells were found at the base of removed oil platforms in 1996, when Chevron removed oil platforms Heidi, Hilda, Hazel, and Hope in State waters near Summerland and Carpinteria. The mounds, which are approximately 200 ft wide and 20 to 30 ft tall, had accumulated as a result of periodic scrapings of the former platform legs (Kaplan et al. 2010). Cores taken from shell mound cores contained elevated concentrations of metals associated with drilling wastes (e.g., barium, chromium, lead, and zinc), and alkylated benzenes and PAH (Kaplan et al. 2010). A more recent study measured PAH in water near shell mounds associated with Platforms A and B on the POCS (Bemis et al. 2014) and detected very low levels of PAH in the parts per trillion range. Chemical characterization of the PAHs in the water samples indicated a predominance of unweathered crude, suggesting nearby petroleum seeps as the likely source of the PAH and a low likelihood of a significant contribution from shell mounds, which would appear as weathered crude because of how long the shell mounds had been on the sea floor. The study further found that PAH concentrations were more than an order of magnitude below California water quality objectives for the protection of marine biota and human health.

3.4.2.2 Other Discharge Sources

Publically Owned Treatment Works (POTWs). Treated municipal wastes from POTWs, along with regulated industrial discharges, are large contributors to hydrocarbon and metal loads in the SCB (MMS 2005). Lyon and Stein (2010) compared 2005 discharges of produced water from POCS oil platforms to POTW effluents, and reported that produced water from oil platforms accounted for only 0.5% of the combined effluent volume from both sources. General constituent and metals loads from oil platforms, likewise, were insignificant compared to discharges from POTWs. However, discharges of petroleum hydrocarbons, including benzene, toluene, ethylbenzene, and PAHs, were greater from produced water than from POTWs. Comparing the spatial distribution of the POCS platforms and POTWs of the area, of the 13 platforms that discharge produced water, three are located outside the SCB, nine are located in the northern SCB between Point Conception and Point Dume, and only one is located in the southern SCB between Point Dume and the U.S.–Mexico border (Lyon and Stein 2010). In contrast, 17 of the 23 POTWs in the region are concentrated in the southern SCB between Point Dume and the U.S.–Mexico border, where they dominate discharges to the region. Constituent loads from platforms in the northern SCB, however, were relatively greater, ranging from 15% up to 100% of the combined platform and POTW loads of most metals, organics, oil/grease, and ammonia.

Shipping. Other minor sources of chemical releases to coastal waters related to shipping include lubricating and hydraulic fluids from ocean vessel machinery. Soaps and solvents used on oceangoing vessels are typically biodegradable and pose little threat to the marine environment. Impacts from discharges of petroleum-based solvents are thought to be small. Small releases of antifouling paint, interior paint, and exterior paint from vessels comprise a very small quantity and impacts are thought to be negligible based on volume. Discharges of kitchen and septic wastes potentially containing treatment chemicals, pathogens, and nutrients most likely represent negligible to minimal impacts on water quality of the POCS (Kaplan et al. 2010).

Ocean Seeps. Natural oil seeps present in the immediate study area contribute to petroleum loads in the ocean. Approximately 50 oil seeps have been identified off the shore of southern California between Point Arguello and Huntington Beach. At least 38 of these seeps are located in the Santa Barbara Channel; they release an estimated 40–670 bbl of crude per day to the channel, with the greatest releases near the Coal Point Seep (MMS 2005). The Coal Oil Point seep field is an approximately 18 km^2 area off the shore of Goleta, California, and emits 50–170 bbl of oil and 100–130 tons of natural gas per day (Hornafius et al. 1999). Farwell et al. (2009) characterize the seeped oil as roughly 30% hydrocarbons and 70% resins plus asphaltenes, and describe an associated 90 km^2 fallout plume on the near-west seafloor estimated to contain 3.1×10^{10} g (3.1×10^4 metric tons) of petroleum in the top 5 cm of sediments.

Gale et al. (2013) compared exposures of Pacific sanddab (a flatfish) to petroleum hydrocarbons from seven platforms (one of which is in State waters) and from natural seeps offshore Goleta, California, in the SCB. Platform sites were found to be no more polluted than the nearby natural areas, exhibiting only low concentrations of PAHs, polychlorinated biphenyls (PCBs), DDTs, and other contaminants.

Hostettler et al. (2004), in a study of tar balls commonly found along beaches of the SCB, concluded that tar balls are of natural and not anthropogenic origin, originating from source rock within the Monterey Formation via shallow offshore seeps. The authors found that the major occurrences were from offshore seepage near the west end of Santa Cruz Island.

Oil Spills. Oil spills have affected water quality of the SCB in the past, with the magnitude and duration of effects proportional to the amount of oil released. Spills of less than 50 bbl have generally minor and short-term impacts. Large spills affect large areas of coastline and can affect water quality for several months, while lingering effects can occur from leaching of oil from contaminated sediments. Thus, past effects have been dominated by a few large spills.

BOEM maintains a database of oil spills on the OCS (BOEM 2015). The database currently includes all Pacific and Gulf of Mexico OCS spills of greater than 1 bbl recorded from 1964 through 2010 and includes platform, pipeline, and vessel spills. Of the 2,833 total spills in the database, more than 91% (2,585) were less than 50 bbl (2,100 gal) in size. A total of six spills, each greater than 50 bbl and totaling 81,250 bbl, (3.4 million gal) were recorded between 1964 and 2011 on the POCS, in Federal waters (BOEM 2015). In addition, in June of 2012, approximately 36 bbl (1,512 gal) spilled from Platform Houchin into the surrounding waters (BSEE 2013).

The largest POCS spill in this period was the 1969 spill resulting from a well blowout at Platform A, which released an estimated 80,000 bbl of crude near Santa Barbara. This blowout most heavily impacted mainland beaches near Platform A and on Anacapa and Santa Cruz Islands (MMS 2005; Houseworth and Stringfellow 2015). A second, smaller 900 bbl spill occurred on the OCS from a pipeline near Platform B in December 1969 (Houseworth and Stringfellow 2015). The largest spill since 1969 was the Platform Irene pipeline spill in September 1997. A rupture in the pipeline that extends from Platform Irene to the shoreline released an estimated 162 bbl of crude oil into State waters and oiled approximately 40 mi of coastline (PXP 2012).

The most recent oil spill in the area occurred on May 19, 2015, when an onshore underground pipeline near Refugio State Beach ruptured, releasing over 2,300 bbl of oil. A portion of this oil reached the ocean via a ravine and oiled a stretch of the coast in Santa Barbara County, California (CDFW 2015).

3.5 ECOLOGICAL RESOURCES

Under the proposed action, operational discharges to the ocean from the platforms and support vessel traffic may affect ecological resources in the project area. This section describes the ecological resources in the project area that could be affected under the proposed action.

3.5.1 Benthic Resources

The 23 platforms (22 production and one processing) operating on the POCS are found less than 15 mi offshore from Point Pedernales south to San Pedro Bay (Figure 3-1). Within this area, there is a major biogeographic transition zone in the vicinity of Point Conception, where the cold-temperate waters of the Oregonian Province located to the north meet with the warm-temperate waters of the Californian Province located to the south. The differences in the physical and water quality conditions between these provinces and the transition zone between them have resulted in the development of distinctive benthic communities (Seapy and Littler 1978; Blanchette and Gaines 2007).

3.5.1.1 Intertidal Benthic Habitats

The two most prominent intertidal benthic habitats within the area are rocky shorelines and sand beaches. Rocky shore habitats are more common north of Point Conception and along the Channel Islands offshore, while sandy beaches predominate south of Point Conception (MMS 2001; Golden 2013). The intertidal rocky shore is a relatively high energy habitat, particularly north of Point Conception and along the seaward face of the Channel Islands. Marine algae are typically associated with the substrate on rocky reefs, because they are unable to firmly attach to shifting sandy or muddy sediments; they include brown algae (*Egregia* spp. and *Eisenia* spp.), surfgrass (*Phyllospadix scouleri* and *P. torreyi*), and rockweed (*Silvetia compressa*) (Robles and Robb 1993; MMS 2001; Sapper and Murray 2003; Shelton 2010).

Mobile invertebrates found on intertidal rocky shorelines include grazers, filter feeders, and predators that live within the cover and protection provided by the larger attached sessile[9] plants and animals (Menge and Branch 2001; Witman and Dayton 2001). Mussels (*Mytilus californianus*) and barnacles (*Balanus glandula*) are dominant sessile intertidal invertebrates that provide structurally complex habitat along rocky shorelines. Rocky shoreline invertebrate communities exhibit distinct zonation due to a combination of physical and biological interactions (Menge and Branch 2001; Witman and Dayton 2001). Detailed descriptions of rocky

9 Sessile means the organism is attached in place and immobile.

benthic communities in southern California are provided in Seapy and Littler (1978), MMS (2001), and Aspen Environmental Group (2005). Rocky intertidal communities have been studied biannually since 1992; data and site descriptions can be found at pacificrockyintertidal.org. The Pacific environmental studies program has performed many other studies intertidal communities.

Intertidal sand beach habitats are much less stable than rocky intertidal shoreline habitats due to the continual shifting of sand by wind, wave, and current actions; as a result, populations of resident benthic biota may vary greatly from year to year. The invertebrates inhabiting sandy intertidal habitats are dominated by burrowing animal species, including crustaceans (isopods and amphipods), polychaete and nemertean worms, mollusks (snails and bivalves), and mole crabs (*Emerita analoga*) (MMS 1987, 2001). Detailed descriptions of sandy beach ecology and associated biotic communities in southern California may be found in Seapy and Littler (1978), MMS (2001), and Aspen Environmental Group (2005).

3.5.1.2 Subtidal Habitats

Subtidal seafloor habitats are strongly influenced by substrate type, food availability, and depth. As a result, the geology, topography, and bathymetry of an area together with oceanographic and biological processes affect the composition and abundance of marine organisms associated with seafloor habitats. Subtidal habitats in southern California are primarily soft sediments (sand and mud in areas receiving river runoff), but significant hard bottom areas are also present in the form of rocky outcrops and topographic features such as submerged reefs and seamounts (Golden 2013).

Subtidal soft sediments are dynamic habitats subject to periodic disturbance from water movement at the seafloor. Invertebrate species inhabiting soft sediments can be classified as infauna (organisms living within sediments) or epifauna (organisms living on the sediment surface). Invertebrate community structure also changes across depth from shallow inshore areas to the continental slope and abyssal plain. One of the most comprehensive studies of subtidal benthic epifauna and infauna in southern California was conducted by the Southern California Bight Regional Monitoring Program (Allen et al. 2011; Ranasinghe et al. 2012), which sampled invertebrates across habitat and depth gradients that included estuaries; bays and harbors (5–30 m); inner (5–30 m), middle (31–120 m), and outer (121–200 m) continental shelf; and the continental slope (>121 m). Across habitat and depth zones, polychaete worms, amphipod crustaceans, bivalve molluscs, and brittle stars dominated the benthic infauna living in the soft sediments (Ranasinghe et al. 2012). The infaunal communities around the Channel Islands had the highest species diversity of all of the subtidal communities sampled. Infaunal diversity and abundance was relatively low in slope communities.

Trawl surveys indicated that epifaunal community structure also varied with habitat and depth. Species abundance was generally highest on the continental slope and the middle shelf near the Channel Island (Allen et al. 2011). The lowest epifaunal abundance was found in the inner continental shelf. The most abundant epifauna were echinoderms, primarily sea stars and sea urchins. A variety of crab species, including the commercially important Dungeness crab and rock crabs (*Cancer* spp.), also occur on sandy substrates (Carroll and Winn 1987).

Exposed rock and coarse grained sediments, such as gravels, generally support sessile organisms, which generally cannot attach to unstable, sandy substrate. One key rocky subtidal habitat is formed by giant kelp (*Macrocystis pyrifera*) beds, which provide important nursery habitats for a wide variety of benthic organisms (Ebeling et al. 1985; Blanchette et al. 2002). The *M. pyrifera* beds of the Channel Islands, in particular, support dense and diverse invertebrate communities of which echinoderms, polychaetes, amphipods, decapods, and gastropods are primary constituents (Graham 2004).

Topographic features can be of low (<1 m) or high (>1 m) relief, and provide structure for the development of rich benthic invertebrate communities that, in turn, support fishes and other marine organisms. Biological communities on these two feature types differ markedly because low-relief areas are subject to greater disturbance from river runoff and sediment deposition, and consequently contain less-diverse, shorter-lived communities tolerant of sedimentation (Aspen Environmental Group 2005). High-relief features are less subject to such disturbances and are characterized by less-tolerant long-lived organisms such as sponges, corals, and feather stars. The implementation of special fishery regulations or designation of such areas as habitats of particular concern is a reflection of the importance of these subtidal habitats to fish and invertebrates (see Section 3.5.2.2).

The 23 platforms in the POCS present a novel habitat when compared with the surrounding soft sediments. The platforms serve as artificial reefs, providing attachment sites for sessile reef invertebrates such as corals, bryozoans, and sponges. The fish and invertebrates associated with the platforms are structure-oriented species similar to those found in natural hard bottom habitats. Platforms in the POCS have been reported to have the highest secondary fish production per unit area of seafloor of all marine habitat that has been studied globally (Claisse et al. 2014).

3.5.1.3 Threatened and Endangered Invertebrate Species

Several species of invertebrates occurring in the coastal and marine habitats in Southern California have been listed as endangered under the Endangered Species Act of 1972 (ESA) (16 U.S.C. § 1531 et seq.). These species are the black abalone (*Haliotis cracherodii*) and the white abalone (*Haliotis sorenseni*). The Morro shoulderband snail is found only in coastal dune and scrub communities in San Luis Obispo County, California (USFWS 1998), and it is not expected to be affected by any of the alternatives.

The black abalone is a marine mollusk found in rocky intertidal and subtidal marine habitats. This species was listed as endangered on January 14, 2009 (74 FR 1937). In addition, most of the rocky subtidal and intertidal areas of the mainland California coastline south of Del Mar Landing Ecological Reserve to Government Point, the shoreline of the Channel Islands, and portions of the California coastline south of Point Conception have been listed as critical habitat for the black abalone (76 FR 66841). The black abalone population along the California coast south of Monterey County, California, has been estimated to have declined by as much as 95% (Neuman et al. 2010). Historical and/or ongoing threats include overfishing, habitat destruction, and more recently, the disease of withering syndrome.

The white abalone, another marine mollusk, was listed as endangered throughout its range along the Pacific Coast (Point Conception, California, United States, to Punta Abreojos, Baja California, Mexico) as of June 2001 (66 FR 29054). No Critical Habitat designation has been made for this species (66 FR 29046). The initial decline in white abalone abundance has been attributed to commercial overharvesting. Regulatory measures taken by the State of California during the past 30 years, including the closure of the white abalone fishery in 1996 and the closure of all abalone fisheries in central and southern California in 1997, have proven inadequate for recovery (NMFS 2008). Surveys conducted in southern California indicate that there has been a 99% reduction in white abalone abundance since the 1970s (NMFS 2008).

3.5.2 Marine and Coastal Fish and Essential Fish Habitat

The POCS supports a diverse fish community, reflecting the diverse habitats (i.e., rocky reef, sand, kelp) and the presence of cold and warm water masses divided by Point Conception (Dailey et al. 1993). Fish species found in the vicinity of the OCS platforms can be characterized as either diadromous, pelagic, or demersal, based on their habitat associations and life history traits.

3.5.2.1 Marine and Coastal Fishes

Diadromous Fish. Diadromous fish, such as salmon (*Oncorhynchus* spp.), are defined by their movement from oceanic feeding grounds to inland freshwater streams for spawning. Five species of salmon use nearshore and offshore waters, as well as spawning streams inshore of the Pacific region. The steelhead salmon (*Oncorhynchus mykiss*) is the predominant diadromous species found in southern California waters. The distribution and life history information of steelhead are detailed in NMFS (2012).

Pelagic Fishes. Pelagic species are those that do not live in or on the ocean bottom, but rather swim through the water column. Pelagic fish may occupy specific depths within the water column from the near-surface epipelagic zone to the deeper mesopelagic and bathypelagic zones. Examples of common pelagic species in southern California include northern anchovy (*Engraulis mordax*), Pacific sardine (*Sardinops sagax*), Pacific mackerel (*Scomber japonicus*), tuna (*Thunnus spp.*), Pacific herring (*Clupea pallasi*), and swordfish (*Xiphias gladius*). Many pelagic fish species are harvested by U.S. commercial and recreational fisheries (PFMC 2011b).

Demersal Fishes. Demersal fish can be generally characterized as soft bottom or hard bottom fishes, according to their association with particular substrate types. Soft bottom habitats are relatively featureless and have lower species diversity than the more structurally complex hard bottom habitats. Flatfish and rays are examples of common soft bottom species. Structure-oriented species like rockfish congregate around hard bottom habitats, including oil platforms (Claisse et al. 2014). Trawl surveys by the Southern California Bight Regional Monitoring Program (Allen et al. 2011) indicate that fish abundance decreases from Point Conception south to San Diego and that the middle and outer continental shelf have higher fish abundance than other habitats surveyed, such as bays and harbors, upper continental slope, and the inner shelf. Flatfish, sanddab, sculpin, greenling, and rockfish are abundant and widely distributed demersal fish of the California bight (Allen et al. 2011). A description of typical assemblages of demersal fish off southern California is provided in MMS (2001), Allen et al. (2011), and PFMC (2014b).

3.5.2.2 Essential Fish Habitat

The Pacific Fishery Management Council (PFMC) was established by the Magnuson Fishery Conservation and Management Act of 1976 (FCMA) (16 USC 1801–1883) to manage fisheries resources in the Pacific exclusive economic zone (EEZ). The Act requires regional fishery management councils, with assistance from the National Marine Fisheries Service (NMFS), to delineate EFH in Fishery Management Plans (FMPs) or FMP amendments for all Federally managed fisheries. An EFH is defined as the water and substrate necessary for fish spawning, breeding, feeding, and growth to maturity (50 CFR Part 600).

In addition to designating EFH, the NMFS requires fishery management councils to identify habitat areas of particular concern (HAPCs), which are discrete subsets of EFH. Councils may designate a HAPC based on (1) the importance of the ecological function provided by the habitat; (2) the extent to which the habitat is sensitive to human-induced environmental degradation; (3) whether, and to what extent, development activities are, or will be, stressing the habitat type; or (4) the rarity of the habitat type. Although a HAPC designation does not confer additional protection for or restrictions on an area, it can help prioritize conservation efforts.

The PFMC has designated EFH for four fishery management groups in the Pacific region based on their habitat associations. These include management groups are for Pacific Coast groundfish, highly migratory species, coastal pelagic species, and Pacific coast salmon (Table 3-7). The Pacific Coast Groundfish Fishery Management Plan includes flatfish, rockfish , roundfish, and sharks and rays (PFMC 2014b). The EFH included in the Pacific Coast Groundfish Fishery Management Plan covers all of the waters within the vicinity of oil platforms (Figure 3-12) and includes all waters and substrate within depths less than or equal to 3,500 m, as well as the upriver extent of saltwater intrusion, and seamounts in depths greater than 3,500 m as mapped in the EFH assessment geographic information system (GIS).

The Pacific Coast groundfish management group also identified a variety of habitats as HAPCs for groundfish, including estuaries, canopy kelp, seagrass, rocky reefs and “areas of interest,” which in southern California includes the San Juan Seamount, the Channel Islands National Marine Sanctuary, and the Cowcod Conservation Area (Table 3-8) (PFMC 2014b).

TABLE 3-7 Fishery Management Plans with Designated Essential Fish Habitat

Management Plan	Number of Species with EFH	Representative Species
Pacific Groundfish Fishery Management Plan	87	61 species of rockfish 12 species of flatfish 6 species of sharks and rays 5 species of roundfish 3 species of ratfish, morids, and grenadiers
Coastal Pelagic Species Fishery Management Plan	9+	6 fish species including sardines, anchovy, mackerel, smelt, and herring 2 squid species Several species of krill
Highly Migratory Species Fishery Management Plan	13	5 species of tuna 5 species of shark A marlin, swordfish, and dolphin
Pacific Coast Salmon Fishery Management Plan	3	3 species of salmon

Source: PFMC (2011a,b; 2014a,b)

The Coastal Pelagic Species Fishery Management Plan identified EFH for six species of coastal schooling fishes, the market squid, and several invertebrate zooplankton that are key food sources for higher trophic levels (Table 3-7), and the combined EFH for these species covers the entire California EEZ (PFMC 2011a) (Figure 3-13). No HAPC have been designated for coastal pelagics (Table 3-8).

Highly migratory species are defined by their pelagic habitat orientation and their geographically large movements. The Highly Migratory Species Fishery Management Plan identified EFH for several species of tuna and oceanic sharks, as well as for a swordfish, a marlin, and a sailfish. For these highly migratory species, EFH varies by species, but in total it covers all offshore waters of southern California (Figure 3-14). No HAPC has been designated for highly migratory species (PFMC 2011b) (Table 3-8).

The Pacific Coast Salmon Fishery Management Plan designates EFH for three salmonid species (Table 3-7); thee EFHs include estuarine and marine areas from the extreme high tide line in nearshore and tidal submerged environments within State territorial waters out to the full extent of the exclusive economic zone (200 nautical mi or 370.4 km) offshore of Washington, Oregon, and California north of Point Conception (PFMC 2014a). Although they have not been mapped, the PFMC also designated five HAPCs for the salmonids: (1) complex channels and floodplain habitats; (2) thermal refugia; (3) spawning habitat; (4) estuaries; and (5) marine and estuarine submerged aquatic vegetation (PFMC 2014a) (Table 3-8).

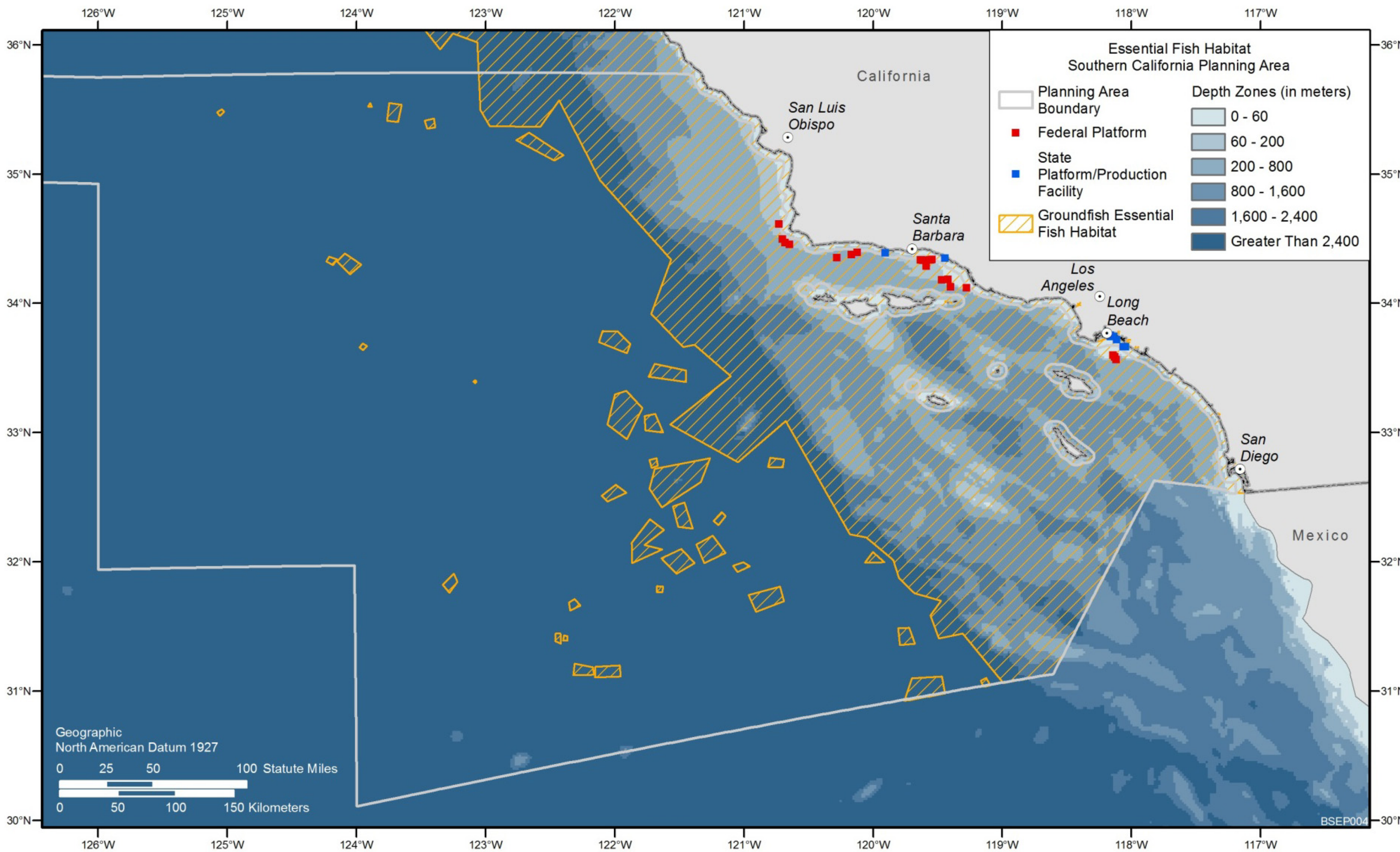

FIGURE 3-12 Groundfish EFH (including EFH-HAPC) Designated by the PFMC and NMFS (Source: NOAA undated)

TABLE 3-8 Species Management Groups and Habitat Areas of Particular Concern (HAPC) Designated by the Pacific Fisheries Management Council

Species Management Group	HAPC
Pacific Coast Groundfish	Estuaries, canopy kelp, seagrass, and rocky reef Areas of interest—San Juan Seamount; the Channel Islands National Marine Sanctuary; Cowcod Conservation Area
Pacific Coast Salmon	Complex channels and floodplain habitats Thermal refugia Spawning habitat Estuaries Marine and estuarine submerged aquatic vegetation.
Coastal Pelagic Species	There are no HAPCs designated at this time
Highly Migratory Species	There are no HAPCs designated at this time

Source: PFMC (2011a,b; 2014a,b)

3.5.2.3 Threatened and Endangered Fish Species

Several species of fish occurring in the coastal and marine habitats in Southern California have been listed as threatened or endangered under the ESA (16 U.S.C. § 1531 et seq.). These species are the green sturgeon (*Acipenser medirostris*), the steelhead (*Oncorhynchus mykiss*), the scalloped hammerhead shark (*Sphyrna lewini*), and the tidewater goby (*Eucyclogobius newberryi*).

Green Sturgeon. The green sturgeon inhabits nearshore marine waters from Mexico to the Bering Sea and enters bays and estuaries along the west coast of North America (Moyle et al. 1995). The NMFS determined that the green sturgeon is composed of southern and northern populations, with the southern population spawning primarily in the Sacramento River Basin (70 FR 17386). The southern population of green sturgeon was listed as threatened (71 CFR 17757). Although the green sturgeon was historically found along the entire coast of California, studies suggest that the southern population of green sturgeon is primarily found to the north of the Sacramento River, and the NMFS has designated no critical habitat south of Monterey Bay (74 FR 52300).

Steelhead. As diadromous fish, adult steelhead migrate to freshwater areas to spawn, and the resulting young fish travel back downstream and eventually enter marine waters to mature. NMFS has identified 10 distinct evolutionarily significant units (ESUs)[10] of steelhead, of which

[10] An evolutionary significant unit (ESU) is a population of organisms considered distinct for conservation purposes. To be considered an ESU, the population must be reproductively isolated from other populations of the same species, and must represent an important component of the evolutionary legacy of the species (61 FR 4722).

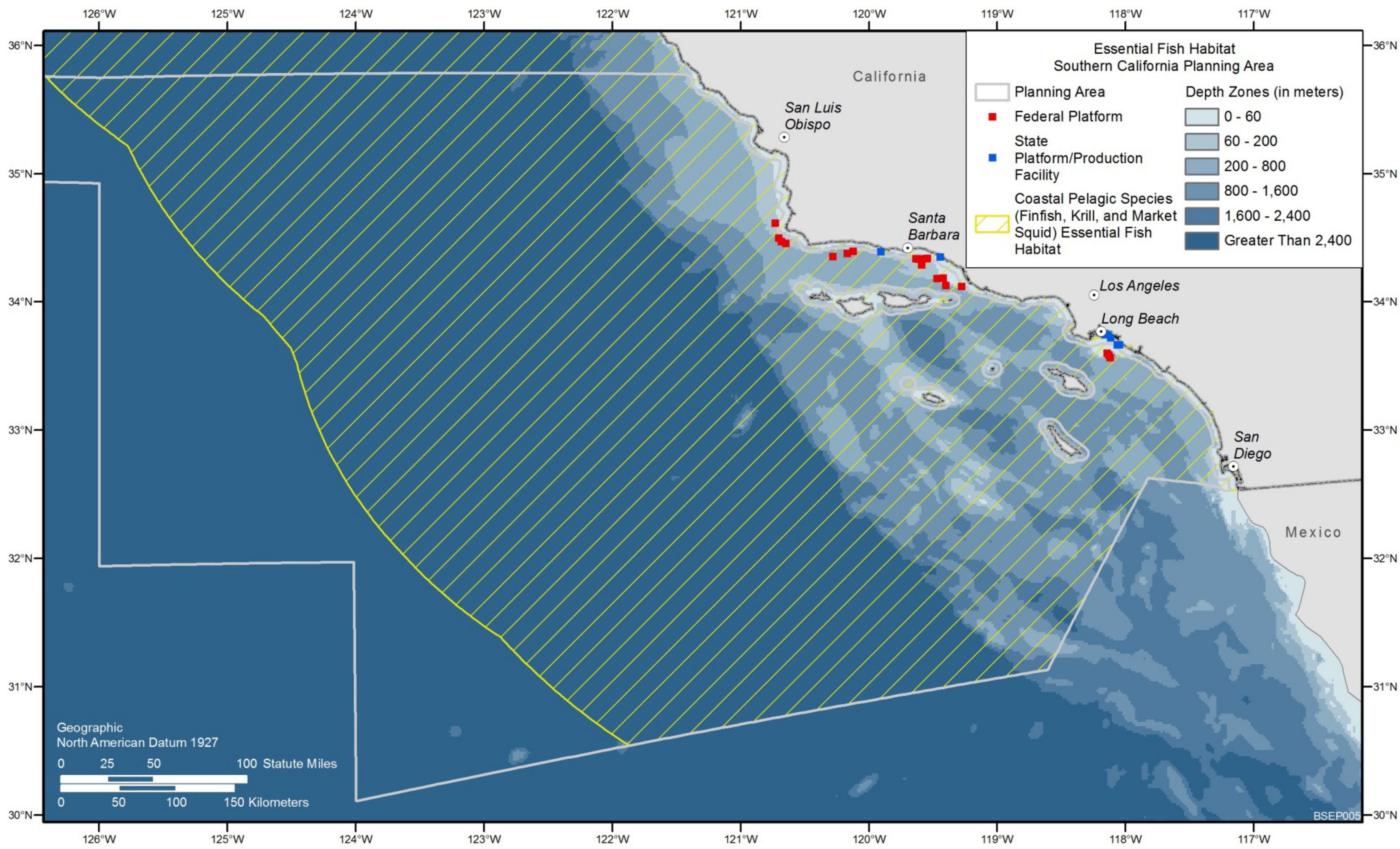

FIGURE 3-13 EFH for Coastal Pelagic Managed Species as Designated by the PFMC and NMFS (Source: NOAA undated)

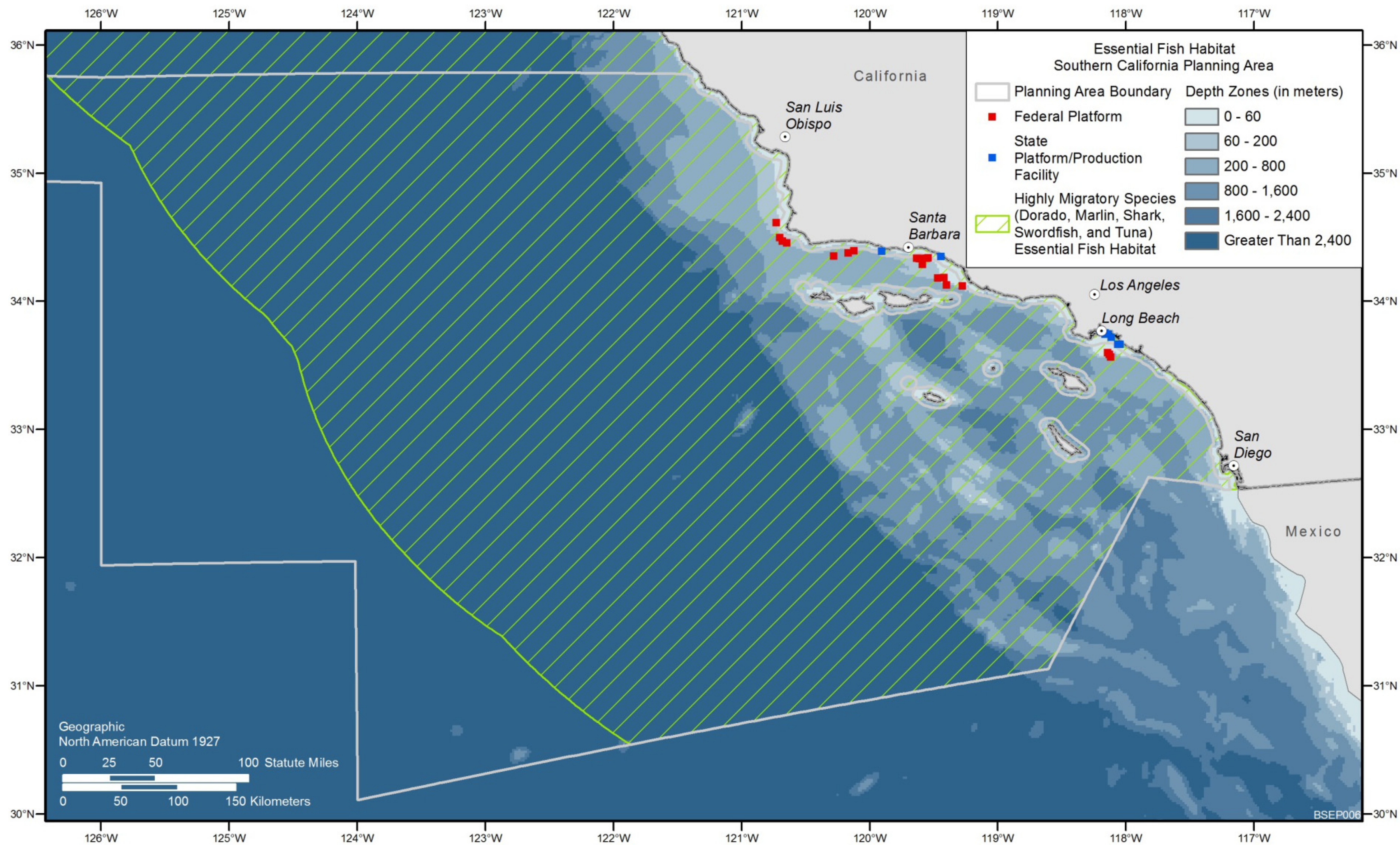

FIGURE 3-14 EFH for Highly Migratory Managed Species as Designated by the PFMC and NMFS (Source: NOAA undated)

two are listed as endangered and eight are listed as threatened (50 CFR 223 and 224). Most of these populations are found north of Monterey Bay (Good et al. 2005) and only the Southern California Steelhead ESU (which is listed as endangered) is likely to occur in the vicinity of the OCS platforms. The geographic range of the Southern California steelhead ESU extends from the Santa Maria River basin to the U.S.–Mexico border. Major river systems with significant historical steelhead runs include the Santa Ynez, Ventura, Matilija Creek, and Santa Clara (Good et al. 2005).

The Southern California Steelhead (SCS) Recovery Planning Area includes seasonally accessible coastal watersheds and the upstream portions of watersheds that were historically used by steelhead, including in its north the Santa Maria, Santa Ynez, Ventura, and Santa Clara Rivers, and Malibu and Topanga Creeks. Major steelhead watersheds in the southern portion of the SCS Recovery Planning Area include the San Gabriel, Santa Margarita, San Luis Rey, San Dieguito, and Sweetwater Rivers, and San Juan and San Mateo Creeks (NMFS 2012). Critical habitat for the southern California steelhead includes multiple rivers between the Santa Maria River and San Mateo Creek (50 CFR Part 226).

Scalloped Hammerhead Shark. The NMFS listed the Eastern Pacific Distinct Population Segment (DPS) of scalloped hammerhead sharks as an endangered species in 2014 (50 CFR Parts 223 and 224). Critical habitat is being considered in the eastern Pacific, but no critical habitat determination has been made at this time. The scalloped hammerhead is found in coastal waters off the California coast.

Tidewater Goby. Although the tidewater goby historically occurred in at least 87 California coastal lagoons from San Diego County to Humboldt County, it has disappeared from most of these sites. The tidewater goby was listed as endangered in 1994 (59 FR 5494), but recently the U.S. Fish and Wildlife Service has proposed to reclassify this species as threatened (50 CFR Part 17).

The tidewater goby is found only in California, where it is restricted primarily to brackish waters of coastal wetlands, brackish shallow lagoons, and lower stream reaches larger than 2.5 ac where the water is fairly still but not stagnant (Lafferty et al. 1999). This goby is tolerant of a wide range of salinities and may be found in ocean water following flushing events that follow major rain events. As of March 8, 2013, a number of estuarine rivers and lagoons in San Luis Obispo, Santa Barbara, Ventura, Los Angeles, Orange, and San Diego Counties have been designated as Critical Habitat (50 CFR Part 17).

3.5.3 Marine Mammals

The POCS offshore of southern California has a diverse marine mammal community. Species in the orders Cetacea and Carnivora occur, at least seasonally, in waters of southern California (Carretta et al. 2014, 2015). The Cetacea include baleen whales (Suborder Mysticeti) and toothed whales (Suborder Odontoceti). The six species of Carnivora in the area include true seals, eared seals, and a sea otter.[11]

3.5.3.1 Whales and Dolphins

Seven species of baleen whales and 12 species of toothed whales and dolphins have been reported from the Southern California OCS Planning Area and may occur in the project area (Table 3-9).[12] Commonly observed baleen whales include the gray whale (*Eschrichtius robustus*), blue whale (*Balaenoptera musculus musculus*), fin whale (*Balaenoptera physalus physalus*), and humpback whale (*Megaptera novaeangliae*). The North Pacific minke whale (*Balaenoptera acutorostrata scammoni*) is also frequently observed in the area. The fin, humpback, and blue whales are the most commonly occurring large whales that use the area for feeding (Douglas et al. 2014). Fin and humpback whales may be observed year-round with peaks in summer and spring, respectively (Campbell et al. 2015). Blue whales are encountered in summer and fall, while minke whales are encountered in spring through fall (Douglas et al. 2014). During migration, gray whales often travel through the Channel Islands but have been observed up to 80 km offshore. Gray whales are generally present off central and southern California from December through May (Aspen Environmental Group 2005). The northward and southward migrations of gray whales overlap in southern California, with individuals observed moving in both directions during January and February (CMLPAI 2009). Because gray whales migrate close to shore, they may often be seen from shore in some portions of the project area, such as the coast along Santa Barbara. Most of the baleen whales mainly consume euphausiid and copepod crustaceans, while the toothed whales, dolphins, and seals generally feed on schooling fishes and squid. The killer whale preys upon fishes, marine mammals, and seabirds, and the southern sea otter preys mainly on benthic macroinvertebrates.

The more frequently encountered small cetaceans observed in shallow depth waters (<2,000 m) off southern California are the short-beaked common dolphins (*Delphinus delphis*), long-beaked common dolphin (*D. capensis*), Pacific white-sided dolphin (*Lagenorhynchus obliquidens*), Risso's dolphin (*Grampus griseus*), northern right whale dolphin (*Lissodelphis borealis*), and Dall's porpoise (*Phocoenoides dalli*) (Douglas et al. 2014). These species occur throughout the year. However, both density and abundance of these species in shallow depth waters differ between winter-spring and summer-fall (Table 3-10).

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[11] Seals (family Phocidae) and fur seals sea lions (family Otariidae) were formerly included in the suborder Pinnipedia, but Pinnipedia is now considered a clade within the suborder Caniformia. One Steller sea lion (*Eumetopias jubatus*) was reported in the region during cruises conducted between 2004 and 2008 (Douglas et al. 2014). As the Eastern Distinct Population of the Steller sea lion (now delisted under the Endangered Species Act [ESA]) generally occurs from central California north to southeast Alaska, it is not addressed in this document.

[12] The rough-toothed dolphin (*Steno bredanensis*) and false killer whale (*Pseudorca crassidens*) are not addressed in this document as their occurrence in the area likely represents extralimital occurrences (Douglas et al. 2014).

TABLE 3-9 Marine Mammals of Southern California[a]

Species	Status[b]	Population Estimate (Minimum Estimate)	Occurrence/Distribution in Southern California
Order Cetacea: Suborder Mysticeti (baleen whales)			
Balaenoptera acutorostrata scammoni (North Pacific minke whale)	–	478 (202)	Occur year-round off California. Winter range includes Southern California Bight with a small portion residing there throughout the summer, especially around the northern Channel Islands.
Balaenoptera borealis borealis (Sei whale—northern hemisphere subspecies)	E/D	126 (83)	Rare in California waters. Usually observed in deeper waters of oceanic areas far from the coastline.
Balaenoptera musculus musculus (Blue whale—northern hemisphere subspecies)	E/D	1.647 (1,551)	First observed around the Channel Islands in May/June and are present on the continental shelf in the area from August to November. Tend to aggregate in the Santa Barbara Channel along the shelf break (seaward of 200-m line).
Balaenoptera physalus physalus (Fin whale—northern hemisphere subspecies)	E/D	3,051 (2,598)	Occur year-round off central and southern California, peaking in summer and fall. In Southern California Bight, summer distribution is generally offshore and south of the northern Channel Island chain.
*Eubalaena japonic*a (North Pacific right whale)	E/D	31 (25.7)	Very few sightings off southern California.
Eschrichtius robustus (Gray whale—Eastern North Pacific population)	DL	20,990 (20,125)	Generally present from December through May.
Megaptera novaeangliae (Humpback whale)	E/D	1,918 (1,855)	Feeds off California in summer and fall. Occurs throughout the western two-thirds of the Santa Barbara Channel. Tends to concentrate along the shelf break north of the Channel Islands.

TABLE 3-9 (Cont.)

Species	Status[b]	Population Estimate (Minimum Estimate)	Occurrence/Distribution in Southern California
Order Cetacea: Suborder Odontoceti (toothed whales and dolphins)			
Delphinus capensis capensis (Long-beaked common dolphin)	–	107,016 (76,224)	Prefer shallow waters closer to the coast (e.g., 50–100 nautical miles) and on the continental shelf. Commonly found from Baja California northward to central California.
Delphinus delphis delphis (Short-beaked common dolphin)	–	411,211 (343,990)	Primarily oceanic and offshore, but also along continental slope in waters 650 to 6,500 ft deep. Prefer waters altered by underwater geologic features where upwelling occurs. Found off California coast especially during warmer months.
Globicephala macrorhynchus (Short-finned pilot whale)	–		Found primarily in deep waters where there is a high density of squid. Observed south of Point Conception.
Grampus griseus (Risso's dolphin)	–	6,272 (4,913)	Present off southern California year-round with highest densities along the shelf break.
Lagenorhynchus obliquidens (Pacific white-sided dolphin)	–	26,930 (21,406)	Inhabits waters from the continental shelf to deep open ocean. Primarily occurs during colder water months. Moderate densities in Santa Barbara Channel and near the northern Channel Islands.
Lissodelphis borealis (Northern right whale dolphin)	–	8,334 (6,019)	Rare south of Point Conception in summer. During winter they are distributed from central California south. Highest annual densities over the shelf north of Point Conception.
Orcinus orca (Killer whale)	–	240 (162)	Observed west of San Miguel Island and over the shelf north of Point Conception.
Phocoena phocoena vomerina (Harbor porpoise)	–	2,917 (2,102)	The Morro Bay stock occurs from Point Conception north to just south of Monterey Bay.

TABLE 3-9 (Cont.)

Species	Status[b]	Population Estimate (Minimum Estimate)	Occurrence/Distribution in Southern California
Phocoenoides dalli dalli (Dall's porpoise)	–	42,000 (32,106)	Observed in offshore, inshore, and nearshore oceanic waters. Common in winter. Western Santa Barbara Channel is an area of higher densities.
Physeter macrocephalus (Sperm whale)	E/D	2,106 (1,332)	Present in offshore waters year-round with peak abundance during migrations from April to mid-June and from late August through November. Generally found in waters with depths >1,000 m.
Stenella coeruleoalba (Striped dolphin)	–	10,908 (8,231)	Prefers oceanic and deep waters. Often linked to upwelling areas and convergence zones. Infrequently observed in project area.
Tursiops truncatus truncatus (Bottlenose dolphin)	–	1,329 (974)	California coastal stock occurs primarily from Point Conception south within 1 km of shore. The California/Oregon/Washington offshore stock has a more-or-less continuous distribution off California.
Order Carnivora: Suborder Caniformia (includes seals and sea otters)			
Arctocephalus townsendi (Guadalupe fur seal)	T/D	7,408 (3,028)	Regularly occurs in the Channel Islands. Breeding occurs off the coast of Baja California, Mexico. A birth was reported on San Miguel Island.
Callorhinus ursinus (Northern fur seal)	–	12,844 (6,722)	Breeds in southern California and is present year-round. Breeds on San Miguel Island. Most fall and winter sightings are in offshore waters west of San Miguel Island.
Enhydra lutris nereis (Southern sea otter)	T/D	2,826 (2,723)	Occurs along mainland coast from San Mateo County south to Santa Barbara County with a small colony also on San Nicolas Island. Typically inhabit waters <18-m deep and rarely move more than 2 km offshore.
Mirounga angustirostris (Northern elephant seal)	–	179,000 (81,368)	Breeds in southern California and are present year-round. San Miguel and San Nicolas are the major rookery islands. Some also born on Santa Rosa, Santa Barbara, and San Clemente islands.

TABLE 3-9 (Cont.)

Species	Status[b]	Population Estimate (Minimum Estimate)	Occurrence/Distribution in Southern California
Phoca vitulina richardii (Pacific harbor seal)	–	30,968 (27,348)	Breed in southern California and are present year-round. Spend most of their time throughout fall and winter at sea. Haul out on all Channel Islands and on beaches along the mainland, particularly from Ventura County northward.
Zalophus californianus californianus (California sea lion)	–	296,750 (153,337)	Breed in southern California and are present year-round. Breed on San Miguel, San Nicolas, Santa Barbara, and San Clemente islands. Highest densities in Santa Barbara Channel in nearshore waters, with moderate densities in nearshore waters north of Point Conception.

[a] As the Eastern Distinct Population of the Steller sea lion generally occurs from central California north to southeast Alaska, it is not addressed in this PEA. One Steller sea lion (*Eumetopias jubatus*) was reported in the region during cruises conducted between 2004 and 2008 (Douglas et al. 2014). The rough-toothed dolphin (*Steno bredanensis*) and false killer whale (*Pseudorca crassidens*) are also not included as their occurrence in the area likely represents extralimital occurrences (Douglas et al. 2014).

[b] Status: D = depleted under the Marine Mammal Protection Act (MMPA); DL = delisted under the ESA; E = endangered under the Endangered Species Act (ESA); T = threatened under the ESA; – = not listed. All species are protected under the MMPA.

Sources: Carretta et al. (2014, 2015); NOAA Fisheries (2015d–j).

TABLE 3-10 Density and Abundance of Most Frequently Observed Small Cetacean Species off Southern California in Shallow Water Depths (<2,000 m)

Species Season	Density (No./1,000 km^2)	Uncorrected Abundance (No./71,407 km^2)
Short-beaked common dolphin (*Delphinus delphis*)		
Winter–spring	307.83	21,981
Summer–fall	1,319.69	94,235
Long-beaked common dolphin (*Delphinus capensis*)		
Winter–spring	30.90	2,207
Summer–fall	687.87	49,118
Pacific white-sided dolphin (*Lagenorhynchus obliquidens*)		
Winter–spring	110.57	7,896
Summer–fall	29.24	2,088
Risso's dolphin (*Grampus griseus*)		
Winter–spring	35.65	2,546
Summer–fall	3.90	279
Northern right sided dolphin (*Lissodelphis borealis*)		
Winter–spring	107.31	7,662
Summer–fall	6.72	480
Dall's porpoise (*Phocoenoides dalli*)		
Winter–spring	45.5	3,249
Summer–fall	2.11	151

Source: Douglas et al. (2014).

Campbell et al. (2014, 2015) also reported on the spatial distribution patterns for several cetacean species off southern California. The humpback whale, gray whale, bottlenose dolphin (*Tursiops truncatus truncatus*), Risso's dolphin, and long-beaked common dolphin concentrate in coastal and shelf waters; whereas, the sperm whale (*Physeter macrocephalus*) was detected exclusively in pelagic waters. Blue whales, fin whales, short-beaked common dolphins, Pacific white-sided dolphins, and Dall's porpoise had broad distributions occurring in coastal, shelf, and pelagic waters.

3.5.3.2 Seals, Sea Lions, and Sea Otters

The six species in the order Carnivora present in the project area includes two species in the family Phocidae (true seals): the northern elephant seal (*Mirounga angustirostris*) and Pacific harbor seal (*Phoca vitulina richardii*); three species in the family Otariidae (eared seal): California sea lion (*Zalophus californianus californianus*), Guadalupe fur seal (*Arctocephalus* *townsendi*), and northern fur seal (*Callorhinus ursinus*); and one species in the family Mustelidae (otters, weasels, and badgers): southern sea otter (*Enhydra lutris nereis*). The Guadalupe fur seal and the southern sea otter are Federally threatened. These species occur throughout portions of the Southern California OCS Planning Area, and mainland coastal areas of the POCS as well as the northern Channel Islands support numerous haulout and rookery sites for many of these species. The California sea lion also uses offshore platforms as haulouts throughout the year (Table 3-11).

The northern elephant seal hauls out during the breeding season (December through March) and during the molt (April through August). Most sites used for breeding are also used for molting. Large numbers of juveniles also haul out at these sites in fall preceding the breeding season. The northern elephant seal migrates north to feeding grounds twice a year. When not on land, they spend most of their time underwater probably feeding on deepwater benthic species such as rockfish, squid, swell sharks, and ratfish (CMLPAI 2009).

The southern Channel Islands have the largest concentration of Pacific harbor seals in California. Pacific harbor seals are year-round residents at most of their haulout sites, but abundance varies seasonally. However, Pacific harbor seals are also prevalent in the northern Channel Islands and along portions of the mainland within the project area. The highest numbers occur during the breeding season (March to June) and the molt (June to July). Their diet is primarily fish, shellfish, and crustaceans (NOAA Fisheries 2015b).

The California sea lion breeds mainly on offshore islands in the southern portion of their range. They occur around a number of the Channel Islands. They opportunistically feed on seasonally abundant schooling fish and squid. Feeding tends to occur in cool upwelling waters of the continental shelf (CMLPAI 2009).

TABLE 3-11 Seal Haulout and Rookery Sites

Species	Haulout Site	Rookery Site
Pacific harbor seal	Point Conception, Goleta Point, Rincon Point, Point Mugu, Purisima Point, Santa Rosa Island, Santa Cruz Island, Anacapa Island	Rincon Point
California sea lion	San Miguel Island, Santa Rosa Island, Anacapa Island, Santa Cruz Island, offshore platforms	San Miguel Island, Anacapa Island, Santa Cruz Island
Guadalupe fur seal	San Miguel Island	San Miguel Island
Northern elephant seal	San Miguel Island, Santa Rosa Island	Santa Rosa Island
Northern fur seal	San Miguel Island	San Miguel Island

Sources: CMLPAI (2005, 2009).

The Guadalupe fur seal is a pelagic species for most of the year. Breeding occurs almost entirely on Isla de Guadalupe, Mexico, from May to July (CMLPAI 2009; NOAA Fisheries 2015c). Their northern range is the Channel Islands (CMLPAI 2009), with a small population occurring on San Miguel Island (NOAA Fisheries 2015c). They feed in deep waters on krill, squid, and small schooling fish (CMLPAI 2009).

One of only three breeding sites in the United States for the northern fur seal occurs on San Miguel Island (the other locations are the Pribilof Islands and Bogoslof Island).[13] The breeding season can range from May to early November. Peak pupping is early July. After the breeding season, the northern fur seal remains pelagic. Southern California is at the southern boundary of its range. Northern fur seals that breed on San Miguel Island tend to remain in the area throughout the year. Major El Niño events have caused declines in the northern fur seal population on San Miguel Island. However, the population began to recover in 1999, and now numbers more than 9,000 individuals. The diet of the northern fur seal includes fish and squid (NOAA Fisheries 2015a).

Within California, the southern sea otter occurs from Pigeon Point, San Mateo County, south to 5 km west of Gaviota State Beach, Santa Barbara County, and on San Nicolas Island off of Ventura County (Hatfield and Tinker 2014). Overall, sea otter numbers have increased on the mainland and San Nicolas Island since the early 1990s. In 2014, the total (3-year average) mainland numbers were 2,881 and 63 for San Nicolas Island. On the mainland, 56 sea otters were counted southeast of Point Conception (the southern end of the mainland range of the sea otter) (Hatfield and Tinker 2014). The trend in abundance of the mainland population remains relatively flat, demonstrating a 5-year average growth rate of 0.2%. However, the growth rate in the southern portion of the range (Cayucos to Gaviota) is negative, −3.3%; although southeast of Point Conception there has been a positive growth rate trend of 2.8% (Hatfield and Tinker 2014). In California, sea otters rarely eat fish; most of their diet is large invertebrates such as abalone, crabs, and sea urchins (CMLPAI 2009).

3.5.3.3 Threatened and Endangered Marine Mammals

All marine mammals that occur in the area are protected under the Marine Mammal Protection Act (MMPA). Eight species are listed under the ESA (Table 3-9). The sei whale (*Balaenoptera borealis borealis*), blue whale, fin whale, North Pacific right whale (*Eubalaena japonica*), humpback whale, and sperm whale are endangered; while the Guadalupe fur seal and the southern sea otter are threatened. All of the Federally listed species are under the jurisdiction of National Oceanic and Atmospheric Administration (NOAA) Fisheries, except the southern sea otter which is under the jurisdiction of the U.S. Fish and Wildlife Service (USFWS).

[13] A small population has developed on South Farallon Island off the coast of San Francisco, presumably immigrants from San Miguel Island (NOAA Fisheries 2015a).

3.5.4 Marine and Coastal Birds

A diverse assemblage of birds occurs within southern California. For example, 387 species are recorded (as of November 2011) on or within 1.5 km of the shore of San Miguel, Santa Rosa, Santa Cruz, Anacapa, and Santa Barbara islands which compose Channel Islands National Park (Collins 2011). Most birds are afforded protection under the Migratory Bird Treaty Act (MBTA), while the Federally listed threatened and endangered species are protected under the ESA. The Bald Eagle (*Haliaeetus leucocephalus*) is afforded protection under the Bald and Golden Eagle Protection Act.[14] Some bird species breed in southern California, while others are non-breeding summer residents, winter residents, or migrants. The two groups of birds most likely to be impacted by OCS O&G developments are seabirds and shorebirds. Waterfowl and wading birds that occupy coastal wetlands and estuaries may also be affected by O&G activities.

3.5.4.1 Seabirds

Mason et al. (2007) identified 54 seabird species between Cambria, California, and the Mexican border, which encompasses the area of the POCS platforms. Seabird densities averaged 33.7 birds/km^2 (range of 0.0 to 12,244 seabirds/km^2) throughout the surveyed area. Average densities were 11.3 seabirds/km^2 for at-sea transects and 70.9 seabirds/km^2 for coastal transects. Highest at-sea densities were near the Channel Islands in January and north of Point Conception in May, with lowest densities in the southwestern portion of the Southern California Bight in all survey months (Mason et al. 2007). Survey results (conducted from May 1999 to January 2002) indicate that seabird abundance has declined off the southern California coast possibly due to environmental degradation in the area or climate change. Species with dramatic decreases included the Common Murre (*Uria aalge*), Sooty Shearwater (*Puffinus griseus*), and Bonaparte's Gull (*Larus philadelphia*) (Mason et al. 2007).

Nearshore seabird species occupy relatively shallow waters close to shore. Common nearshore species include the Common Loon (*Gavia immer*), Pacific Loon (*G. pacifica*), Western Grebe (*Aechmophorus occidentalis*), and Surf Scoter (*Melanitta perspicillata*) (Mason et al. 2007). Nearshore species are most numerous in winter months, with relatively few remaining during the summer (MMS 2001).

Pelagic seabirds generally occur over deeper waters compared with nearshore species. Common pelagic species off southern California include the Black-footed Albatross (*Phoebastria nigripes*), Sooty Shearwater, Black-vented Shearwater (*Puffinus opisthomelas*), Pink-footed Shearwater (*P. creatopus*), Leach's Storm-petrel (*Oceanodroma leucorhoa*), California Brown Pelican (*Pelecanus occidentalis*), cormorants (*Phalacrocorax* spp.), Red Phalarope (*Phalaropus fulicaria*), Red-necked Phalarope (*P. lobatus*), and the Common Murre (Mason et al. 2007). Although pelagic species are generally present throughout the year, their abundance varies seasonally. For example, the Sooty Shearwater and Pink-footed Shearwater are

[14] The Bald Eagle was delisted from the ESA in 2007. Prior to delisting, Bald Eagles were successfully introduced into the project area. Nesting occurs on several of the Channel Islands (e.g., Santa Catalina and Santa Cruz Islands) (CMLPAI 2009).

most abundant during summer months (although they do not breed in southern California) (Mason et al. 2007).

Common gulls and terns in the area include the California Gull (*Larus californicus*), Ring-billed Gull (*L. delawarensis*), Heermann's Gull (*L. heermanni*), Bonaparte's Gull, Black-legged Kittiwake (*Rissa tridactyla*), and Caspian Tern (*Hydroprogne caspia*). Densities of the gulls and terns tend to be highest along the mainland and Channel Island coasts and within the Santa Barbara Channel (Mason et al. 2007).

The migratory flyways for most seabirds are located farther offshore than the nearshore coastal region within which the OCS platforms are located. Spring coastal seabird migration begins in late February, with peak movement occurring between late March and early May. Fall movements of coastal seabirds generally occur between October and December (Johnson et al. 2011). Pelagic migratory species are most numerous from mid-April to early June and from mid-August to mid-October (Johnson et al. 2011).

Twenty seabird species breed in southern California, almost entirely on the Channel Islands (Mason et al. 2007). The Channel Islands provide essential nesting and feeding grounds for many of the seabirds in southern California. The islands support colonies of California Brown Pelicans, Scripps's Murrelets (*Synthliboramphus scrippsi*), Cassin's Auklet (*Ptychoramphus aleuticus*), Western Gulls (*Larus occidentalis*), Ashy Storm-petrels (*Oceanodroma homochroa*), Black Storm-petrels (*O. melania*), Double-crested Cormorants (*Phalacrocorax auritus*), Pigeon Guillemots (*Cepphus columba*), and Common Murres (NPS 2015).

Sydeman et al. (2012) identified "hotspots" of seabird abundance within the California Current Ecosystem along the west coast of North America from Vancouver Island, British Columbia, Canada, to Punta Eugenia, Baja California, Mexico. The hotspots are areas of consistently elevated abundance for a seabird species. Those identified within the general area of the POCS platforms include Point Conception (Ashy Storm-petrel and Pink-footed Shearwater), San Miguel Island (Brandt's Cormorant [*Phalacrocorax penicillatus*]), south San Miguel Island (Pink-footed Shearwater), Santa Monica Basin (California Brown Pelican), Anacapa Island (California Brown Pelican), Santa Barbara Island (Western Gull), Santa Barbara Basin (California Brown Pelican and Western Gull), Santa Monica Basin (Black-vented Shearwater), Bolsa Bay (California Gull), Palos Verdes/Bolsa Chica (Elegant Tern [*Sterna elegans*]), Santa Cruz Island (Red-necked Phalarope), Santa Cruz Basin (Pink-footed Shearwater), off San Juan Seamount (Red-necked Phalarope), and Santa Rosa/Cortes Ridge (Sooty Shearwater) (Sydeman et al. 2012).

3.5.4.2 Shorebirds

While more than 40 shorebird species are recorded from central and southern California, less than 25 species occur regularly in the area. Few shorebirds breed in the area; most species migrate to the area in the fall to overwinter and then leave in spring to return to their northern breeding grounds. Most shorebirds inhabit tidal wetlands, sandy beaches, and rocky shorelines

(Hickey et al. 2003). Shorebird species in the area include Black-bellied Plover (*Pluvialis squatarola*), Semipalmated Plover (*Charadrius semipalmatus*), Willet (*Tringa semipalmata*), Wandering Tattler (*T. incana*), Whimbrel (*Numenius phaeopus*), Marbled Godwit (*Limosa fedoa*), Black Turnstone (*Arenaria melanocephala*), Sanderling (*Calidris alba*), Western Sandpiper (*C. mauri*), Least Sandpiper (*C. minutilla*), Spotted Sandpiper (*Actitis macularius*), Dunlin (*C. alpina*), and Long-billed Curlew (*Numenius americanus*). Shorebirds that do breed in the area include the Black Oystercatcher (*Haematopus bachmani*), Black-necked Stilt (*Himantopus mexicanus*), Killdeer (*Charadrius melodus*), and the Federally threatened Western snowy Plover (*C. nivosus nivosus*) (Arata and Pitkin 2009; Rodriguez et al. 2011). Areas commonly used by shorebirds include Mugu Lagoon, Santa Clara River mouth, Carpinteria Marsh, Goleta Slough, and the Santa Ynez River mouth (MMS 2001).

Rodriguez et al. (2011) conducted monthly counts of shorebirds on 14 beaches in Ventura County from July 2007 through June 2010. The mean number of shorebirds sighted per kilometer was 77.5 (34.8 for the six focal shorebird species). The range in numbers of birds counted per kilometer for the six focal species during the 3-year study period were Black-bellied Plover (0.5 to 0.8/km), Snowy Plover (1.9 to 5.4/km), Willet (5.8 to 10.4/km), Whimbrel (1.6 to 3.9/km), Marbled Godwit (1.6 to 6.8/km), and Sanderling (11.1 to 16.9/km).

3.5.4.3 Waterfowl and Wading Birds

Waterfowl and wading birds (e.g., ducks, geese, herons, egrets, and rails) inhabit coastal and interior wetlands. In the project area, they inhabit saltwater marshes such as Carpinteria Marsh and Mugu Lagoon and various river and stream mouths. About 25 species of wading birds have been reported from the coastal regions of central and southern California. Common species include Black-crowned Night Heron (*Nycticorax nycticorax*), Green Heron (*Butorides virescens*), Snowy Egret (*Egretta thula*), Great Egret (*Ardea alba*), Great Blue Heron (*A. herodias*), Virginia Rail (*Rallus limicola*), Sora (*Porzana carolina*), and American Coot (*Fulica americana*). Around 40 waterfowl species also occur in the coastal areas of central and southern California. Common waterfowl include Canada Goose (*Branta canadensis*), Green-winged Teal (*Anus crecca*), American Wigeon (*A. americana*), Northern Pintail (*A acuta*), Northern Shoveler (*A. clypeata*), and Cinnamon Teal (*A. cyanoptera*) (MMS 2001).

3.5.4.4 Special Status Bird Species

Table 3-12 lists the special status marine and coastal bird species within or near the project area.

Federally Listed Bird Species. Past analyses determined that a number of Federally listed bird species would not be affected by proposed offshore O&G activities. The current status of these species was reexamined, and listed species not considered in past analyses were also evaluated. We have determined that the continuation of existing offshore O&G development and production activities (including well stimulation activities) in the Southern California Planning

TABLE 3-12 Special-Status Marine and Coastal Birds within or near the Project Area

Common Name	Scientific Name	Federal Status[a]	State Status[a]
Brant	*Branta bernicla*	–	SSC
Black-footed Albatross	*Phoebastria nigripes*	BCC	–
Short-tailed Albatross	*Phoebastria albatrus*	E	SSC
Pink-footed Shearwater	*Puffinus creatopus*	BCC	–
Black-vented Shearwater	*Puffinus opisthomelas*	BCC	–
Ashy Storm-Petrel	*Oceanodroma homochroa*	BCC	SSC
Black Storm-Petrel	*Oceanodroma melania*	–	SSC
Double-crested Cormorant	*Phalacrocorax auritus*	–	TW
Light-footed Ridgway's Rail	*Rallus obsoletus levipes*	E	E
Western Snowy Plover	*Charadrius nivosus nivosus*	T	SSC
Marbled Murrelet	*Brachyramphus marmoratus*	T	E
Scripps's Murrelet	*Synthliboramphus scrippsi*	C, BCC	T
Guadalupe Murrelet	*Synthliboramphus hypoleucus*	C, BCC	T
Cassin's Auklet	*Ptychoramphus aleuticus*	BCC	SSC
Rhinoceros Auklet	*Cerorhinca monocerata*	–	TW
Tufted Puffin	*Fratercula cirrhata*	–	SSC
California Gull	*Larus californicus*	–	TW
California Least Tern	*Sternula antillarum browni*	E	E
Elegant Tern	*Thalasseus elegans*	–	TW

[a] Status: C = candidate; BCC = bird of conservation concern; DE = delisted (formerly endangered); E = endangered; SSC = species of special concern; T = threatened; TW = taxa to watch; – = not listed.

Area will have no effect on the following listed species: Short-tailed Albatross (*Phoebastria albatrus*), Hawaiian Petrel (*Pterodroma sandwichensis*), California Condor (*Gymnogyps californianus*), and California Ridgway's Rail (*Rallus obsoletus obsoletus*). Brief descriptions of these species and the rationale for anticipated project effects on them follow.

Short-tailed Albatross. The Federally endangered Short-tailed Albatross is also a California species of special concern. It breeds on islands surrounding Japan. During the non-breeding season, the Short-tailed Albatross regularly ranges along the Pacific Rim from southern Japan to the Gulf of Alaska, primarily along continental shelf margins. It is rare to casual but increasing offshore from British Columbia to southern California (Howell 2012). All recent records along the west coast have been stage 1 immatures (Howell 2012) which travel more broadly throughout the north Pacific than adults (USFWS 2014). Most individuals off California in recent years have been observed during fall and early winter, with a few records in late winter and early spring (Iliff et al. 2007). There have been 40 records of the species off California since 1977, with 36 records between 1998 and 2014. Nine of the 40 records have occurred in the Southern California Planning Area off the coast of San Luis Obispo and Santa Barbara counties, and around and beyond the Channel Islands. This species is not expected to occur with any regularity in the Southern California Planning Area site due to its rarity and the lack of recorded sightings in the vicinity of the project area; therefore, we have determined that the proposed activities will have no effect on this species.

Hawaiian Petrel. The Federally endangered Hawaiian Petrel breeds on the larger Hawaiian islands. The global population is composed of approximately 19,000 individuals, including an estimated 4,500 to 5,000 breeding pairs (USFWS 2011; Lebbin et al. 2010). Individuals have been recorded off of Oregon and California from April through October (Onley and Scofield 2007), with the California records occurring from April through early September. There are 12 records in the vicinity of the Southern California Planning Area; one was nearshore and the others were 24 to 100 mi offshore. Hawaiian Petrels make regular foraging excursions to areas off of northern California, but there does not appear to be a regular pattern of occurrence off central and southern California. As the Hawaiian Petrel is not expected to occur with any regularity in the Southern California Planning Area, the proposed activities will have no effect on this species.

California Condor. All free-ranging Federally endangered California Condors were removed from the wild by 1987 for captive breeding. Since 1992, California Condor chicks have regularly been released to the wild, and the total world population now numbers about 400 birds; 235 of which are free-flying wild birds in California, Arizona, Utah, and Baja California, Mexico (USFWS 2013a). In California, California Condors now inhabit the mountain ranges that surround the southern part of the San Joaquin Valley. Those that live along the coast in the Big Sur area on the Monterey County coastline have been observed feeding on the carrion of whales, California sea lions, and other marine species along the marine coastline (USFWS 2013a). We are not aware of any observations of California Condors feeding along the marine coastline south of Big Sur, as most of the birds south of Monterey County are restricted to more inland mountain ranges in San Luis Obispo, Santa Barbara, Ventura, and Los Angeles counties. Because of their absence from the marine coastline south of Monterey County, we have determined that the proposed activities will have no effect on this species.

California Ridgway's Rail. The Federally endangered California Ridgway's Rail, formerly known as the California Clapper Rail (*Rallus longirostris obsoletus*), is generally restricted to the San Francisco Bay area. The California Ridgway's Rail was formerly a breeding species in Morro Bay and Elkhorn Slough but was extirpated from those locations. Records of California Ridgway's Rail sightings beyond San Francisco Bay are now sparse (USFWS 2013b). Due to the species current distribution, we have determined that the proposed activities will have no effect on this species.

The following Federally listed bird species occur within the Southern California Planning Area and could potentially be affected by project-related activities: Light-footed Ridgway's Rail (*Rallus obsoletus levipes*), Pacific Coast population of the Western Snowy Plover (*Charadrius nivosus nivosus*), Marbled Murrelet (*Brachyramphus marmoratus marmoratus*), and California Least Tern (*Sternula antillarum browni*). Brief descriptions of these species follow. Potential project-related impacts are provided in Section 4.5.1.4.

Light-footed Ridgway's Rail. The endangered Light-footed Ridgway's Rail was formerly known as the Light-footed Clapper Rail (*Rallus longirostris levipes*). A recovery plan was approved in 1979 (USFWS 1979). Critical habitat has not been designated for this subspecies. Habitat loss and degradation were the primary reason for ESA listing.

The Light-footed Ridgway's Rail inhabits coastal salt marshes from the Carpinteria Marsh in Santa Barbara County, California, to Bahia de San Quintin, Baja California, Mexico (Zembal et al. 1989, 1998). Dense growths of cordgrass (*Spartina foliosa*) and pickleweed (*Salicornia* sp.) are conspicuous components of rail habitat, and nests are located most frequently in cordgrass. Light-footed Ridgway's Rails construct loose nests of plant stems, either directly on the ground when in pickleweed or somewhat elevated when in cordgrass (USFWS 1979). Although nests are usually located in the higher portions of the marsh, they are buoyant and will float up with the tide. The laying of eggs occurs from mid-March to the end of June, but mostly from early April to early May. The incubation period is about 23 days, and young can swim soon after hatching.

Historically, Light-footed Ridgway's Rails probably occupied most of the salt marshes in the region, but no more than 24 marshes have been occupied since about 1980 (Zembal and Hoffman 1999). Approximately 500 pairs are believed to be left in California, with most occurring in Upper Newport Bay, Seal Beach, and the Tijuana Marsh. The vast majority (more than 95%) of the remaining Light-footed Ridgway's Rails are in Orange and San Diego counties. In 2013, a total of 525 pairs exhibited breeding behavior in 22 marshes in southern California (Zembal et al. 2013). This is the largest Statewide breeding population detected since the counts began in 1980, and represents an 18.5% increase over the former high count in 2007. It also represents the third successive year of record-breaking high counts. Although surveys have not been conducted in Baja California for several years, the Baja population is thought to consist of at least 400 to 500 pairs.

In the vicinity of the Santa Barbara Channel, there are two marshes that are, or have the potential to be, occupied by Light-footed Ridgway's Rails. These are Carpinteria Marsh in Santa Barbara County and Mugu Lagoon in Ventura County. The next closest occupied location is the Seal Beach National Wildlife Refuge (NWR) in Orange County. These locations represent the northern extent of the subspecies range along the California coast. The subpopulation at Mugu Lagoon fluctuated between 3 and 7 pairs for nearly 20 years until recent augmentations with translocated birds from Newport Bay fostered its growth. During 2010 through 2014, there was an average of 18 pairs and five unmated males in Mugu Lagoon on Naval Base Ventura County (Pereksta 2015a). The increased population at this location appears to have led to an expansion of habitat use within the lagoon. For example, in 2004, a pair of rails was observed attempting to breed in the eastern arm of the lagoon for the first time in many years (Zembal et al. 2006). In Santa Barbara County, the Light-footed Ridgeway's Rail was formerly more widespread, but the loss of habitat and other factors restricted it to the Carpinteria Salt Marsh during the late 1900s (Lehman 2014). Approximately 20 pairs were there in the early 1980s, dropping to just one individual by 2004. None were recorded after 2004 until a single individual was heard vocalizing there in 2011.

Western Snowy Plover. The Pacific Coast population of the Western Snowy Plover is listed as threatened. The primary reasons for its listing are loss and degradation of habitat and human disturbance. A final recovery plan has been adopted (USFWS 2007). Critical habitat for the species was last revised in 2012 (USFWS 2012). The revised critical habitat for the Western Snowy Plover includes 60 units totaling 24,526 acres (9,925 ha). Thirty-five of these units occur along the coast of the Southern California Planning Area, comprising 6,117 acres (2,475 ha) (USFWS 2012). This acreage is 25% of the total critical habitat designation.

The Pacific Coast population of the Western Snowy Plover breeds on the Pacific Coast from southern Washington to southern Baja California, Mexico. It nests in depressions in the sand above the drift zone on coastal beaches, sand spits, dune-backed beaches, sparsely vegetated dunes, beaches at creeks and river mouths, and salt pans at lagoons and estuaries. The breeding season extends from early March to late September, with birds at more southerly locations beginning to nest earlier in the season than birds at more northerly locations (USFWS 1999). In most years, the earliest nests on the California coast generally occur during the first to third week of March. Peak nesting in California occurs from mid-April to mid-June, while hatching lasts from early April through mid-August.

Western Snowy Plover chicks leave the nest within hours after hatching to search for food. Adult plovers do not feed their chicks but lead them to suitable feeding areas. The chicks reach fledging age approximately 1 month after hatching; however, broods rarely remain in the nesting area throughout this time. Plover broods may travel along the beach as far as 4 mi (6.4 km) from their natal area.

Western Snowy Plovers are primarily visual foragers. They forage for invertebrates across sandy beaches from the swash zone to the macrophyte wrack line of the dry upper beach. They also forage in dry sandy areas above the high tide, on salt flats, and along the edges of salt marshes and salt ponds (USFWS 1993).

In winter, Western Snowy Plovers occur on many of the beaches used for nesting as well as on beaches where they do not nest, in man-made salt ponds, and on estuarine sand and mud flats. The winter range is somewhat broader and may extend to Central America (Page et al. 1995). During winter, the majority of the birds occur south of Bodega Bay, California (Page et al. 1986).

The Western Snowy Plover was formerly found on quiet beaches the length of the State, but it has declined in abundance and is discontinuous in its distribution. Habitat degradation caused by human disturbance, urban development, introduced beachgrass (*Ammophila* spp.), and expanding predator populations have led to declines in nesting areas and the size of breeding and wintering populations (USFWS 2007). The summer window survey conducted in 2014 found 2,016 birds throughout Washington, Oregon, and California.

In the Southern California Planning Area, Western Snowy Plovers breed or winter along the coasts of San Luis Obispo, Santa Barbara, Ventura, Los Angeles, Orange, and San Diego Counties from San Carpoforo Creek in northern San Luis Obispo County to Border Field State Park in San Diego County. They also occur on several of the Channel Islands, including

San Miguel, Santa Rosa, Santa Cruz, San Nicolas, and San Clemente islands. From 2010 through 2014, an average of 1,100 breeding adults occurred in this area, which is 58% of breeding adults in the range of the listed population. Significant breeding areas within this stretch of coast include the Morro Bay Sandspit, Oceano Dunes State Vehicular Recreation Area, the Guadalupe Dunes, Vandenberg Air Force Base beaches, Coal Oil Point, Ventura Beaches (McGrath, Mandalay, and Hollywood), Ormond Beach, Naval Base Ventura County, San Nicolas Island, the Bolsa Chica Ecological Reserve, and Camp Pendleton. The average number of wintering Western Snowy Plovers in this area from 2008 through 2012 was 2,463, approximately 70% of the wintering population along the California coast.

Marbled Murrelet. The Marbled Murrelet is listed as threatened within the States of Washington, Oregon, and California (USFWS 1992). It spends most of its life in the nearshore marine environment, but nests and roosts inland in low-elevation old growth forests, or other forests with remnant large trees. Revised critical habitat for the species was published in 2011 (USFWS 2011). No marine areas were designated as critical habitat, and none of the terrestrial units are south of the Santa Cruz Mountains (the southern extent of known breeding along the Pacific Coast), which is approximately 100 mi (160 km) north of the Southern California Planning Area.

While the Marbled Murrelet does not nest in the vicinity of the project area, individuals from the population nesting in the Santa Cruz Mountains (and perhaps from more northerly populations) do disperse to the coast and offshore waters of San Luis Obispo and Santa Barbara counties. Marantz (1986) characterized them as a rare transient and winter visitors offshore, but possibly regular in late summer in San Luis Obispo County. Lehman (2014) described the species as a very rare late-summer, fall, and winter visitor along the Santa Barbara County coast, but somewhat regular in late summer in the Point Sal/north Vandenberg Air Force Base area. The San Luis Obispo coast extending south to Point Sal in Santa Barbara County is an important wintering area for the species (Peery et al. 2008). Point Sal is more than 15 mi (24 km) north of Irene (the northernmost platform in the Southern California Planning Area).

A review of records in eBird (2015) shows Marbled Murrelet observations along the coast from Arroyo de la Cruz in northern San Luis Obispo County to the Purisima Point area on Vandenberg Air Force Base. Areas with concentrations of Marbled Murrelet observations include San Simeon Bay, offshore of San Simeon State Park, Cayucos, Morro Bay, San Luis Obispo Bay, and off the Santa Maria River mouth. These records show peaks of occurrence along this stretch of coast in mid-January, May to early June, and mid-August to early November. Marbled Murrelets occur less frequently south of Point Conception; however, they are observed occasionally off of Ventura, along the Malibu coastline, and in Santa Monica Bay.

Marbled Murrelets forage at sea by pursuit diving in relatively shallow waters, usually between 66 and 262 ft (20 and 80 m) in depth, with the majority of birds found as singles or pairs in a band 985 to 6,560 ft (300 to 2,000 m) from shore (Strachan et al. 1995). After the breeding season, some birds disperse and are less concentrated in nearshore coastal waters, as is the case with some other alcids. Ainley et al. (1995) conducted ship-based surveys off central California and detected most Marbled Murrelets within 4 mi (7 km) of shore, with the largest number occurring 2 to 3 mi (3 to 5 km) offshore. They observed one individual 15 mi (24 km) offshore near the edge of the continental shelf break.

California Least Tern. The California Least Tern was listed as endangered in 1970 (USFWS 1970). The recovery plan for the species was first published in 1980 (USFWS 1980) and revised in 1985 (USFWS 1985). Critical habitat has not been designated. The primary reasons for its listing were habitat loss, human disturbance, and predation. In the 5-year review of the California least tern, it was recommended to downlist the species to threatened (USFWS 2006). However, this recommendation has not yet been enacted.

The California Least Tern is a summer visitor to California. It breeds on sandy beaches close to estuaries and embayments discontinuously along the California coast from San Francisco Bay south into Baja California. The earliest spring migrants arrive in the San Diego area after the first week in April and reach the greater San Francisco Bay area by late April (Small 1994). Nesting colonies are usually located on open expanses of sand, dirt, or dried mud, typically in areas with sparse or no vegetation. Colonies are also usually located in close proximity to a lagoon or estuary where they obtain most of the small fish the birds consume, although they may also forage up to 2 to 3 mi (3 to 5 km) offshore. Nests consist of a shallow scrape in the sand, sometimes surrounded by shell fragments. Eggs (usually two per clutch) are laid from mid-May to early August. Incubation takes 20 to 28 days, and young fledge in about 20 days (USFWS 1980). California Least Terns are fairly faithful to breeding sites and return year after year regardless of past nesting success. In the Southern California Planning Area, California Least Terns breed along the coasts of San Luis Obispo, Santa Barbara, Ventura, Los Angeles, and Orange counties from Oceano Dunes in San Luis Obispo County to the Tijuana River Estuary in San Diego County. Fall migration begins the last week of July and first week of August (USFWS 2006) when it departs for its wintering grounds in Central and South America. Most individuals are gone from southern California by mid-September.

In 1970, the California Least Tern population in California was estimated at 600 breeding pairs. Population growth rates have increased, especially since the mid-1980s, when active management was initiated at breeding colonies. Although the increase in the breeding population has not been consistent from year to year, the long-term trends have shown steady population growth. Fluctuations in the California Least Tern population are thought to be attributable to a combination of high levels of predation and low prey availability.

In the general area of the Southern California Planning Area, California Least Terns used as many as 28 sites for nesting in 2013. Range-wide survey results from 2013 reported a minimum of 3,904 breeding pairs, a maximum of 5,094 breeding pairs, and 5,406 nests in this region, which is approximately 92% of the nesting population and effort in California. Significant breeding areas within this stretch of coastline include Oceano Dunes, Vandenberg Air Force Base, McGrath State Beach, Hollywood Beach, Ormond Beach, Point Mugu, Venice Beach, Los Angeles Harbor, Seal Beach NWR, Bolsa Chica Ecological Reserve, Huntington State Beach, Burris Basin, Upper Newport Bay, Camp Pendleton, Batiquitos Lagoon, Mission Bay, Naval Base Coronado, Sweetwater Marsh NWR, and Tijuana River Estuary.

Studies conducted at some of the larger colonies in southern California show that at least 75% of all California Least Tern foraging activity during the breeding season occurs in the ocean (Atwood and Minsky 1983). Approximately 90 to 95% of ocean feeding occurred within 1 mi (1.6 km) of shore in water depths of 60 ft (18 m) or less. California Least Terns were rarely seen foraging at distances between 1 and 2 mi (1.6 and 3.2 km) from shore and were never encountered farther than 2 mi offshore (Atwood and Minsky 1983). However, there is evidence of some migration off California that occurs as far as 20 mi (32 km) offshore or more based on observations off southern California (Pereksta 2015b). Observations from offshore Mexico possibly corroborate this evidence (Howell and Engel 1993; Ryan and Kluza 1999).

Other Special Status Bird Species. In addition to the Federally listed species, the following special status species (e.g., USFWS Bird of Conservation Concern, Federal candidate, and/or State listed), which are considered globally rare, have a significant percentage of their populations within the Southern California Planning Area and could potentially be affected by project-related activities: Ashy Storm-petrel, Scripps's Murrelet, and Guadalupe Murrelet (*Synthliboramphus hypoleucus*). Brief descriptions of these species follow. Potential project-related impacts are provided in Section 4.5.1.4.

Ashy Storm-Petrel. The Ashy Storm-petrel is a USFWS Bird of Conservation Concern and a California Species of Special Concern. It is one of the rarest storm-petrels in the world, with an estimated global population of no more than 10,000 individuals. The ashy storm-petrel breeds on offshore islands from central Mendocino County to the southern Channel Islands and the Todos Santos Islands off northwestern Baja California, Mexico (Carter et al. 2008). It moves to and from colonies at night. Its breeding season is spread throughout most of the year (Carter et al. 2008), although it typically occurs off southern California from March to October. This species breeds on six of the eight California Channel Islands (it does not breed on Santa Rosa and San Nicolas Islands).

The Ashy Storm-petrel forages widely in waters seaward of the continental shelf, near islands, and near the coast within the southern California Current ecosystem (Ainley et al. 1974; Briggs et al. 1987; Mason et al. 2007; Spear and Ainley 2007). The species does not travel significantly far from its colonies after breeding, and many birds remain offshore from their breeding grounds. However, some individuals can make short seasonal migrations. In fall, large numbers congregate in Monterey Bay and on the Cordell Bank. Fall concentrations in Monterey Bay probably include Farallon Islands' breeders, non-breeders, and fledglings along with individuals from southern populations (Ainley 1976).

Mason et al. (2007) observed Ashy Storm-petrels throughout their study area in the Southern California Bight and the waters north of Point Conception. Three specific areas where they found aggregations of Ashy Storm-petrels included the waters between Santa Cruz and San Nicolas Islands, the western Santa Barbara Channel, and 6 to 43 mi (10 to 70 km) offshore from San Miguel Island to Point Buchon. Briggs et al. (1987) observed Ashy Storm-petrels in greatest abundance near San Miguel Island from April to June. After October, birds occurred near San Clemente and Santa Catalina Islands, over the Santa Rosa-Cortes Ridge, and in the western

Santa Barbara Channel to Point Buchon (Briggs et al. 1987). Based on the normal distribution and abundance, this species could occur within the project site year-round but has the highest potential of occurrence during the spring and fall months.

Scripps's and Guadalupe Murrelets. The Scripps's Murrelet and Guadalupe Murrelet are listed as threatened species by the State of California, candidates for Federal listing by the USFWS, and USFWS Birds of Conservation Concern. These species were formerly considered one species, the Xantus's Murrelet (*Synthliboramphus hypoleucus*), until a recent taxonomic revision by the American Ornithologists' Union (2012). The breeding range of these species is restricted to 12 nesting islands or groups of islands over a distance of 500 mi (800 km) in southern California and Baja, Mexico (Pacific Seabird Group 2002). The estimated remaining global population (Scripps's Murrelet <20,000 breeding birds; Guadalupe Murrelet <5,000 breeding birds) is concentrated during the breeding season in or near the breeding colonies on the Channel Islands and off the coast of northern Baja California. The two species typically nest in crevices, caves, under large rocks, on steep cliffs and canyons of offshore islands. The nesting period extends from February through July but may vary depending on food supplies (BirdLife International 2015).

The two murrelet species occur off southern California at different times of the year. The northern breeding Scripps's Murrelet occurs primarily from January to September, with a peak of abundance between late February and July. This species breeds from San Miguel Island south to the San Benito Islands off Baja California. The Guadalupe Murrelet breeds primarily on Guadalupe Island off Baja California; however, the species also breeds in small numbers on the San Benito Islands (Carter et al. 2005). It occurs off southern California from July to December.

During the breeding season, Scripps's Murrelets are generally concentrated in the Southern California Bight. Their distribution at sea during this time varies based on conditions in the marine environment. Whitworth et al. (2000) tracked Scripps's Murrelets nesting on Santa Barbara Island and found that they were dispersing to forage in cool upwelling areas averaging 39 mi (62 km) from the island in 1996 and 69 mi (111 km) in 1997. Briggs et al. (1987) observed bird concentrations around Santa Barbara Island and off San Diego in the breeding months (March to May), with birds off San Diego presumably from the nearby Coronado Islands. The greatest densities were near Santa Barbara and Anacapa Islands and north of Point Conception along the coast.

The pelagic distributions of both species overlap during the post-breeding dispersal in late summer and autumn, when both move primarily northward (Whitworth et al. 2000). At this time of year, they occur from southern Baja California to Vancouver Island, British Columbia, with the bulk between central Oregon and central Baja California, Mexico. Outside of the breeding season beyond foraging areas used by birds attending colonies, Karnovsky et al. (2005) found the murrelets (reported as Xantus's Murrelets) at an average ocean depth of 5,013 ft (range 85 to 15,056 ft or 1,528 m (range 26 to 4,589 m), with the highest densities occurring over the upper continental slope (depth: 656 to 3,280 ft or 200 to 1,000 m). Densities were moderately high over the outer slope (depth: 3,280 to 9,840 ft or 1,000 to 3,000 m) but were low over pelagic waters (depths > 9,840 ft or 3,000 m), as well as over the continental shelf (depth: 656 ft or 200 m). The average distance from the mainland was 52 mi (range 1.2 to 156 mi) or 83 km (range 2 to 251 km), with highest densities 16 to 93 mi (26 to 150 km) from shore. In central California waters, the murrelets were associated with high sea surface temperature, low salinity, and a shallow but highly stratified thermocline.

Therefore, these species could be found in the vicinity of the project site year-round; however, the greatest possibility for either of them to occur in the area is from January to September when Scripps's Murrelets are breeding on islands in the Southern California Bight.

3.5.5 Sea Turtles

Four sea turtle species occur in the POCS offshore of southern California, all of which are Federally listed as threatened or endangered under the ESA. Two species are endangered: the loggerhead turtle (North Pacific Ocean Distinct Population Species [DPS]) (*Caretta caretta*) and the leatherback turtle (*Dermochelys coriacea*); and two species are threatened: the green turtle (*Chelonia mydas*) and the olive Ridley turtle (*Lepidochelys olivacea*). The USFWS and NOAA Fisheries (2015) have proposed to remove the current range-wide threatened listing of the green turtle and in its place list eight DPSs as threatened and three DPSs as endangered. Southern California is within the range of the proposed threatened East Pacific DPS of the green turtle. No known nesting habitat for any of the sea turtles occurs in the project area. Threats to sea turtles include incidental capture, entanglement, and injury/death from fishing gear; marine debris; environmental contamination; disease, loss, or degradation of nesting habitat; beach armoring; artificial lighting; non-native vegetation; and directed harvest (NOAA Fisheries 2014a–c; 2015k,l).

The loggerhead turtle occurs worldwide in subtropical to temperate waters. In the eastern Pacific, loggerhead turtles are reported from Chile to Alaska. They are occasionally sited from the coasts of Washington and Oregon, but most records are of juveniles of the coast of California. The most important development habitats for juveniles along the eastern Pacific are off the west coast of Mexico, including the Baja Peninsula. The only known nesting areas in the North Pacific are found in southern Japan (NOAA Fisheries 2014c). Sightings in California tend to occur from July to September but can occur over most of the year during El Niño years when ocean temperatures rise. The leatherback is primarily pelagic, but occasionally enters coastal bays, lagoons, salt marshes, estuaries, creeks, and mouths of large rivers (California Herps 2015). Loggerhead turtles consume sponges, crustaceans, mollusks, jellyfish, worms, squid, barnacles, fish, and plants (NOAA Fisheries 2014c; California Herps 2015).

The leatherback turtle is mostly pelagic, but occasionally enter shallower waters of bays and estuaries (NOAA Fisheries 2015l). It is the most common sea turtle in U.S. waters north of Mexico. They tend to arrive in California waters in June and stay until mid-October when they move to waters off Hawaii. Diet is primarily jellyfish, but they also consume other invertebrates, small fish, and plant material (NOAA Fisheries 2015l: California Herps 2015). Revised critical habitat for the leatherback turtle (NOAA Fisheries 2012) encompasses the northern portion of the project area (encompassing Platform Irene). This segment of critical habitat stretches along the California coast from Point Arguello north to Point Arena east of the 9,842-ft (3,000-m) depth contour (NOAA Fisheries 2012).

The green turtle occurs worldwide in waters that remain above 20°C during the coldest months. It is uncommon along the California coast, but becomes more common south of San Diego (NOAA Fisheries 2015k). The green turtle is usually seen in El Niño years when ocean temperatures are warmer than normal. It inhabits shallow waters of lagoons, bays, estuaries, mangroves, eelgrass, and seaweed beds; it prefers areas with abundant vegetation in shallow, protected water. Green turtles consume seaweed, algae, and invertebrates, including sponges and jellyfish (NOAA Fisheries and USFWS 2007; California Herps 2015).

The olive Ridley turtle occurs worldwide in tropical to warm temperate waters. In the Eastern Pacific, they range from southern California to Chile. It is considered the most abundant sea turtle in the world, with an estimated 800,000 nesting females annually (NOAA Fisheries 2014b), but is rare along the California coast. In the eastern Pacific, olive Ridley turtles are highly migratory and spend much of their non-breeding life cycle in the oceanic zone (NOAA Fisheries and USFWS 2014), but are known to inhabit coastal areas (e.g., bays, estuaries) (NOAA Fisheries 2014b). Olive Ridley turtles are omnivorous and consume mollusks, crustaceans, jellyfish, sea urchins, fish, and occasional plant material (e.g., algae, seagrass) (NOAA Fisheries 2014b; California Herps 2015). They dive to depths up to 500 ft (150 m) to forage on benthic invertebrates (NOAA Fisheries 2014b).

3.6 RECREATIONAL AND COMMERCIAL FISHING

3.6.1 Commercial Fisheries

Although OCS operators are required to conduct activities without interfering with fishing activities, there is still a potential for fishers to be affected by O&G related activities on the POCS. Past effects have been associated with space use conflicts, OCS-associated seafloor debris, and reduced catch due to seismic surveys.

Commercial fishing occurs at various locations off the coast of southern and central California. The nearshore waters along the coast from Los Angeles to Monterey counties and the waters just off the Channel Islands contain beds of giant kelp that provide habitats for numerous species of commercially important fish and shellfish. The majority of commercially harvested fish are caught within these areas. About 64 commercial fish and shellfish species are fished using up to 15 gear types. Fishery seasons are established and regulated by the California Department of Fish and Wildlife (CDFW). Figure 3-15 shows the distribution of fish blocks in the project area, which are used to organize information on commercial fish catch. Fish blocks are 9- by 11-mi rectangles, or approximately 100 mi^2 of ocean area.

The CDFW reports the total number of pounds of commercial fishery species (comprised of fishes, invertebrates, and kelp) landed in California and the value of those landings annually for six reporting areas along the coast. From north to south, the California reporting areas are

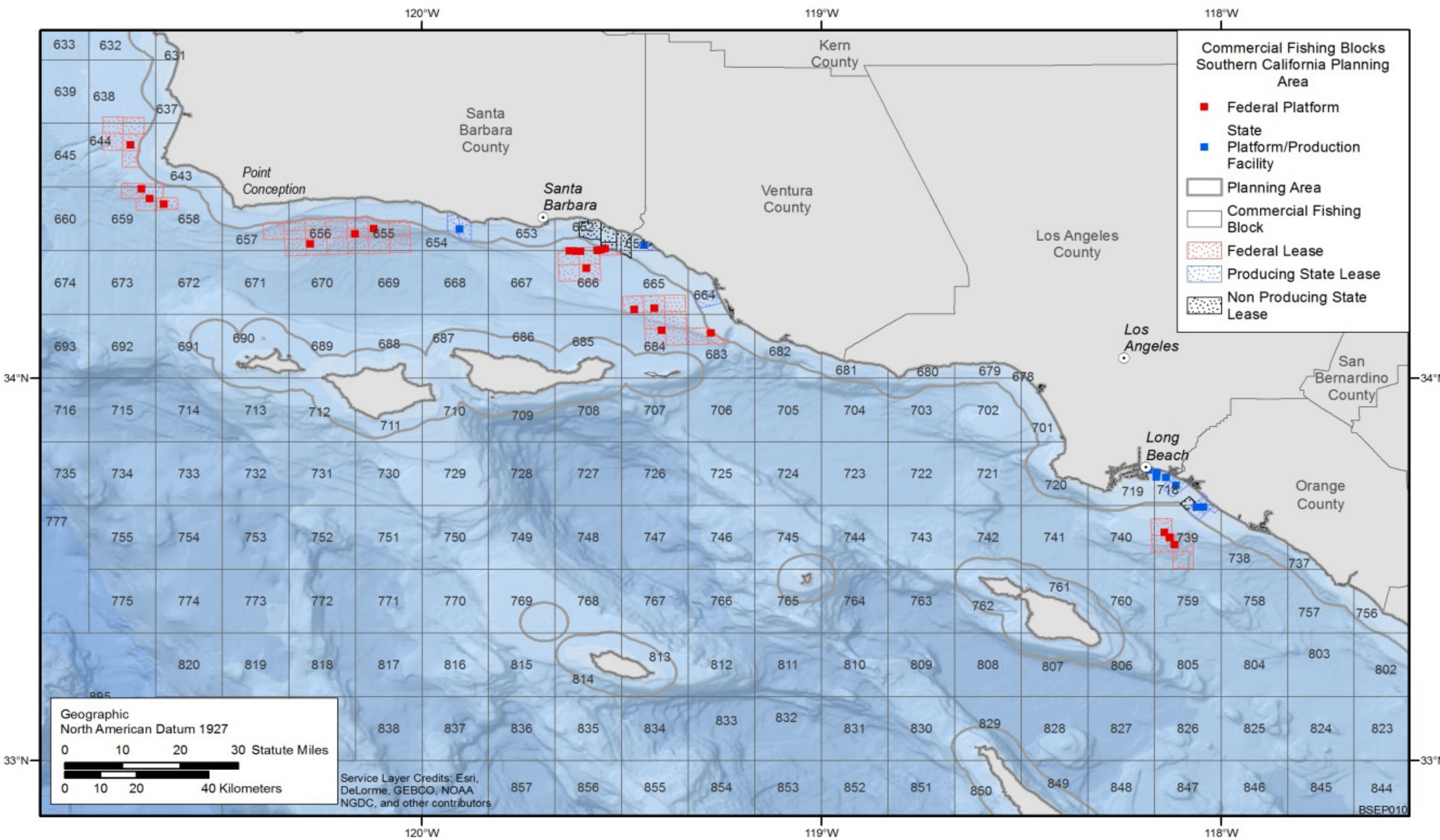

FIGURE 3-15 Commercial Fishing Blocks in the Project Area (Source: Perry et al. 2010)

Eureka, San Francisco, Monterey, Santa Barbara, Los Angeles, and San Diego. The project area is located in the Santa Barbara reporting area (includes the ports of Morro Bay, Avila Beach, Oceano, Santa Barbara, Ventura, Oxnard, and Port Hueneme) and the Los Angeles reporting area (includes the ports of Santa Monica, Redondo Beach, San Pedro, Huntington Beach, Dana Point, and Los Angeles). Landing weights and values in the Santa Barbara reporting area for the years 2000–2013 are provided in Table 3-13. Nearly all of the landings in the Santa Barbara reporting area are from Santa Barbara, Ventura, Oxnard, and Port Hueneme harbors; nearly all the landings in the Los Angeles reporting area are from the San Pedro, Terminal Island, Long Beach, and Dana Point harbors. Except for Dana Point, all of these harbors are located in the vicinity of Federal and State oil platforms within the project area (Figure 3-15).

Many species of fish and invertebrates are caught and landed in commercial fisheries off the California coast. The most important species groups are benthic invertebrates, oceanic pelagic (epipelagic) fishes, demersal fish species, and anadromous species. Important invertebrate species include Dungeness crab, spiny lobster, squid, and oysters (though oysters are primarily harvested in coastal, nearshore waters). Important targeted fish species include anadromous salmon (primarily Chinook), tuna, and swordfish (epipelagic); and sablefish, halibut, and rockfishes (demersal). Many fishers in the project area do not fish for just one species, or use only one gear-type. Most switch fisheries during any given year depending on market demand, prices, harvest regulations, weather conditions, and fish availability. During

TABLE 3-13 Annual Reported Landing Weights and Landing Values for the Commercial Fishery in the Santa Barbara Reporting Area, 2000–2013

	Santa Barbara Reporting Area		Los Angeles Reporting Area	
Reporting Year	Landing Weight (lb.)	Landing Value ($)	Landing Weight (lb.)	Landing Value ($)
2000	171,440,307	27,470,031	254,442,454	40,933,089
2001	109,956,541	17,600,164	218,641,818	31,603,239
2002	62,086,380	17,232,730	170,125,068	23,273,932
2003	60,373,853	22,906,278	88,473,636	18,942,786
2004	77,883,985	24,258,955	92,236,447	18,808,330
2005	70,116,910	23,313,676	139,665,143	28,901,187
2006	50,544,914	18,943,042	165,394,646	32,980,846
2007	101,601,398	33,758,431	142,114,144	21,466,986
2008	55,307,331	28,386,173	124,265,046	25,554,951
2009	147,618,279	49,856,516	114,400,580	31,694,118
2010	139,308,501	49,260,868	187,344,671	41,340,125
2011	134,256,459	48,738,293	158,129,849	43,846,470
2012	76,334,129	37,030,772	162,739,931	47,336,390
2013	111,068,052	50,473,294	115,623,747	37,420,884
Average	97,706,931	32,087,802	152,399,799	31,721,667

Source: CDFW (2015a).

2013, landings of more than 111 million pounds of fish and invertebrates, with a value of more than $50.4 million, were reported for the Santa Barbara reporting area (CDFW 2015a).

Each species or species group is caught using various methods and gear types. Traps are used for crab, spiny lobster, and some demersal fish species; sardines are usually caught in surrounding lampara or purse nets; tuna are caught on surface troll lines or longlines; rockfishes are generally captured using trawls, set longlines, or trolling rigs; and squid are caught by encircling schools with a round-haul net, such as a purse seine or lampara net. Generally, fishing activities with the highest potential for interactions (or conflicts) with OCS activities (e.g., oil and gas operations) are bottom trawling (potential for snagging on pipelines, cables, and debris) and surface longlining (potential for space-use conflicts with seismic survey vessels and possible entanglement with thrusters on dynamically positioned drill ships).

Seaweeds, especially kelp, are also commercially harvested within the project area using bow- or stern-mounted cutting mechanisms and conveyor systems (CDFW 2004). Commercial kelp harvesting is regulated by the California Fish and Game Commission through the issuance of licenses. Depending upon the status of the kelp resource within a given year, specific kelp beds may be open or closed to commercial harvesting (CDFW 2014a) and may be open or leased by specific harvesters. From 2004 to 2013, a total of more than 234.4 million pounds of kelp and other seaweeds were harvested within California with a value of more than $185,000.

3.6.2 Recreational Fishing

Southern California is a leading recreational fishing area along the west coast. Weather and sea conditions allow for year-round fishing. Recreational fishing includes hook-and-line fishing from piers and docks, jetties and breakwaters, beaches and banks, private or rental boats, and commercial passenger fishing vessels. Recreational fishing also includes activities such as dive, spear, and net fishing. Recreational fisheries in southern California access both nearshore and offshore areas, targeting both bottom fish and mid-water fish species. Boats can either drift with the currents, anchor, or live-boat to remain on the specific spot. The majority of recreational fishing is done by "jigging" baited hooks or lures. Several hooks or lures often occur on a single weighted line. For pelagic species such as salmon, trolling methods are also used.

The top five recreational landings for the Channel District of California (which includes the majority of the project area) between 2010 and 2014 were barred surfperch, vermilion rockfish, lingcod, bocaccio, and copper rockfish (Table 3-14). The top five recreational landings between 2010 and 2014 for the Southern California District (which extends from Los Angeles County to San Diego) were kelp bass, chub mackerel, California halibut, skate and ray species, and barred sandbass (Table 3-15).

TABLE 3-14 Estimated Total Catch (Metric Tons) of Fish Caught by Marine Recreational Anglers in the California Channel District, 2010–2014[a,b]

	Landing Weights (Metric Tons)						
Species Name	2010	2011	2012	2013	2014	Total	Percent of Total
Barred surfperch	1.09	78.10	87.39	49.65	143.45	359.69	12.6
Vermilion rockfish	26.24	53.65	68.77	69.58	60.15	278.40	9.7
Lingcod	8.73	45.14	60.57	93.56	68.48	276.48	9.7
Bocaccio	16.52	52.30	47.27	53.91	40.99	211.00	7.4
Copper rockfish	18.18	35.75	41.16	61.03	51.87	207.99	7.3
Pacific barracuda	68.82	6.10	36.69	4.13	6.50	122.24	4.3
White seabass	10.36	18.24	28.16	31.09	23.26	111.11	3.9
Bat ray	10.78	9.97	34.89	19.88	15.08	90.60	3.2
California halibut	20.89	16.86	23.67	13.33	13.75	88.49	3.1
Chub (Pacific) mackerel	6.80	33.46	7.81	5.74	26.01	79.82	2.8
Leopard shark	0.66	6.29	25.41	12.15	18.90	63.41	2.2
Pacific sardine	10.43	5.61	25.76	16.41	2.61	60.82	2.1
Pacific sanddab	3.69	15.90	14.00	16.62	7.10	57.30	2.0
Jacksmelt	4.13	8.98	11.00	21.49	8.15	53.74	1.9
Brown rockfish	5.65	10.02	8.77	12.01	12.47	48.92	1.7
California sheephead	4.30	11.35	7.59	6.83	14.81	44.89	1.6
Ocean whitefish	4.33	2.36	14.66	7.74	14.41	43.51	1.5
Kelp bass	3.60	9.83	9.18	7.22	13.12	42.96	1.5
Greenspotted rockfish	6.87	12.29	9.59	4.83	4.90	38.48	1.3
Yellowtail	0.32	1.63	0.38	7.79	28.32	38.45	1.3
Walleye surfperch	4.00	4.13	12.96	5.00	6.00	32.08	1.1
Starry rockfish	4.75	6.12	6.03	6.33	4.05	27.29	1.0

[a] Information for species comprising less than 1% of the total 5-year catch is not shown.

[b] Values derived from the RecFin database (http://www.recfin.org/data/estimates/tabulate-recent-estimates-2004-current) using a query for estimated total catch of fish caught by marine recreational anglers using all modes of fishing in all marine areas in the Channel District from January–December of 2010–2014.

Source: Pacific States Marines Fisheries Commission (2015).

TABLE 3-15 Estimated Total Catch (Metric Tons) of Fish Caught by Marine Recreational Anglers in the California Southern District (Los Angeles to San Diego), 2010–2014[a,b]

	Landing Weights (Metric Tons)						
Species Name	2010	2011	2012	2013	2014	Total	Percent of Total
Kelp bass	205.60	219.76	207.55	263.37	483.37	1379.64	9.9
Chub (Pacific) mackerel	336.92	192.27	194.01	150.69	248.63	1122.51	8.0
California halibut	237.41	89.78	187.06	260.24	144.61	919.10	6.6
Skates and rays[c]	55.23	36.36	260.79	184.73	296.63	833.74	6.0
Barred sandbass	173.50	214.15	158.01	120.91	116.94	783.52	5.6
Yellowtail	39.03	6.11	73.56	70.74	578.77	768.21	5.5
California scorpionfish	97.93	137.42	146.52	152.94	161.75	696.56	5.0
Pacific barracuda	141.79	140.48	95.39	65.50	111.76	554.93	4.0
Bat ray	86.21	31.86	104.18	250.67	60.38	533.30	3.8
Spotted sandbass	127.28	58.41	76.30	98.14	69.84	429.97	3.1
Yellowfin tuna	2.00	—[d]	21.55	0.10	350.27	373.92	2.7
Vermilion rockfish	32.50	64.33	80.40	82.99	70.50	330.72	2.4
Pacific bonito	102.30	4.20	0.96	12.64	199.76	319.86	2.3
Bocaccio	34.34	51.03	76.04	73.92	54.42	289.76	2.1
Pacific sanddab	38.92	65.77	50.08	68.73	62.85	286.36	2.1
White seabass	134.81	26.62	22.02	70.05	29.40	282.90	2.0
Barred surfperch	6.51	32.72	120.24	62.30	30.63	252.39	1.8
California sheephead	35.60	40.74	40.36	65.32	49.58	231.60	1.7
Thresher shark	74.01	79.67	17.49	25.58	10.76	207.51	1.5
Shovelnose guitarfish	36.30	13.46	70.22	28.87	33.48	182.33	1.3
Pacific sardine	46.70	18.34	45.68	56.80	7.48	175.00	1.3
Spotfin croaker	11.91	8.68	54.75	49.13	23.28	147.75	1.1
Rockfish[c]	18.30	22.05	24.31	38.66	41.88	145.19	1.0
Opaleye	46.35	7.52	33.97	17.88	29.35	135.07	1.0

[a] Information for species comprising less than 1% of the total 5-year catch is not shown.

[b] Values are from the RecFin database (http://www.recfin.org/data/estimates/tabulate-recent-estimates-2004–present) using a query for estimated total catch of fish caught by marine recreational anglers using all modes of fishing in all marine areas in the California Southern District from January-December of 2010–2014.

[c] Species not reported.

[d] Annual value not reported.

Source: Pacific States Marines Fisheries Commission (2015).

Private boat fishing, the most popular fishing method, occurs heavily around the Channel Islands and along the coastline off Point Sal on the central coast. Charter and party boat fishing, the most productive method, is heaviest at the Channel Islands and along the Santa Barbara Channel coastline. The most popular fishing grounds for private boat fishing are along the kelp beds within 1 nautical mi of shore, although some fishing areas extend as far as 5 nautical mi from shore (and thus on the OCS) and include lingcod and rockfish grounds over hard bottom areas. Trolling for pelagic species such as salmon, tunas, and billfish species can occur throughout the project area depending on the year and ocean conditions.

A commercial passenger fishing vessel (CPFV) is a boat that is operated by a hired skipper, and on which anglers pay a fee to board and fish. The term CPFV encompasses the terms charter boat (which usually refers to a boat carrying a prearranged, or closed, group of anglers) and party boat (which usually refers to a boat carrying a non-prearranged group). The capacities of CPFVs in the Santa Barbara Channel and central California typically range from six to 50 anglers. Fishing trips normally are for one-half day or a full day; overnight trips are unusual. Private boat fishing encompasses all hook-and-line sport fishing activity from boats other than CPFVs. These vessels are typically 5–8 m long, privately owned, trailered, and launched from ramps for single-day trips.

Estimated angler-days during 2013 for California Fishing District 1 (extends from Los Angeles to San Diego) totaled 532,000, 302,000, and 2,536,000 for recreational party/charter boat, private/rental boat, and shore fishing, respectively (NOAA 2014). The estimated economic benefits to California from District 1 fishing levels totaled approximately $119.4 million, $36.1 million, and $161.7 million for party/charter, private/rental boat, and shore fishing, respectively, and are estimated to have resulted in jobs for approximately 2,950 full- and part-time employees (NOAA 2014). For California Fishing District 2 (Ventura to Santa Barbara, including the Channel Islands), estimated angler-days during 2013 totaled 78,000, 43,000, and 445,000 for recreational party/charter boat, private/rental boat, and shore fishing, respectively (NOAA 2014). The estimated benefits to California from District 2 fishing levels totaled approximately $17.6 million, $5.1 million, and $28.4 million for party/charter, private/rental boat, and shore fishing, respectively, and are estimated to have resulted in jobs for approximately 465 full- and part-time employees (NOAA 2014).

3.7 AREAS OF SPECIAL CONCERN

Areas of special concern, shown in Figure 3-16, are Federally managed areas, also called Marine Protected Areas (MPAs). These include areas designated as national marine sanctuaries (NMSs), NPs, and national wildlife refuges (NWRs). There are also several coastal and aquatic reserves managed by State agencies or nongovernmental organizations along the Pacific coast (BOEMRE 2010). Locations given special designations by Federal and State agencies, such as national estuarine research reserves (NERRs), are also included here. In addition to these types of areas of special concern, the project area also includes offshore military use areas. Critical habitat (as designated under the ESA) for endangered species is discussed in biota-specific subsections of Section 3.5.

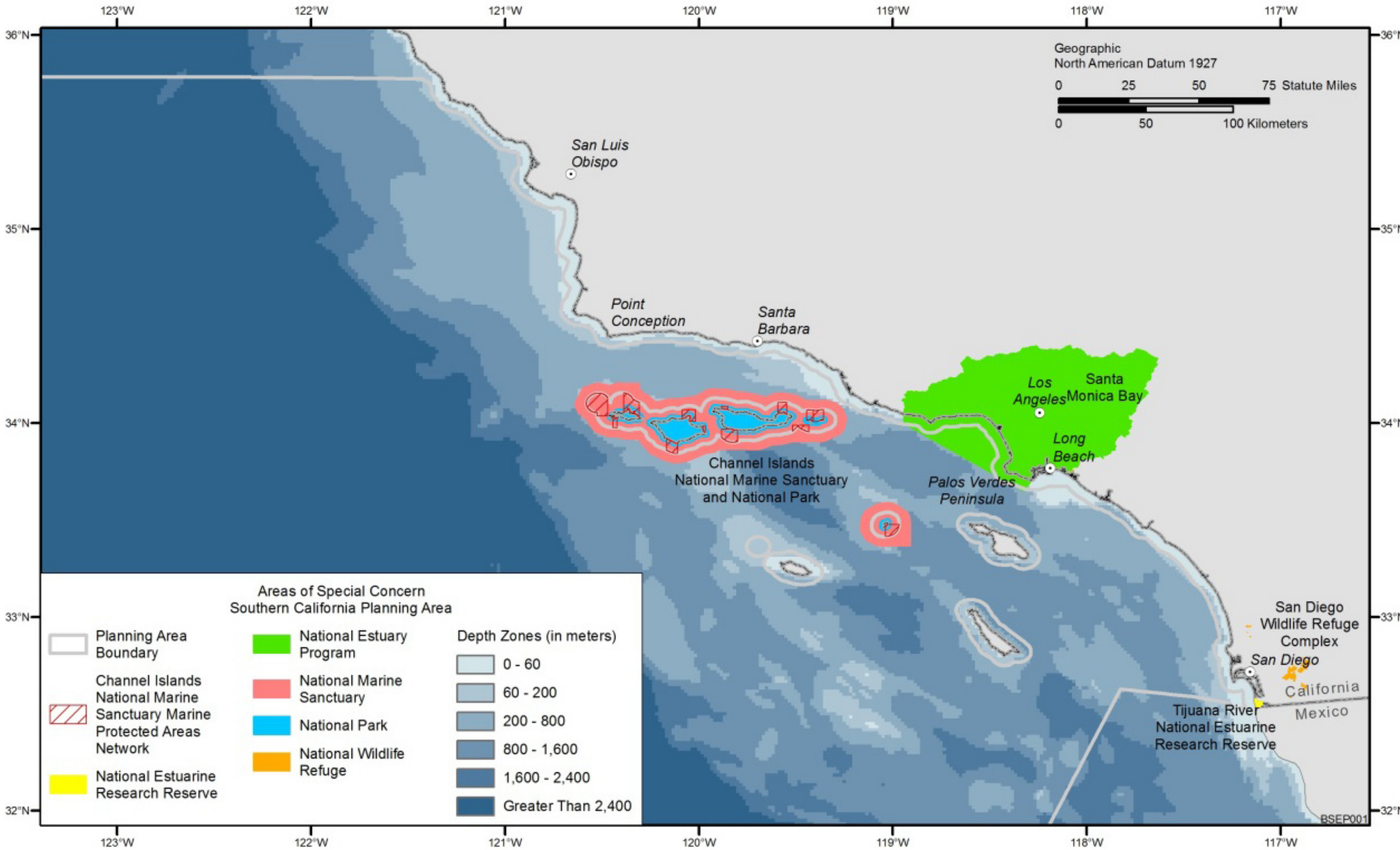

FIGURE 3-16 Areas of Special Concern along the Southern Pacific Coast

3.7.1 Marine Sanctuaries

The only NMS along the southern Pacific coast is the Channel Islands NMS, designated in 1980 under the National Marine Sanctuaries Act (16 U.S.C. 1431 et seq.; U.S. Department of Commerce et al. 2008). The Channel Islands NMS is located in the waters surrounding the islands and offshore rocks in the Santa Barbara Channel: San Miguel Island, Santa Rosa Island, Santa Cruz Island, Anacapa Island, Santa Barbara Island, Richardson Rock, and Castle Rock (Figure 3-16). The sanctuary covers an area of about 1,128 nautical mi^2 and extends seaward about 6 nautical mi from the Channel Islands and offshore rocks.

In 2002, the California Fish and Game established a network of MPAs within the nearshore waters of sanctuary; in 2006 and 2007, NOAA expanded the MPA network into the sanctuary's deeper waters (National Ocean Service 2015). The entire MPA network consists of 11 marine reserves (where all fish take and harvest is prohibited) and two marine conservation areas (where limited take of lobster and pelagic fish is allowed). The Channel Island NMS supports a diversity of marine life and habitats, unique and productive oceanographic processes and ecosystems, and culturally significant resources such as submerged cultural artifacts and shipwrecks (U.S. Department of Commerce et al. 2008).

3.7.2 National Parks

The Channel Islands NP encompasses an area of over 380 nautical mi^2, including the five islands off the southern coast of California (San Miguel Island, Santa Rosa Island, Santa Cruz Island, Anacapa Island, and Santa Barbara Island) and the seaward waters for a nautical mile beyond the islands. The park has both terrestrial and submerged (aquatic) habitats: kelp forests, seagrass beds, rock reefs, rock canyons, pelagic waters, coastal marshes and lagoons, sand beaches, sea cliffs, and rocky intertidal benches. Ecological resources in the park include seal and seabird rookeries, and at least 26 species of cetaceans have been reported. Archaeological and cultural resources (spanning more than 10,000 years) are also present (BOEMRE 2010).

3.7.3 National Wildlife Refuges

There are 28 NWRs designated as MPAs along the Pacific coast, most of which were established to provide feeding, resting, and wintering areas for migratory waterfowl and shorebirds. Four of these are located off the southern coast of California: (1) Seal Beach, (2) San Diego Bay, (3) San Diego, and (4) Tijuana Slough. Together, these NWRs comprise the San Diego Wildlife Refuge Complex. There are no NWRs directly offshore of Santa Barbara or Ventura Counties (BOEMRE 2010).

3.7.4 National Estuarine Research Reserves

There are six NERRs within the Pacific Region, one of which (the Tijuana River NERR) is located on the southern Pacific coast just to the north of the U.S.–Mexico border. Established in 1982, the Tijuana River NERR is a saline marsh reserve that encompasses 2,500 acres. It is home to eight threatened and endangered species, including the light-footed clapper rail and the California least tern (BOEMRE 2010).

3.7.5 National Estuary Program

Of the six estuaries in the Nation Estuary Program established in the Pacific region, one is located along the southern Pacific coast. The Santa Monica Bay, encompassing nearly 1,500 km^2, was established in 1988 to protect several threatened and endangered species, including the California least tern, western snowy plover, all four sea turtles (green, leatherback, loggerhead, and olive Ridley), and steelhead (BOEMRE 2010).

3.7.6 Military Use Areas

Military use areas, established in numerous areas off all U.S. coastlines, are used by the U.S. Air Force, Navy, Marine Corps, and Special Operations Forces to conduct various testing and training missions. Military activities can be quite varied but normally consist of air-to-air, air-to-surface, and surface-to-surface naval fleet training, submarine and antisubmarine training, and air force exercises. The Point Mugu Sea Range is a region in the southern Pacific region used intensively for military-related operations. The Point Mugu Sea Range encompasses 36,000 nautical mi^2 of ocean and controlled airspace, is about 200 nm long (north to south), and extends west into the Pacific Ocean from its nearest point at the mainland coast (3 nautical mi at Ventura County) out to about 180 nautical mi offshore (Figure 3-17). There are four OCS platforms (Harvest, Hermosa, Hidalgo, and Irene) located in Military Warning Area W-532; these were installed in 1985 and 1986 and are still in place (BOEMRE 2010). Lessees and platform operators are required to coordinate their oil and gas activities with appropriate military operations to prevent potential conflicts with military training and use activities.

The Navy Fleet and Marine Corps amphibious training occurs almost daily along the Pacific coast, with activity varying from unit-level training to full-scale carrier/expeditionary strike group operations and certification.

The U.S. Army Corps of Engineers has established surface danger zones and restricted areas used for a variety of hazardous operations (Figure 3-17) (33 CFR Part 34). The danger zones may be closed to the public on a fulltime or intermittent basis. A restricted area is a defined water area for the purpose of prohibiting or limiting public access. Restricted areas generally provide security for government property and/or protection to the public from the risks of damage or injury arising from the government's use of that area.

3.7.7 California State Protected Areas

There are more than 50 State-designated MPAs along the southern Pacific coast (from Point Conception to the U.S.–Mexico border), covering about 2,351 mi^2 of ocean, estuary, and

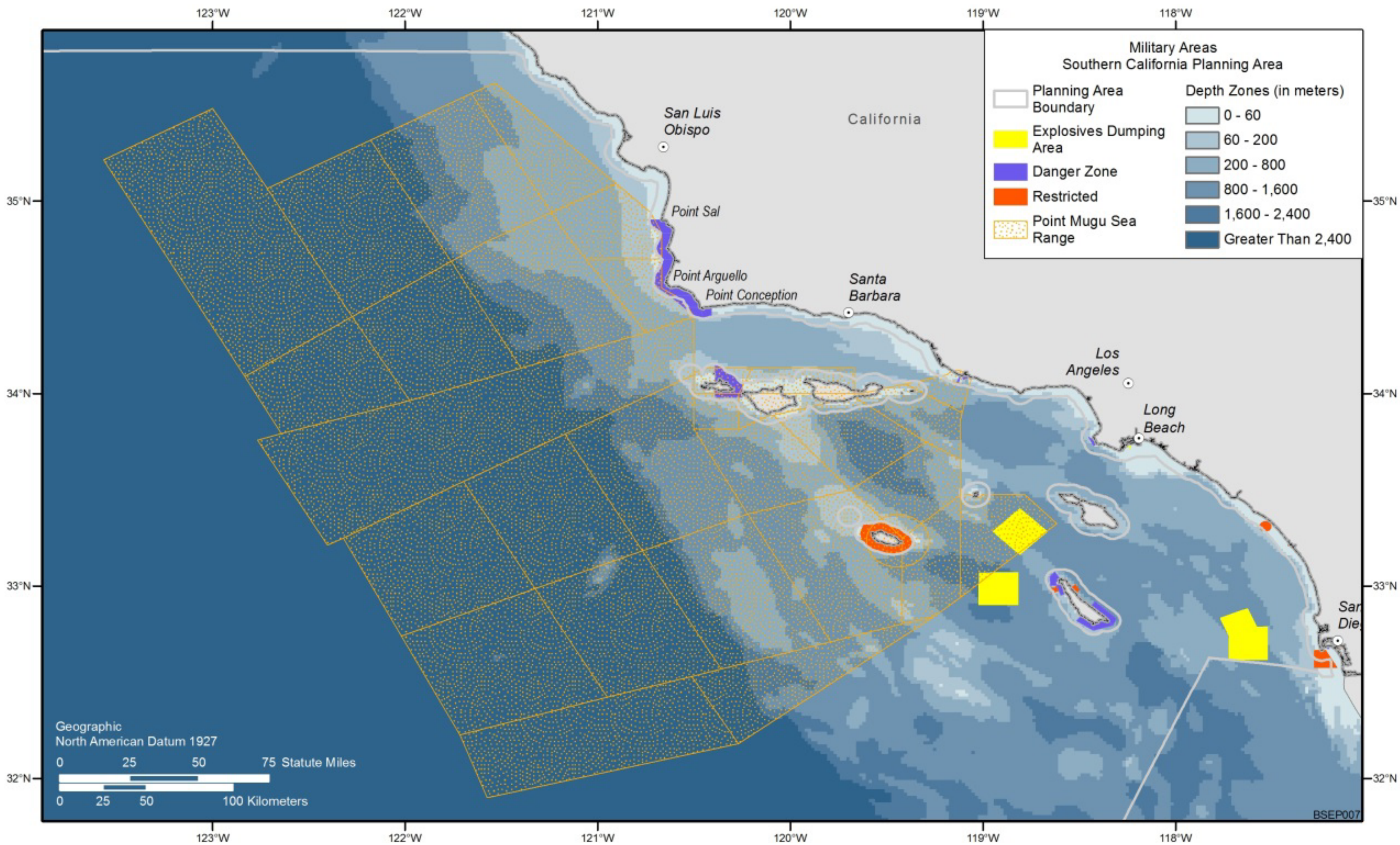

FIGURE 3-17 Military Use Areas along the Southern Pacific Coast

offshore rock/island waters and 356 mi of coastline (Figure 3-18). These designations have been in effect in State waters since January 1, 2012, and include the following:

- 19 State marine reserves, which prohibit damage or take of all marine resources (living, geological, or cultural);

- 21 State marine conservation areas, which allow some recreational and/or commercial take of marine resources;

- 10 State marine conservation areas, which generally prohibit the take of marine resources (living, geological, or cultural), but allow some ongoing permitted activities such as dredging to continue; and

- 2 special closure areas, designated by the California Fish and Game Commission, which prohibit access or restrict boating activities in waters adjacent to seabird rookeries or marine mammal haul-out sites (CDFW 2014b, 2015b).

3.8 ARCHAEOLOGICAL RESOURCES

3.8.1 Regulatory Overview

Section 106 of the National Historic Preservation Act of 1966, as amended (NHPA; 54 U.S.C. 306108) requires that Federal agencies take into account the effect of an undertaking under their jurisdiction on significant cultural resources. A cultural resource is considered significant when it meets the eligibility criteria for listing on the *National Register of Historic Places* (NRHP) (36 CFR 60.4). The Section 106 process requires the identification of cultural resources within the area of potential effect of a Federal project, consideration of a project's impact on cultural resources, and the mitigation of adverse effects on significant cultural resources. The process also requires consultation with State Historic Preservation Officers, the Advisory Council on Historic Preservation, Native American tribes, and interested parties. In the case of oil, gas, and sulfur leases, BSEE and BOEM have established regulations (e.g., 30 CFR 250.194) and issued guidance to lessees (e.g., NTL No. 2006-P03) to ensure compliance with Section 106 of the NHPA and its implementing regulations in 36 CFR Part 800.

3.8.2 Pacific Region

Cultural resources found in the Pacific Region can include submerged prehistoric archaeological sites, shipwrecks, and architectural resources found on the shore. Many of the oldest archaeological sites associated with prehistoric peoples are located on the OCS and were inundated as sea levels rose. Historic resources date to 1542 when Europeans first reached California. The first permanent settlements in the Santa Barbara region began in 1769. Most of

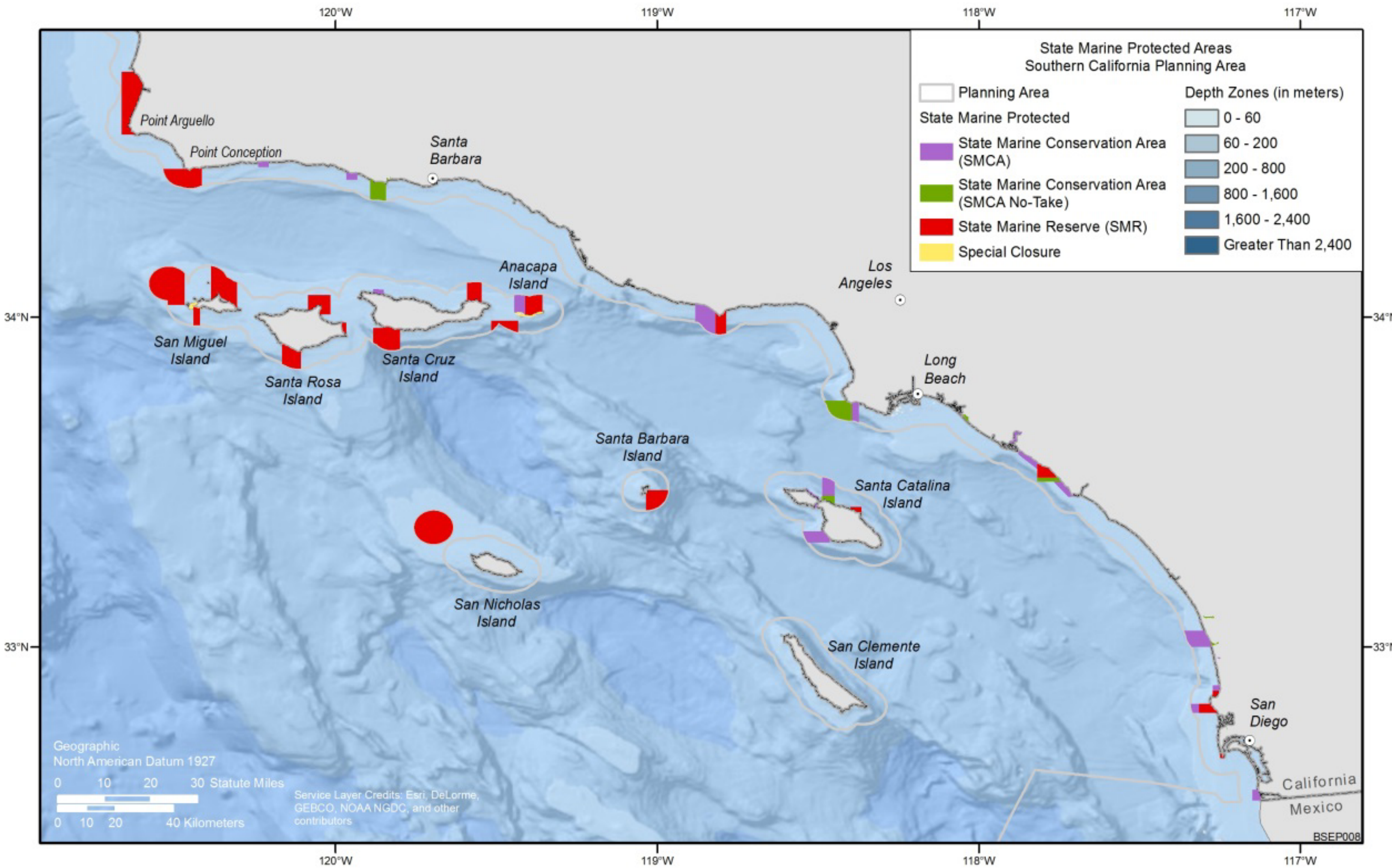

FIGURE 3-18 State-Designated MPAs along the Southern Pacific Coast

the historic resources found on the OCS are shipwrecks. Architectural resources located on the shore consist of buildings and districts associated with American history.

The Santa Barbara Channel Region contains numerous cultural resources (MMS 2005). Past studies indicate that while numerous cultural resources are known in the region, there are likely many more that have yet to be discovered. Only a small percentage of the ships reported lost near the Channel Islands have been located and identified (MMS 2005). Locating inundated archaeological sites is very difficult, and in many cases impossible, because most of the material is below the seafloor. Cultural resources on the seafloor are primarily affected by activities that alter the seafloor, such as platform installation, pipeline installation, and anchor drags.

3.9 RECREATION AND TOURISM

The Pacific coastline is an outstanding natural resource, providing an important recreational asset and contributing to the economic success of the region's tourist industry. Many of its parks, reserves, sanctuaries, and marine protected areas are preferred destinations for residents and visitors. The main recreation and tourism activities in the coastal zone include beach recreation, surfing, sightseeing, diving, and recreational fishing (BOEMRE 2010). Most of these activities occur near established shoreline park, recreation, beach, and public-access sites.

Dean Runyan Associates provides annual analyses of the economic impacts of travel to and through the counties of California. As shown in Table 3-16, visitor spending in the coastal counties of the southern Pacific coast totaled $45.8 billion in 2014.[15] As in previous years, visitor expenditures are concentrated in Los Angeles County ($19.9 billion in 2014) and San Diego County ($13.2 billion in 2014). Travel also results in fiscal impacts in the form of State and local tax revenue. Tax receipts from travel in all the southern coastal counties totaled $4.3 billion in 2014.

Based on data compiled from the U.S. Bureau of Labor Statistics, the NOAA Coastal Services Center (NOEP 2015) estimates employment and wages in the ocean-related sectors in which recreation and tourism occur (Table 3-17). In the southern coastal counties, these wages totaled $4.4 billion in 2012, the most recent year for which data are available. Employment is concentrated in San Diego County (81,200 in 2012) and Los Angeles County (45,400 in 2012). The ocean-related recreation and tourism employment for all coastal counties was 193,000 in 2012.

As indicated by Tables 3-16 and 3-17, tourism is a major economic force for coastal counties along the southern Pacific coast, and any negative changes in tourism would be of major concern. Although few tourism activities are coast-dependent (i.e., cannot occur without access to the coast), the majority are coast-enhanced; it is the coastal orientation of the counties that contributes to the sense of place and the general ambiance so highly valued by visitors to the area.

[15] The estimates for 2014 are considered preliminary (Dean Runyan Associates 2015).

TABLE 3-16 Economic Impacts of Travel in Counties of the Southern Pacific Coast ($ million), 2014

County	Visitor Spending at Destination	Total Direct Tax Receipts (State and Local)
Los Angeles	$19,899	$2,062
Orange	$9,385	$842
San Diego	$13,217	$1,097
Santa Barbara	$1,859	$170
Ventura	$1,403	$127
Total	$45,763	$4,298

Source: Dean Runyan Associates (2015).

TABLE 3-17 Employment and Wages in Ocean-Related Recreation and Tourism Sector in the Southern Coastal Counties, 2012

County	Employment (thousands)	Wages (millions)
Los Angeles	45,440	$1,026.43
Orange	40,081	$935.84
San Diego	81,214	$1,909.28
Santa Barbara	13,231	$287.26
Ventura	13,090	$267.78
Total	193,056	$4,426.59

Source: NOEP (2015).

3.10 ENVIRONMENTAL JUSTICE

E.O. 12898, “Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations” (59 FR 7629) requires Federal agencies to incorporate environmental justice as part of their missions. Specifically, it directs these agencies to address, as appropriate, any disproportionately high and adverse human health or environmental effects of their actions, programs, or policies on minority and low-income populations.

A description of the geographic distribution of minority and low-income groups within the region of influence (ROI) was based on demographic data from the 2014 census estimates (U.S. Census Bureau 2015a–d). The following definitions were used to define minority and low-income population groups:

- **Minority.** Persons are included in the minority category if they identify themselves as belonging to any of the following racial groups: (1) Hispanic; (2) Black (not of Hispanic origin) or African American; (3) American Indian or Alaska Native; (4) Asian; or (5) Native Hawaiian or Other Pacific Islander. Persons may classify themselves as having multiple racial origins (up to six racial groups as the basis of their racial origins).

- **Low-Income.** Individuals who fall below the poverty line are classified as low-income. The poverty line takes into account family size and age of individuals in the family. For any given family below the poverty line, all family members are considered as being below the poverty line for the purposes of the analysis without consideration of individual income variations within the family.

The CEQ (1997) guidance states that low-income and minority populations should be identified where either (1) the low-income or minority population of the affected area exceeds 50%, or (2) the low-income or minority population percentage of the affected area is meaningfully greater than the low-income or minority population percentage in the general population or other appropriate unit of geographic analysis.

Table 3-18 lists the minority and low-income composition within the ROI on the basis of 2010 census data. Although the total minority population (those not listed as white alone) in the ROI exceeds 50%, it not meaningfully greater than that Statewide. The number of persons below the poverty level in the ROI is also comparable to the Statewide level (Table 3-18).

TABLE 3-18 Minority and Low-Income Population Percentage for 2014 within the Region of Influence

Population Category	County				California
	Santa Barbara	Ventura	Los Angeles	Orange	
Black or African American alone	2.4	2.2	9.2	2.1	6.5
American Indian and Alaska Native alone	2.2	1.9	1.5	1.1	1.7
Asian alone	5.7	7.5	14.8	19.6	14.4
Native Hawaiian and other Pacific Islander alone	0.2	0.3	0.4	0.4	0.5
Two or more races	3.5	3.3	2.9	3.3	3.7
Hispanic or Latino	44.4	42.0	48.4	34.3	38.6
White alone, not Hispanic or Latino	45.9	46.6	26.8	42.0	38.5
Persons below poverty level (2009–2013, all races)	16.0	11.1	17.8	12.4	15.8

Sources: U.S. Census Bureau (2015a–d).

3.11 SOCIOECONOMICS

Socioeconomic data are presented for a ROI composed of Santa Barbara, Ventura, Los Angeles, and Orange counties. The ROI captures the area within which any potential impacts of offshore WSTs would be experienced, the area within which workers would spend their wages and salaries, and the expected location of many of the vendors that would supply materials, equipment, and services for the use of the proposed WSTs. The ROI is used to assess the impacts WSTs from each alternative would have on population, employment, income, housing, recreation and tourism, and environmental justice.

3.11.1 Population

In 2014, the estimated population within the four-county ROI was more than 14.5 million people (Table 3-19). The estimated population within the ROI has increased between 2010 and 2014, with the increase over the 5-year time period ranging from 2.8% for Ventura County to 4.5% for Los Angeles County. The Statewide population has increased an estimated 4.2% during this time.

3.11.2 Employment and Income

Table 3-20 presents the average civilian labor force statistics for 2014. For the ROI in 2014, about 6.7 million people in the civilian labor force were employed and more than 543 thousand civilian workers were unemployed. Unemployment rates ranged from 5.5% for Orange County to 8.3% for Los Angeles County (Table 3-20). Employment by industry for 2013 is provided in Table 3-21. For the ROI, only 4,980 (0.09%) of paid employees were part of the mining, quarrying, and oil and gas extraction sector.

TABLE 3-19 Population within the Region of Influence

	Population	
Location	2010	2014 (estimate)
Santa Barbara	423,895	440,668
Ventura	823,318	846,178
Los Angeles	9,818,605	10,116,705
Orange	3,010,232	3,145,515
California	37,253,956	38,802,500

Sources: U.S. Census Bureau (2015a–d).

TABLE 3-20 Average Civilian Labor Force Statistics for 2014

Location	Civilian Labor Force Numbers	Number (Percentage) Employed	Number (Percentage) Unemployed
Santa Barbara County	218,721	205,421 (93.9)	13,300 (6.1)
Ventura County	431,547	402,720 (93.3)	28,827 (6.7)
Los Angeles County	5,025,883	4,610,795 (91.7)	415,088 (8.3)
Orange County	1,575,606	1,489,164 (94.5)	86,442 (5.5)
California	18,831,395	17,397,119 (92.5)	1,414,276 (7.5)

Source: U.S. Bureau of Labor Statistics (2015).

TABLE 3-21 Paid Employees by Industry within the Region of Influence, 2013

	County					
Sector	Santa Barbara	Ventura	Los Angeles	Orange	ROI Total	Share of ROI Total (%)
Agriculture, forestry, fishing and hunting	723	601	440	187	1,962	0.04
Mining, quarrying, and oil and gas extraction	876	766	2,873	465	4,980	0.09
Utilities	250 to 499	992	10,000 to 24,999	5,000 to 9,999	16,242 to 36,489	0.29 to 0.66
Construction	6,632	12,334	113,059	78,866	210,891	3.79
Manufacturing	13,333	23,031	358,922	149,604	544,890	9.79
Wholesale and retail trade	24,772	52,595	654,906	252,828	985,051	17.70
Transportation and warehousing	2,470	4,971	156,665	24,602	188,708	3.39
Finance, insurance, and real estate	7,415	17,894	240,771	128,410	394,490	7.09
Services	70,855	118,790	1,862,630	618,754	2,671,029	47.99
Other	10,057 to 10,306	15,142	384,566 to 399,565	117,433 to 122,432	527,228 to 547,475	9.47 to 9.84
Total	137,623	247,116	3,799,831	1,381,148	5,565,718	100.00

Source: U.S. Census Bureau (2015e).

Table 3-22 details personal income in the ROI for 2013. Per-capita annual income ranged from $46,530 for Los Angeles County to $54,519 for Orange County, bracketing the Statewide average of $47,434.

3.11.3 Housing

Table 3-23 details the housing characteristics within the ROI. Homeowner vacancy rates within the ROI range from 0.8 to 1.4%, and rental vacancy rates range from 3.3 to 4.2%.

TABLE 3-22 Personal Income (2013 dollars) within the Region of Influence

Location	Total Personal Income	Population	Per-Capita Income
Santa Barbara County	21,725,550	435,697	49,864
Ventura County	42,406,474	839,620	50,507
Los Angeles County	466,098,988	10,017,068	46,530
Orange County	169,792,810	3,114,363	54,519
California	1,856,614,186	38,332,521	48,434

Source: U.S. Bureau of Economic Analysis (2014).

TABLE 3-23 2014 Average Housing Characteristics for the Region of Influence

	Housing Units			Vacancy Rate	
County	Total	Occupied	Vacant	Homeowner	Rental
Santa Barbara	154,414	142,912	11,502	1.4	4.2
Ventura	284,527	269,869	14,658	0.8	3.4
Los Angeles	3,482,681	3,269,112	213,569	1.1	3.3
Orange	1,072,078	1,018,862	53,216	0.8	3.4

Source: U.S. Census Bureau (2015f).

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