Offshore Information for Area Contingency Planning

Pacific

Offshore Oil and Gas Infrastructure

Technical Document #1

July 2024

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Table of Contents

Tables

Figures

1 Introduction

In 2019, the Bureau of Safety and Environmental Enforcement (BSEE) sponsored a project in cooperation with the United States Coast Guard (USCG) to improve the content of the coastal zone area contingency plans (ACPs) with respect to the information necessary to effectively plan for and respond to large oil spills from offshore oil and gas facilities. This collaboration between BSEE, USCG Sector Los Angeles-Long Beach (LA-LB), resource trustees, state agencies, oil spill response organizations (OSROs), and Area Committees resulted in a series of technical documents that provide offshore information for southern California on:

- **Offshore Oil and Gas Infrastructure (Pacific Technical Document #1)**
- Offshore Worst-Case Discharge Scenarios (Pacific Technical Document #2 and Appendices 2A-B)
- Offshore Response Concept of Operations (Pacific Technical Document #3)
- Offshore Response Strategies and Best Management Practices (Pacific Technical Document #4)
- Sensitive Species Profiles and Best Management Practices (Pacific Technical Document #5).
- Offshore Environmental Sensitivity Indices (ESI) Atlas (Pacific Technical Document #6)

These documents were developed specifically for incorporation by reference into the coastal zone ACPs and are hosted on the BSEE Oil Spill Preparedness Division's (OSPD) website. In addition to the above technical documents, an inventory of offshore spill response equipment and a set of Offshore ESI maps were created and embedded in NOAA's Environmental Response Management Application (ERMA). Collectively, these materials provide a foundation of risk assessment, resources at risk, and conceptual response information to inform coastal zone ACP planning and responses to a significant offshore facility oil spill incident.

1.1 Content

This document provides information on:

- The geology of the Pacific Basin;
- The oil and gas infrastructure, including leases, platforms, wells, and offshore pipelines, present in southern California federal and state waters; and
- The oil products stored and handled at the offshore oil and gas facilities and transported through pipelines that may potentially spill.

Information in this document is presented by the two regions of the Los Angeles-Long Beach ACP Planning Area. These areas, shown in Figure 1, are:

- Los Angeles-Long Beach North ACP Planning Area (ACP-4)
- Los Angeles-Long Beach South ACP Planning Area (ACP-5)

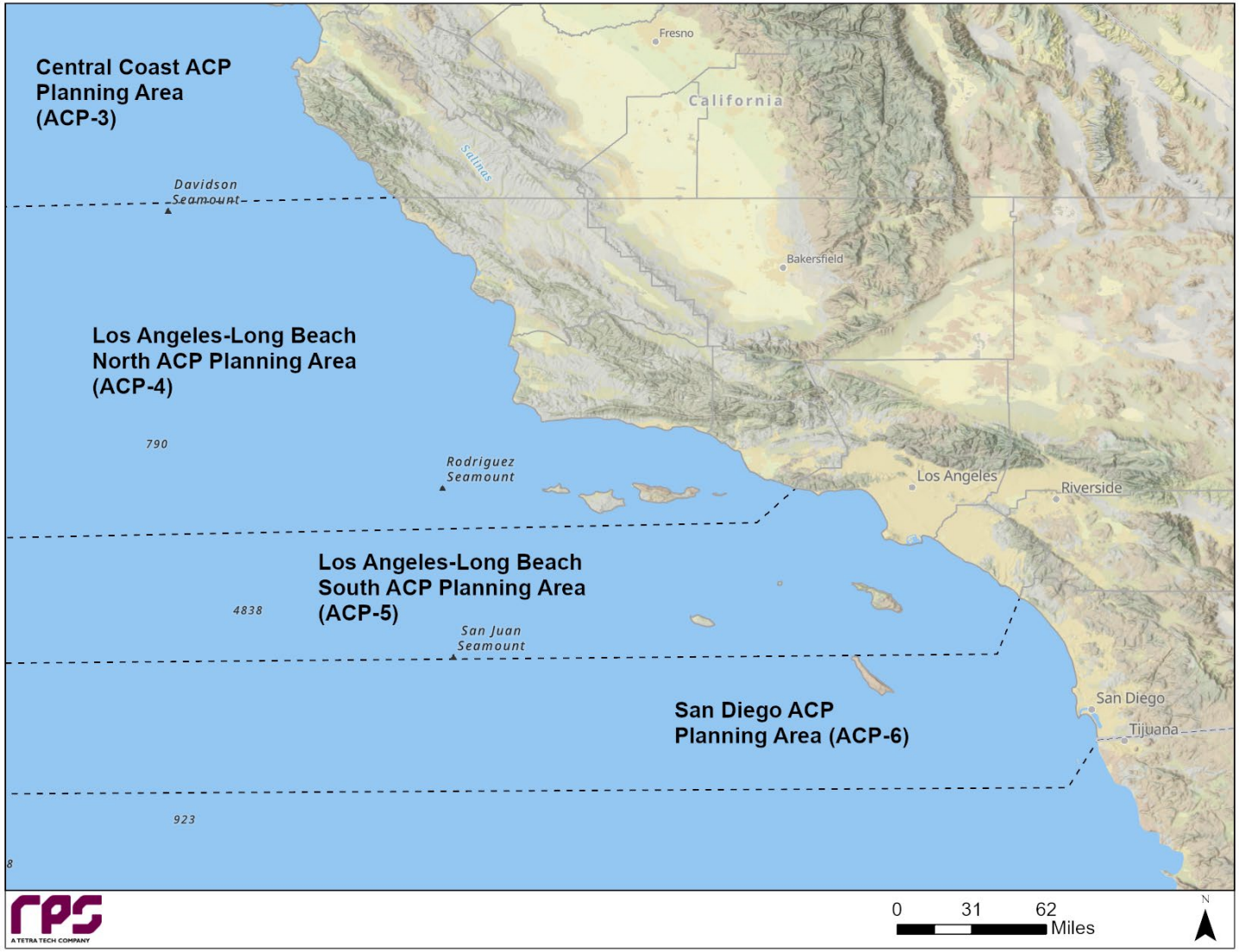

Figure 1. ACP Planning Areas in the Pacific.

2 Pacific OCS

2.1 Description of the Pacific OCS

The Pacific OCS begins three nautical miles off of the Pacific coast in Southern California. BSEE regulates offshore drilling in this region. The area includes 23 active crude oil and gas-producing platforms. Twenty of the 23 platforms produce crude oil and gas. Platform Elly serves as a processing facility for the platforms, Ellen and Eureka. While Elly does not have wells, it is connected to shore by a 17.7-mile pipeline. On October 1, 2021, this pipeline broke causing a spill of 25,000 gallons. The largest historical spill in this region was the Santa Barbara Oil Spill on January 28, 1969. This incident occurred when Platform A experienced a surface blowout spilling an estimated 4.2 million gallons of oil that leaked until December 1969. Since 2011, Pacific coast offshore oil production reduced significantly as show in Figure 2.

Figure 2. Federal Offshore Oil Production in Millions of Barrels from July 2011 to July 2020. (Source: California Energy Commission).

Following the Platform A spill, the California State Lands Commission (SLC) put a moratorium on new oil and gas leases in state waters from the shoreline to three miles offshore. Due to this moratorium, there are now only nine active oil and gas platforms in state waters, down from 60 platforms at its maximum. These platforms include Holly, Eva, Emmy, and Esther and five manmade islands, four islands comprising the Long Beach Unit and one small island referred to as Rincon Island.

Platforms in California waters are all fixed platforms. These facilities are immobile and attached to the seafloor. Horizontal drilling allows for oil to be drawn from a large area around the platform as shown in Figure 3. Oil drilled offshore is pumped to shore through pipelines. These pipelines are built with several layers of concrete and stainless steel to ensure their safety.

A summary of federal and state offshore oil platforms can be seen in Figure 4.[1]

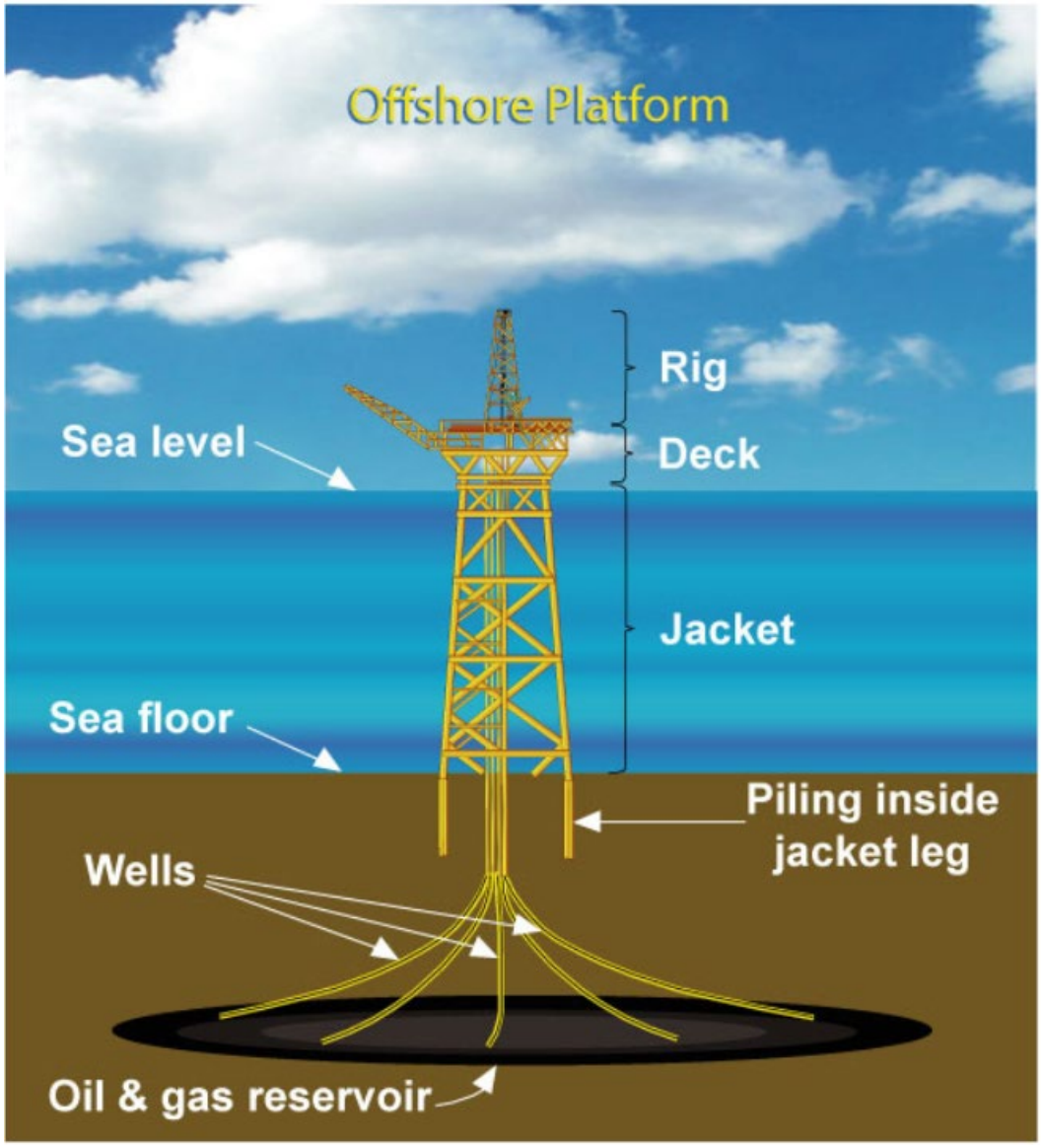

Figure 3. California Offshore Platform Diagram. (Source: California Geologic Energy Management Division).

[1] https://www.energy.ca.gov/sites/default/files/2021-11/November_Petroleum_Watch_ADA.pdf

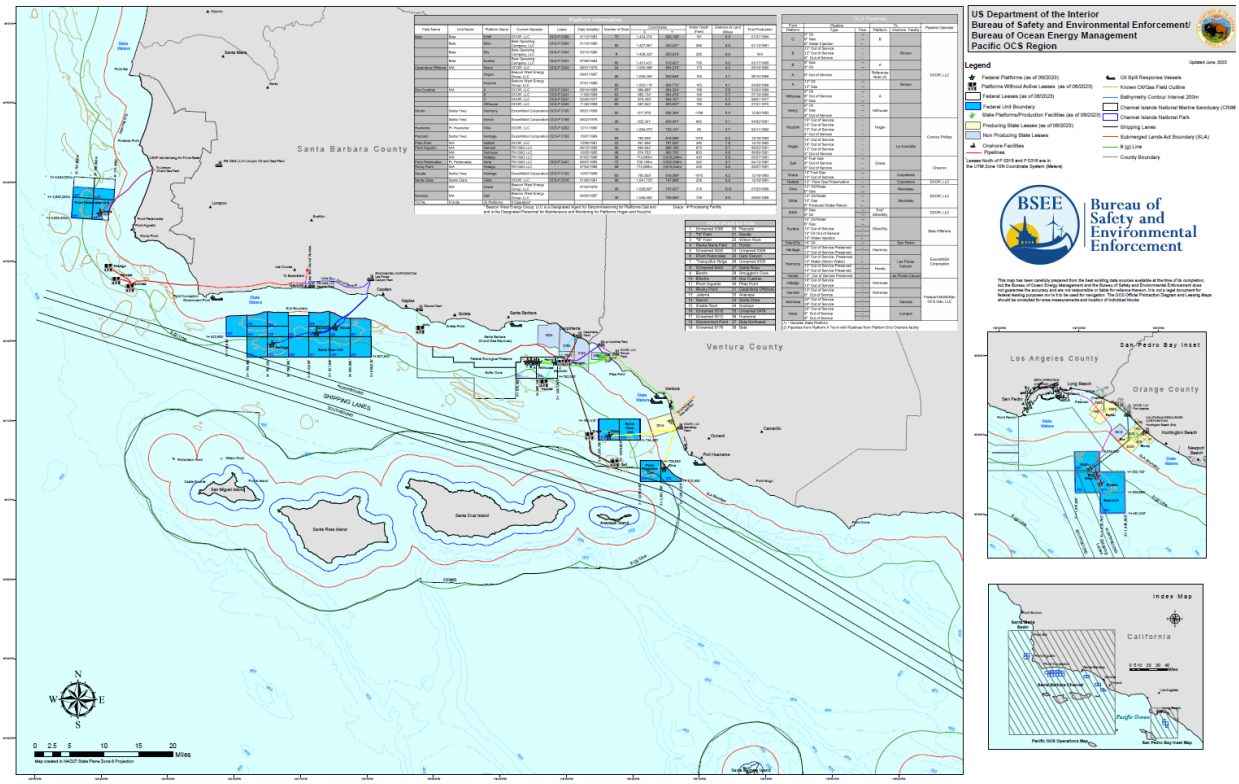

Figure 4. Federal and Offshore Oil and Gas Platforms in Southern California (Source: BSEE).

Sections 3, 4, and 5 provide detailed information about the federal oil and gas infrastructure in Southern California. Section 6 consolidates data about State of California oil and gas infrastructure in the region.

2.2 Geologic Features of the Pacific OCS

Figure 5 illustrates the major geologic features of the Pacific OCS.

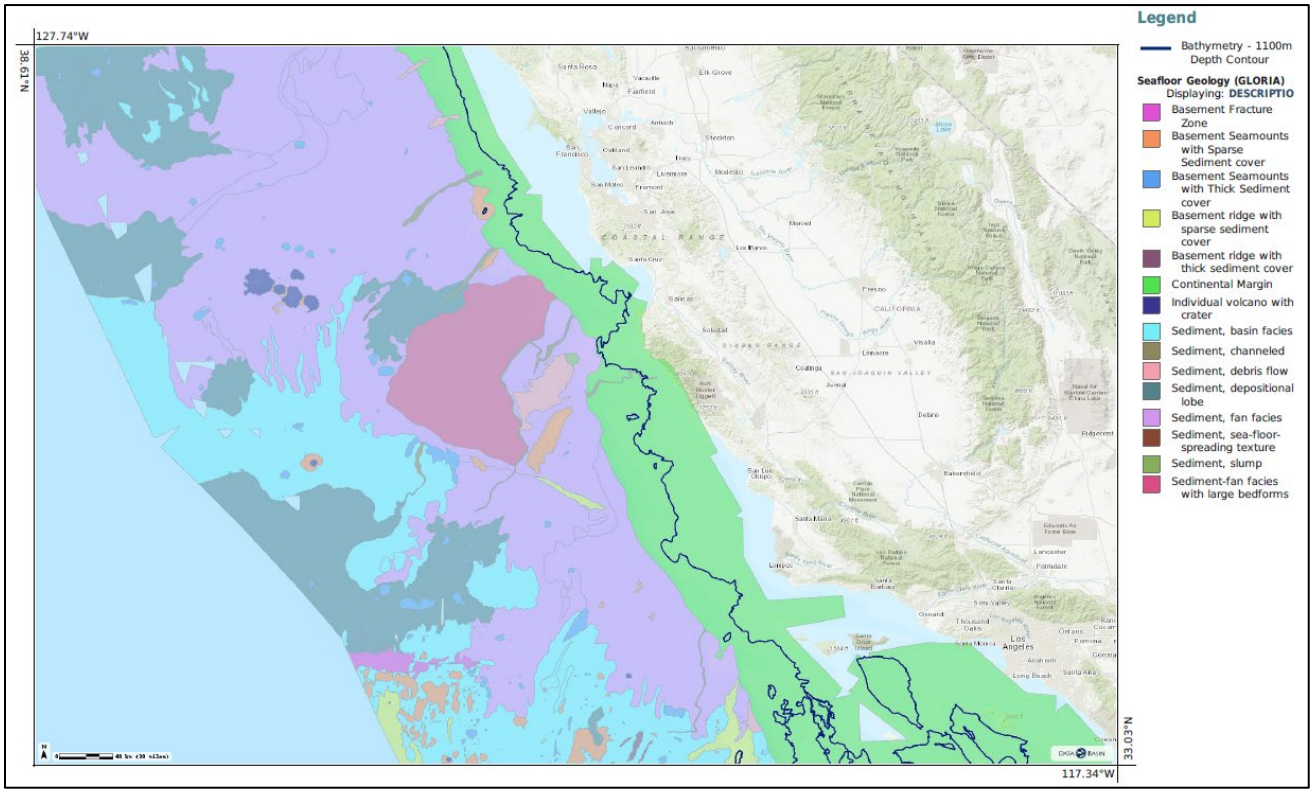

Figure 5. Bathymetric Map of Pacific Showing Major Geologic Features[2].

2.3 Bathymetry of the Pacific OCS

The Southern California Bight region can be seen in the vicinity of Los Angeles. This active tectonics of this area can be seen in the mountainous landscape and numerous offshore basins and islands in Figure 6.[3]

[2] Source: Databasin.org/USGS/California Energy Commission. https://databasin.org/maps/9e7a5f05fd3d4865adb931a57db5f034/

[3] https://www.researchgate.net/figure/Topographic-and-bathymetric-map-of-the-Southern-California-Bight-region-The-active_fig1_280291833

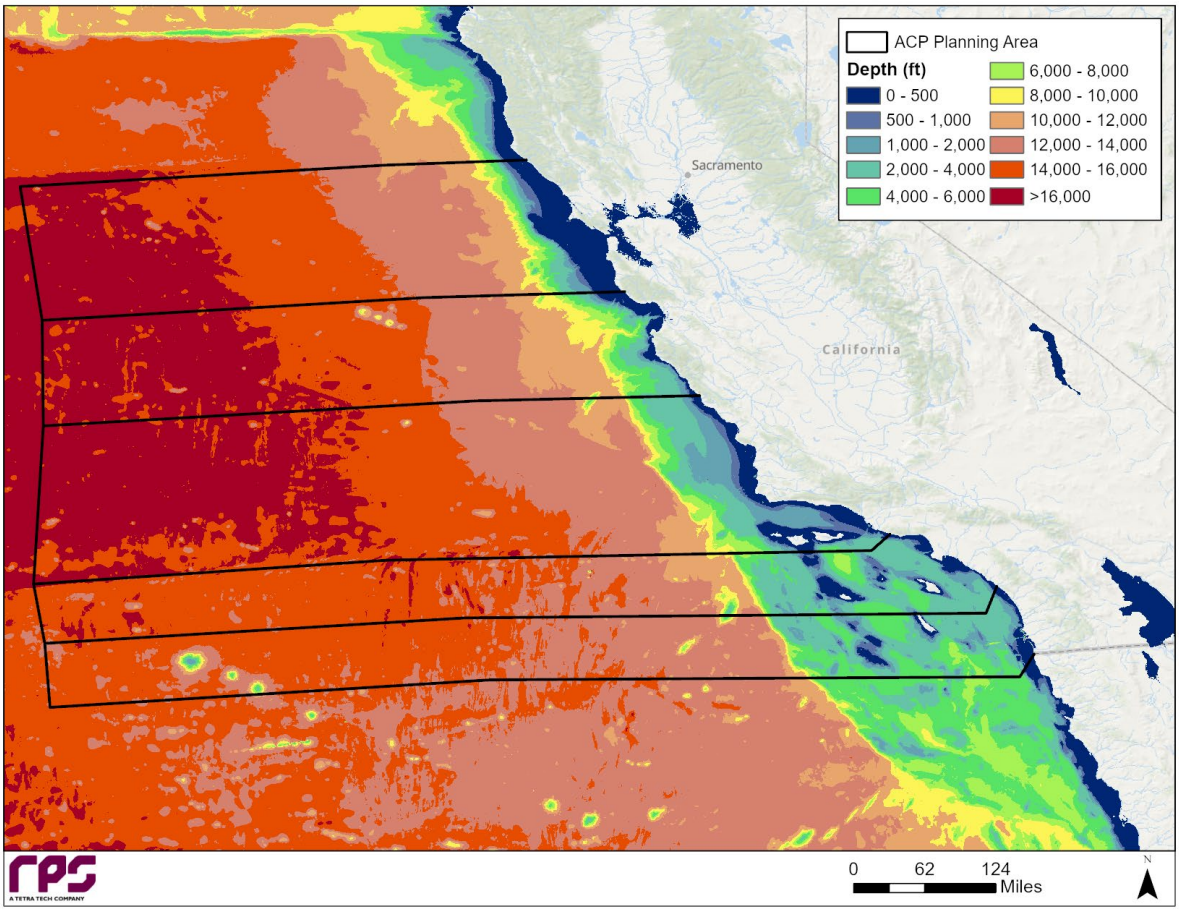

Figure 6. Bathymetry of the Pacific OCS.

3 Pacific OCS Oil and Gas Infrastructure

3.1 Description of Oil and Gas Infrastructure

3.1.1 Key Definitions

- **bbl**: standard unit for measuring volume of crude oil, equal to 42 US gallons.
- **Lease:** A grant by the Bureau of Ocean Energy Management (BOEM) to one or more parties of exclusive rights to a specific area located on the Outer Continental Shelf (see below) for the purpose of exploring for, developing, and producing oil and gas.
- **mcf:** standard unit for measuring volume of natural gas, equal to one thousand cubic feet. (1 million mcf = 1 billion cubic feet of gas)
- **Offshore supply vessel:** An offshore supply or service vessel brings supplies and personnel to offshore platforms.
- **Outer Continental Shelf (OCS):** The Outer Continental Shelf Lands Act (OCSLA), created on August 7, 1953, defines the OCS as all submerged lands lying seaward of state coastal waters which are under U.S. jurisdiction (i.e., those within 200 miles of the coastline).
- **Pipeline:** A pipeline is a steel pipe with pumps, valves, and control devices used to transport oil, gas, water, etc. A pipeline that is used to connect a single wellhead to a manifold or platform within a field is often called a flowline.
- **Platform:** A platform is an offshore structure used to support oil and gas drilling, development, and production activities. A fixed platform is a permanent structure that consists of a jacket (a tall vertical section made of tubular steel members supported by piles driven into the seabed) with a deck placed on top, providing working space that may include such things as crew quarters, one or more drilling rigs, and production and processing facilities. A floating platform is a structure that is not fixed to the ocean floor but floats and is usually attached to the ocean floor with anchors and chains. It could also be held in place through dynamic positioning with thrusters that automatically adjust to counter the effects of ocean currents. Figure 4 shows examples of different types of platforms.
- **Right-of-Way (ROW):** Right-of-Way (ROW) means an authorization issued by BSEE under the authority of section 5(e) of the OCSLA (43 U.S.C. 1334(e)) for the use of submerged lands of the Outer Continental Shelf for pipeline purposes. Pipelines contained within one or more leases with the same owner/operator are known as lease-term pipelines. Pipelines laid outside those boundaries (on other leased or unleased areas) require a Right-of-Way.
- **Shallow:** Water depths of 500 feet or less.
- **Shelf:** The continental shelf is the shallower area adjacent to the coastline. The water depth is generally 500 feet or less.
- **Sidetracks:** An additional well drilled from an existing borehole to a new geologic target, or a new location within the original target, by cutting through the side of the existing casing and drilling a new borehole. A bypass is a well drilled using the same method as a sidetrack to get around a mechanical problem in the original borehole to reach the original target.

- **Well:** A well is a hole drilled into the Earth for the purpose of extracting oil and/or gas from a petroleum reservoir. It may also be called a borehole. A well drilled to determine if a petroleum reservoir can be economically produced is known as an exploration well. A well that has been fully cased with steel pipe and is used to extract oil and/or gas is a production well. Most production wells are located beneath or immediately adjacent to a platform. A production well not located beneath or adjacent to a platform is known as a subsea well.

3.2 Active OCS Lease Areas

Oil and gas exploration and production activities in OCS waters are conducted by leasing through the Bureau of Ocean Energy Management (BOEM) leasing policy and program. The active OCS oil and gas leases and BOEM protraction areas from the OPD in the Pacific OCS are shown in Figure 7.

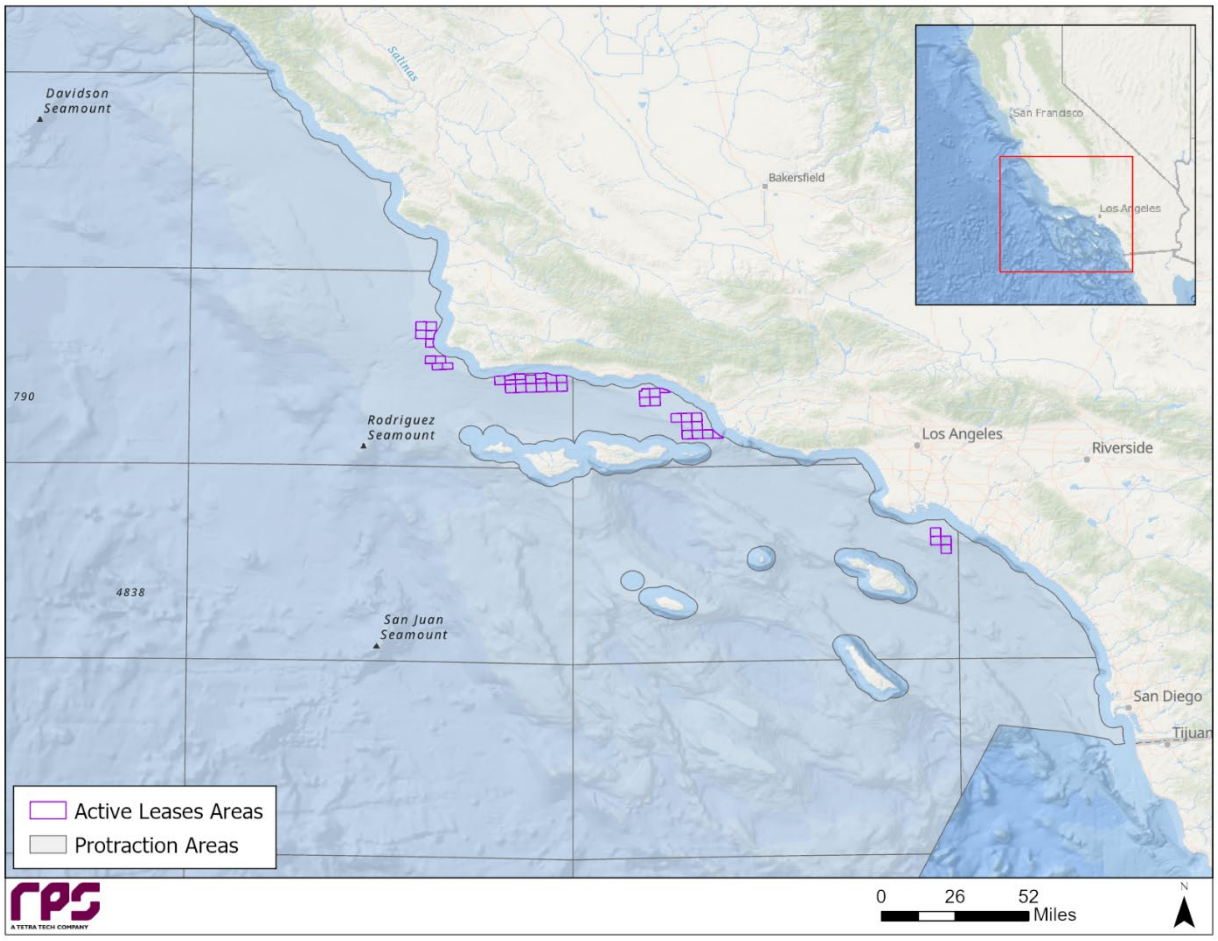

Figure 7. Active OCS Lease Areas in the Pacific OCS.

3.3 Pacific OCS Platforms and Wells

3.3.1 Wells in the Pacific OCS

There are 1,684 oil and gas wells in the Pacific OCS area.[4] Nearly 66% of the wells are in shallower waters (≤500 feet deep) on the Shelf. The numbers of wells in the entire Pacific OCS by well status are summarized in Table 1. The numbers of wells by status and ACP Planning Area are shown in Table 2. The locations of active wells are shown in Figure 8, which include all wells except those that are sidetracks or are permanently abandoned.

Table 1. Numbers of OCS Wells in the Pacific OCS by Well Status and Water Depth.

Well Status[5]			Total
Water Depth	**Active Wells**	**Permanently Abandoned**	
Shallow (≤ 500 ft.)	821	283	**1,104**
Deepwater (> 500 ft.)	317	263	**580**
Total	**1,138**	**546**	**1,684**

Table 2. Numbers of OCS Wells in the Pacific OCS by Well Status.

ACP Planning Area	Well Status[6]		Total
	Active Wells	**Permanently Abandoned**	
Santa Barbara Channel (Area 4)	752	358	**1,110**
San Pedro Bay (Area 5)	386	188	**574**
Total	**1,138**	**546**	**1,684**

[4] https://www.bsee.gov/stats-facts/offshore-information/pacific-facts-and-figures

[5] Based on BSEE data available as of 28 February 2024. For the purposes of this document "Active Wells" are any wells that have not been designated as "Plugged and Abandoned, "Permanently Abandoned," or "Borehole Cancelled." "Active Wells" includes wells that are in any of the following categories: "Drilling Active," "Producing Oil Completion," "Producing Oil Gas Lift," "Gas Injection," "Water Injection," "Non-Producing Gas Completion," " Wellbore Temporarily Abandoned," "Inactive Drilling," "Water Source Well," or "Borehole Sidetracked."

[6] Based on BSEE data available as of 28 February 2024. For the purposes of this document "Active Wells" are any wells that have not been designated as "Plugged and Abandoned, "Permanently Abandoned," or "Borehole Cancelled." "Active Wells" includes wells that are in any of the following categories: "Drilling Active," "Producing Oil Completion," "Producing Oil Gas Lift," "Gas Injection," "Water Injection," "Non-Producing Gas Completion," " Wellbore Temporarily Abandoned," "Inactive Drilling," "Water Source Well," or "Borehole Sidetracked."

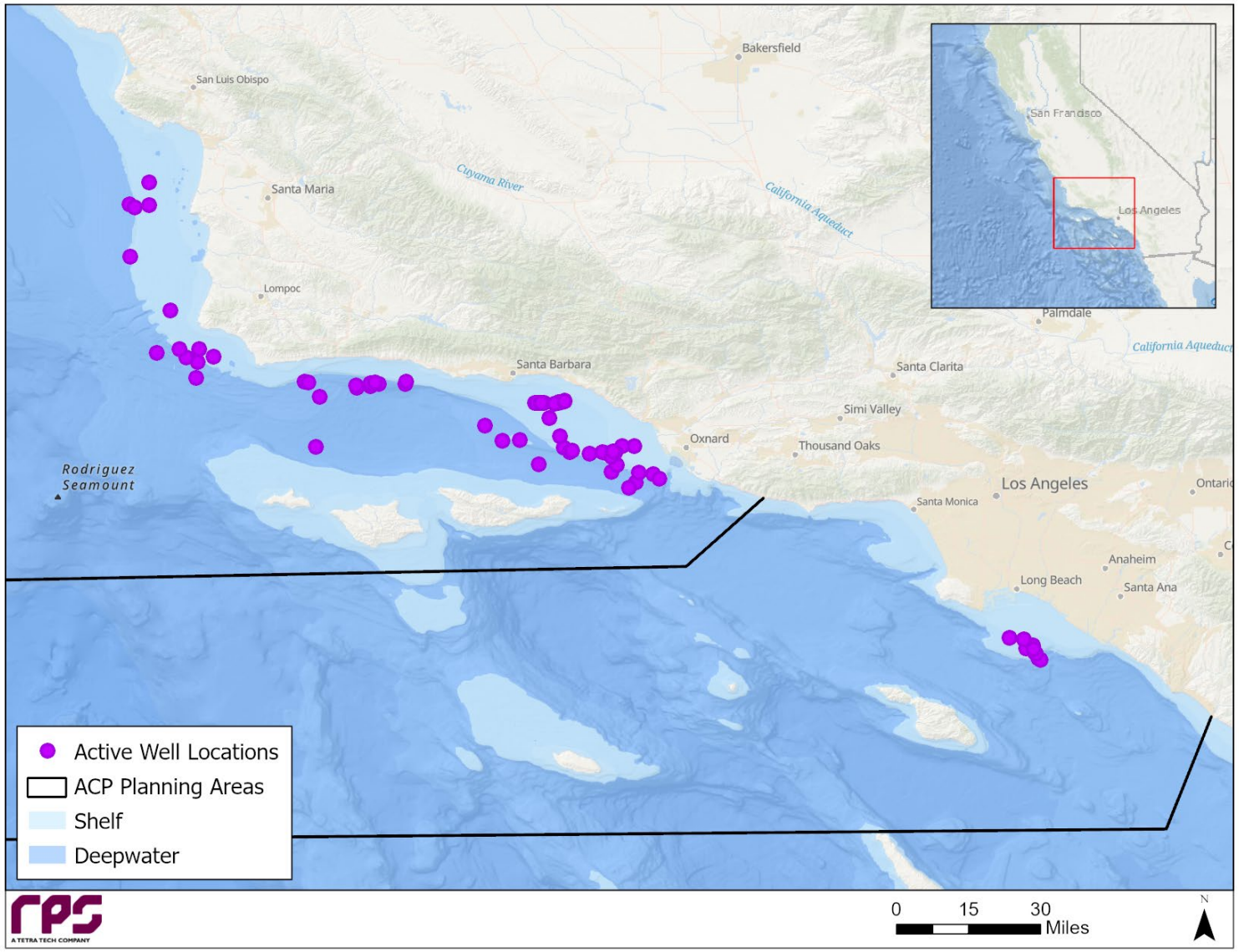

Figure 8. Active OCS Wells in the Pacific OCS.

3.3.2 OCS Platforms in the Pacific

There are 23 platforms in the Southern California Pacific OCS of which 18 are currently producing oil and 19 are producing gas (Table 3). All the structures are production platforms, except for Elly, which is a processing facility associated with Platforms Ellen and Eureka. The platforms are shown in Figure 9.

Table 3. Oil and Gas Platforms in the Pacific OCS

Area/ Block	Lease	Lease Status	Structure Name	Producing Oil/Gas	Installed	First Produced	Miles to Land	Well Slots	Water Depth (ft)
LA 6658	P0241	Active	A	O/G	1968	1969	5.8	57	188
LA 6658	P0241	Active	B	O/G	1968	1969	5.7	63	190
LA 6658	P0241	Active	C	O/G	1977	1977	5.7	60	192
LA 6912	P0205	Relinquished	Gail		1987	1988	9.9	36	739
LA 6862	P0216	Active	Gilda	O/G	1981	1981	8.8	96	205
LA 6965	P0202	Active	Gina	O/G	1980	1982	3.7	15	95
LA 6861	P0217	Relinquished	Grace		1979	1980	10.5	48	318
LA 6709	P0234	Active	Habitat	G	1981	1983	7.8	24	290
LA 6659	P0240	Active	Henry	O/G	1979	1980	4.3	24	173
LA 6659	P0240	Active	Hillhouse	O/G	1969	1970	5.5	60	190
LA 6660	P0166	Active	Hogan	O/G	1967	1968	3.7	66	154
LA 6660	P0166	Active	Houchin	O/G	1968	1969	4.1	60	163
LB 6437	P0296	Active	Edith	O/G	1983	1984	8.5	72	161
LB 6438	P0300	Active	Ellen	O/G	1980	1981	8.6	80	265
LB 6438	P0300	Active	Elly	O/G	1980	n/a	8.6	n/a	255
LB 6488	P0301	Active	Eureka	O/G	1984	1985	9.0	60	700
SM 6635	P0190	Active	Harmony	O/G	1989	1993	6.4	60	1,198
SM 6525	P0315	Active	Harvest		1985	1991	6.7	50	675
SM 6683	P0182	Active	Heritage	O/G	1989	1993	8.2	60	1,075
SM 6576	P0315	Active	Hermosa	O/G	1985	1991	6.8	48	603
SM 6524	P0450	Active	Hidalgo	O/G	1986	1991	5.9	56	430
SM 6636	P0188	Active	Hondo	O/G	1976	1981	5.1	28	842
SM 6374	P0441	Active	Irene	O/G	1985	1987	4.7	72	242

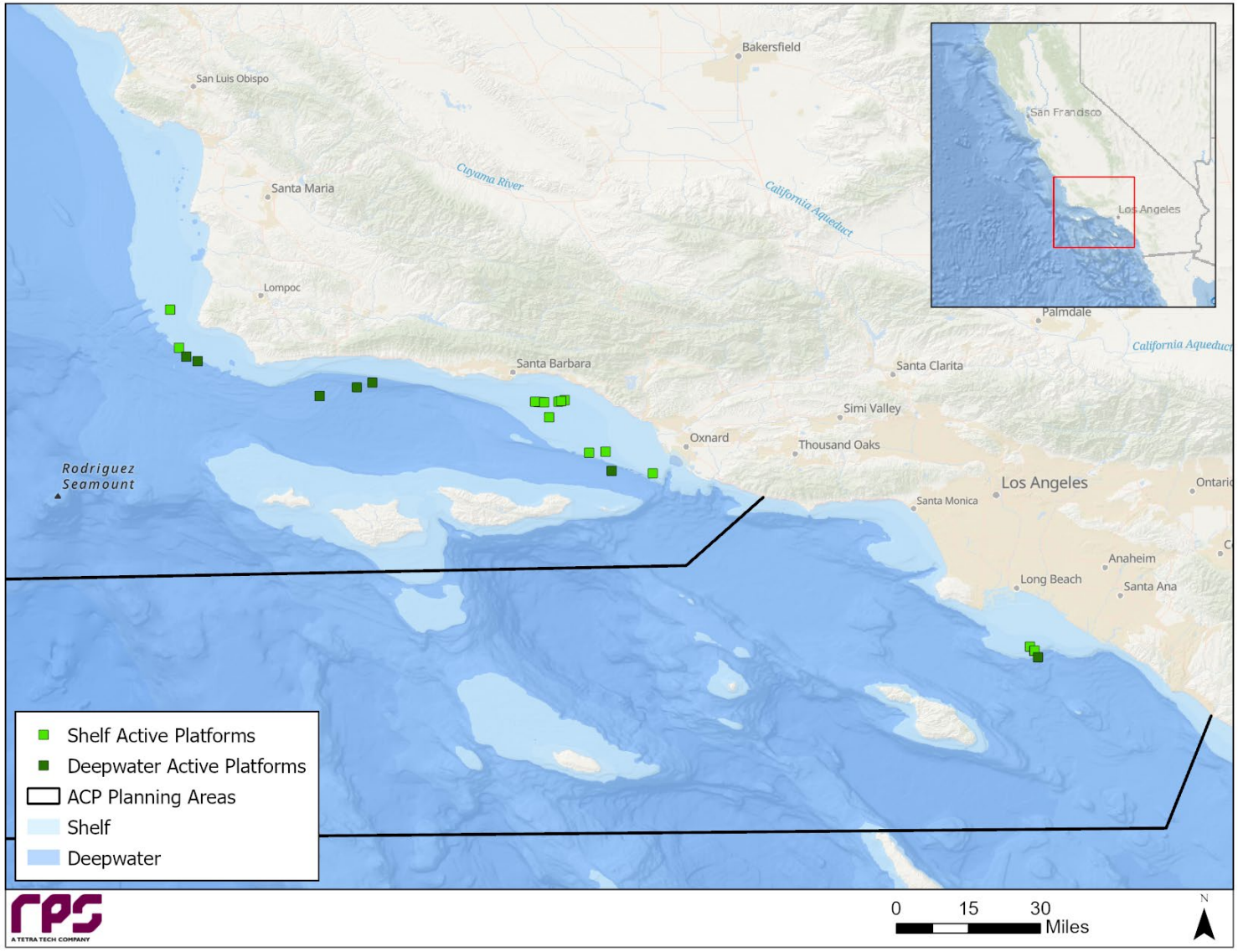

Figure 9. Active OCS Platforms in the Pacific OCS.

3.3.3 Well Age

The oil and gas wells in the Pacific OCS differ significantly with respect to age in shallow (shelf) waters (Table 4) and deep waters (Table 5).

Table 4. Age Categories of Shallow Wells in the Pacific OCS by Well Status.

Well Status[7]	Total Wells (by Age)			Total
	< 20 years	20–50 years	> 50 years	
Active Wells	91	509	221	**821**
Plugged & Abandoned	43	173	67	**283**
Total Wells	**134**	**682**	**288**	**1,104**

Table 5. Age Categories of Deepwater Wells in the Southern California Pacific OCS by Well Status..

Well Status[8]	Total Wells (by Age)			Total
	< 20 years	20–50 years	> 50 years	
Active Wells	61	250	6	**317**
Plugged & Abandoned	35	190	38	**263**
Total Wells	**96**	**440**	**44**	**580**

[7] Based on BSEE data available as of 28 February 2024. For the purposes of this document "Active Wells" are any wells that have not been designated as "Plugged and Abandoned, "Permanently Abandoned," or "Borehole Cancelled." "Active Wells" includes wells that are in any of the following categories: "Drilling Active," "Producing Oil Completion," "Producing Oil Gas Lift," "Gas Injection," "Water Injection," "Non-Producing Gas Completion," " Wellbore Temporarily Abandoned," "Inactive Drilling," "Water Source Well," or "Borehole Sidetracked."

[8] Based on BSEE data available as of 28 February 2024. For the purposes of this document "Active Wells" are any wells that have not been designated as "Plugged and Abandoned, "Permanently Abandoned," or "Borehole Cancelled." "Active Wells" includes wells that are in any of the following categories: "Drilling Active," "Producing Oil Completion," "Producing Oil Gas Lift," "Gas Injection," "Water Injection," "Non-Producing Gas Completion," " Wellbore Temporarily Abandoned," "Inactive Drilling," "Water Source Well," or "Borehole Sidetracked."

3.4 Offshore ROW Pipelines

The Pacific OCS contains over 93 miles of active oil and gas pipelines in 29 segments (Table 6). About 38% of the pipelines transport oil, and 62% transport gas. Pipeline product types are based on BSEE categorizations, and the products carried in a pipeline may change over time. None of the pipelines are buried.

Table 6. Active Oil and Gas Pipelines in the Pacific OCS.

Origin		Destination		Segment Length (ft)	Size (in)	Product
Platform	Area Block/ Lease	Location	Area Block/ Lease			
Hogan	LA 6660 P00166	La Conchita Beach		4,172	10 3/4	Oil
B	LA 6658 P00241	Platform A	LA 6658 P00241	2,599	8	Oil
C	LA 6658 P00241	Platform B	LA 6658 P00241	2,839	6	Oil
Houchin	LA 6660 P00166	Platform Hogan	LA 6660 P00166	3,355	10 3/4	Oil
Hillhouse	LA 6659 P00240	Platform A	LA 6658 P00241	2,811	8	Oil
Grace	LA 6861 P00217	Carpinteria		61,500	12	Oil
Henry	LA 6659 P00240	Platform Hillhouse	LA 6659 P00240	13,150	8 5/8	Oil
Elly	LB 6438 P00300	Beta Pump Station (Port of LB)		33,677	16	Oil
Gilda	LA 6862 P00216	Mandalay (Oxnard)		32,928	12	Oil
Edith	LB 6437 P00296	Processing Elly	LB 6438 P00300	6,146	6	Oil
Irene	SM 6374 P00441	Lompoc (Vandenberg)		12,100	8	Oil
Eureka	LB 6488 P00301	Processing Platform Elly	LB 6438 P00300	9,330	10	Oil
Gina	LA 6965 P00202	Mandalay (Oxnard)		1,587	10	Oil/ Water
Hillhouse	LA 6659 P00240	Platform A	LA 6658 P00241	2,661	6	Gas
Hogan	LA 6660 P00166	La Conchita Beach		4,172	12	Gas
B	LA 6658 P00241	Platform A	LA 6658 P00241	2,601	8	Gas
C	LA 6658 P00241	Platform B	LA 6658 P00241	2,839	6	Gas
Houchin	LA 6660 P00166	Platform Hogan	LA 6660 P00166	3,355	12 3/4	Gas

Origin		Destination		Segment Length (ft)	Size (in)	Product
Platform	Area Block/ Lease	Location	Area Block/ Lease			
Grace	LA 6861 P00217	Carpinteria		61,500	10	Gas
Henry	LA 6659 P00240	Platform Hillhouse	LA 6659 P00240	13,150	6	Gas
Gina	LA 6965 P00202	Mandalay (Oxnard)		1,587	6	Gas
Gilda	LA 6862 P00216	Mandalay (Oxnard)		32,928	10	Gas
Edith	LB 6437 P00296	Platform Eva		26,849	6	Gas
Eureka	LB 6488 P00301	Processing Platform Elly	LB 6438 P00300	9,330	6	Gas
Harvest	SM 6525 P00315	Platform Hermosa	SM 6576 P00316	17,212	8	Gas
Hermosa	SM 6576 P00316	Gaviota (Point Conception)		31,700	20	Gas
Hidalgo	SM 6524 P00450	Platform Hermosa	SM 6576 P00316	28,500	10	Gas
Gail	LA 6912 P00205	Platform Grace	LA 6861 P00217	33,400	8 5/8	Gas
A	LA 6658 P00241	Rincon Beach		33,735	12	Gas

3.4.1 ROW Pipeline Locations Across the Pacific OCS

The locations of offshore ROW pipelines in the Pacific OCS are shown in Figure 10.

3.4.2 Pipeline Age

Determining the age of the pipe used in a pipeline is difficult. Any section of pipe in a pipeline can be reused from an older pipeline or replaced with a newer section of pipe. Multiple pipeline routes can be combined or modified with segments of pipe that vary in age. There are incomplete data on pipeline approval and installation dates. However, active pipelines associated with Platforms B and C are known to have originally been installed in 1968, making them 55 years old.

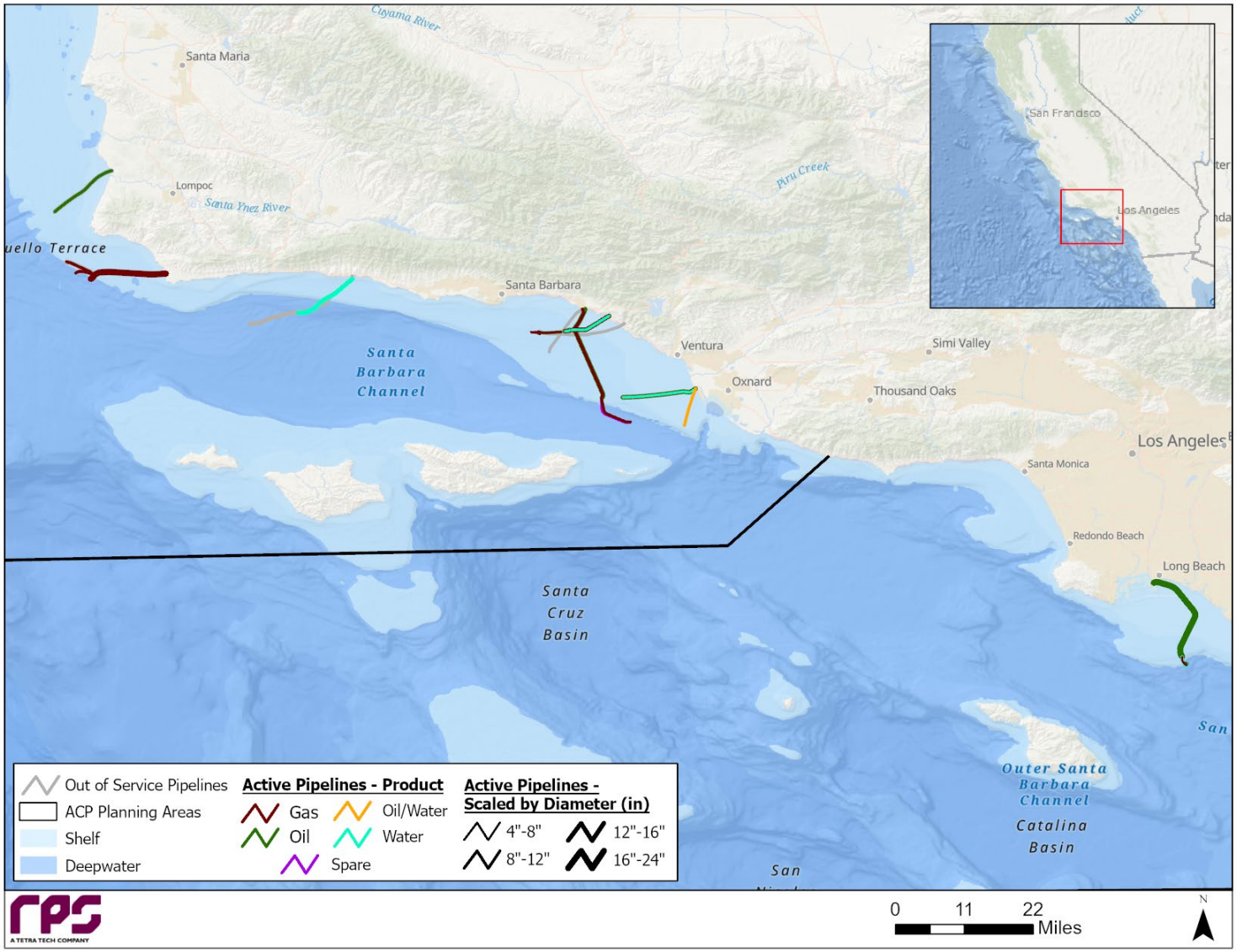

Figure 10. Active Offshore ROW Pipelines in the Pacific OCS.

3.5 OCS Oil and Gas Production

Each year, about 3.5 million bbl of oil and 2.9 million mcf of gas are produced in the Pacific OCS. Most of the oil (over 84%) is produced in the shallow areas. Most of the gas (nearly 97%) is also produced in the shallow areas. Over 61% of the oil and over 76% of the gas are produced in the ACP-4 Planning Area.

Oil and gas production in the Pacific OCS decreased by 95% and 96%, respectively, since the late 1990s (Figure 11).

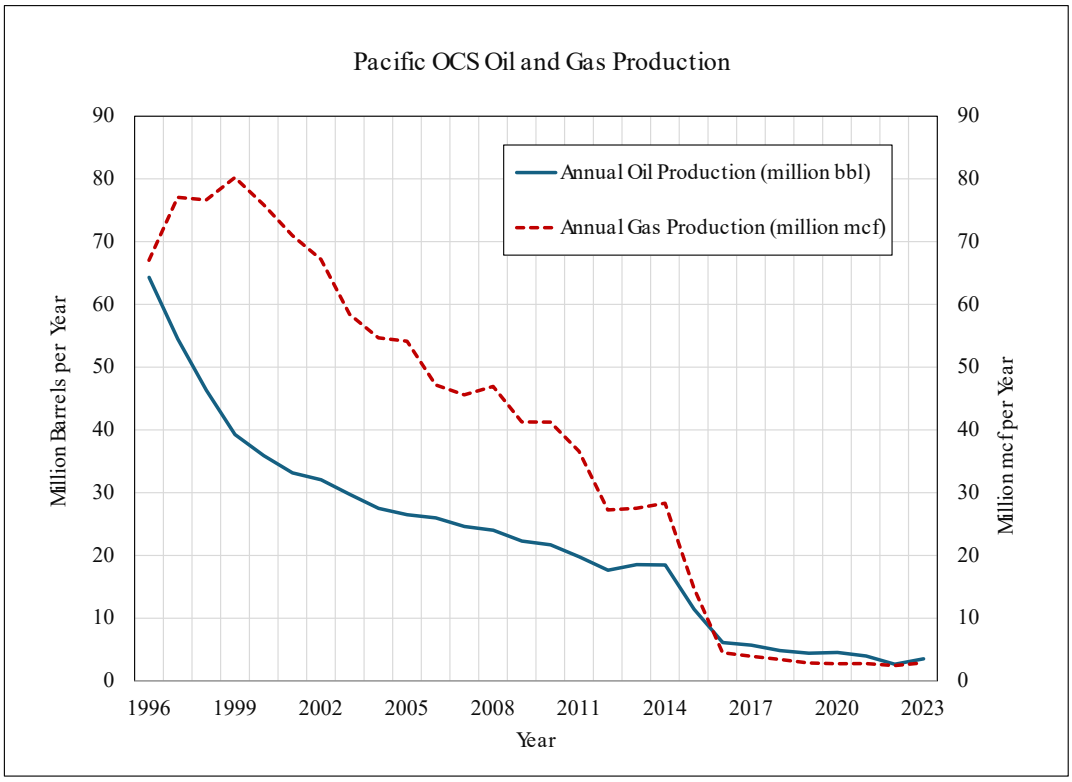

Figure 11. Pacific Oil and Gas Production (1996–2023).

There is considerable variation in the amount of oil and gas production by individual wells in the Pacific OCS. The highest-producing oil well produces almost 173,000 bbl of oil per year. The lowest-producing wells produce less than 200 bbl per year. The highest-producing gas wells produce over 258 million cubic feet of gas annually.

For leases, each may contain numerous wells and platforms. The highest-producing oil and gas leases are shown in Table 7 and Table 8. The highest-producing oil leases are shown in Figure 12, and the highest producing gas leases are shown in Figure 13.

NOTE: The oil and gas production data used throughout this report is for 2023. These figures include data listed in Table 5, Table 6, Figure 12, and Figure 13 below, as well as each of the corresponding "lease production" Tables and Figures in each of the ACP-specific sections.

Table 7. Highest-Producing Oil Leases in the Pacific OCS

Lease Number	ACP	Area-Block	Depth Category	Annual Production	
				Oil (bbl)	Gas in Same Lease (mcf)
P00241	ACP-4 (LA-LB Northern)	LA 6658	Shallow (190 ft.)	1,146,208	1,699,330
P00301	ACP-5 (LA-LB Southern)	LB 6488	Deepwater (700 ft.)	767,243	179,160
P00240	ACP-4 (LA-LB Northern)	LA 6659	Shallow (190 ft.)	497,437	490,921
P00216	ACP-4 (LA-LB Northern)	LA 6862	Shallow (205 ft.)	310,132	357,011
P00300	ACP-5 (LA-LB Southern)	LB 6438	Shallow (265 ft.)	137,076	58,870
P00296	ACP-5 (LA-LB Southern)	LB 6438	Shallow (161 ft.)	108,255	20,434
P00202	ACP-4 (LA-LB Northern)	LA 6965	Shallow (95 ft.)	40,866	47,771
P00203	ACP-4 (LA-LB Northern)	LA 6964	Shallow (95 ft.)	11,511	30,253

Table 8. Highest-Producing Gas Leases in the Pacific OCS

Lease Number	ACP	Area-Block	Depth Category	Annual Production	
				Gas (mcf)	Oil in Same Lease (bbl)
P00241	ACP-4 (LA-LB Northern)	LA 6658	Shallow (190 ft.)	1,699,330	1,146,208
P00240	ACP-4 (LA-LB Northern)	LA 6659	Shallow (190 ft.)	490,921	497,437
P00216	ACP-4 (LA-LB Northern)	LA 6862	Shallow (205 ft.)	357,011	310,132
P00301	ACP-5 (LA-LB Southern)	LB 6488	Deepwater (700 ft.)	179,160	767,243
P00300	ACP-5 (LA-LB Southern)	LB 6438	Shallow (265 ft.)	58,870	137,076
P00202	ACP-4 (LA-LB Northern)	LA 6965	Shallow (95 ft.)	47,771	40,866
P00203	ACP-4 (LA-LB Northern)	LA 6964	Shallow (95 ft.)	30,253	11,511
P00296	ACP-5 (LA-LB Southern)	LB 6438	Shallow (161 ft.)	20,434	108,255

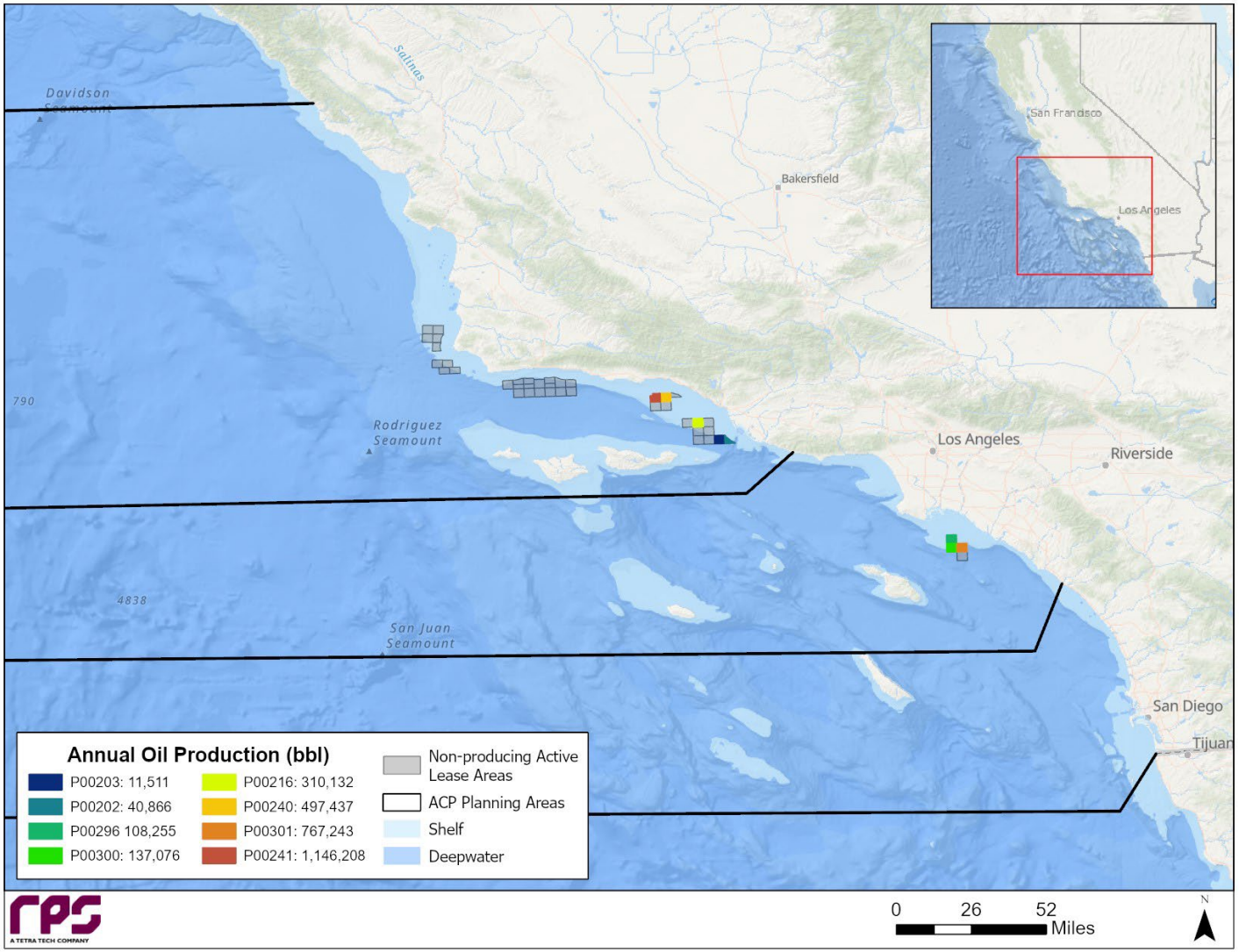

Figure 12. Highest-Producing Annual Oil Leases in the Pacific OCS.

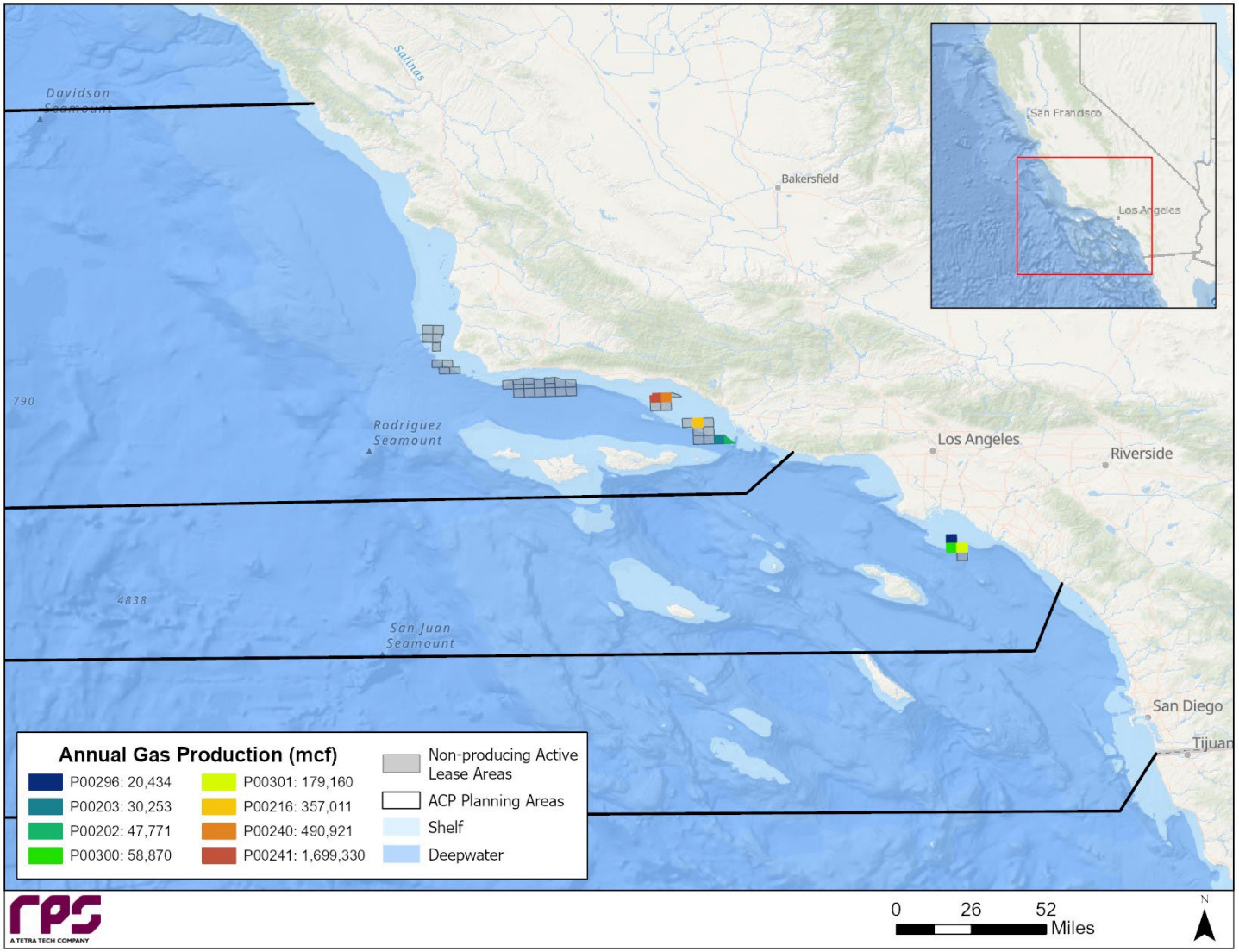

Figure 13. Highest-Producing Annual Gas Leases in the Pacific OCS

3.6 Additional Information Resources for Offshore Infrastructure

NOAA's Environmental Response Management Application (ERMA) also contains data on offshore infrastructure that can be viewed under "Public Safety and Infrastructure/Oil and Gas" layers. ERMA can be accessed at https://response.restoration.noaa.gov/resources/maps-and-spatial-data/environmental-response-management-application-erma. Figure 14 shows offshore infrastructure data displayed in ERMA in the Pacific OCS.

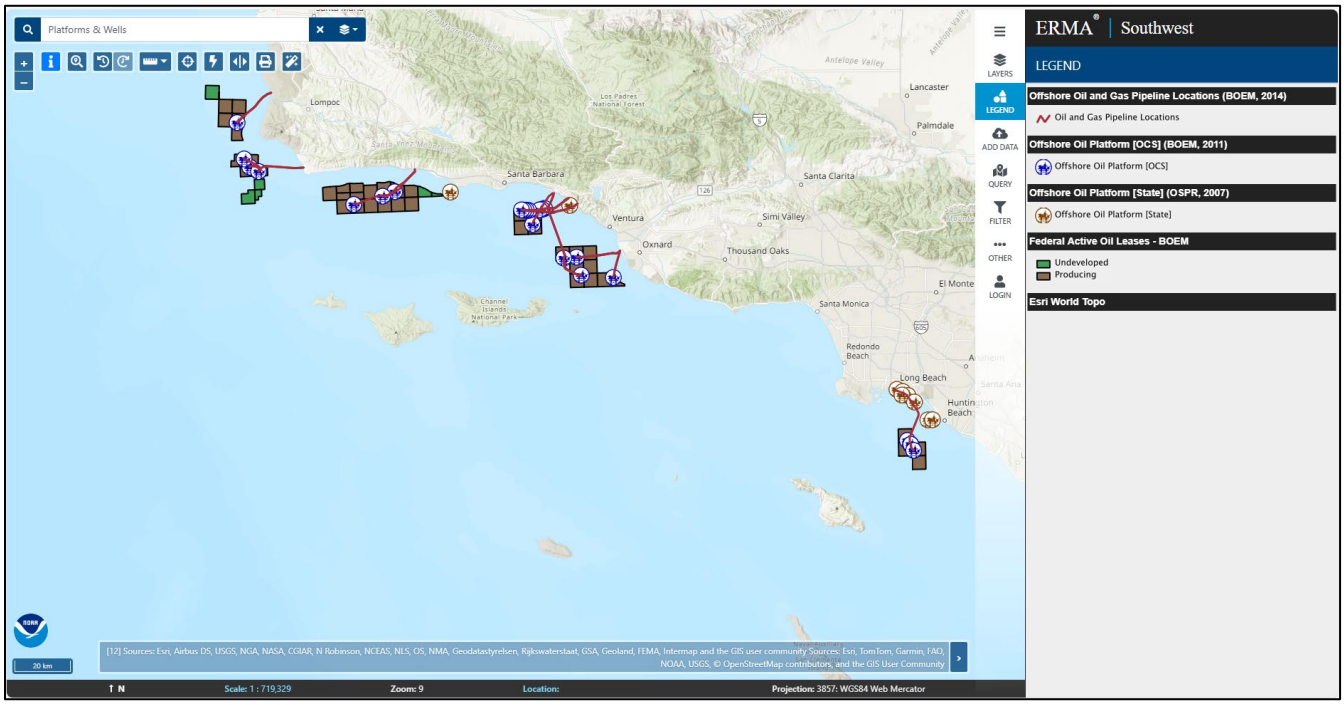

Figure 14. Offshore infrastructure layers near Southern California displayed in NOAA ERMA (https://response.restoration.noaa.gov/resources/maps-and-spatial-data/environmental-response-management-application-erma).

3.7 Oil Products in the Pacific OCS

A variety of oil types may potentially discharge from offshore oil and gas operations in the Pacific OCS – including very heavy crude oils from wells and pipelines, as well as fuels, lubricating oils, and hydraulic oils used on platforms and offshore supply vessels.

Oils differ considerably in their properties based on their composition and the degree of weathering after discharging. Crude oils are composed of a mixture of many different types of hydrocarbons – from light, volatile compounds, such as benzene, toluene, ethylbenzene, and xylene (BTEX), to heavier compounds, such as asphaltenes. Refined petroleum products made from crude oils, such as gasoline, diesel fuel, and heavy fuel oil, exhibit different properties as well.

3.7.1 API Gravity (Oil Density)

The most commonly referenced oil property is its density. Oil density can be expressed in two ways: specific gravity or °API gravity.

Specific gravity is the ratio of the density of oil relative to water. The density of freshwater is 1.0 while the density of salt water (seawater) is 1.02 to 1.03, depending on the temperature. At colder temperatures, sea water is slightly denser. Oil is generally lighter than water (with a density of less than 1.0) which means that it floats on water. The lighter the oil, the lower the density or specific gravity value.

°API gravity is a measure developed by the American Petroleum Institute (API) to represent how light or heavy an oil is compared to water. °API gravity is an inverse measure, meaning the higher the number, the lighter the oil. Heavier oils have lower °API gravities.

The density of oil increases with weathering (evaporation of volatile hydrocarbon components) and decreasing temperature. The density of oil affects its buoyancy. An increase in the oil density increases the possibility of the oil sinking. Oil will sink if its density is higher than that of the water. It will also sink when it comes in contact with sediment, other particles, or debris that make the mixture heavier than water. Sunken oil presents challenges for spill response.

Oil density also affects the rate of natural dispersion with lighter oils dispersing more readily. Lighter oils also spread faster on the water surface in the early stages of a spill.

3.7.2 Lowest °API Gravity and Heaviest Oil Group in the Pacific OCS

The lowest °API gravity oil (i.e., the heaviest oil) in the Pacific OCS has an °API gravity of 10, which is classified as a Group IV oil.

3.8 Other Oil Products Handled in Offshore Oil and Gas Operations

Offshore oil and gas operations include the use of various types of oils, such as fuels and lubricants for platform and drilling rig or mobile offshore drilling unit operations, as well as fuels and lubricants for the offshore supply or service vessels that bring supplies to the offshore facilities. The most commonly encountered oils include hydraulic fluids, diesel fuel, and drilling muds.

3.8.1 Synthetic-Based Drilling Muds (SBMs)

Synthetic-based drilling muds (SBMs) are often used during drilling of deep water and directional wells. The EPA prohibits the routine discharge of synthetic-based drilling muds and oil-based drilling muds and cuttings. SBMs almost completely replaced oil-based muds, which are very

rarely used in the Pacific at this point in time. Both SBMs and cuttings mixed with the muds can be accidentally discharged.

SBMs are generally comprised of 30–90% by volume (20–50% by weight) of synthetic organic compounds (which act as lubricants), that are dispersed in a salt brine to form an emulsion, along with other ingredients including emulsifiers, wetting agents, a weighting material (usually barite, $BaSO_4$, or ilmenite, $FeTiO_3$), clays, lignite, and lime. They are much denser than seawater. SBMs are synthesized specifically to not include PAHs, thus resulting in less environmental impact and lower toxicity for workers.

3.8.2 Diesel Fuel

Diesel fuel, a Group II oil, is commonly used on offshore platforms and in vessels. This product is the only type of non-crude petroleum that would be found in significant quantities in a single container (> 1,000 bbl). When spilled, diesel fuel will evaporate, dissolve, and naturally disperse to some extent. Diesel fuel includes moderate concentrations of toxic, soluble compounds. These components tend to evaporate (often more than 50%), but they can also leave residues that persist in the environment for days to weeks.

3.8.3 Hydraulic Fluids

Hydraulic fluids or oils are used on both vessels and on offshore platforms. Based on density, hydraulic oils range from Group II to Group IV, depending on their specific formulation and application. They are usually found in relatively small quantities.

3.8.4 Lubricants

Lubricating oils (lubricants) are also used on both vessels and offshore platforms. Based on density, lubricants range from Group II to Group IV, depending on their specific formulation and application. They are also usually found in relatively small quantities.

4 ACP 4 (LA-LB Northern Sector) Zone

4.1 Oil and Gas Fields

The northern ACP Planning Area in the Pacific OCS, ACP-4 includes the protraction areas of Monterey Fan, Sur Canyon, San Luis Obispo, Santa Maria, and Arguello Fan.

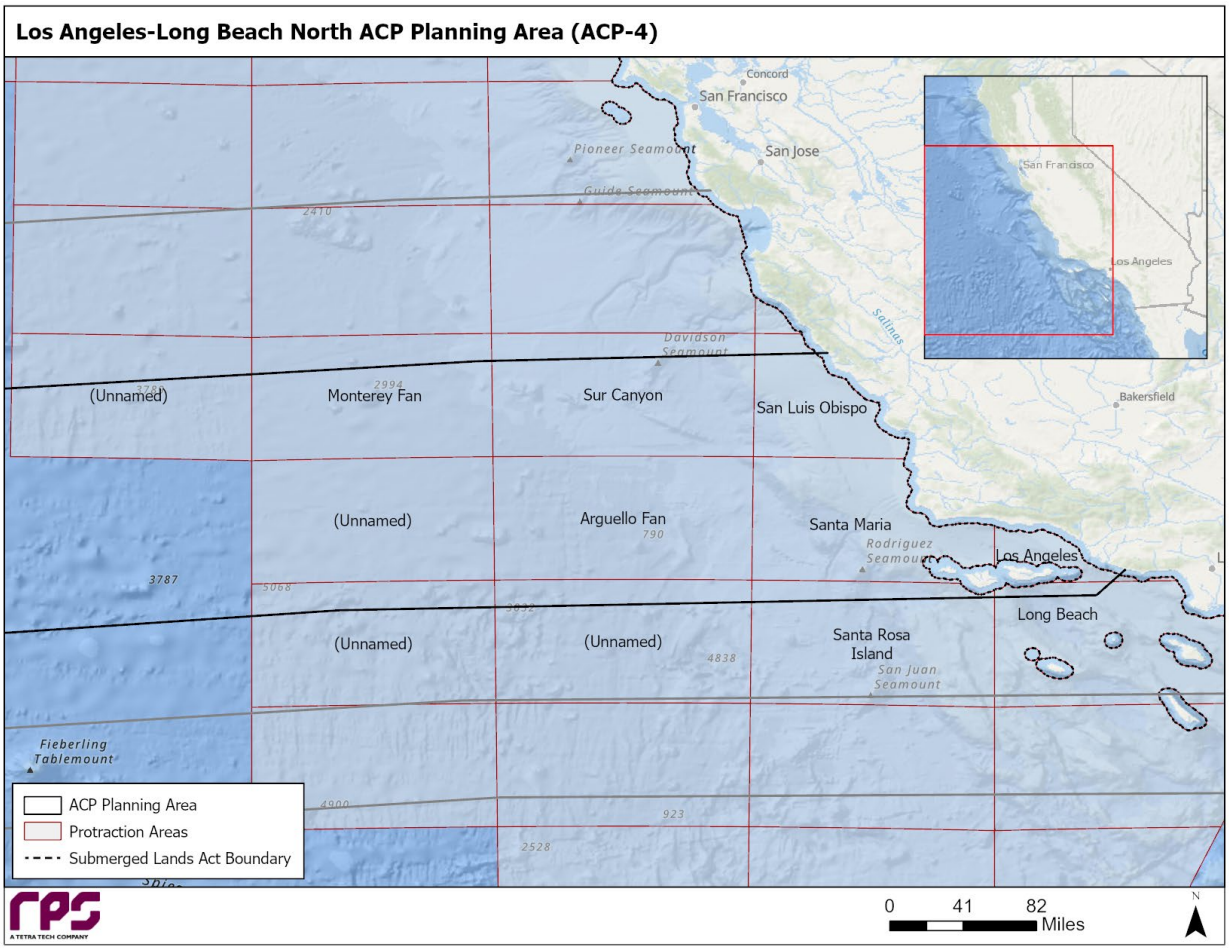

Figure 15. Protraction Areas in the ACP-4 Planning Area.

4.2 Bathymetry

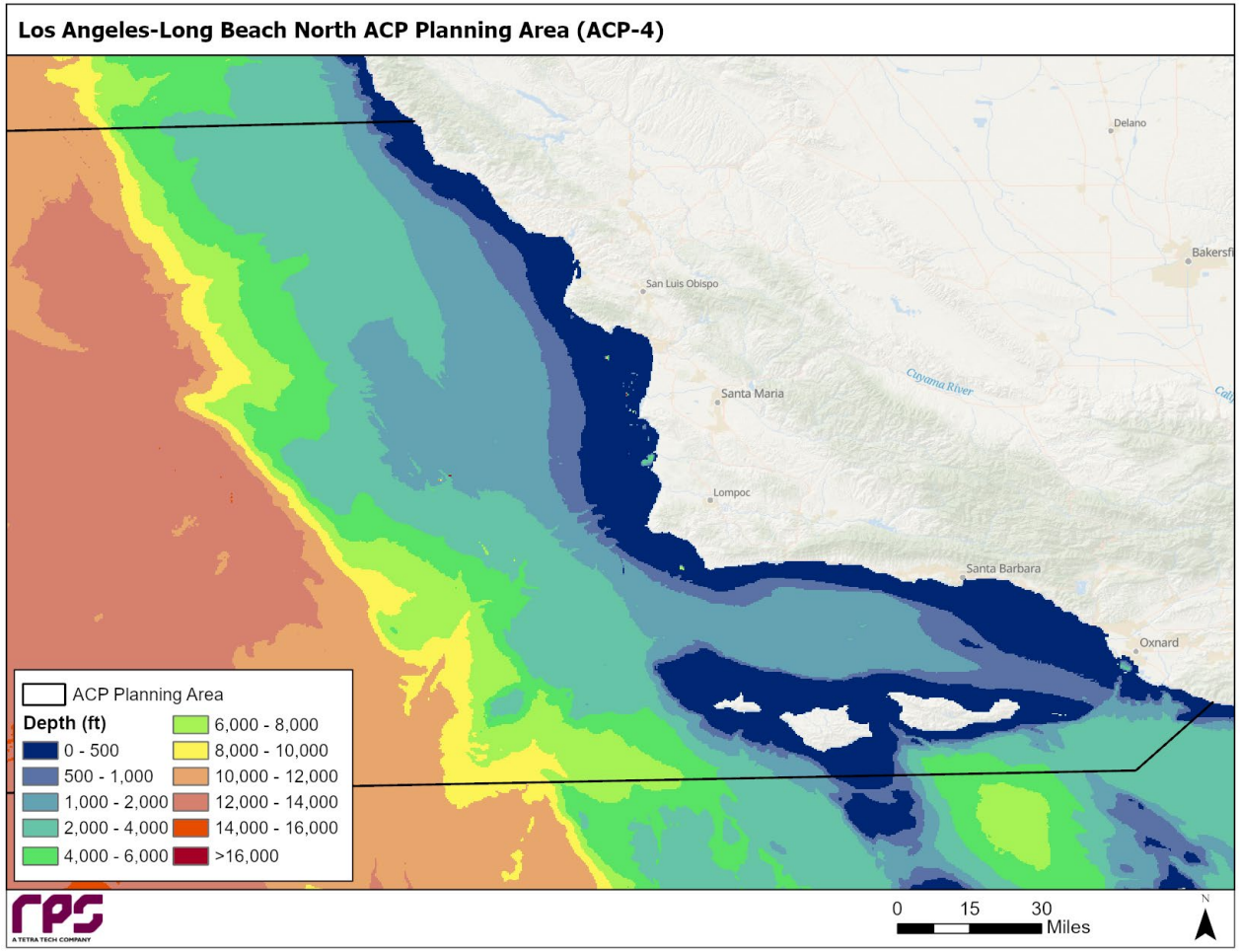

Figure 16. Bathymetry of ACP-4 Planning Area.

4.3 OCS Wells in ACP-4 Zone

The wells by status in the ACP-4 Planning Area are summarized in Table 9, Table 10, and Table 11. A map of the active well locations by production type is shown in Figure 17.

Table 9. Numbers of OCS Wells in ACP-4 Planning Area.

Location Depth	Well Status[9]		Total
	Active Wells	Permanently Abandoned	
Shallow (≤ 500 ft.)	529	170	**699**
Deepwater (> 500 ft.)	223	188	**411**
Total	**752**	**358**	**1,110**

Table 10. Age Categories of Shallow Wells in ACP-4 Planning Area by Well Status.

Well Status[10]	Total Wells (by Age)			Total
	< 20 years	20–50 years	> 50 years	
Active Wells	70	248	211	**529**
Permanently Abandoned	24	98	48	**170**
Total Wells	**94**	**346**	**259**	**699**

Table 11. Age Categories of Deepwater Wells in ACP-4 Planning Area by Well Status.

Well Status[11]	Total Wells (by Age)			Total
	< 20 years	20–50 years	> 50 years	
Active Wells	41	176	6	**223**
Permanently Abandoned	15	142	31	**188**
Total Wells	**56**	**318**	**37**	**411**

[9] Based on BSEE data available as of 28 February 2024. For the purposes of this document "Active Wells" are any wells that have not been designated as "Plugged and Abandoned, "Permanently Abandoned," or "Borehole Cancelled." "Active Wells" includes wells that are in any of the following categories: "Drilling Active," "Producing Oil Completion," "Producing Oil Gas Lift," "Gas Injection," "Water Injection," "Non-Producing Gas Completion," " Wellbore Temporarily Abandoned," "Inactive Drilling," "Water Source Well," or "Borehole Sidetracked."

[10] Based on BSEE data available as of 28 February 2024. For the purposes of this document "Active Wells" are any wells that have not been designated as "Plugged and Abandoned, "Permanently Abandoned," or "Borehole Cancelled." "Active Wells" includes wells that are in any of the following categories: "Drilling Active," "Producing Oil Completion," "Producing Oil Gas Lift," "Gas Injection," "Water Injection," "Non-Producing Gas Completion," " Wellbore Temporarily Abandoned," "Inactive Drilling," "Water Source Well," or "Borehole Sidetracked."

[11] Based on BSEE data available as of 28 February 2024. For the purposes of this document "Active Wells" are any wells that have not been designated as "Plugged and Abandoned, "Permanently Abandoned," or "Borehole Cancelled." "Active Wells" includes wells that are in any of the following categories: "Drilling Active," "Producing Oil Completion," "Producing Oil Gas Lift," "Gas Injection," "Water Injection," "Non-Producing Gas Completion," " Wellbore Temporarily Abandoned," "Inactive Drilling," "Water Source Well," or "Borehole Sidetracked."

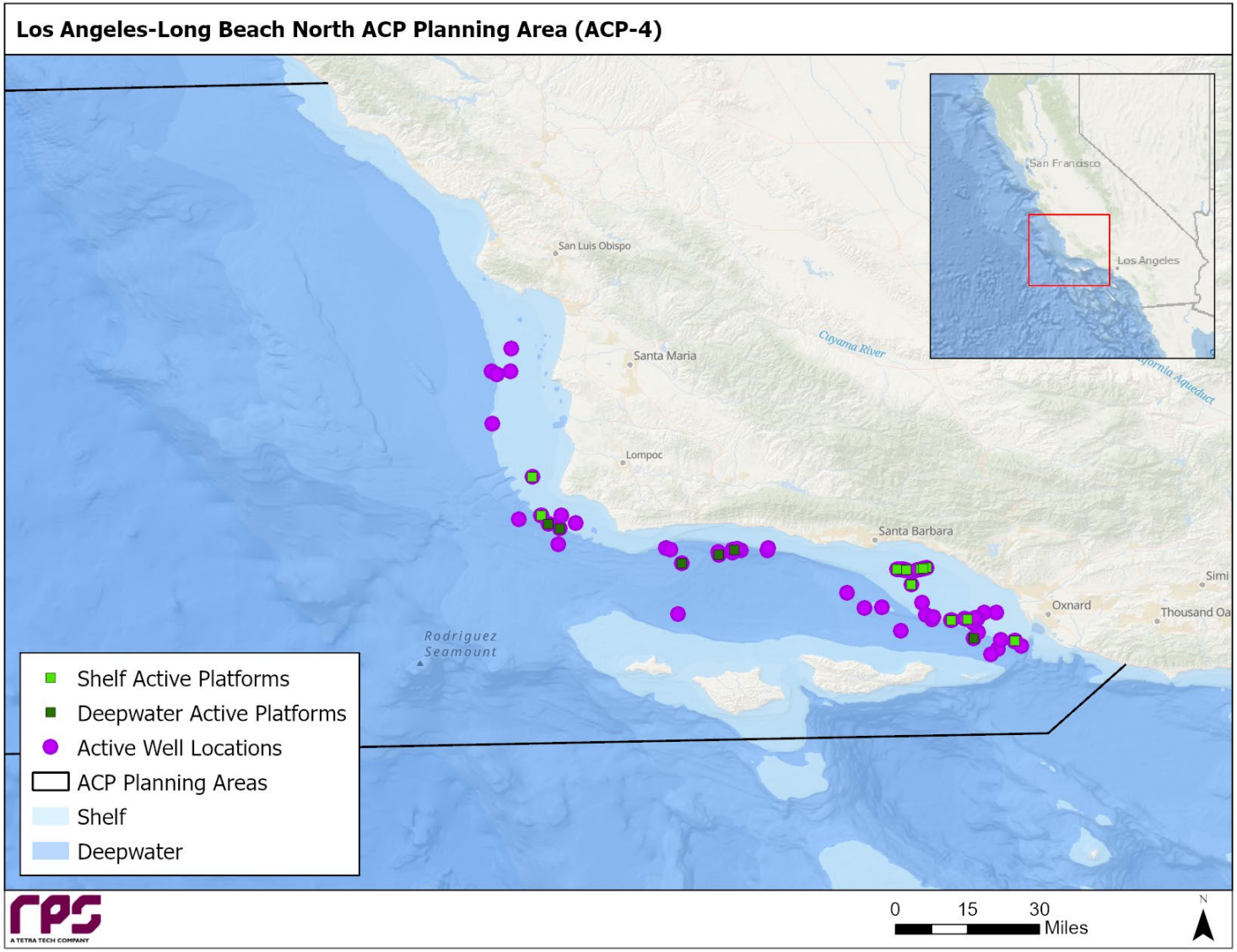

Figure 17. OCS Platforms and Wells in ACP-4 Planning Area.

4.4 ROW Pipelines in ACP-4 Planning Area

The locations of ROW pipelines that cross through the ACP-4 Planning Area are shown in Figure 18.

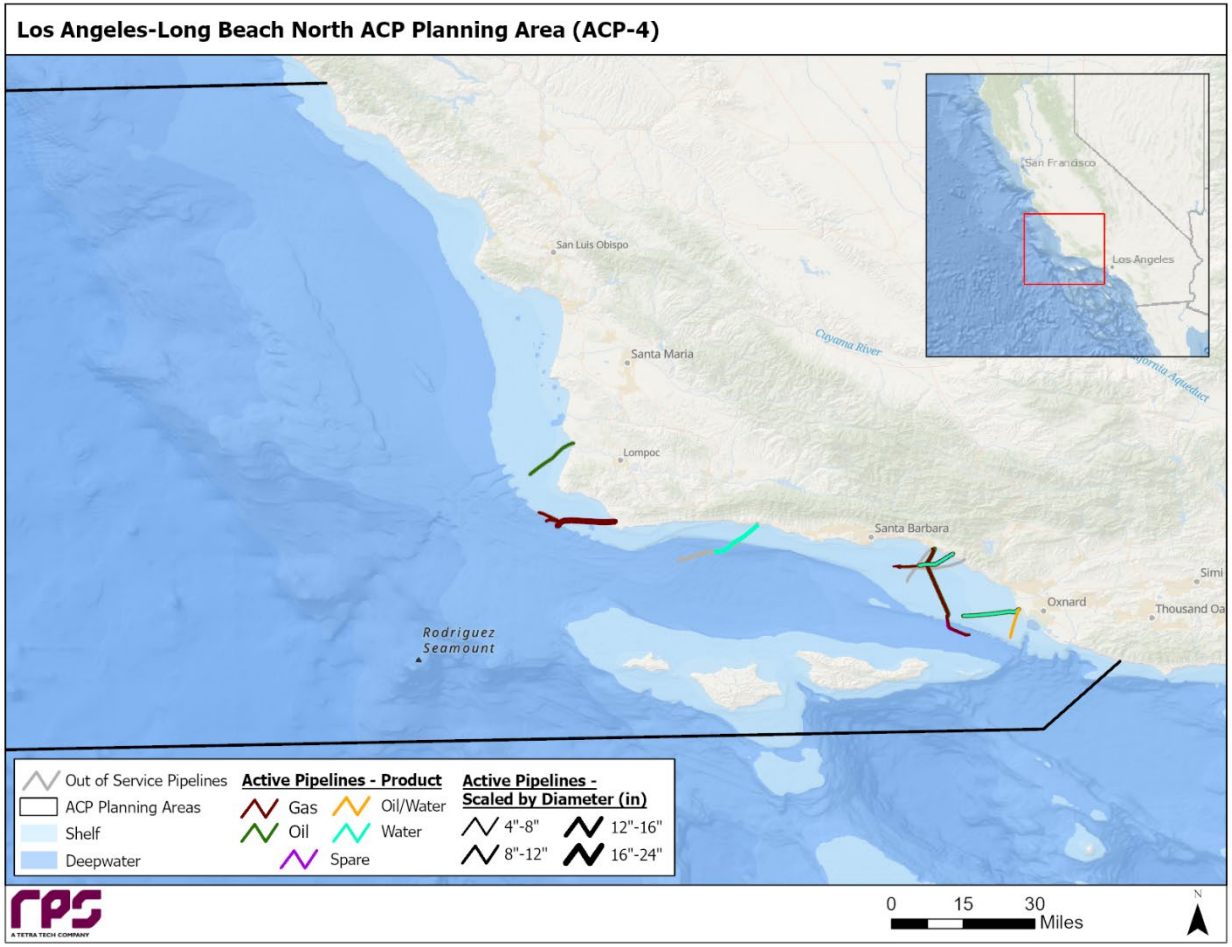

Figure 18. ROW Pipelines in ACP-4 Planning Area.

4.5 Offshore Production in ACP-4 Planning Area

Offshore oil and gas production in the ACP-4 Planning Area is summarized in Table 12. Each year, about 2.2 million bbl of oil and 2.2 million mcf of gas are produced. All of the oil and gas is produced in shallow areas.

Table 12. Offshore Oil and Gas Production in ACP-4 Planning Area.

Location Type	Annual Oil Production (bbl)	Annual Gas Production (mcf)
Shallow	2,170,230	2,197,211
Deepwater	0	0
Total	**2,170,230**	**2,197,211**

4.5.1 Highest-Producing Leases

The highest-producing oil and gas leases in the ACP-4 Planning Area are shown in Table 13 and Table 14, respectively. The highest-producing oil lease locations are shown in the map in Figure 19 and the highest-producing gas lease locations in Figure 20.

Table 13. Highest-Producing Oil Leases in ACP-4 Planning Area.[12]

Lease Number	Area-Block	Depth Category	Annual Production	
			Oil (bbl)	Gas in Same Lease (mcf)
P00241	LA 6658	Shallow (190 ft.)	1,146,208	1,699,330
P00240	LA 6659	Shallow (190 ft.)	497,437	490,921
P00216	LA 6862	Shallow (205 ft.)	310,132	357,011
P00202	LA 6965	Shallow (95 ft.)	40,866	47,771
P00203	LA 6964	Shallow (95 ft.)	11,511	30,253

Table 14. Highest-Producing Gas Leases in ACP-4 Planning Area.

Lease Number	Area-Block	Depth Category	Annual Production	
			Gas (mcf)	Oil in Same Lease (bbl)
P00241	LA 6658	Shallow (190 ft.)	1,699,330	1,146,208
P00240	LA 6659	Shallow (190 ft.)	490,921	497,437
P00216	LA 6862	Shallow (205 ft.)	357,011	310,132
P00202	LA 6965	Shallow (95 ft.)	47,771	40,866
P00203	LA 6964	Shallow (95 ft.)	30,253	11,511

[12] Based on BSEE data for 2023.

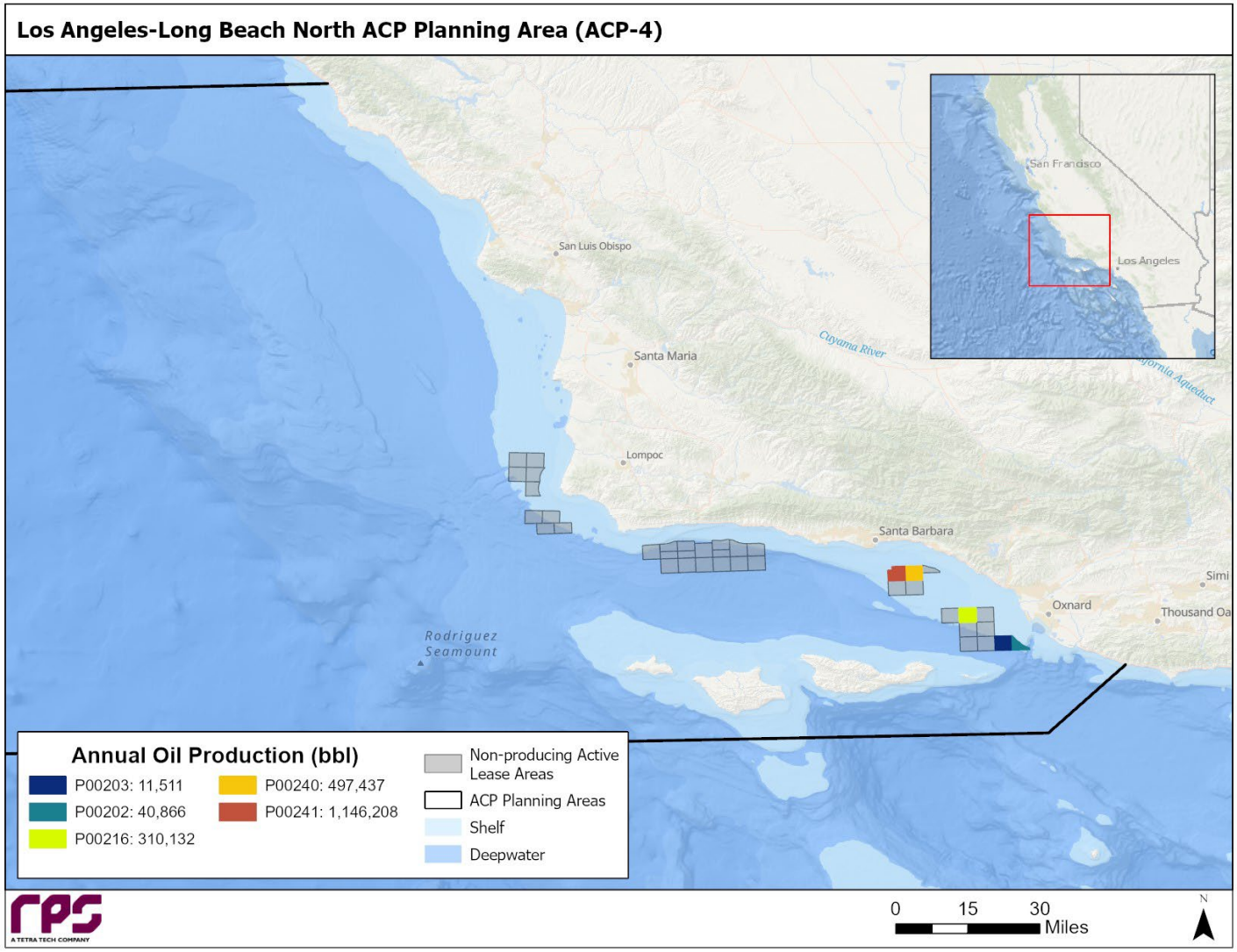

Figure 19. Highest-Producing Oil Leases in ACP-4 Planning Area.

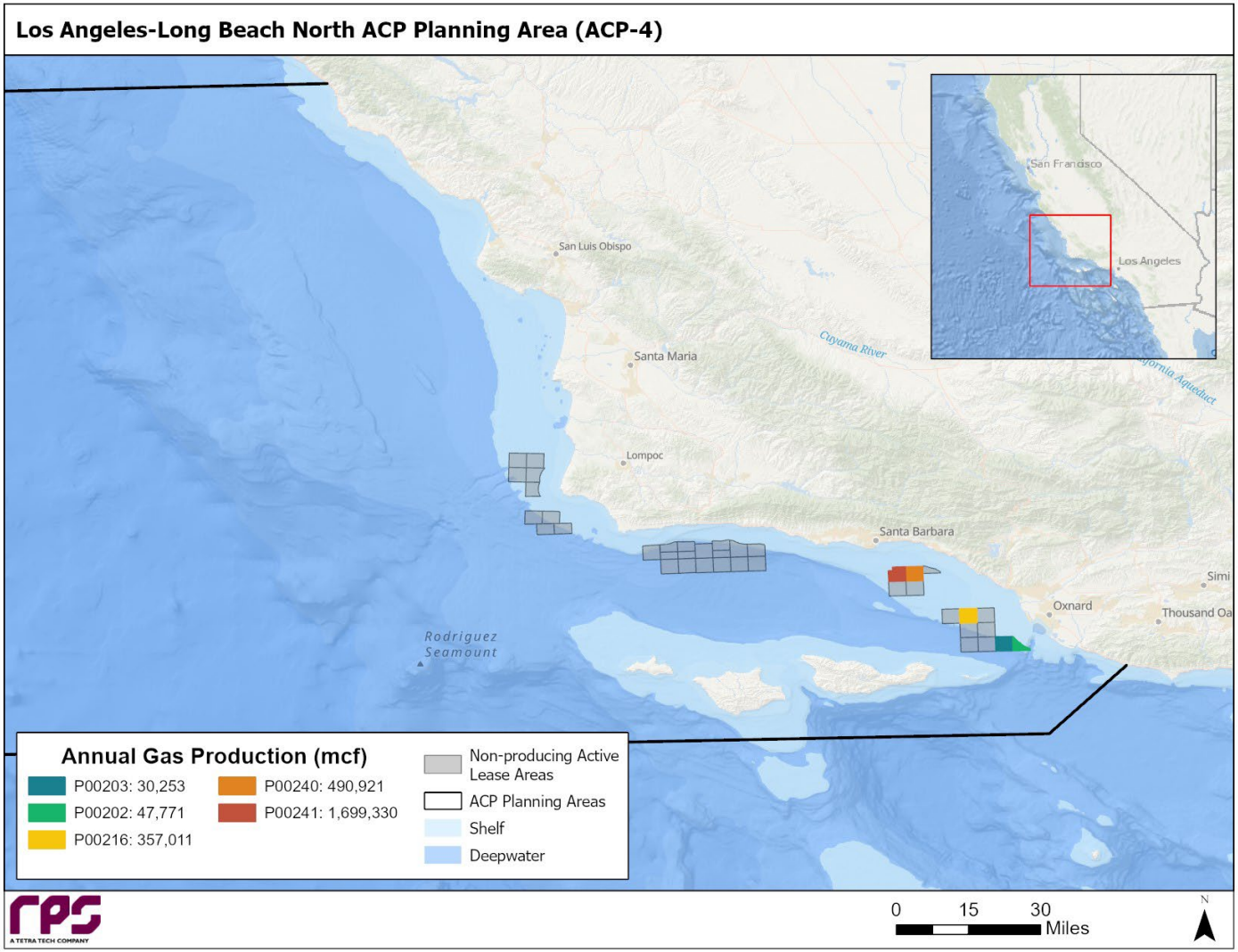

Figure 20. Highest-Producing Gas Leases in ACP-4 Planning Area.

5 ACP-5 (LA-LB Southern Sector) Zone

5.1 Oil and Gas Fields

The ACP-5 Planning Area includes the protraction areas of Santa Rosa Island, Long Beach, and Santa Ana.

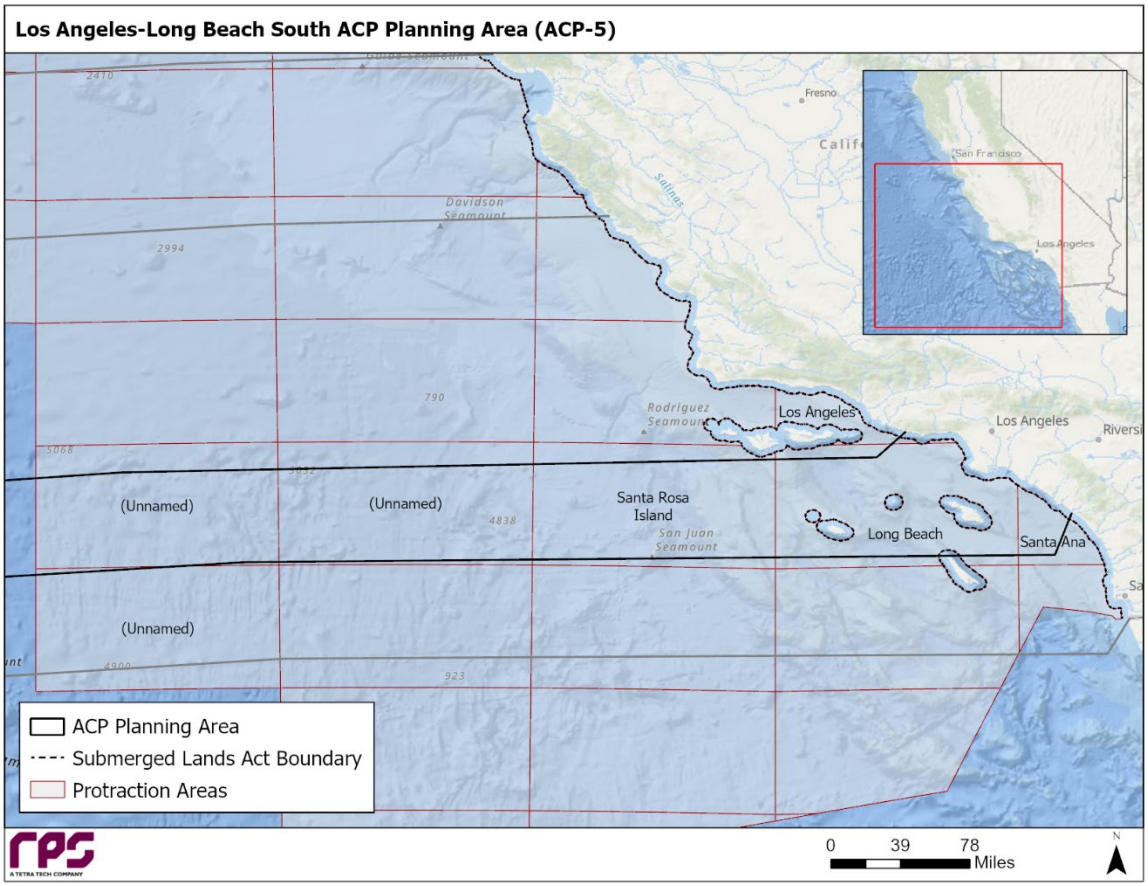

Figure 21. Protraction Areas in the ACP-5 Planning Area.

5.2 Bathymetry

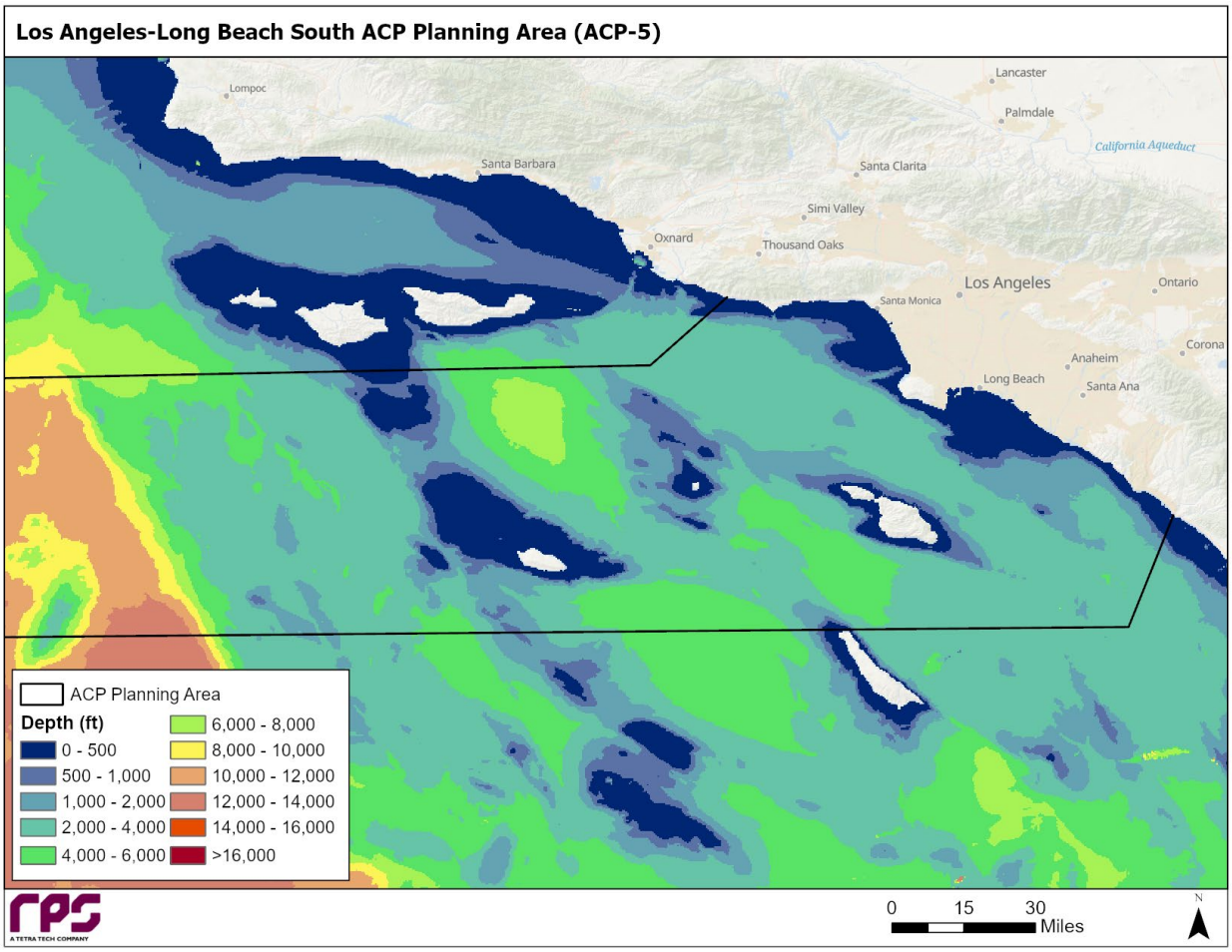

Figure 22. Bathymetry of the ACP-5 Planning Area.

5.3 OCS Wells in ACP-5 Planning Area

The wells by status in the ACP-5 Planning Area are summarized in Table 15. A map of the active well locations by production type is shown in Figure 23. Shallow wells are classified by age in Table 16, and deepwater wells are classified by age in Table 17.

Table 15. Numbers of OCS Wells in ACP-5 Planning Area.

Location Depth	Well Status[13]		Total
	Active Wells	Permanently Abandoned	
Shallow (≤ 500 ft.)	292	113	**405**
Deepwater (> 500 ft.)	94	75	**169**
Total	**386**	**188**	**574**

Table 16. Age Categories of Shallow Wells in ACP-5 Planning Area by Well Status.

Well Status[14]	Total Wells (by Age)			Total
	< 20 years	20–50 years	> 50 years	
Active Wells	21	261	10	**292**
Permanently Abandoned	19	75	19	**113**
Total Wells	**40**	**336**	**29**	**405**

Table 17. Age Categories of Deepwater Wells in ACP-5 Planning Area by Well Status.

Well Status[15]	Total Wells (by Age)			Total
	< 20 years	20–50 years	> 50 years	
Active Wells	20	74	0	**94**
Permanently Abandoned	20	48	7	**75**
Total Wells	**40**	**122**	**7**	**169**

[13] Based on BSEE data available as of 28 February 2024. For the purposes of this document "Active Wells" are any wells that have not been designated as "Plugged and Abandoned, "Permanently Abandoned," or "Borehole Cancelled." "Active Wells" includes wells that are in any of the following categories: "Drilling Active," "Producing Oil Completion," "Producing Oil Gas Lift," "Gas Injection," "Water Injection," "Non-Producing Gas Completion," " Wellbore Temporarily Abandoned," "Inactive Drilling," "Water Source Well," or "Borehole Sidetracked."

[14] Based on BSEE data available as of 28 February 2024. For the purposes of this document "Active Wells" are any wells that have not been designated as "Plugged and Abandoned, "Permanently Abandoned," or "Borehole Cancelled." "Active Wells" includes wells that are in any of the following categories: "Drilling Active," "Producing Oil Completion," "Producing Oil Gas Lift," "Gas Injection," "Water Injection," "Non-Producing Gas Completion," " Wellbore Temporarily Abandoned," "Inactive Drilling," "Water Source Well," or "Borehole Sidetracked."

[15] Based on BSEE data available as of 28 February 2024. For the purposes of this document "Active Wells" are any wells that have not been designated as "Plugged and Abandoned, "Permanently Abandoned," or "Borehole Cancelled." "Active Wells" includes wells that are in any of the following categories: "Drilling Active," "Producing Oil Completion," "Producing Oil Gas Lift," "Gas Injection," "Water Injection," "Non-Producing Gas Completion," " Wellbore Temporarily Abandoned," "Inactive Drilling," "Water Source Well," or "Borehole Sidetracked."

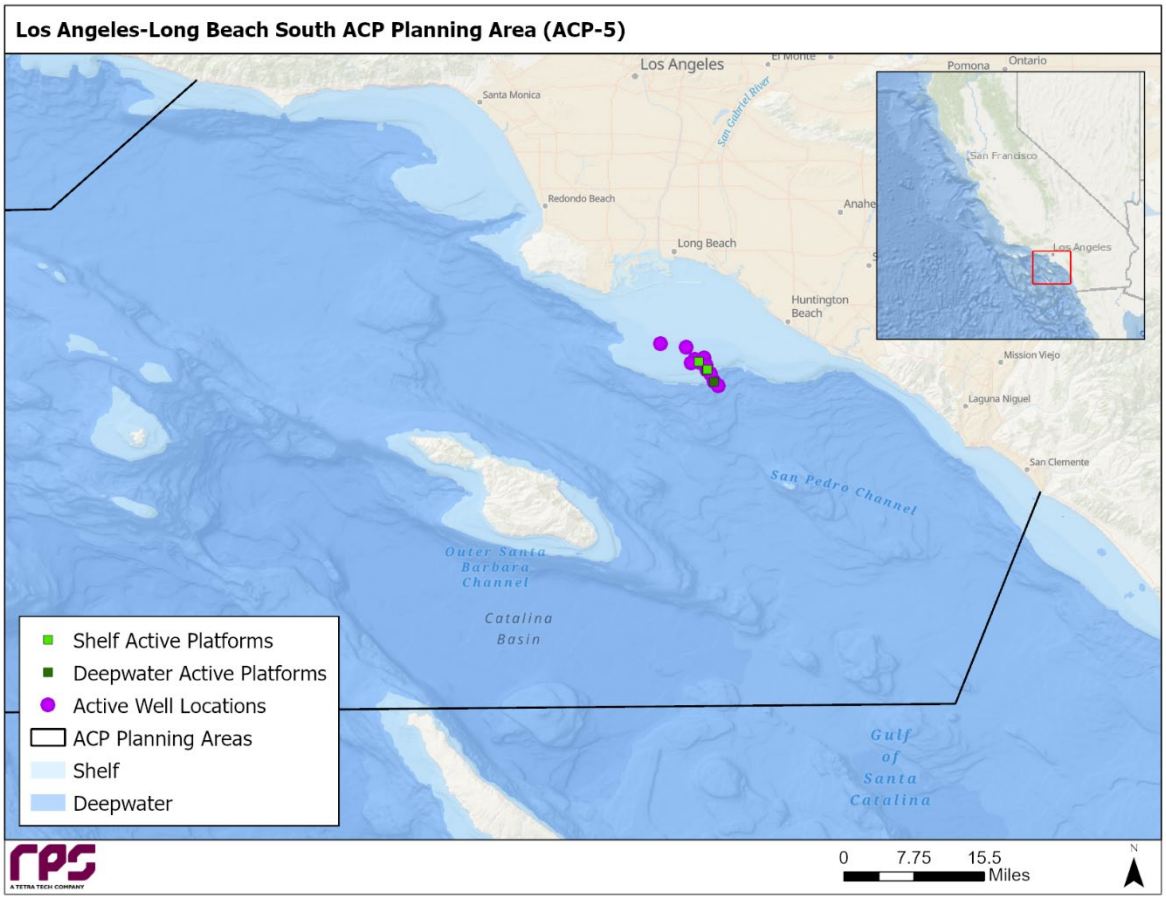

Figure 23. OCS Platforms and Wells in ACP-5 Planning Area.

5.4 ROW Pipelines

The locations of ROW pipelines that cross through the ACP-5 Planning Area are shown in Figure 24.

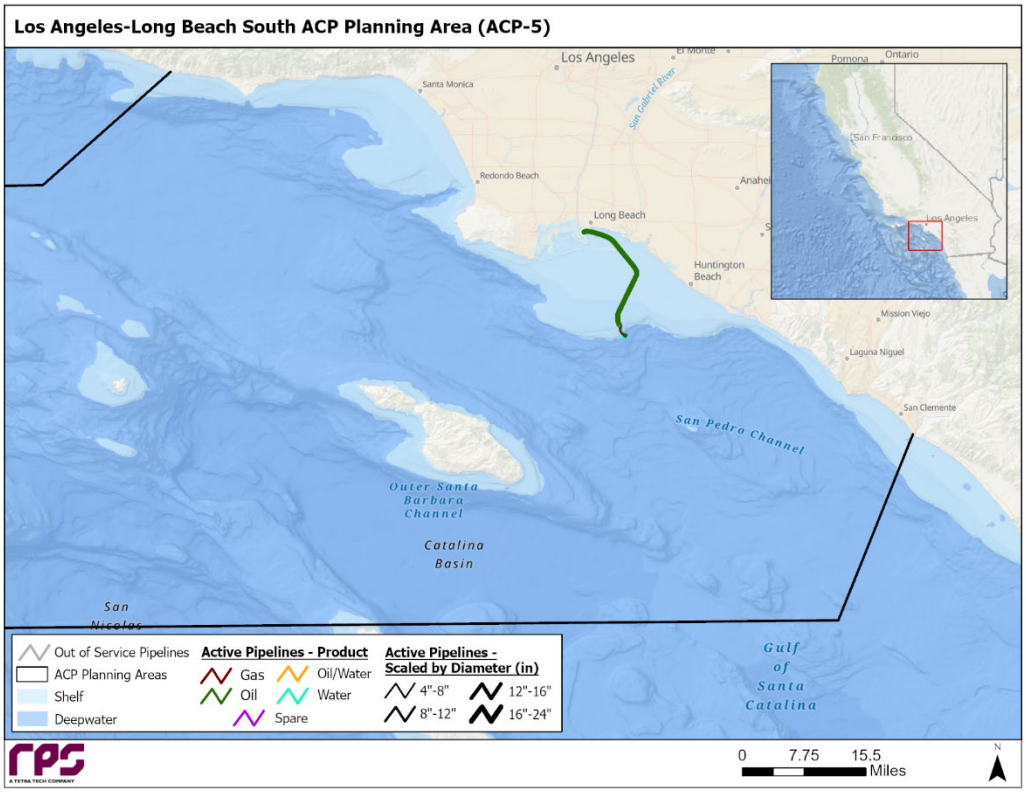

Figure 24. ROW Pipelines in the ACP-5 Planning Area.

5.5 Offshore Production in ACP-5 Planning Area

Offshore oil and gas production in the ACP-5 Planning Area is summarized in Table 18. Each year, almost 1.4 million bbl of oil and over 694,000 mcf of gas are produced. Most of the oil (59%) is produced in the shallow areas. Most of the gas (nearly 87%) is also produced in the shallow areas.

Table 18. Offshore Oil and Gas Production in ACP-5 Planning Area.

Location Type	Annual Oil Production (bbl)	Annual Gas Production (mcf)
Shallow	814,130	601,327
Deepwater	561,659	92,335
Total	**1,375,789**	**693,662**

5.5.1 Highest-Producing Leases

The highest-producing oil and gas leases in the ACP-5 Planning Area are shown in Table 19 and Table 20, respectively. The locations of the highest-producing oil leases are shown in the map in Figure 25 and the highest-producing gas leases in Figure 26.

Table 19. Highest-Producing Oil Leases in ACP-5 Planning Area.[16]

Lease Number	Area-Block	Depth Category	Annual Production	
			Oil (bbl)	Gas in Same Lease (mcf)
P00301	LB 6488	Deepwater (700 ft.)	767,243	179,160
P00300	LB 6438	Shallow (265 ft.)	137,076	58,870
P00296	LB 6438	Shallow (161 ft.)	108,255	20,434

Table 20. Highest-Producing Gas Leases in ACP-5 Planning Area.

Lease Number	Area-Block	Depth Category	Annual Production	
			Gas (mcf)	Oil in Same Lease (bbl)
P00301	LB 6488	Deepwater (700 ft.)	179,160	767,243
P00300	LB 6438	Shallow (265 ft.)	58,870	137,076
P00296	LB 6438	Shallow (161 ft.)	20,434	108,255

[16] Based on BSEE data for 2023.

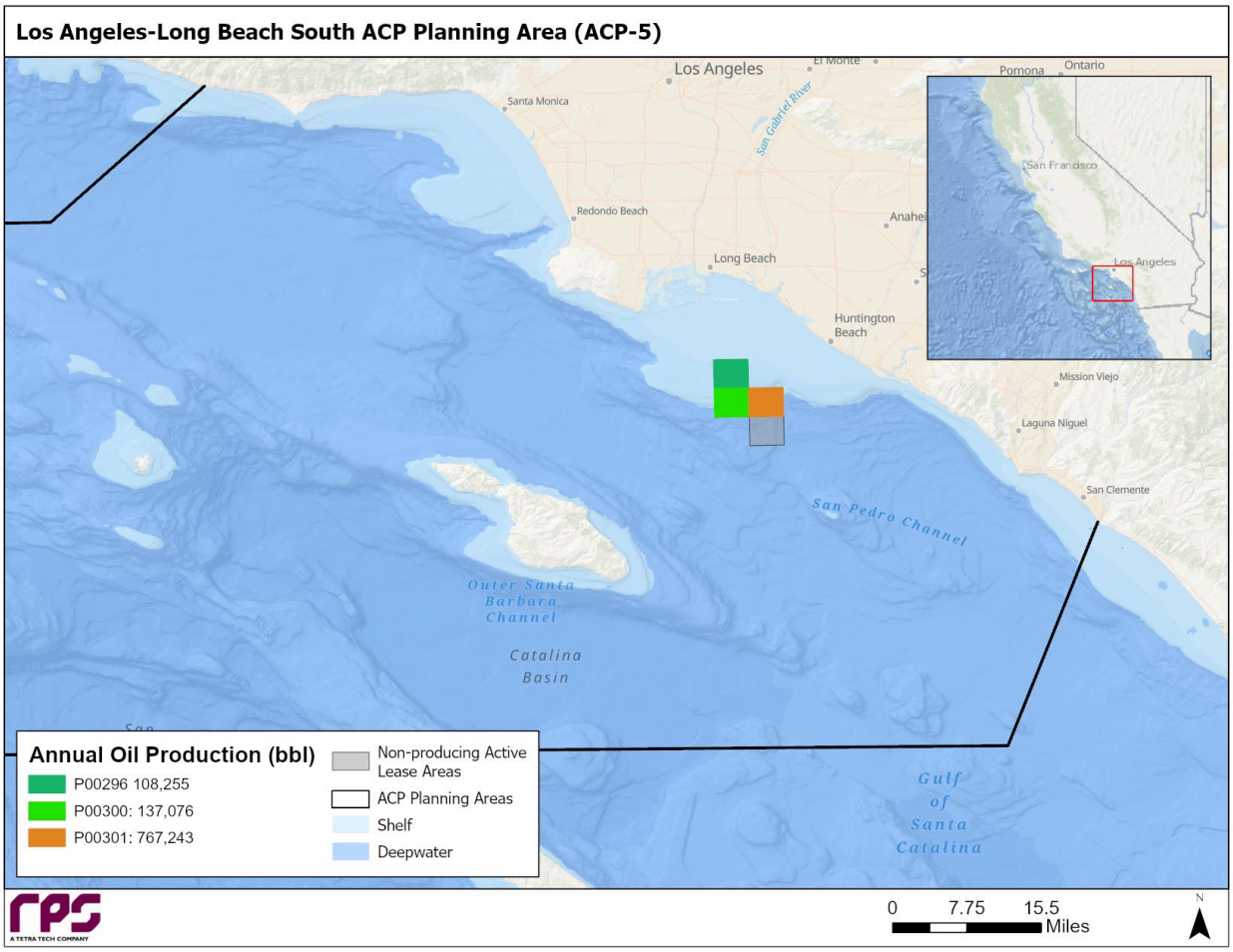

Figure 25. Highest-Producing Oil Leases in the ACP-5 Planning Area.

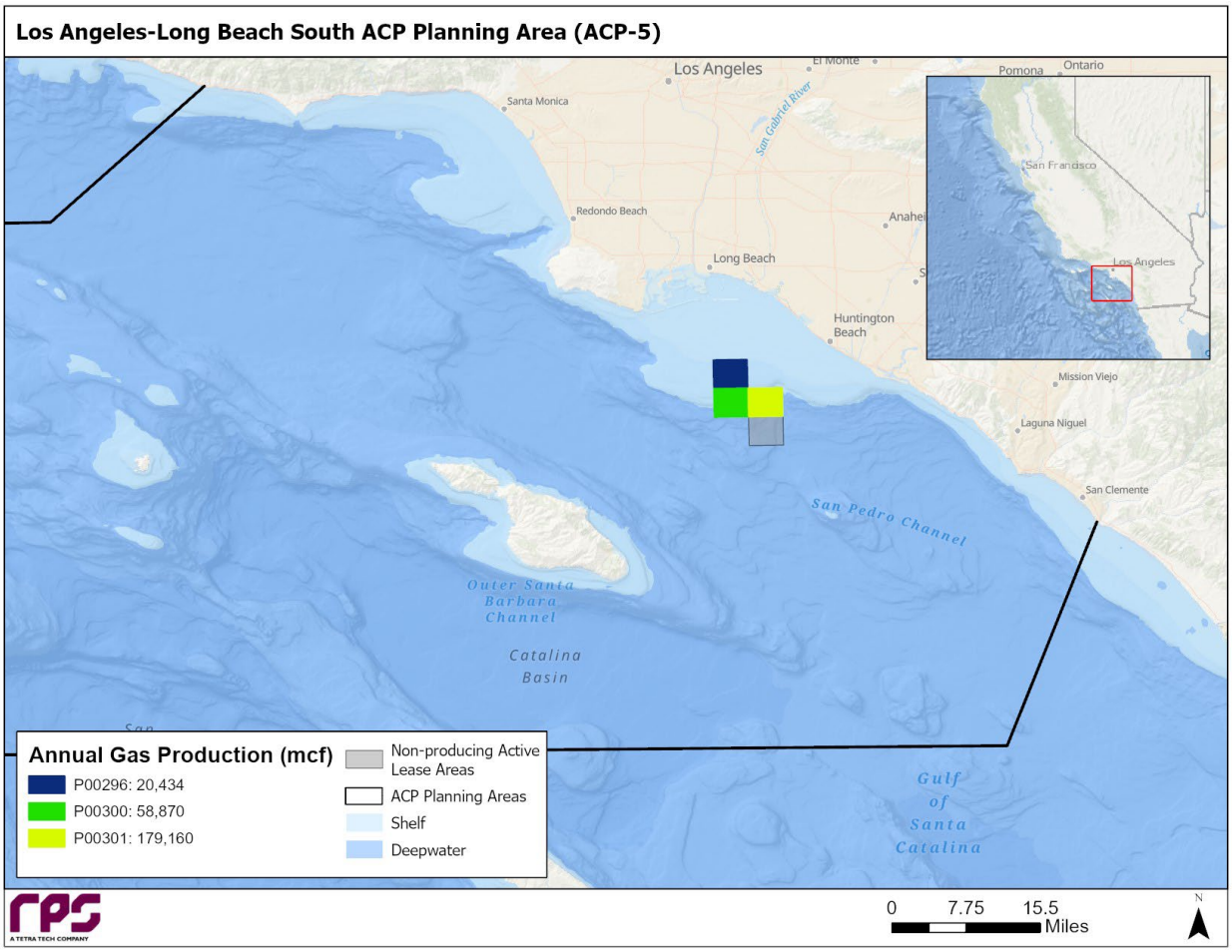

Figure 26. Highest-Producing Gas Leases in the ACP-5 Planning Area.

6 California State Infrastructure

6.1 California State Wells and Platforms

The California State wells and platforms by status in ACP-4 Planning Areas and ACP-5 Planning Area are summarized in Table 21. A map of the California State active well and platform locations are shown in Figure 28.

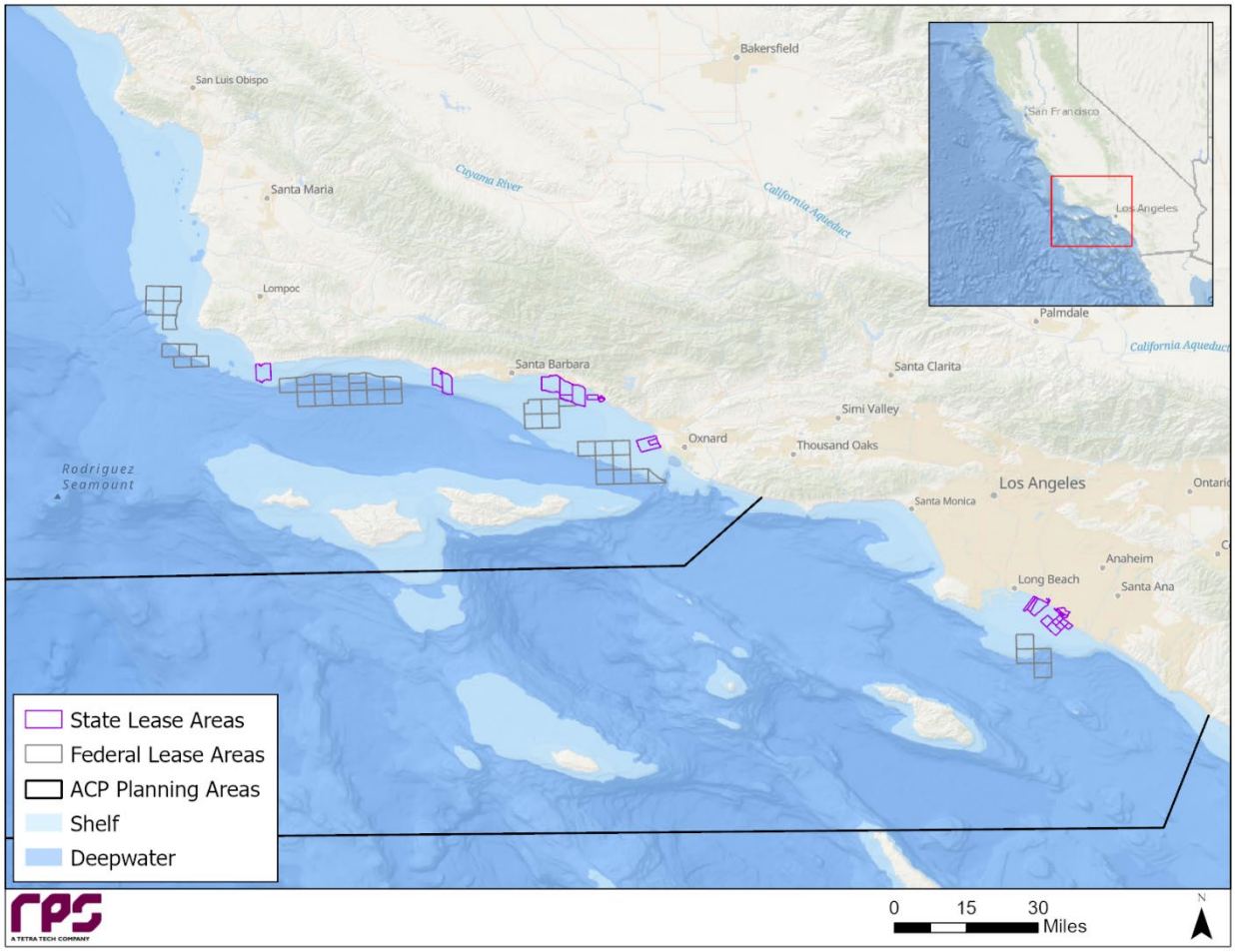

Figure 27. California State Active Lease Areas in ACP-4 and ACP-5 Planning Areas.

Table 211. Numbers of California State Wells by Well Status.

ACP Planning Area	Well Status[17]		Total
	Active Wells	Permanently Abandoned	
Santa Barbara Channel (Area 4)	90	1,160	**1,250**
San Pedro Bay (Area 5)	1,535	309	**1,844**
Total	**1,625**	**1,472**	**3,097**

Table 222. Age Categories of California State Wells by Well Status.

Well Status[18]	Total Wells (by Age)				Total
	< 20 years	20–50 years	>50 years	Unknown	
Active Wells	254	106	96	1,170	**1,626**
Permanently Abandoned	17	11	97	1,346	**1,471**
Total Wells	**271**	**117**	**193**	**2,516**	**3,097**

Table 233. California State Oil and Gas Platforms

Lease	Lease Status	Structure Name	Year Installed	Miles to Land	Water Depth (ft)
N/A	Active	Grissom	1967	0.2	40
N/A	Active	White	1967	0.5	40
N/A	Active	Chaffee	1967	0.8	40
N/A	Active	Freeman	1967	1.2	40
PRC3095	Active p/Caslc	Esther	1990	1.2	22
PRC3033	Active p/Caslc	Eva	1964	1.8	57
PRC425	Active p/Caslc	Emmy	1963	1.2	47
PRC3242	Active p/Caslc	Holly	1966	1.8	211
PRC1466	Active p/Caslc	Rincon Island	1958	0.5	45

[17] Based on ERMA data available as of 8 July 2024. For the purposes of this document "Active Wells" are any wells that have not been designated as "Plugged and Abandoned, "Permanently Abandoned," or "Cancelled." "Active Wells" includes wells that are in any of the following categories: "Drilling Active," "Permitted," "Producing Oil Completion," "Producing Oil Gas Lift," "Non-Producing Gas Completion," "Wellbore Temporarily Abandoned," or "Inactive Drilling."

[18] Based on ERMA data available as of 8 July 2024. For the purposes of this document "Active Wells" are any wells that have not been designated as "Plugged and Abandoned, "Permanently Abandoned," or "Cancelled." "Active Wells" includes wells that are in any of the following categories: "Drilling Active," "Permitted," "Producing Oil Completion," "Producing Oil Gas Lift," "Non-Producing Gas Completion," "Wellbore Temporarily Abandoned," or "Inactive Drilling."

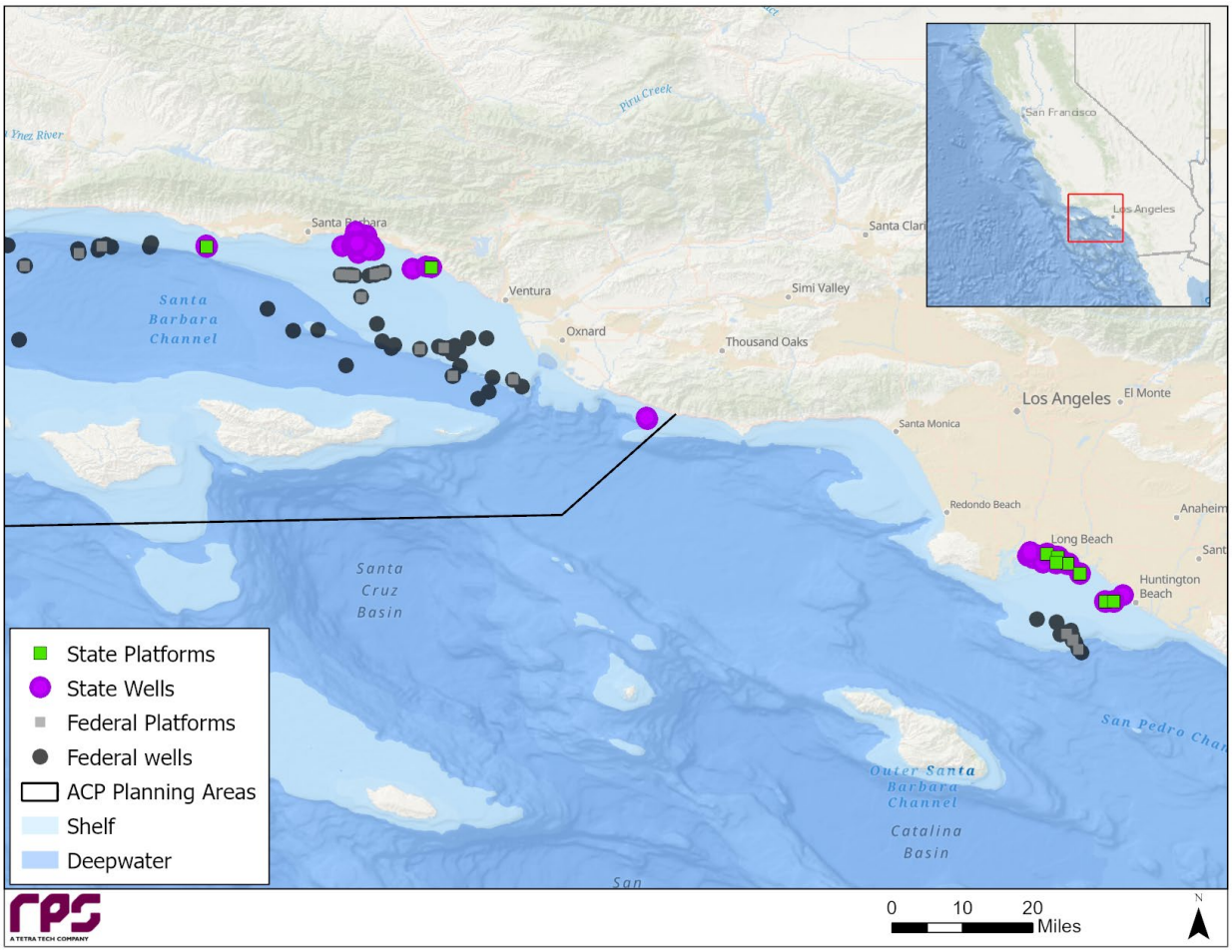

Figure 28. California State Wells and Platforms in ACP-4 and ACP-5 Planning Areas.